

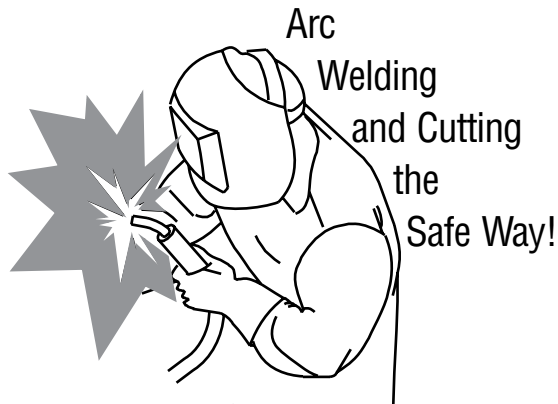


**Topic 11.**

**Welding Process Training Series**

# **Troubleshooting Welding Processes**

# SAFETY



As in all occupations, safety is paramount. Because there are numerous safety codes and regulations in place, we recommend that you always read all labels and the Owner's Manual carefully before installing, operating, or servicing the unit. Read the safety information at the beginning of the manual and in each section. Also read and follow all applicable safety standards, especially ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes.

ANSI Z49.1: Safety in Welding, Cutting, and Allied Processes is available as a free download from the American Welding Society at: <http://www.aws.org>

Here is a list of additional safety standards and where to get them.

*Safe Practices for the Preparation of Containers and Piping for Welding and Cutting*, American Welding Society Standard AWS F4.1, from Global Engineering Documents (Phone: 1-877-413-5184, website: [www.global.ihs.com](http://www.global.ihs.com)).

*National Electrical Code*, NFPA Standard 70, from National Fire Protection Association, Quincy, MA 02269 (Phone: 1-800-344-3555, website: [www.nfpa.org](http://www.nfpa.org) and [www.sparky.org](http://www.sparky.org)).

*Safe Handling of Compressed Gases in Cylinders*, CGA Pamphlet P-1, from Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151 (Phone: 703-788-2700, website: [www.cganet.com](http://www.cganet.com)).

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 5060 Spectrum Way, Suite 100, Ontario, Canada L4W 5N5 (Phone: 800-463-6727, website: [www.csa-international.org](http://www.csa-international.org)).

*Safe Practice For Occupational And Educational Eye And Face Protection*, ANSI Standard Z87.1, from American National Standards Institute, 25 West 43rd Street, New York, NY 10036 (Phone: 212-642-4900, website: [www.ansi.org](http://www.ansi.org)).

*Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, NFPA Standard 51B, from National Fire Protection Association, Quincy, MA 02269 (Phone: 1-800-344-3555, website: [www.nfpa.org](http://www.nfpa.org)).

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, from U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 (Phone: 1-866-512-1800) (There are 10 OSHA Regional Offices—phone for Region 5, Chicago, is 312-353-2220, website: [www.osha.gov](http://www.osha.gov)).

Booklet, *TLVs, Threshold Limit Values*, from American Conference of Governmental Industrial Hygienists (ACGIH), 1330 Kemper Meadow Drive, Cincinnati, OH 45240 (Phone: 513-742-3355, website: [www.acgih.org](http://www.acgih.org)).

*Towing a Trailer – Being Equipped for Safety*, Publication from U.S. Department of Transportation, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, D.C. 20590

U.S. Consumer Product Safety Commission (CPSC), 4330 East West Highway, Bethesda, MD 20814 (Phone: 301-504-7923, website: [www.cpsc.gov](http://www.cpsc.gov)).

*Applications Manual for the Revised NIOSH Lifting Equation*, The National Institute for Occupational Safety and Health (NIOSH), 1600 Clifton Rd, Atlanta, GA 30333 (Phone: 1-800-232-4636, website: [www.cdc.gov/NIOSH](http://www.cdc.gov/NIOSH)).

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## WARNING

This document contains general information about the topics discussed herein. This document is not an application manual and does not contain a complete statement of all factors pertaining to those topics.

The installation, operation, and maintenance of arc welding equipment and the employment of procedures described in this document should be conducted only by qualified persons in accordance with applicable codes, safe practices, and manufacturer's instructions.

Always be certain that work areas are clean and safe and that proper ventilation is used. Misuse of equipment and failure to observe applicable codes and safe practices can result in serious personal injury and property damage.

# Troubleshooting Welding Processes

## Welding Process and Filler Metals Training Series:

Welcome to the Welding Process and Filler Metals Training Series. This training series was developed for the purpose of providing a basic set of educational materials that can be used individually or in a classroom setting.

The topics covered in the series are:

### Welding Processes

- Topic 1. Introduction To Welding
- Topic 2. Welding Safety
- Topic 3. Basic Electricity For Welding
- Topic 4. Welding Power Source Design
- Topic 5. Engine Driven Power Sources
- Topic 6. Shielded Metal Arc Welding
- Topic 7. Gas Tungsten Arc Welding
- Topic 8. Gas Metal Arc Welding
- Topic 9. Flux Cored Arc Welding
- Topic 10. Plasma Arc Cutting And Gouging
- Topic 11. Troubleshooting Welding Processes
- Topic 12. Submerged Arc Welding

### Filler Metals

- Topic A. Introduction To Metals
- Topic B. Tubular Wires
- Topic C. Low Alloy Steel
- Topic D. Stainless Steel
- Topic E. Aluminum
- Topic F. Hard Surfacing

Please note, this series was not developed to teach the skill of welding or cutting, but rather to provide a foundation of general knowledge about the various processes and related topics.

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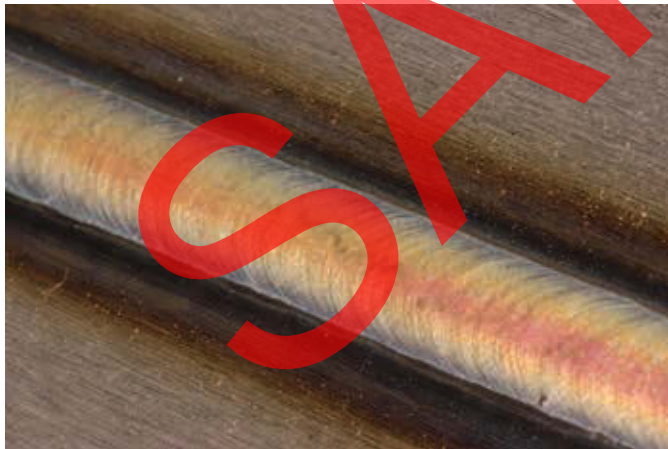




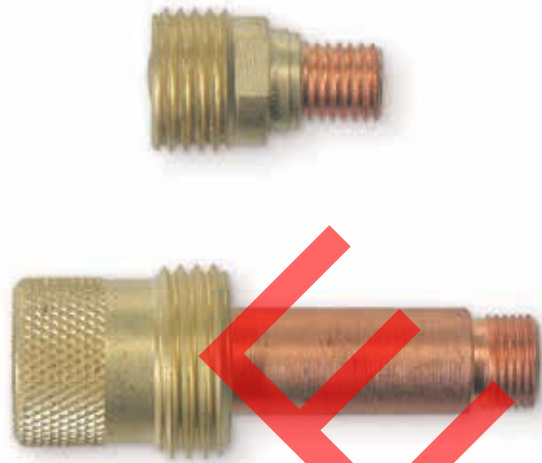
**Figure 18 – Erratic Gas Flow On A Collet Body (Left)  
Smooth Directed Gas Flow Of A Gas Lens (Right)**

In GTAW, adequate gas coverage is very important to ensure that the weld pool is adequately protected from atmospheric contamination. Too often, a nozzle that is too small is chosen to produce a “small” weld. The smaller the diameter of the nozzle, the smaller the gas envelope is to adequately shield the weld pool. The discoloration often referred to as “blueing” or “straw color” on stainless steel, for example, is simply an indication of what the surface temperature was when the shielding gas was removed and the base metal became oxidized as it was exposed to the atmosphere (Figure 19). Using a gas lens, for example, helps to ensure adequate coverage of the material and weld pool to minimize any oxidization on the surface (Figure 18).

All connections and hoses can be checked with a soapy water solution to locate gas shielding leaks. Remember, gas connections and hoses downstream from the gas valve have to be checked with the gas flowing – use the purge function on the wire feeder.



**Figure 19 – Coloring Of A Stainless Steel Weld, Note The Coloring Indicates The Temperature Of The Surface When The Inert Shielding Was Removed And Is Essentially A Layer Of Oxidation (This Is An Acceptable Level Of Oxidation)**



**Figure 20 – Gas Lens For A 250A Water-Cooled Torch (Top)  
And A Gas Lens For A 150A Air-Cooled Torch (Bottom)**

### Gas Supply And Delivery Checklist



**Always read and follow the Owner's Manual, the safety labels on the product, and all applicable safety standards, especially ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes.**

- Check o-rings on inlet connection (Figure 15 on page 10).
- Check to be sure the gas line on a GTAW torch is not being kinked. (The wheels of a chair tend to cut off the gas flow or someone is standing on the hose.)
- Ensure there is an adequate gas supply.
- Check for proper flow rate adjustment for the process being performed.
- Use a leak-check solution to determine if there are leaks at any connections.
- Inspect all hoses for any leaks (which can be as small as a pinhole).
- Verify diffuser gas ports or gas lenses are clear of spatter.
- Ensure the nozzle is clean and spatter-free.
- Use a nozzle that is sized to ensure that the weld pool is properly shielded from atmospheric contamination.

# Troubleshooting Welding Processes

## Troubleshooting SMAW Systems

Figure 22 shows the typical maintenance schedule for a Shielded Metal Arc Welding System. SMAW systems do not require as many intricate components to perform the process making maintenance fairly simple. Cable conditions and connections are the biggest source of problems in any SMAW system.

The majority of SMAW problems can be avoided if the initial setup of the welding system is correct. We are assuming that a qualified electrician has properly installed the primary power and correctly set any jumper links present in the welding power source. Differences can be expected when SMAW welding with different welding power sources that may be capable of performing multiple welding processes.

When troubleshooting any welding system, always check the primary power first. If the welding power source is not getting the proper input power, or if the jumper links (if applicable) are not configured to match the supplied primary power, the problem may be a faulty primary fuse or circuit breaker. Have a qualified electrician check this out. A faulty welding power source could have caused the primary fuse to open or the circuit breaker to trip.

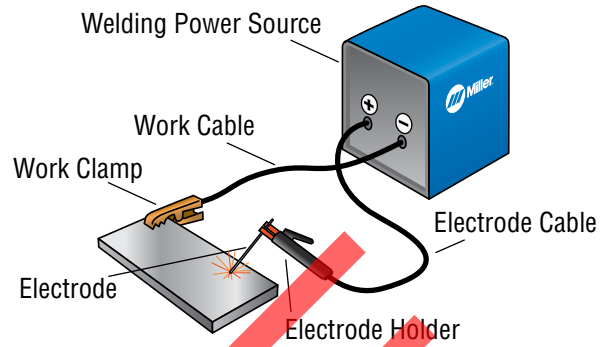


Figure 21 – SMAW System

If the primary power is okay, refer to the troubleshooting section of the owners manual for that specific piece of equipment. Figure 24 shows a typical troubleshooting chart for an SMAW power source. Use the troubleshooting table of the owner's manual to find the remedy for the trouble you are experiencing.

### SMAW System Routine Maintenance

<b>Disconnect power before maintaining.</b>				
✓ = Check    ◇ = Change    ● = Clean    △ = Repair    ☆ = Replace * To be done by Factory Authorized Service Agent				
Every 3 Months	 ☆ Unreadable Labels	 ● Weld Terminals	 ☆ Damaged Gas Hose	
	 ☆ Damaged Weld Cables	 ☆ Damaged Cords	 ☆ Damaged Torch Cable	
Every 6 Months	 ● Inside Unit			
<b>Do not remove case when blowing out inside of unit.</b>				

Figure 22 – Typical SMAW Welding System Routine Maintenance Schedule