e-Weldone
www.adorwelding.com
July 2013
Vol. 46

Technical Newsletter from
ADOR WELDING LIMITED
Formerly **Advani - Oerlikon Ltd.**

IMPROVING PRODUCTIVITY WITH TUNGSTEN INERT GAS (TIG) WELDING

Introduction

TIG welding is a relatively slow process by its nature such as the welder having to synchronize the flow of shielding gas with the feeding of filler wire. But it is also a very versatile process, as it can be used to weld more materials than with any other welding process, including non ferrous, exotic and heavier alloyed metals. It is also ideal for thin materials, as it generates low heat input to prevent burn-through. Plus, no matter the application, when done properly TIG welding can provide extremely high weld quality.
Achieving such positive results is not always easy and requires great effort and skill, compared to manual arc welding. With the help of few tips and by following certain methods one can improve the efficiency in the TIG welding process. After all, nobody wants an already slow welding process to become slower! Some procedures to increase productivity with the TIG process are described below.

Use of Inverter TIG power source:

Using an inverter power source is one of the first steps to improve TIG welding efficiency. Inverters operate at very high switching frequency up to 50 KHz which converts high AC input supply voltage to low TIG welding DC voltage. The overall result is a smooth arc that provides consistent welding performance.

Inverters also have frequency controls that allow welders to adjust the frequency from

Product Update

ZEDALLOY 350

- An electrode to deposit air hardening type of weld metal having hardness in the range of 330-380 BHN approx.
- Weld metal is machinable with carbide tools.
- Excellent arc stability and low spatter loss.
- All sizes strike and re-strike easily .
- Weld beads are smooth, uniform and of excellent appearance.

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20 Hz – 400 Hz. (transformer-based power sources only produce an output of 50/60 Hz, which is the same frequency of input mains supply voltage available from Electricity Board).The inverter's frequency control feature helps improve welding efficiency by narrowing the focus of the arc, which in turn creates a narrower weld bead and minimizes the heat-affected zone. With this feature, you will need less time and filler metal to complete the weld and can also obtain faster travel speeds. Due to reduced heat-affected zone, it minimizes the chance of burn-through and the need for rework, which is a definite cost saver in any welding application.

Inverters also have a feature of balance control, which allows welders to adjust the time the current spends in each part of the AC cycle and is especially useful if welding aluminum. Balance control can be adjusted toward the electrode positive part of the cycle to gain more cleaning action (removal of the oxide layer) or toward the electrode negative to gain greater weld penetration and faster travel speeds to finish the job sooner.

Use of suitable TIG torch:

Selecting the right TIG torch for a particular application can also help to make the process more efficient. The torch should be provided with good insulation to avoid high frequency leakage and/or cracking and to avoid premature torch failure and downtime for torch changeover. Silicone rubber is a good insulating and heat resistant material which can be used for this purpose.

Efficiency also depends on whether an air- or water-cooled TIG torch is to be used. Air-cooled models can be used on low amperage applications, or those applications where current to be used is below 200 amps. They are the best option if you are welding very thin materials, under 5 mm, and/or need to be able to move from one area to another easily, as they do not require an external cooling. Water-cooled TIG torches can be considered for applications where current to be used will be over 200 amps. This type of torch helps prevent overheating and allows operator to achieve faster travel speeds which ultimately provide more weld deposit in less time.

When selecting a TIG torch, also consider the angles of joints that need to be welded, since maneuvering around difficult joints can be time-consuming and uncomfortable. Most TIG torch manufacturers offer models with flexible necks that are convenient for welding in particularly tight joints or awkward positions. Some torch body styles also feature a modular design, which allows addition of a flexible neck and different head angles to an existing torch. These kits provide good joint access and can lower downtime associated with changing over to different torches for multiple applications. Plus, one can save money on extra inventory.

Use of gas lenses:

- A 19/10 electrodes with controlled Ferrite content of 3 to 7% for maximum resistance to cracking, corrosion and high temperatures up to 8000 C.
- The weld metal has excellent creep strength and is of radiographic quality.
- Excellent arc stability and low spatter loss.
- All sizes strike and re-strike easily.
- The slag is easily controlled and does not interfere with the arc action.
- Weld beads are smooth, uniform and of excellent appearance.

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CHAMP MIG 250

Inverter based GMAW process welding outfit

- Digital Panel for adjusting the welding parameters
- 30% more Energy efficient than conventional machines.
- Maximum Power factor is 0.94

When possible, use a gas lens. A gas lens replaces the collet body in a TIG torch to help hold the tungsten in place and creates the electrical contact necessary for proper current transfer. It also provides two other functions which help to improve efficiency: it improves shielding gas coverage and provides better joint accessibility.

This photo shows the even gas flow created by using a gas lens.

Photo shows gas coverage without a gas lens.

Gas lenses typically comprise of a copper and/or brass body that contain layered mesh stainless steel screens. These screens distribute the shielding gas evenly around the tungsten electrode, along the weld puddle and the arc to help prevent oxygen contamination that could lead to weld defects. Hence welder can spend more time on welding rather than on rework , which lower weld defects and thus increase productivity.

Gas lenses also allow operator to extend the tungsten electrode further out from the nozzle. This additional electrode extension provides better visibility of the joint and arc, which gives greater torch control and achieve better weld quality especially on critical applications and/or hard-to-reach areas such as “T”, “K” and “Y” joints.

Gas lenses are particularly helpful when TIG welding alloys that are highly reactive to atmospheric contaminants or welding materials which are used in high temperature applications. They can also be used with all types of shielding gases and are available for both air- and water-cooled TIG torches.

Avoiding Overwelding:

Avoiding overwelding can significantly improve the TIG welding efficiency and it can save the money, as well! Overwelding occurs when more weld metal is deposited in a

joint than required to obtain the necessary weld strength. Depositing more weld metal is a result of poor joint-fit up or preparation, improper weld parameters.

Overwelding, unfortunately, wastes shielding gas and filler metal, and it increases welding time. In addition, overwelding increases the heat input into the base material and with it raises the risk of burn-through or distortion that will require costly and time-consuming rework. It may even increase the need for grinding and finishing.

To prevent overwelding, ensure that joints are not larger than necessary to gain the appropriate strength for the application. A good rule of thumb is to make the leg of a fillet weld no wider than the thickness of the thinnest plate and weld accordingly. For example, when joining a 3mm thick plate to a 6mm one, it only needs a 3mm weld bead. Proper joint preparation and close fit-up are also good defenses against overwelding, as is welding vertical down on thinner materials.

Use of suitable tungsten electrode and its shape:

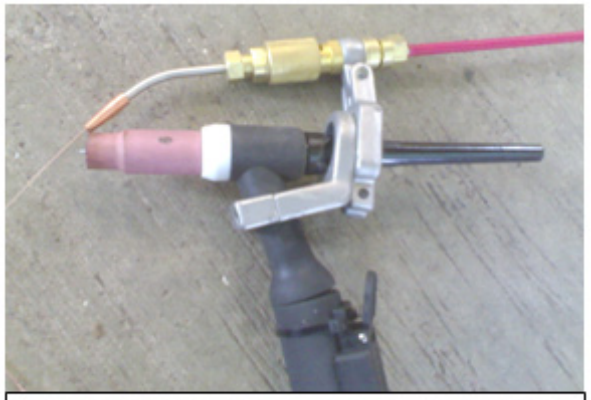
Selection of type of tungsten electrode depends on the kind of power source, as well as on the welding material, but it can have a significant impact on efficiency of welding. So can the shape of the tungsten electrode.

For AC and DC welding using an inverter, a pointed and/or truncated tip (for ceriated, lanthanated and thoriated tungsten) provides the stable arc needed to achieve good welding performance and quality. To achieve this shape (and to prevent contamination or arc wandering) grind the tungsten on a borazon or diamond grinding wheel specially designated for the purpose. Next, grind the taper on the tungsten to a distance of no more than 2.5 times the electrode diameter (for example, with a 3mm electrode, grind a surface 6 to 8 mm long), as this eases arc starting and helps creates a more focused arc.

When welding with lower amperage on thinner materials (those ranging from 0.125mm- to 1.0 mm.), it is best to grind the tungsten electrode to a point. A pointed tungsten electrode allows the welding current to transfer in a focused arc and helps prevent distortion. Pointed ceriated tungsten electrode, in particular, works well when welding aluminum, as it provides 30 to 40 percent more current capacity than pure tungsten before it begins to melt. As a side note, do not use a balled tungsten electrode for such an application. On higher current applications, grinding the tungsten to a truncated tip can help the welding performance by preventing the tungsten from balling. First grind the tungsten electrode to a taper as explained above, then grind a .25 mm- to 0.8 mm flat land on the end of the tungsten electrode.

Use of cold TIG wire feeders:

For long weld runs where filler wire is used for increasing the weld metal deposition, then continuous feeding mechanism will be helpful to improve the efficiency of total welding operation. In such feeding system, filler wire in the form of spool is fed by the wire-feeder and mechanical arrangement for wire guiding is mounted on the TIG torch. The main components in this wire-feeder system are the mechanical drive units, the electrical control systems and the wire guiding parts up to the welding arc.



Wire guiding part arrangement on the TIG Torch

This semi-automatic cold wire-feeder increases TIG welding productivity by eliminating time-consuming arc “stops-and-starts” common with cut-length-rod. It saves 20-40% on filler metal costs because spooled-wire is less expensive than individual cut-length rod, and the unused rod end wastage is eliminated. It reduces process variables with continuous spooled-wire which provides quick and consistent filler metal reliability eliminating the potential weld quality problems associated with unidentified welding alloys.

Conclusion:

Although TIG welding is a slow process, by having some know-how and a bit of practice, it can become more efficient. With help of proper selection of equipment and accessories and taking care about the size of the welds, welding efficiency will improve which in turn will save money in the long run.

Ador Welding Ltd. manufactures and supplies a wide range of TIG welding equipment. Please visit www.adorwelding.com to know about this range. Please also contact cmo@adorians.com for guidance in improving productivity as well as advice with TIG welding applications.

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