

Chapter 11 WELDING SAFETY

General

There are many methods of electric and gas welding which present different hazards. Various hazards exist from fumes and gasses generated depending upon the chemical composition of the materials being used, the concentration of contaminants at the worker's breathing zone, duration of exposure. Fire hazards exist both on premises and in the field, especially at elevated levels.

Purpose

This guideline identifies some of the hazards and establishes policy in preventing injuries and illnesses due to welding hazards. All supervisors and welders should be properly trained and only those individuals who are certified for various welding techniques are permitted to weld.

Personal Protective Equipment

Proper personal protective equipment must be used at all times when welding. Leather aprons, welding gloves, respirators, and welding helmets are provided, and must be used at all times.

First-Aid Equipment.

First-aid equipment shall be available at all times. All injuries shall be reported as soon as possible for medical attention. First aid shall be rendered until medical attention can be provided.

Ventilation

Sign Designs has provided welding areas with high ceilings, proper ventilation, and the ability to weld using open air both inside and outside. Proper personal protective equipment must be used at all times. Welding should not be performed on offsite locations unless proper ventilation is provided or proper personal protective equipment is used.

Safety Guidelines

Only operate welding equipment you have been trained to use. Know what the substance is that is being welded and any coating on it. Take proper precautions.

Authorization. Before cutting or welding is permitted, the area shall be inspected by the individual responsible for authorizing cutting and welding operations. The individual shall designate precautions to be followed in granting authorization to proceed in the form of a written permit.

Make sure a fire extinguisher is near for immediate use. Check the area before welding to be sure no flammable material or degreasing solvents are in the welding area. Do not weld within 35 feet of a flammable material or where wall, or floor openings within a 35-foot (10.7 m) radius expose combustible material in adjacent areas including concealed spaces in walls or floors, or where combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are likely to be ignited by conduction or radiation. All flammable materials must be moved to a safe distance prior to welding. If it

is not possible to move the welding site or flammable material, then take proper precautions to assure safety before welding by using proper shielding. Use spark catchers when working at elevations. Always use a fire watcher who is properly trained in the use of extinguishing equipment. If it is not possible to secure the welding area do not weld. Familiarize yourself with facilities and local alarm equipment in the event of a fire. When the job is complete, inspect the area to be sure there are no smoldering materials. Fire watchers should remain onsite for at least ½ hour after welding is complete. Deposit all scraps and electrode butts in proper waste containers to avoid fire and toxic fumes.

Do not weld within 200 feet of a degreasing solvent. Deadly phosgene gas is produced by welding near degreasing solvents.

Wear protective clothing to cover all exposed areas of the body. Wear leather aprons, closely woven clothing, long socks, gloves. Welder's helmet, respirators when necessary, and proper footwear. Tennis shoes are never permitted.

If others are working in the area be sure they are warned of the arc and protected against arc, fumes, sparks and other welding hazards.

Confined Spaces. As used herein confined space is intended to mean a relatively small or restricted space such as a tank, boiler, pressure vessel, or small compartment of a ship.

Ventilation. Ventilation is a prerequisite to work in confined spaces.

Securing cylinders and machinery. When welding or cutting is being performed in any confined spaces the gas cylinders and welding machines shall be left on the outside. Before operations are started, heavy portable equipment mounted on wheels shall be securely blocked to prevent accidental movement

Lifelines. Where a welder must enter a confined space through a manhole or other small opening, means shall be provided for quickly removing him in case of emergency. When safety belts and lifelines are used for this purpose they shall be so attached to the welder's body that his body cannot be jammed in a small exit opening. An attendant with a preplanned rescue procedure shall be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.

Electrode removal. When arc welding is to be suspended for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders carefully located so that accidental contact cannot occur and the machine disconnected from the power source.

Warning sign. After welding operations are completed, the welder shall mark the hot metal or provide some other means of warning other workers.

Gas cylinder shutoff. In order to eliminate the possibility of gas escaping through leaks of improperly closed valves, when gas welding or cutting, the torch valves shall be closed and the fuel-gas and oxygen supply to the torch positively shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time, such as during lunch hour or overnight. Where practicable the torch and hose shall also be removed from the confined space.

Electric Arc

Before starting work, be sure the electrode is clear of any conductor. Keep yourself insulated from ground or metal when changing electrodes. Be sure all connections or leads are in place. Leads should be insulated. At completion of work, shut machine off and disconnect at the power source. Never look at a flash, even for an instant. Your eyes can be severely damaged by the infrared rays.

Workmen designated to operate or maintain arc welding equipment shall have been properly instructed and qualified to operate such equipment. Workmen assigned to operate or maintain arc welding equipment shall be acquainted with the requirements of this OSHA Standards 1910.252 (a), (b), and (c); if doing gas-shielded arc welding, also Recommended Safe Practices for Gas-Shielded Arc Welding, A6.1-1966, American Welding Society.

Maintenance. The operator should report any equipment defect or safety hazard to his supervisor and the use of the equipment shall be discontinued until its safety has been assured. Repairs shall be made only by qualified personnel.

Machines which have become wet shall be thoroughly dried and tested before being used. Cables with damaged insulation or exposed bare conductors shall be replaced. Joining lengths of work and electrode cables shall be done by the use of connecting means specifically intended for the purpose. The connecting means shall have insulation adequate for the service conditions

Acetylene & Oxygen

Apparatus. Only approved apparatus such as torches, regulators or pressure-reducing valves, acetylene generators, and manifolds shall be used.

Personnel. Workmen in charge of the oxygen or fuel-gas supply equipment, including generators, and oxygen or fuel-gas distribution piping systems shall be instructed and judged competent by their employers for this important work before being left in charge. Rules and instructions covering the operation and maintenance of oxygen or fuel-gas supply equipment including generators, and oxygen or fuel-gas distribution piping systems shall be readily available.

Storage. Cylinders shall be kept away from radiators and other sources of heat. Inside of buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location, at least 20 feet from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage spaces shall be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons. Cylinders shall not be kept in unventilated enclosures such as lockers and cupboards.

Oxygen under pressure reacts violently with grease or oil. Keep oxygen away from grease and oil and never handle oxygen bottles, valves, regulators, hose or other fittings with oily hands, gloves or tools. If there is a leak in oxygen or gas cylinder take it outside and slowly release gas. Close cylinder valve as soon as work is finished or when taking a break for any period of time. When cylinders are emptied, close the valve, replace the protective cap and mark the cylinder "MT." The valve on the acetylene cylinder should never be opened more than one and one-half turns. Make sure gas systems have check valves to prevent backflow into the fittings and that couplings are secure.

HIGH VOLTAGE

Electrodes

Source:	live electrode
effect:	burns, shocks, electrocution
control:	cover electrodes, keep splices in safe condition; no welding in wet conditions

FUMES

control: local exhaust ventilation; wear an approved NIOSH respirator if in confined area.
See a physician if overexposure to welding fumes is suspected.

Antimony

source: antimony-lead solder
effect: irritates skin and eyes; headache and vomiting.

Brass

source: welding; lead and copper alloy
effect: dermatitis; metal-fume fever; see also copper and lead effects

Cadmium

source: paint, some silver solders, filler materials for welding
effect: irritates skin and mucous membranes; gastroenteritis (stomach pain), lung irritation, chest pain, bronchitis, fluid in lungs, chills with fever

Chromium

source: adhesives, cement, paint, metal coating and stainless steel
effect: bronchitis, skin ulcers, nose and nasal passage irritant

Copper

source: cutting, soldering of copper pipe
effect: irritates nose and throat; metal-fume fever

Cobalt

source: welding fumes and grinding dusts
effect: irritates skin; can damage lungs, liver, kidneys; metal-fume fever

Iron

source: welding on iron or steel, scraping iron or steel
effect: metal-fume fever

Lead

source: pipe joints, paints, demolition and remodeling
effect: abdominal pain, headache, muscular aches, weakness, central nervous systems and kidney damage, anemia, effects on bone marrow; metal-fume fever and impotency

Magnesium

source: welding fumes and grinding dust
effect: metal-fume fever

Manganese

source: welding electrodes
effect: increased levels of manganese in blood and urine; chronic manganese poisoning; headache, apathy, sexual impotence, speech disturbances, slowed reflexes and effects on central nervous system

Nickel

source: welding fumes and grinding dust
effect: giddiness, headache, shortness of breath, vomiting; lung inflammation with fever; muscular disorders; long-term exposure can lead to cancer of the nasal sinuses and respiratory passages

Tin

source: welding fumes and grinding dust
effect: metal-fume fever

Zinc

source: soldering or welding zinc coated or galvanized metal; paint pigment
effect: irritation of respiratory tract, dryness of throat, dry cough, malaise, headache, nausea, severe chills with fever, pain in limbs, sweating; metal-fume fever

Aluminum

source: cans, cars, bicycles, trucks; aluminum powder can be found in many different paints.
effect: if exposed to a high concentration of aluminum powder coughing and mild irritation may occur.

VAPORS

source: degreaser solvents; ultraviolet rays in welding can decompose degreasing solvents forming highly toxic gases.
effect: phosgene is a highly toxic gas which can cause death. Initial effects are irritation to skin, eyes, nose, throat, and chest; dizziness and chills. Delayed effects: 2 to 24 hours after exposure, outpouring of fluid into air sacs of lungs. **Can be fatal.**
control: good ventilation; protective clothing; **do not weld near degreasing operation as toxic gases can be formed when degreasing solvents are exposed to strong ultraviolet light from welding.**

GASES

Note: When welding in any confined area a respirator should always be used.

Acetylene

source: gas used in oxyacetylene welding
effect: rapid breathing, loss of coordination; high concentration can cause suffocation
control: good local exhaust ventilation

Arsine

source: possible contaminant of commercial acetylene
effect: anemia (breakdown of red blood cells); jaundice, pulmonary edema, irritates eyes, nose, skin and lungs
control: good local exhaust ventilation

Carbon Dioxide

source: welding by-product
effect: headache, dizziness, nausea, vomiting; in high concentrations symptoms of suffocation, eventually unconsciousness and suffocation
control: good local exhaust ventilation

Carbon Monoxide

source: incomplete burning of organic materials (gasoline, paper, diesel, or wood)
effect: headache, dizziness, concentration problems; in very high concentrations coma and death

control: good local exhaust ventilation

Carbonic Acid

source: in a damp atmosphere carbon dioxide combines with water vapor
effect: irritates eyes, skin and mucous membranes
control: good general ventilation and dry work conditions

Nitrogen Dioxide

source: welding by-product
effect: irritates nose, throat, lungs; causes headache, chest pain, drowsiness, hemorrhage, fluid in lungs, lung damage
control: good general ventilation (if air smells sweet like electrical storm, stop work immediately and get fresh air)

Ozone

source: welding by-product
effect: irritates nose, throat and eyes; coughing, chest pain, headache, shortness of breath, pulmonary edema
control: good general ventilation of welding area (if air smells sweet like electrical storm, stop work immediately and get fresh air)

Phosgene

source: welding by-product; produced when ultraviolet rays given off by welding decompose degreasing chemicals
effect: highly toxic, can cause death. Initial effects are irritation to skin, eyes, nose, throat and chest; dizziness, chills, thirst; delayed effects: 2 to 24 hours after exposure outpouring of fluid into air sacs of lungs. **Can be fatal.**
control: no welding should be done within 200 feet of degreasing operations; if gas is smelled, evacuate area immediately

Phosphine

source: possible contaminant of commercial acetylene
effect: fatigue, tremors, coma, convulsions, pulmonary edema; long term exposure can cause anemia and stomach problems
control: good local exhaust ventilation

RADIATION, NON-IONIZING

Ultraviolet

source: arc or its reflection
effect: irritates and damages eye tissue; can cause painful sunburn and possibly skin cancer
control: proper eye protection; clothing covering all parts of the body; separate welders from all other workers

Infrared

source: heat waves given off by all bodies that radiate heat
effect: can cause damage to parts of the eye; workers may develop a condition called "heat cataract"
control: regular clothing; goggles to protect eyes

METALLIC SPARKS/MOLTEN METAL

Sparks

source: heated metal, hot metal

effect: burns, fires

control: eye protection; protective clothing including long pants, sleeves, and socks; gloves