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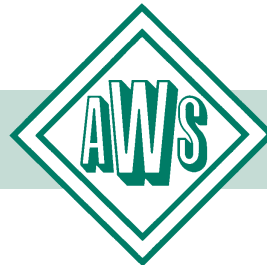
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The Professional's Advisor
on
**Arc Welding
Power Sources
and Related
Equipment**



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Introduction

This *Professional's Advisor on Arc Welding Power Sources and Related Equipment* is intended to be a primer on the subject. It is organized in a systematic approach. Common arc welding processes are covered, starting at the arc, its users, environmental safety, and power source to the primary power supply. The common arc welding processes that will be covered are Shielded Metal Arc Welding, Gas Tungsten Arc Welding, Gas Metal Arc Welding, Flux Cored Arc Welding and Carbon Arc Cutting-Air (gouging). The welding processes covered account for approximately 90% of the deposited weld metal used in production. The focus of this document is intended for arc welding equipment/process specifiers, supervisors, set-up and maintenance personnel. It is not presented as a design or engineering document, but as a reference for application in the Construction, Manufacturing, and Maintenance/Repair industries.

Chapter 1—Basic Safety Precautions

As with any industrial process welding has certain hazards that must be guarded against. Welding should not be undertaken by anyone other than highly knowledgeable and skilled personnel.

Safety should be focused on those individuals that are exposed most directly to the hazards involved, namely the welder and those in the general vicinity of the welding operation. Warning labels on the equipment are a reminder of hazards. Figure 1 is an example of how one manufacturer uses warning labels and an educational statement directly on their products.

All of the arc welding and cutting processes covered use electricity as a source of energy. Thus electrical safety is a principal concern. All of these welding processes are popular because of their ability to deposit or remove great amounts of material. Due to the high energy levels, noise, fumes and flying hot metal and slag present additional safety concerns. A number of these processes use external shielding gases, generally supplied in high-pressure cylinders, and these pose additional hazards.

Electric shock can cause sudden death. Injuries and fatalities from electric shock in welding and gouging operations can occur if proper precautionary measures are not followed. These shocks occur when an electric current of sufficient magnitude to create an adverse effect passes through the body. The severity of the shock depends mainly on the amount of current, the duration of flow, the path of flow, and the state of health of the person. The amount of current caused to flow is determined by the applied voltage and the resistance of the body path. The frequency of the current may also be a factor when alternating current is involved.

Since voltage is required to push the current through the body path, the lower the voltage, the safer the operation. OSHA dictates the correct voltage

for the arc welding processes—Table 1 gives the maximum open circuit voltage of various power sources for various types of applications. (Note that it takes into account the frequency concern by reducing the voltage rms to 80 for alternating current machines being used in the manual or semiautomatic mode.) As can be seen, the secondary voltage is kept low. However, on the primary side of the power source the voltages can range from 120–600 volts. Equipment must be properly installed, used and maintained. Most electric shock in the welding industry occurs as the result of accidental contact with bare or poorly insulated conductors, operating at such voltages. Installation should be done by qualified personnel and follow all applicable codes. The manufacturer's installation instructions are a good source of information.

Welders can best protect themselves by having a good understanding of the processes being used and proper equipment operation. The welder should be familiar with the following:

- (1) Keep the voltage as low as possible.
- (2) Have insulation between body contact with any conductive surface (dry gloves, proper clothing, rubber-soled shoes, rubber mats or dry wooden boards).
- (3) Attach the work connection as close to the arc area as practical (never through gears, bearings, chains, wire rope, hoists, elevators, or any other surface where an improper path for the welding current can be produced). Figure 2 is an example of the electrical ground becoming an improper path for the welding current.
- (4) Be aware of current type (AC-DC), the polarity electrode negative (EN), and electrode positive (EP). Figure 3 shows an application where two different processes are being used on the same work piece.