APPLICATION

WELDING ALUMINUM WITH THE INVERTEC® V205-T AC/DC

BY FRANK G. ARMAO, APPLICATION ENGINEER, NON-FERROUS METALS

FRANK G. ARMAO
Mr. Armao is a member of the Lincoln Electric Company's Application Engineering Department. As Group Leader, Non-Ferrous Materials, he is responsible for evaluating customer welding procedures, equipment and consumables for aluminum applications in order to improve quality, enhance functionality and reduce fabrication costs. He also conducts domestic and international training programs for customers and distributors.

In this document, Mr. Armao provides a practical guide to TIG welding aluminum alloys, details Invertec® V205-T operation, and explains system setup for optimum performance on aluminum.

Input Power: The V205-T will operate on either 230VAC or 115VAC single phase input power. It will only obtain its rated 200 amp output capacity when operated from 230VAC and supplied with a 230V input plug.

However, it can be operated on 115V by changing the plug to a 115V. With 115 volt input power, the maximum output will be reduced to a lower current level, depending on the input current draw and the branch supply circuits amp rating. Typically, on 115V supply circuits, up to 130 amperes welding output can be reached at 10% duty cycle.

High Frequency: Transformer type welders require the high frequency (HF) to be on continuously to stabilize the AC arc. However, the V205-T is inverter-based. Continuous HF is not necessary for stable AC output. In fact, there is no way to get continuous HF on the V205-T.

In AC TIG mode, the HF will come on when the foot pedal is depressed (or the Arc Start switch is turned on, etc). It will stay on only until the arc is established and will then turn off. If, for some reason, the arc is not established within 4 seconds, the HF will go off and will not go on again until you take your foot off the pedal (or turn the Arc Start switch off, etc) and begin the cycle again.

In DC output, you have the option of using HF start or lift start. The option is chosen in position #8 of the Setup Menu (see IM page B-6). HF start will operate the same in DC as it does in AC.

Lift Start™: If you choose Lift Start in the Setup Menu for DC output, the method of starting is as follows:

1. Touch the tip of the tungsten to the work
2. Rock the torch back until the ceramic cup touches the work
3. Continue rocking back. When the tungsten breaks contact with the work, the arc will strike.

Scratch Start: The V205-T will not scratch start when it is set up for Lift Start. If you want to scratch start, the only way to do it is to put the V205-T in Stick Mode and use a TIG torch with a gas valve. The gas line is run directly to the gas flow meter to bypass the solenoid in the V205-T, which does not function in Stick Mode.

TIG Torch Connection: Remember that, as normally connected, the negative terminal supplies power and also supplies the inert gas through the TwistLock™

WELDING ALUMINUM WITH THE INVERTEC V205T

BY FRANK G. ARMAO, APPLICATION ENGINEER, NON-FERROUS METALS

connector to the torch. If the arc is behaving as if there is no shielding gas, it is likely that you have the torch plugged into the positive terminal Twist Lock, so that the torch is getting no shielding gas. Check all connections.

Balance Control: In AC TIG welding, the part of the cycle in which the tungsten is negative (EN) provides weld penetration. During this time about 80% of the arc energy goes into melting the work and the filler rod. Only a small amount goes back to heat up the tungsten and the torch. During the part of the AC cycle in which the tungsten is positive (EP), we get little penetration, but the arc helps to clean the oxide off the aluminum surface, making welding easier. During this time, about 80% of the arc energy goes back into the tungsten and the torch, heating them up. This extra heat must be dissipated. That is why we need much larger diameter tungsten electrodes when AC TIG welding.

So the EN part of the cycle gives us the weld penetration we want, while the EP part of the AC cycle gives us the arc cleaning we need to weld aluminum. However, we don't need 50% EP to get good arc cleaning. Conventional TIG power supplies usually use around 65% EN and 35% EP.

Here is where the V205-T has an advantage. The V205-T is able to get good arc cleaning on AC welding with as little as 15% EP. This gives better penetration and puts less heat into the torch so you can use a smaller diameter pointed 2% thoriated tungsten electrode for most of your welding.

Set the AC balance by pressing and holding the Parameter button for 3 seconds. The AC Frequency control pops up (see below). Press and hold the Parameter button for 3 more seconds. The AC Balance control pops up. Adjust the AC Balance control to 85 (see below).

AC Frequency: Traditional transformer welders have no capability to adjust the output AC frequency. It is fixed at 60Hz. Inverter power supplies, where the inverter works at frequencies as high as 20 KHz, are often capable of varying the AC output frequency.

On the V205-T, AC output frequency can be adjusted anywhere in the range of 20 Hz to 150Hz. Why would you want to adjust it? As the frequency goes up, the arc narrows and becomes more focused. If you want to make small, narrow welds, use frequencies in the upper end of the range. If you want to make larger, wider welds, reduce the AC output frequency.

AC Wave Shape: The V205-T can deliver a square wave output, a sine wave output, or a sawtooth wave output. When should you use one or the other? Frankly, there is no real answer for this. Use the one which best matches your personal arc preference. Most people use the square wave. The sine wave output is softer and the sawtooth wave is crisper (i.e., harsher). The sawtooth wave will produce larger peak currents for the same amount of average welding current. This can cause premature tungsten erosion, so typically, it is not ideal for medium to high amperage welding

Pulsing: Some people prefer to weld using pulsing and some do not. Pulsing is a way to keep a stiff arc by keeping the Welding Current (i.e., the peak current) high, while keeping the average current low to make welding thin materials easier. Four adjustments are possible — Welding Current, Background Current, Pulse Frequency, and Percent On Time.

As a starting point, the following settings are suggested. Set Background Current to 50% of Welding Current. Set Percent On Time to 50%. Set Pulse frequency between 0.5Hz and 1 Hz. The Welding Current will depend on material thickness.