

34—Welding and Cutting

Most welding and cutting processes—for construction, demolition, maintenance, and repair—use portable, manually operated equipment. The major portion of this chapter discusses ways of minimizing the hazards encountered in this type of intermittent operation. Since production line welding and cutting equipment is usually permanently installed, the source of hazards can be minimized through safe design. The safety professional, however, can use this chapter to help him check the operation and maintenance of production line equipment.

The detailed specifications of ANSI Standard Z49.1, *Safety in Welding and Cutting*, should be followed. In addition, city, state, and Federal codes and regulations, where applicable, should be consulted.

This chapter uses the American Welding Society's welding and cutting definitions.

A **WELDER** is "one who is capable of performing a manual or semiautomatic welding operation."

A **WELDING OPERATOR** is "one who operates machine or automatic welding equipment."

Gas Welding and Oxygen Cutting

A gas-welding process unites metals by heating them with the flame from the combustion of a fuel gas or gases and sometimes includes the use of pressure and a filler metal.

An oxygen-cutting process severs or removes metal by the chemical reaction of the metal with oxygen at an elevated temperature maintained with heat from the combustion of fuel gases. In the powder-cutting process, a finely divided material, such as iron powder, is added to the cutting oxygen stream. The powder bursts into flame in the oxygen stream and starts cutting without preheating the material to be cut. Powder cutting is used on stainless and other steels, on many nonferrous metals, and on concrete in construction and demolition jobs. Plasma arc cutting is now replacing powder oxy-fuel cutting.

Welding and cutting gases

Oxygen is furnished to the consumer in steel cylinders, usually under a pressure of about 2200 psi at 70 F, or as a liquid to be gasified on the consumer's premises.

Pure oxygen will not burn or explode. It supports combustion, that is, it causes other substances to burn when they are raised to the kindling temperature. Combustible materials burn much more rapidly in oxygen than in air. Oxygen forms explosive mixtures in certain proportions with acetylene, hydrogen, and other combustible gases.

Acetylene (C_2H_2) consists of 92.3 percent by weight of carbon and 7.7 percent by weight of hydrogen in chemical combination. It contains stored-up energy which is released as heat when it burns, as in the welding flame. This heat is in addition to that which would be obtained by combustion of equivalent amounts of elemental carbon and hydrogen.

Acetylene burned with oxygen can produce a higher flame temperature (approximately 6000 F) than any other gas used commercially. Acetylene, like other combustible gases, ignites readily, and in certain proportions forms a flammable mixture with air or oxygen. The range of flammable limits of acetylene (2.5 to 81 percent acetylene in air) is greater than that of other commonly used gases, with consequently greater hazard.

Acetylene is either supplied in cylinders or generated as needed. It is a product of the reaction between water and calcium carbide, a gray crystalline substance made commercially by fusing lime and coke in an electric furnace. Calcium carbide itself is neither flammable nor explosive. It is stored and sold in airtight and watertight cans or drums. If the drums are damaged in handling and if water comes in contact with carbide, acetylene will be generated and there is then danger of ignition and explosion.

Hydrogen is furnished in cylinders under a pressure of about 2000 psi at 70 F. It may ignite in the presence of air or oxygen when in contact with a spark, open flame, or other source of ignition. Hydrogen-air mixtures in the range from 4.1 to 74.2 percent hydrogen are flammable.

Other fuel gases are used with oxygen in torches, primarily for oxygen cutting. For example, propane, butane, and their mixtures are supplied in cylinders in liquid form, generally under various trade names. These gases