

Welding and Cutting

or not the base metal is coated with such materials as tar, paint, lead, or zinc. Gases—the oxides of nitrogen, carbon monoxide, ozone—and metallic dusts and fumes may, in varying degrees, present inhalation hazards if adequate respiratory protection is not provided.

ASI Standard Z49.1, *Safety in Welding and Cutting*, gives specifications for local exhaust systems, general ventilation, and health protection of workers on various types of welding and cutting. The following discussion is based on this standard, which should be consulted for further information.

In open-air welding or cutting or in large, well-ventilated areas, where clean carbon steel is welded or cut with bare or coated carbon-steel electrodes and without inert-gas shielding, minimum health hazards exist.

In confined areas, such as tanks, pressure vessels, and holds of ships, local exhaust or general ventilation systems should be provided to maintain concentrations of toxic gases, fumes, or dusts below maximum allowable concentrations (MAC) as defined in ASI Standard Z37 Series "Allowable Concentrations of Toxic Dust and Gases," or below threshold limit values (TLV) specified by the American Conference of Governmental Industrial Hygienists. For a complete discussion, see Chapters 41 and 42, "Industrial Hygiene" and "Elements of Industrial Toxicology."

If gases, dusts, and fumes cannot be kept below the MAC or TLV because work is intermittent or for other reasons, welders should wear respiratory protective equipment approved for the exposure by the U.S. Bureau of Mines. Where oxygen is also deficient, self-contained breathing apparatus or hose masks with blowers are necessary.

Coatings, fluxes, and base metals. When welding or cutting involves coatings or fluxes containing base metals that contain elements such as zinc, fluorine, beryllium, lead, or cadmium, and their compounds, local exhaust removal or general ventilation should be provided to maintain the concentration of any toxic fume generated below the MAC or TLV. Outdoor welding and cutting involving lead, mercury, and cadmium require that the worker wear respiratory protective equipment.

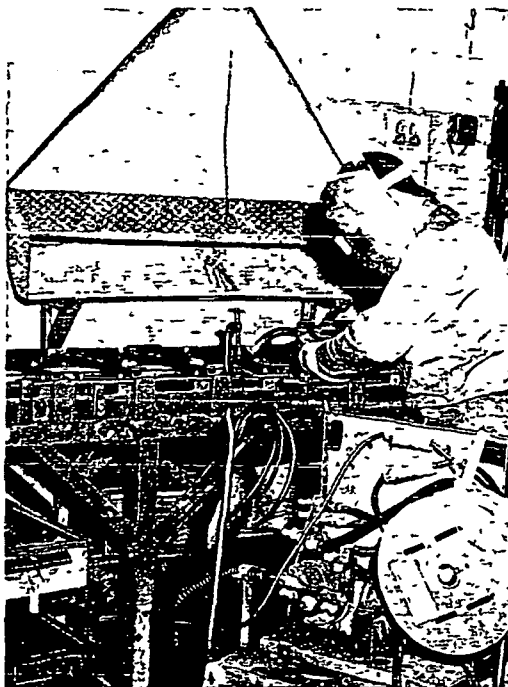


FIG 31-11 — Local exhaust for gas welding

Courtesy Automatic Electric Co.

Generation of gases and fumes. Oxides of nitrogen from the high-temperature combination of nitrogen and oxygen in the air are always generated near the welding or cutting arc. An inert gas shield, however, minimizes the introduction of air to the arc. Concentrations of these oxides are generally above their MAC or TLV within a few inches of the arc, but are diluted rapidly by air movements. Local exhaust or general ventilation should be used to keep the concentrations of oxides of nitrogen within safe limits.

Ozone—a triatomic form of gaseous oxygen, chemically designated by the symbol O_3 —is formed by ultraviolet radiation acting on oxygen in air. It is a highly toxic and irritating gas. Since ultraviolet radiation passes through the air, ozone may be formed several feet from the welding or cutting arc. The amount of ozone formed depends on the metal and the gas shield being used and the arc temperature. A greater amount of ultraviolet is produced with argon gas shield than with helium. General ventilation will usually