Practical WELDING Today®

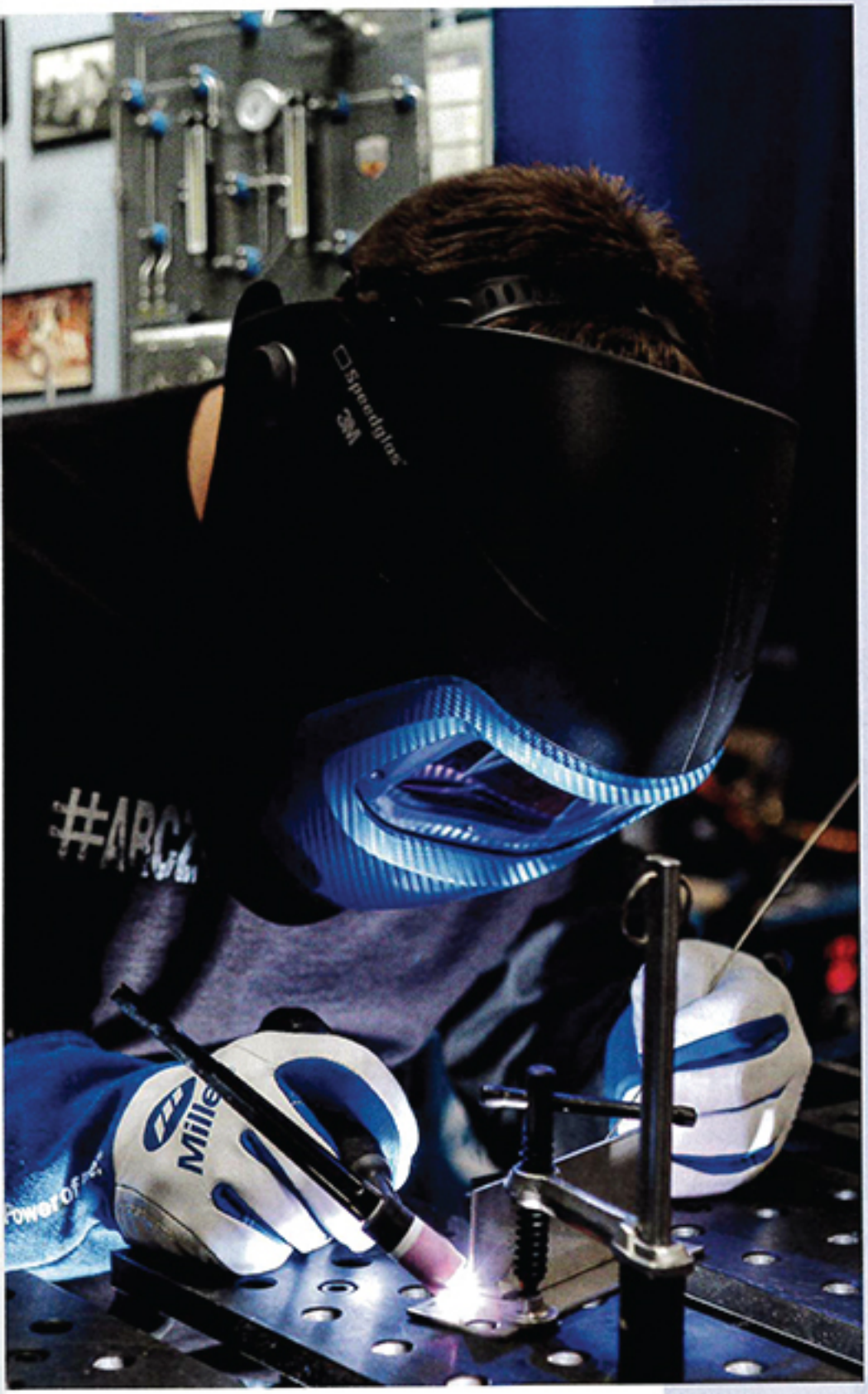
THE REAL WORLD FOR WELDING PROFESSIONALS
March/April 2016

What's inside your GTAW torch?

6 tips for better GTAW results

Can industrial fans and welding mix?

FMA
An official publication of the Fabricators & Manufacturers Association, International®
www.practicalwelding.com



Why shouldn't you scrutinize your GTAW torch components in the same way that you or someone else would scrutinize your welds? If your GTAW torch doesn't pass inspection, there's a good chance that your welds won't either.

What's inside your GTAW torch?

What you don't know about torch components could hurt your weld

By Jim Watson

The gas tungsten arc welding (GTAW) process, also known as tungsten inert gas welding, was developed in Southern California in the early 1940s and patented in 1942 by Russell Meredith of Northrop Aircraft Corporation. The process allowed fabricators to join light alloys used in aircraft manufacturing and provided a consistent, inexpensive way to quickly achieve high-quality welds.

The Linde Division of Union Carbide Corporation bought the rights to the GTAW patent and developed a variety of heliarc torches, so named for their use of helium as a shield gas, a term still in use today. In the 1960s and 1970s, when many of the original patents expired on the welding process and the torch designs, several companies began making GTAW torches, adding their own improvements and design innovations along the way.

One Southern California company began by repairing used GTAW torches that had been scrapped by the local aircraft manufacturers. They did this by burning off the hard plastic molding, repairing the torch body, and then remolding the torch with high dielectric silicone rubber, making it less apt to arc out, a common problem caused by the use of high-frequency current in starting the arc.

Another improvement to the initial GTAW torch design was using state-of-the-art conductive materials like tellurium copper, silver brazing alloys, and high-performance silicone rubber to insulate electrically conductive parts. Those improvements minimized the loss of electric current, a problem that can result in inconsistent arc starts and difficulty in controlling the welding arc, particularly on thin material and areas where you need finite power inputs to achieve bead and edge control.

Other developments included precision-machined component parts, advanced injection molding processes, and new water and gas cooling technology—all changes that improved the performance of the torch by minimizing resistance and maximizing current-carrying capacity. Present-day GTAW torches are smaller, lighter, and more ergonomic, which reduces fatigue for fabricators.

Throughout the 1980s and 1990s many companies began to outsource the manufacture of GTAW torches to China, placing value on lowering production costs by using lower-quality materials and employing cheap, unskilled labor. In many instances, this move hurt torch performance and ultimately the quality of the weld.

The bottom line is that if you are welding precision parts, welding in aerospace, food process piping and other sanitary applications, or performing any kind of high-purity GTAW work, you'll need to make an investment in good tools that will help you achieve consistent welds that pass visual and technical inspection.

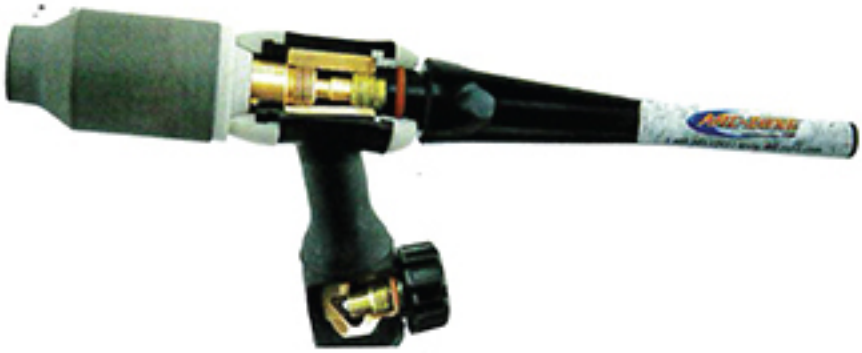


FIGURE 1
A portion of this air-cooled GTAW torch has been cut away to show the head component assembly and the valve design. Note the precision-machined parts.

Checking Your GTAW Torch

When choosing a GTAW torch, simply inspect the componentry to help you determine if it is built to last or if it isn't.

Lead sets. A telltale sign of a poorly constructed lead set is improperly installed current nipples, which can cause inconsistent electric current or complete loss of current.

Crimped hoses. Poorly crimped hoses can cause inconsistent flow, gas leaks, and water leaks. If your torch has bare copper cable material, be aware that the material rapidly deteriorates, leading to contamination and restriction of the water flow passages within the GTAW torch and the cooling system. Additionally, poor-quality rubber hose material can actually leach atmosphere into the weld zone and cause porosity in the weld.

Machined parts. Subpar torches typically contain poorly machined parts and are made with lower-quality metals. This can result in myriad problems, including poor fit, decreased conductivity, gas leakage, and gas contamination (see **Figure 1**).

Insulation materials. A precision-manufactured GTAW torch is made with quality insulating materials like silicone, rubber, and glass-filled Teflon® rather than generic rubber or virgin Teflon. Higher-quality insulating materials are less prone to high-frequency leakage, arcing out, and failing.

In all, you need to look for dissimilar or lower-quality metals, poorly machined parts, improperly brazed joints, inferior insulating materials, low-cost cable and hose material, and poor construction of insulating handles and back caps. You're more likely to experience premature torch failure, loss of electric current, inconsistent gas and water flow, gas and water leaks, increased gas usage, overheating, poor arc start, and poor weld quality.

Preweld GTAW Torch Check List, Other Tips

Even if you have a top-quality GTAW torch, you'll want to make sure you do a preweld check before embarking on any high-purity welding.

- Inspect your torch for any obvious defects that could hinder its performance (see **Figure 2**).
- Test all mechanical connections to ensure they are tight.
- Leak-test all gas connections from the flowmeter to the back cap on the GTAW torch to ensure there are no gas leaks, minimizing the opportunity to draw atmosphere into the weld zone. You can use an off-the-shelf gas leak tester or you can mix dish soap and water and apply the solution liberally to every mechanical connection, including hose ferrules and flowmeter components. If there are signs of any bubbles, you know you have a leak.
- Test water flow rates by removing the torch's water-return line. Drop the line into a bucket, start the water cooler or welding machine if they are in

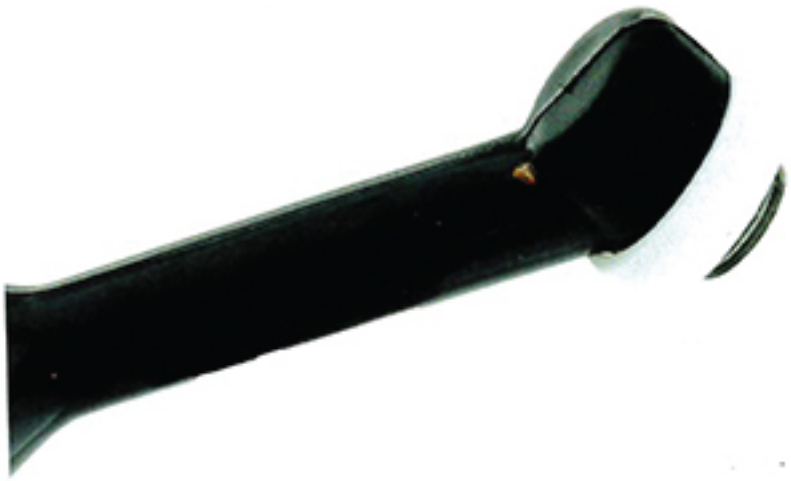


FIGURE 2
Not all torch problems are hidden by its casing. This brand-new GTAW torch has an exposed copper tube, proving why it's important to visually inspect your torch before you use it.

series, and time the flow rate. Water-cooled GTAW torches require 1 quart of flow per minute, and the line pressure should be maximum 45 PSI.

• Verify gas flow rates with a shielding gas flow tester at the gas nozzle (cup) to confirm that the flow matches the desired settings of your flowmeter or weld parameters.

• Ensure that there are no kinks or tight bends in the water and gas supply hoses, which may reduce or restrict gas and water flow.

• Install a gas lens collet body for all applications. Doing so will allow the torch to run cooler, help the tungsten electrode to last longer, and give you a better-quality weld using less shielding gas.

• Use a medium or short back cap whenever possible. Long caps are convenient because you can use a 7-in. tungsten, but long caps can cause your shield gas flow to be inconsistent.

• Bundle the hoses and power cables in a protective cable cover to prevent them from becoming tangled up or damaged.

• Use high-quality front-end consumables from a reputable supplier.

• Use only verified high-quality tungsten electrodes.

• Prepare your tungsten tips using a dedicated grinder with a diamond wheel.

Jim Watson is founder and CEO, Arc-Zone.com Inc.®, 760-931-1500, www.arc-zone.com.