



Department of  
Transportation

# Safety Bulletin

**Subject:**      **WELDING, CUTTING,  
BRAZING & HEATING**

**Approved by:**

  
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6/19/17  
Date

**Organization Responsible for Interpretation:**

**Administrative Services /  
Employee Safety & Health**

This policy establishes safety procedures for gas and arc welding, cutting, brazing and heating operations based on OSHA Standards 1910 and 1926. Because many of the hazards associated with this type of work are made worse by the location of the operation and types of materials involved, many aspects must be considered when determining appropriate steps to protect employees.

## **EXPOSURE TO HAZARDOUS AIRBORNE MATERIALS**

Respiratory hazards from welding, cutting, brazing and heating operations can pose health hazards. Most hazardous airborne materials are heavy metals found in welding fumes. Metals are present in paint coatings (chromium and lead), in surface coatings such as zinc on galvanize, and cadmium used to protect surfaces. Very high temperatures that occur during welding, cutting, brazing or heating release these materials in the form of fumes (fine particle smoke). Wherever practical, surfaces shall have coatings removed for at least 4 inches in all directions from the location where the heat or weld will be applied. The backside of the piece shall also be cleaned of coating in the immediate area of the work, if burning this coating will cause hazardous fumes. Removal shall be by means other than burning, i.e. abrasive blasting or grinding. Refer to Abrasive Blasting Safety Bulletin.

Many welding rods also contain additives (flux, for ex.) which can produce hazardous fumes. It is important to review Safety Data Sheets (SDS) to determine if a hazard exists from the welding rod itself.

## **RESPIRATORY PROTECTION**

Employees over exposed to hazardous fumes due to the location of the operation, the material worked on, and/or the rod used, shall use appropriate respiratory protection. Cartridge type respirators shall be supplied with filters designed specifically to protect against contaminants found in welding fumes. These filters will have a one-half inch gray strip completely around the

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outside of the cartridge. Air supplied respirators shall be used where the concentration of hazardous materials may exceed the capabilities of filter type respirators. It should be noted that work between two beams beneath a bridge deck requires confined space consideration. Refer to Compressed Breathing Air and Permit Required Confined Space Safety Bulletins, and/or contact the Regional Safety and Health Representative for more information.

Respirators shall be regularly cleaned and disinfected. Those used by more than one employee shall be thoroughly cleaned and disinfected after each use. Respirators shall be stored in a convenient, clean, and sanitary location. Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Employees shall be instructed in the use, maintenance, and limitations of the assigned respirator. Respirators found to be damaged or inoperative shall be taken out of service immediately.

Employees required to wear a half or full face cartridge, or a supplied air respirator in the demand mode shall be fit tested for the proper face piece. Facial hair, hats, or any other obstruction shall not be allowed to interfere with a proper seal between face and respirator.

**PERSONAL PROTECTIVE EQUIPMENT**

Employees exposed to hazards created by welding, cutting, brazing, or heating operations shall be protected by personal protective equipment.

**Protective Clothing**

Fire retardant clothing shall be worn by employees engaged in burning or welding operations.

**Hand and Face**

For arc operations the helmets or goggles and gloves shall be made of a material which is an insulator for heat and electricity. Helmets, shields and goggles shall not be readily flammable and shall be capable of withstanding cleaning. Helmets shall be provided that protect face, neck and ears from direct radiant energy from the arc.

**Eye Protection**

Goggles shall be ventilated to prevent fogging. Lens glass shall be tempered, substantially free from flaws. Lenses shall bear distinctive markings to readily identify source and shade. The following shade chart shall be followed:

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OPERATION	ELECTRODE DIAMETER	NUMBER
Shielded Metal-Arc Welding	1/16 inch, 3/32 inch, 1/8 inch, 5/32 inch	10
Gas-Shielded Arc Welding (non-ferrous)	1/16 inch, 3/32 inch, 1/8 inch, 5/32inch	11
Shielded Metal-Arc Welding	3/16 inch, 7/32 inch, 1/4 inch	12
	5/16 inch, 3/8 inch	14
Carbon Arc Welding		14
Torch Brazing		3 or 4
Light Cutting, up to 6 inches		3 or 4
Medium Cutting, up to 6 inches		4 or 5
Heavy Cutting, 6 inches and over		5 or 6
Gas Welding (light)	1/8 inch	4 or 5
Gas Welding (medium)	1/8 inch to 1/2 inch	5 or 6
Gas Welding (heavy)	1/2 inch and over	6 or 8

For gas welding or oxygen cutting that produces a high intensity yellow light, it is desirable to use a filter or lens that absorbs the yellow or sodium line.

### MEDICAL

Employees shall receive physician certification that they are physically capable of wearing the type of respirator for their assigned duties. Certification may contain limitations as required for individual employees and have a specified length of time for which the certification is valid (usually one to three years).

Employees exposed to hazardous materials shall also receive proper periodic medical monitoring required by the specific standards that govern the various materials to which they are exposed (i.e. lead, cadmium).

### VENTILATION

**Indoors** - Mechanical ventilation shall be provided for all operations that: are performed in spaces of less than 10,000 cubic feet per welder; **OR** have ceiling height of less than 16 feet; **OR** occur in areas that contain partitions, balconies or other structural barriers which significantly obstruct cross ventilation.

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Mechanical ventilation can be 'general' or 'local' in design. General ventilation draws air from the entire work area at a rate of not less than 2,000 cubic feet per minute per welder. Local ventilation (also referred to as point-of-work ventilation) draws air from a location 4 inches to 12 inches from the welding, cutting or heating operation itself.

**Outdoors** - Mechanical ventilation is not generally required if there are no obstructions to natural ventilation. If for any reason hazardous materials accumulate in the employees work area, above the permissible exposure level (PEL), general ventilation is required.

Mechanical ventilation is required for confined spaces, areas of obstructed natural ventilation, or locations where hazardous materials may concentrate. Refer to SB-91-4 CONFINED SPACE for more information. When work involves materials that pose a risk of high exposure to toxic materials, ventilation shall be used or the work shall not be performed.

## **HAZARD COMMUNICATION**

Employees engaged in welding, cutting, brazing, and heating operations shall receive annual hazard communication training, including, but not limited to:

- hazardous materials contained in the coatings or contents of metals.
- availability of Material Safety Data Sheets for welding rods.
- use and availability of personal protective equipment.

Employees assigned to tasks that may cause lead exposure shall receive training which complies with OSHA Standards 1910.1025(L) and 1926.62(L).

## **SAFE HANDLING OF WELDING EQUIPMENT**

**Gas Welding and Cutting** - Requirements of OSHA Standards 1910.253 and 1926.350

When transporting, moving and storing compressed gas cylinders, the valve protection cap shall be in place and secured.

All cylinder valves shall be closed when work is finished and before vehicle transport.

When cylinders are hoisted, they shall be secured on a cradle, sling board or pallet, not hoisted or transported with magnets or choker slings.

Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be dropped, struck or permitted to strike each other.

When transported in a vehicle, cylinders shall be secured in a vertical position.

Valve protection shall not be used to lift cylinders.

Unless cylinders are firmly secured on specially designed carriers, regulators shall be removed and valve protection in place before cylinders are moved.

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When work is finished, when cylinders are empty, or when cylinders are moved, cylinder valves shall be closed.

Cylinders shall be kept far enough away from the actual welding or cutting operation to avoid contact from sparks, hot slag, or flame; or fire resistant shields shall be used.

Cylinders containing oxygen or any fuel gas shall not be taken into confined spaces.

Cylinder valves shall be opened slowly to prevent damage to regulators. Fuel cylinders shall not be opened more than 1 1/2 turns. When a special wrench is required, it shall be left on the stem of the valve while the cylinder is in use so that gas flow can be shut off quickly in an emergency. Before a regulator is removed from a cylinder valve, the cylinder valve shall be closed and gas released from the regulator.

Cylinders that develop leaks in or around the valve stem or fuse plug shall be tagged and removed from service. Caution shall be used in storage of leaking cylinders.

Hoses and connections shall be kept free of grease and oil and inspected for defects before each use. Damaged or defective hoses shall be removed from service.

Torches shall be inspected before each use. Defective torches shall be removed from service.

Torches shall be lighted by friction lighters or other approved devices, not by matches or from hot work.

Regulators and gauges shall be in proper working order.

Back flow prevention devices (flash back arresters) are required. Torches certified by the manufacturer to comply with this requirement are acceptable.

Non-combustible or flameproof screens shall be used to protect employees working in adjacent areas.

**Arc Welding and Cutting - Requirements of OSHA Standards 1910.254 and 1926.351**

Arc welding and cutting equipment shall be inspected before each use.

All connections shall be checked before each use.

Cables with damaged or exposed conductors shall be replaced.

Cables with splices within 10 feet of the holder shall not be used.

Cables shall be uncoiled to prevent overheating.

Electrode holders not in use shall be stored to prevent electrical contact with persons, conductors, fuel or compressed gas tanks.

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Voltage shall not exceed 80 volts for alternating current machines or 100 volts for direct-current machines.

Terminals for welding leads shall be protected to avoid accidental contact by personnel or metal objects.

Welding machines shall be grounded according to manufacturer specifications.

Non-combustible or flameproof screens shall be used to protect employees working in adjacent areas.

### **FIRE PREVENTION AND PROTECTION**

Welding or cutting operations conducted in areas which may cause fire hazards require work practices that include fire prevention and protection. Combustible materials within 35 feet of the operation shall be removed. When this is not possible, guards shall be used to confine heat, sparks, and slag.

Never use cutting or welding torches where there is an explosive hazard caused by vapors, liquids or dusts.

Oxygen pressure greater than necessary will cause extra sparks and increase slag flow, and thus increase the potential for a fire.

Oxygen shall not be used to clean equipment or clothing.

Appropriate fire extinguishing equipment and precautions shall be maintained in a state of readiness for instant use to include pails of water, buckets of sand, hose or portable extinguishers depending upon the combustibility and quantity of material exposed.

A fire watch shall be required whenever welding or cutting is performed in locations where major fires could develop, or any of the following conditions exist:

- appreciable combustible material closer than 35 feet to the operation, or extremely combustible material more than 35 feet away, but in the proximate area.
- wall or floor openings within a 35 foot radius which expose combustible material in adjacent areas.
- combustible materials adjacent to the opposite side of metal partitions, walls, ceilings, or roofs likely to be ignited by conduction or radiation.

Fire watch personnel shall have fire extinguishing equipment readily available and be trained in its use. A fire watch shall be maintained for at least one half hour after completion of welding or cutting operations when conditions above exist.