



Pathway to the Future

BUSD Welding, Cutting and Brazing Safety Program

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WELDING, CUTTING AND BRAZING SAFETY PROGRAM



OVERVIEW

Welding, cutting and brazing operations have the potential to create a wide variety of hazards, including toxic fumes and gases, explosion, fire, arc radiation, noise, and electrical shock. These hazards, combined with several different methods and technologies for performing the operation and crossover with other safety program areas (e.g. compressed gas, confined space, fire prevention), result in complex safety and health issues. This program is not meant to summarize or prioritize the health and safety issues for these operations, but rather as a starting point and collection of useful reference material for supervisors, employees, and the Berryessa Union School District Safety Committee.

There is no regulatory requirement to create and maintain a written program for welding, cutting and brazing operations. However, these operations may cross into other program areas that do have written program requirements (e.g. permit-required confined space or respiratory protection). Also, it is recommended by OSHA to implement written policies for the workplace so that the necessary or required practices and controls can be more reliably and continuously implemented.

OSHA DEFINES “HOT WORK”

OSHA defines "hot work" as any work that involves burning, welding, using fire or spark-producing tools, or that produces a source of ignition. The four basic elements in this program will identify the hazards associated with hot work activities and the hazard controls and associated best practices required to prevent injuries and illnesses in the general industry work environment.

WORKSITE ANALYSIS

Worksite analysis involves a variety of worksite examinations to identify not only existing hazards, but also conditions and operations in which changes might create hazards. Effective safety management practices actively analyze the work and the worksite to anticipate and prevent harmful occurrences. Routine site safety and health inspections are designed to catch hazards missed at other stages. This type of inspection should be done at regular intervals, generally on a weekly basis. The OSHA Small Business Handbook (OSHA Publication 2209) provides a Welding, Cutting and Brazing Checklist (see excerpt above) that can be used as a point of reference by personnel performing self-inspections of the workplace.

A job hazard analysis (JHA) is another workplace analysis technique that can be used to identify potential hazards in the workplace. A JHA is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools and the work environment. Ideally, once uncontrolled hazards are identified, you will take steps to eliminate or

reduce them to an acceptable risk level. OSHA publication 3071, "Job Hazard Analysis," provides employers with the framework and necessary tools to perform a JHA of welding and cutting tasks performed in their workplace.

GENERAL REQUIREMENTS

A. Basic Precautions for Fire Prevention

1. The object to be welded should be moved to a safe place, when possible.
2. If the object cannot be readily moved, all movable fire hazards in the vicinity shall be moved to a safe location.
3. If the object cannot be readily moved and all fire hazards cannot be removed, guards shall be used to confine the heat, sparks, and slag, and protect immovable fire hazards. (i.e. curtains)

SPECIAL PRECAUTIONS WHENEVER GUARDS ARE USED:

Wherever floor cracks, or holes in walls, open doorways, open or broken windows, or openings that cannot be closed are present, take precautions to insure that readily combustible materials on the floor below will not be exposed to sparks which may drop through the cracks or openings. It is the welder's responsibility to notify their supervisor and take appropriate action whenever the welder feels that guards are required as they pertain to the rules of this standard, and must ensure that "special precautions" are observed.

A fire watch is required whenever there is a possibility of a fire developing. The fire watchers will have fire extinguishing equipment immediately available and shall be trained in its use. They will also be familiar with the methods used to sound an alarm. Details on fire extinguisher and fire emergency procedures can be found on the MOT website. The fire watch must be maintained for at least ½ hour after welding operations have stopped.

A Fire Watch is required whenever there is a possibility of a fire developing or any of the following conditions exist:

- a. Appreciable combustible material, in building construction or contents, are closer than 35 feet to the point of operation.
- b. Appreciable combustibles are more than 35 feet away, but are easily ignited by sparks.
- c. Wall or floor openings within 35 foot radius expose combustible material in adjacent areas including concealed spaces in walls or floors.
- d. 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.

If requirements above cannot be followed, welding and cutting shall not be performed.

HAZARD PREVENTION AND CONTROL

After detection, all current and potential health and safety hazards must be prevented, corrected or controlled. OSHA's recommended systems used to prevent and control hazards include engineering controls, safe work practices, administrative controls, personal protective equipment (PPE) and emergency preparation.

Engineering controls are the first and best strategy to control the hazard at its source and can be used to control health hazards from welding, cutting and brazing operations. These hazards include employee exposures to metal fumes and to ultraviolet (UV) radiation. Local exhaust ventilation installed at a welding station for the purpose of removing air contaminants generated during the welding process is an example of an engineering control. The segregation of welding and cutting from other operations in the workplace to prevent employee exposure can be achieved by use non-combustible barrier walls and portable welding screens. Oxygen cylinders in storage can be separated from fuel-gas cylinders or combustible materials (especially oil or grease), by a noncombustible barrier at least 5 feet (1.5 meters) high having a fire-resistance rating of at least a half-hour.

Safe work practices include the company's general workplace rules and other operation-specific rules. Management should establish a written rule that only authorized and trained personnel are permitted to use welding, cutting or brazing equipment. Supervisors should ensure that each operator have a copy of and follow the appropriate welding and cutting equipment operating instructions.

While safe work practices can be considered forms of administrative controls, OSHA uses the term administrative controls to mean other measures aimed at reducing employee exposure to hazards. Rotation of workers performing welding and cutting tasks and fire watch tasks is an example of an administrative control. The rotation of workers will limit their potential exposure to safety hazards from welding, cutting and brazing operations including burns, eye damage, electrical shock, cuts and crushed toes and fingers.

Prior to performing hot work tasks, employers should instruct employees in the use of PPE, fire prevention and protection requirements and the safe use of welding/cutting-related equipment. The workplace safety coordinator should conduct a PPE assessment of hot work tasks that will be performed by employees in the workplace. OSHA standard 29 CFR 1910.132(d)(1) requires "that the employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of PPE", and this activity must be documented by the employer. Furthermore, OSHA's cutting and welding-related standards have specific PPE requirements. Hazards associated with welding and cutting may include employee exposure to:

- Ultraviolet and infrared radiation
- Metal fumes and welding gases
- Electrical current
- Hot metal
- Noise.

OSHA publication 3077, "Personal Protective Equipment (PPE)," is an excellent reference for training employees on the use of PPE in the workplace. PPE should not be used as a substitute for engineering, work practice or administrative controls. Personal protective equipment should be used in conjunction

with these controls to provide for employee safety and health in the work place. PPE includes all clothing and other work accessories designed to create a barrier against workplace hazards. The basic element of any management program for PPE should be an in-depth evaluation of the equipment needed to protect against the hazards at the workplace. Management dedicated to the safety and health of the employees should use that evaluation to set a standard operating procedure for personnel, and then train employees on the protective limitations of PPE, and on its proper use and maintenance.

As a result of the PPE assessment, employees should be required to use PPE including protective eyewear, hand protection and protective clothing.

Respiratory protection should be provided only if engineering controls are not feasible in the work environment. OSHA's Technical Manual TED 01-00-015 [TED 1-0.15A] (Jan. 20, 1999) includes a section on sampling for welding fumes. Local exhaust or general ventilating systems should be provided and arranged to keep the amount of toxic fumes, gases or dusts below the maximum allowable concentration as specified in 29 CFR 1910.1000.

Management should become aware of possible emergencies and plan the best way to control or prevent the hazards they present. Specific written hazard control programs including a fire prevention plan, emergency action plan and hot work permit program should be developed and implemented in the workplace to address welding and cutting hazards. The fire prevention plan describes the fuel sources (hazardous or other materials) on site that could initiate or contribute to the spread of a fire, as well as the building systems (such as fixed fire extinguishing systems and alarm systems) in place to control the ignition or spread of a fire. An emergency action plan is available on the Berryessa Union School District website.

The National Fire Protection Association (NFPA) establishes scientifically based fire prevention and protection consensus codes and standards. An excellent resource for the development of a Hot Work Permit Program is the NFPA 51B Standard for Fire Prevention in Use of Cutting and Welding Processes. These standards review the basic precautions and special precautions that should be followed to prevent loss of life and property from uncontrolled welding and cutting loss exposures. In addition, these standards address the fire protection and prevention responsibilities of welders and cutters, their supervisors (including outside contractors) and those in management on whose property cutting and welding are to be performed.

A supervisor should develop a "Permit for Cutting and Welding with Portable Gas or Arc Equipment" using NFPA 51B, Appendix A "Suggested Form of Written Cutting and Welding Permit," as a point of reference. This NFPA standard covers the provisions to prevent loss of life and property from fire or explosion as a result of hot work. Before cutting or welding is permitted, the area must be inspected by the individual responsible for the welding and cutting operations, to ensure that it is a fire safe area. The individual shall designate precautions to be followed in the form of a written permit or other equivalent means. In addition, NFPA 51B requires that the individual verify all fire prevention precautions have been taken; they include that welding and cutting equipment is in good operating condition; no combustible material is within 35 feet; and that nearby personnel and building walls and ceilings are suitably protected against heat, sparks, slag, etc.

The establishment of a fire watch is critical in welding and cutting tasks. Although the cutter or welder has the best opportunity to avoid fire or injury by proper control of the equipment he is using, there are many circumstances in which fire, explosion, or severe injuries would be inevitable if an oxy-fuel gas torch or an electrode were used. Such circumstances can arise in which the cutter or welder may not be

aware of (1) proximity or the flammable nature of nearby combustible solids, liquids or dusts; (2) the presence or development of possible explosive mixtures of flammable gases or vapors and air; or (3) the presence of an oxygen-enriched atmosphere in the location where the work will be performed. The precautions taken by the welder or cutter often will be governed by the desire of others for speed or economy in his work or by the failure of management to emphasize the possible extent or seriousness of a fire in the work area. Therefore, the cutter or welder, his supervisor and management share the responsibility for the safe use of cutting and welding equipment.⁷

TRAINING

An employee should be provided necessary training prior to being assigned to perform hot work tasks. Specifically, that means how to recognize and evaluate hazards, and the controls to prevent injuries to employees performing welding and cutting tasks in the workplace. OSHA Publication 2254, "Training Requirements in OSHA Standards and Training Guidelines," provides a review of mandatory OSHA training required for employees engaged in welding and cutting tasks. These requirements are summarized below:

Management. The Maintenance Supervisor shall recognize its responsibility for the safe usage of cutting and welding equipment on its property and insist that cutters or welders and their supervisors are suitably trained in the safe operation of their equipment and the safe use of the process.

Supervisor	Department	Contact Number
Dan Norris	Maintenance, Operations and Transportation (MOT)	(408) 923-1893

The supervisor or their designee will ensure the following before performing any welding, cutting and/or brazing:

1. Be responsible for the safe handling of the cutting or welding equipment and the safe use of this equipment during the cutting or welding process.
2. Determine the combustible materials and hazardous areas present or likely to be present in the work location.
3. Protect combustibles from ignition by the following:
 - Have the work moved to a location free from dangerous combustibles.
 - If the work cannot be moved, have the combustibles moved to a safe distance from the work or have the combustibles properly shielded against ignition.
 - See that cutting and welding are so scheduled that operations that might expose combustibles to ignition are not started during cutting or welding.
4. Secure authorization for the cutting or welding operations from the departmental supervisory representative.

5. Determine that the cutter or welder ensures that conditions are safe before proceeding.
6. Determine that fire protection and extinguishing equipment are functional and located in the immediate vicinity of the site.
7. Where fire watchers are required, see that they are present at the site.
8. Verify that hot work permits are completed as required and that copies are maintained in departmental files for a period of one year. The retention of these permits allows for audits and may be required during an OSHA inspection.

Personnel. Workers in charge of the oxygen or fuel-gas supply equipment, including generators and oxygen or fuel-gas distribution piping systems shall be instructed 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.

In addition, workers designated to operate resistance-welding equipment shall have been properly instructed and judged competent to operate such equipment.

Instruction. Workers designated to operate arc-welding equipment shall have been properly instructed and qualified to operate such equipment.

In summary, hot work tasks can create many hazards in the workplace that if left unchecked by an employer may result in serious employee injury and/or illness and significant property damage. All injuries and illnesses on the job must be reported to their immediate supervisor and Human Resources within 24 hours.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

1. When working on platforms, scaffolds, or runways, welders and their helpers shall be protected against falling by use of railings, safety belts, lifelines, or other effective safeguards. Specifics on fall protection can be found under Slips, Trips and Falls in the Maintenance Folder on the BUSD website.
2. Helmets or hand shields shall be used during all arc welding/cutting operations, excluding submerged arc welding. All helpers and attendants shall be provided with proper eye protection. Goggles or other suitable eye protection shall be used during all gas welding or oxygen cutting operations. Spectacles with side shields and suitable filter lenses are required during gas welding operations on light work, torch brazing, and for inspections. Operators and attendants of resistance welding or brazing shall use transparent face shields or goggles, depending on the particular job.

Specifications for eye protection:

- Helmets and hand shields shall be made of material, which is an insulator for heat and electricity. Helmets, shields and goggles shall not be readily flammable and shall be capable of withstanding sterilization.

- Helmets and hand shields shall be arranged to protect face, neck, and ears from direct radiant energy from the arc. Helmets shall be provided with filter plates designed for easy removal. Parts shall be constructed of material, which will not readily corrode or discolor the skin.
 - Goggles shall be ventilated to prevent fogging of lens as much as possible. All glass lenses shall be tempered and free from flaws. The front and rear surfaces of lenses shall be smooth and parallel, except prescription lenses for optical correction.
 - Lenses shall bear permanent distinctive markings, which denote source and shade for easy identification. All filter lenses and plates must meet the test for transmission of radiant energy set forth in ANSI Z87.1-1968, American National Standard Practice for Occupational & Educational Eye and Face Protection.
3. Special protection for arc welding rays shall be used. Where the work permits, the welder should be enclosed in an individual booth constructed of non-combustible, non- reflective material. All booths shall allow for either natural or mechanical ventilation to protect against the build-up of hazardous atmospheres.
 4. Protective clothing shall be worn in accordance with 1910.132. The degree of protective clothing will vary with size, nature, and location of work to be performed.
 5. Additional details on personal protective equipment can found in the BUSD PPE Safety Plan on the website in Business Folder.

Listed below are the major regulations that apply to welding, cutting and brazing operations at Berryessa Union School District. Other regulations may apply to specific activities.

MSD creates and enforces occupational safety and health rules for its employees and has adopted OSHA's General Industry and Construction standards, including the OSHA standards listed below that apply to welding, cutting and brazing operations.

OSHA

The federal Occupational Safety and Health Administration (OSHA) standards individually linked below are the most current version published on the OSHA website. Sometimes, these standards will have been revised since the last print. Always check OSHA.com for updated regulations.

General Industry (29 CFR 1910)

1910 part H – Hazardous Materials

1910.101 – Compressed gases (general requirements).

1910.102 – Acetylene.

1910 part I, Personal protective equipment

1911 Appendix B, Non-mandatory compliance guidelines for hazard assessment and personal protective equipment selection

1910 Subpart Q, Welding, cutting, and brazing

1910.251, Definitions

1910.252, General requirements

1910.253, Oxygen-fuel gas welding and cutting

1910.254, Arc welding and cutting

1910.255, Resistance welding

1910 part Z, Toxic and hazardous substances

1911 1910.1026, Chromium (VI)

Construction Industry (29 CFR 1926)

1926 Subpart J, Welding and cutting

- 1926.350, Gas welding and cutting
- 1926.351, Arc welding and cutting
- 1926.352, Fire prevention
- 1926.353, Ventilation and protection in welding, cutting, and heating
- 1926.354, Welding, cutting, and heating in way of preservative coatings

1926 Subpart Z, Toxic and hazardous substances

- 1926.1126, Chromium (VI)
- 1926.1127, Cadmium

Consensus Standards

There are many consensus standards either directly addressing welding, or practices that may involve welding.

ANSI Z49.1—*Safety in Welding and Cutting*, 1967 edition was used by OSHA to develop their welding standard. The most current standard in the series is the 2005 edition, *Safety in Welding, Cutting and Allied Processes*. The American Welding Society provides a free download of this welding safety and health standard.

NFPA 51B—*Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*. The 2009 edition is the most current. [Note: The general requirements of OSHA's welding, cutting and brazing standard at 29 CFR 1910.252 still incorporates the 1962 edition.]

NFPA 51—*Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*. Current edition is 2007.

CGA Pamphlet G-1-2003 ("Acetylene")—Employers must ensure that the in-plant transfer, handling, storage, and use of acetylene in cylinders comply with the provisions of CGA Pamphlet G-1-2003 (Compressed Gas Association, Inc., 11th ed., 2003)

Related safety program areas

- Compressed gas
- Confined space
- Hot work programs
- Personal protective equipment
- Respiratory protection

Reference material, files, and websites

General reference material

American Welding Society Safety and Health Fact Sheets—Fact sheets covering 35 health and safety topic areas.

Welding and Manganese: Potential Neurologic Effects—NIOSH Workplace Safety & Health Topics.

PPE Case Study: Welding—IUOE National Training Fund, National HAZMAT program. A three-minute video overview of required PPE.

Welding, Cutting, and Brazing General Requirements: Self-Inspection Checklist—DHHS (NIOSH) Publication Number 2004-101. The checklist applies to operations involving welding, cutting, brazing, and heating. It does not cover in detail regulations dealing with work in confined or enclosed spaces.

Welding, Cutting, and Brazing Checklist for General Industry and Construction—Texas Department of Insurance, Division of Workers' Compensation, HS03-004B (10-10).

Safety Requirements for Welding, Cutting and Brazing (checklist)—Kentucky Department of Workplace Standards.

Reference material for this program:

- 29 CFR 1910 Subpart Q, Welding, cutting, and brazing.
- ANSI Z49.1:2005 — *Safety in Welding, Cutting, and Allied Processes*.
- *Accident Prevention Manual for Business and Industry—Engineering & Technology*, 11th edition. National Safety Council.
- Welding, Cutting, and Brazing. *OSHA's Safety and Health Topics* (webpage).
- *OSHA Health and Safety Training Requirement*

Reference websites

www.osha.gov/SLTC/constructionwelding/index.html

www.osha.gov/SLTC/etools/shipyard/shiprepair/hotwork/index_hw.html

U.S. Department of Labor, Occupational Safety and Health Administration, "Safety and Health Program Management Guidelines (Issuance of Voluntary Guidelines; Notice." *Federal Register*, Vol. 54, No. 16, Jan. 26, 1989, pp. 3904-3916).

www.osha.gov/SLTC/etools/oilandgas/general_safety/hot_work_welding.html

"^{6,7} NFPA 51B *Standard for Fire Prevention in Use of Cutting and Welding Processes*, Chapter 2, Responsibility for Cutting and Welding, 2-1 General, 2003 Edition.

Disclaimer

This publication was prepared by the Berryessa Union School District to assist in finding resources and information for regulatory compliance. It is not intended to render legal advice.

Approved by the Berryessa Union School District Safety Committee on October 2022