Important Considerations Before Purchasing a TIG Welder

Gas Tungsten Arc Welding (GTAW or TIG) has a long list of advantages. However, it may not be the correct process to use in all applications. The following questions may be used as a helpful guide in determining when to use this process.

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Good TIG welds on stainless steel require good arc control. Operator Tony Rennock reports that the Maxstar® 300 DX gives him more control over bead quality, as shown here.

Q: Is TIG welding the best welding process for the job at hand?

A: Here is an example of a possible welding job: A small assembly within a car engine is made of 1/8" aluminum. You would not choose Stick because it is rarely used due to the fumes and poor weld results on aluminum. While MIG could complete the job faster, the welding engineers decided in this case that the precision of the TIG welding process is needed. Are all welding jobs this easy to decide upon? There are many tradeoffs, which leads us directly to consideration number two.

Q: What level of quality is needed for the job at hand?

A: Another factor to consider is weld bead appearance. When manufacturing highly visible consumer products, the choice would be TIG, for its better appearance. Such jobs as nuclear work, piping, and high profile consumer goods often require at least the root pass (the first weld in the pipe joint) to be TIG welded for a good bond. In some cases all the passes on a multi-pass pipe weld may have to be done with TIG, depending upon quality and code requirements.

When appearance or "X-ray" quality are not required, but speed is, MIG welding may be the best choice. This is not to say that MIG is a "poor quality" welding process, it is simply a reference to the generally accepted concept in the welding field that, properly made, a TIG weld will often be a better quality weld than a MIG weld.

Q: What metal thickness is being welded?

A: Suppose an application requires welding wafer-thin bellows at three amps. Selecting a welding machine that goes down to a low enough amperage to accommodate requirements is necessary. Also, when considering welding materials in the five-thousandths inch range, you would not be able to use the common welding processes, MIG or Stick, because they would put too much heat into the metal. However, when welding thick metal, such as 1/2 in., you probably wouldn't consider TIG at all, but rather MIG or Stick, as they can weld 1/2 in. material much faster.

Q: Is a basic machine, or a complex machine, needed to accomplish the welding requirements?

A: Hobbyists with a need to supplement their small MIG machine do not need a sophisticated, high-tech TIG welder. Likewise, when looking for an industrial power source to do automatic welding with external fixturing control and software programming, a hobbyist-type machine would not be appropriate. Decide how much power and sophistication are needed for the job and how much can be afforded, then think beyond the jobs at hand and anticipate what might be welded in the future.

Q: Is an AC/DC power source needed?

A: Aluminum and magnesium are two common metals that are best welded using the AC output from the power source. Steels and stainless steels are most often welded with DC output. To weld a variety of metals use a combination AC and DC machine. Also available are machines with both Constant Current (Stick and TIG) and Constant Voltage (MIG and Flux Cored) welding outputs. A general rule would be: If

This 10 lb. DC TIG/Stick welder provides maximum portability.

your application is strictly TIG, get a TlG-only machine. Get a combination CC/CV only if you are sure you want to do MIG or Flux Cored along with TIG.

Q: Is there a need for portable welding?

A: When buying a machine that will always be in one spot, this may not be a concern. But if the power source will be moved around the shop, or into the field, then a portable welder is needed. There are two basic ways to accomplish portability: inverters and engine-driven welders.

Inverters are now available that weigh about 10 pounds and run on 115 volt and 230 volt current. Inverters are power converters that allow a machine to be smaller and lighter than conventional machines.

Engine-driven machines are used when a welder has no access to primary power for welding. Engine-driven power sources can be used for in-the-field maintenance, pipe welding, or construction work, and many also have power generating capabilities.

Q: Why is welding power source duty cycle important?

A: The duty cycle of a welding power source is the amount of time you can weld at a given output without having to worry about overheating or burning up the power source. In the United States and some other countries, duty cycle is based upon a 10 minute period of time. For example, if a machine is rated at 300 Amps/60% duty cycle, it can weld at 300 amps for six minutes. For the remaining four minutes, the power source needs to idle and cool. The duty cycle for many machines goes up as the amperage goes down.

A typical duty cycle for a hobbyist-type TIG welder would be 20%. An automatic set-up for TIG, on the other hand, can require a 100% duty cycle because of the long weld times possible. Duty cycles of about 40% - 60% are often sufficient for many handheld TIG applications in construction and industry.

Q: When is a “high frequency,” “scratch start,” or other starting method used?

A: Whether welding in the DC EN mode (the normal mode for work on ferrous metal) or the AC mode, the current must flow from the tungsten to the work piece. Starts cause problems because the current first must overcome the resistance of the tungsten.

That is, the current must heat the tungsten so it becomes a better emitter of electrons; at that point, the arc can jump from the tungsten to the work piece. One traditional option for solving DC arc starting problems, and the standard method for improving AC arc starts, involves superimposing a high frequency (HF) current over the welding current. Basically, the HF current forms a path for the welding current to follow and so the arc can be established. Unfortunately, HF interferes with CNC machines, computers and other electronic equipment because its frequency is similar to a radio’s and can be “broadcasted” (one user of continuous HF reported that it affected the accounting computer ... and was changing invoice figures!).

Note that inverter-based TIG machines offer an “HF start only” feature that provides a brief burst of HF at the start of the weld. Inverter-based machines do not experience as much difficulty with arc starts or arc stumbling because the machine

Designed for hobby work, Miller’s Econotig® creates AC and DC arcs for TIG and Stick welding.

operates so quickly. In fact, all good inverters eliminate the need for continuous HF when AC welding on aluminum and other non-ferrous metals.

Other starting methods, such as Lift-Arc,™ have been developed to avoid scratching the electrode. Scratch starts may contaminate the weld with tungsten, but welds made with the Lift-Arc starting method can consistently pass x-ray or ultrasonic tests. Lift-Arc enables the operator to touch the tungsten to the work piece, lift it off the work piece, and then have full welding current begin flowing. With the scratch start method, the electrode is hot the instant it touches metal.

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