

Welding, Cutting and Brazing Safety Program

Effective Date:

Revision #:

OSHA

Reference Standard

Occupational Safety and Health Administration, including Subpart Q, Welding, Cutting and Brazing:

29 CFR 1910.251, Definitions

29 CFR 1910.252, General Requirements

29 CFR 1910.253, Oxygen-Fuel Gas Welding and Cutting

29 CFR 1910.254, Arc Welding and Cutting

Purpose

This procedure establishes minimum safety procedures for the selection, inspection and use of welding torches, cutting torches and associated equipment as well as required safe procedures and training for personnel involved in welding and cutting operations.

Scope

This procedure applies to all of our company employees, all contractors and vendors performing work on company property, and all other individuals who are visiting or have business with our company.

Responsibilities

Management is responsible for development and review of this program. Management is also responsible for appropriate employee training.

Management and supervisors are responsible for enforcement of this program.

Employees shall comply with all procedures outlined in this policy.

Contractors and vendors shall comply with all procedures outlined in this policy.

Definitions

Arc Welding/Cutting: Use of an electric arc to melt metal

Base Metal: Starting parts in a welding or brazing operation; not the filler metal

Brazing: A technique use to join base metals with a filler metal. The base metals are not melted in brazing

Contractor: A non-company employee being paid to perform work in our facility.

Cutting: Use of a torch to melt metal and cut a unit part into multiple parts

Filler Metal: The material that is melted to join the base metals in a welding or brazing operation

Filter Lens: A deeply tinted lens used to protect the eyes from the intensely bright light of welding and cutting. The shade (relative darkness) of the lens will vary depending upon the

type and intensity of the energy released by the various techniques

Fire Watch: A worker who is designated to stay in the area of hot work and look for fires. A fire watch must be capable of traveling above, below and to the sides of the hot work or additional personnel must be assigned to watch these exposures. Fire watch personnel must be trained and equipped with fire extinguishment equipment and must be trained how to activate the fire alarm. A fire watch is **not** a fire brigade.

Hot Work: Welding, Cutting and Brazing

Hot Work Permit: A permit issued after an area has been inspected and found not to contain any unusual fire hazards. After issuance of the permit, hot work can be undertaken for the duration of the permit but never longer than one shift.

Inert Gas: A gas that is non-reactive, non-flammable and does not contain oxygen

Inert Gas Welding: Welding techniques where the electrical welding activity is conducted under an inert gas blanket such as carbon dioxide or argon. The inert gas prevents the oxygen in air from interfering with the weld. Also called Shielded Gas welding.

MIG Welding: Metal Inert Gas welding: a wire is fed under an inert gas blanket and transfers the heat for welding as it is consumed to form the weld bead

Oxygen-Fuel Gas Welding/Cutting: Mixing of oxygen and a fuel gas to the correct proportions and burning the resultant mixture with a torch.

Resistance Welding: Technique of using the resistance of pieces of metal to create heat and fuse the pieces together

TIG Welding: Tungsten Inert Gas welding, the tungsten electrode is not consumed

Vendor: A non-company employee being paid to perform a service in our facility.

Welding: Technique of joining metal by melting the base metals with or without the use of filler metal

Procedure

Fire Protection

- Only personnel trained and authorized to weld, cut or braze will perform such operations. Contractors will be required to furnish only trained and authorized personnel for jobs in this facility.
- Welding, cutting and brazing will be performed in designated areas designed and maintained for the hot work processes or a hot work permit will be issued for an area to certify that there are no unusual fire hazards for the duration of the hot work
- At least one 10 lb. Multi purpose dry chemical fire extinguisher (or an equivalent extinguisher(s) provided) will be permanently mounted in each area where hot work occurs or will be located temporarily in areas where a hot work permit has been issued
- Hot work will be suspended whenever our facility fixed fire protection systems are impaired unless alternate precautions are taken
- Combustible materials will be located at least 35 feet from hot work areas or fire proof barriers will be erected. Floor and wall openings will be sealed and precautions will be taken to prevent transmission of heat along pipes, conduit, ducts, etc.
- Hot work will not be allowed in any area where there is any detectable flammable vapor or gas-a reading of 0% Lower Explosive Limit (LEL) on the meter is required
- Hot work is not permitted on drums, tanks or other closed and semi-closed containers until the container is emptied, cleaned and purged of all possible flammable residue, vapor or gas. Closed containers (pipes, tanks, etc.) must be vented prior to welding or cutting.
- Areas where hot work has taken place will have a fire watch in attendance during the hot work and for at least 30 minutes after the conclusion of the work. Exception: for areas designated and maintained as production welding areas.

Ventilation

- All areas designated as welding or cutting areas will be provided with adequate natural or mechanical ventilation. Mechanical ventilation will always be provided if there is less than 10,000 cubic feet of space for each welder or in a room having a ceiling height less than 16 feet.
- Mechanical ventilation will always be provided if cadmium, lead, beryllium or other acutely toxic metals or fluxes are used in the process. The mechanical ventilation will be designed and operated to maintain exposures at or below regulatory standard.
- Mechanical ventilation will always be provided when performing welding in temporary areas that have limited natural ventilation such as: confined spaces, balconies or spaces with structural barriers
- Ventilation will be provided at a rate of 2,000 cubic feet of air per minute, per welder unless local exhaust inlets are provided
- Local exhaust ventilation provided by a movable hood will furnish 100 linear feet per minute of air flow via a freely movable hood or intake at the zone of weld smoke generation
- Fixed enclosures (such as a booth) will provide an air velocity of 100 linear feet per minute away from the welder
- If our company chooses to use respirators a formal respiratory protection program will be implemented
- Oxygen will never be used to provide ventilation

Oxygen-Fuel Gas Safety

- All gas cylinders will be labeled with the contents and hazards of the gas contained
- Cylinders are never allowed to stand unsupported. Cylinders will be secured by chain to an a secure object, held in a cradle, cylinder cart or other device designed for the purpose
- Cylinder Transportation:
 - When transporting cylinders a cradle, hand truck or other device designed for cylinders will be used. Slings and electromagnets will not be used for transportation of cylinders. Valve caps will never be used to lift cylinders.
 - When transporting cylinders the valve cap will always be installed unless they are being transported on a torch cart
- Cylinder Storage:
 - Cylinders will be stored away from heat sources
 - In buildings, cylinders will be stored in well protected, well ventilated and dry locations at least 20 feet from highly combustible material such as paper, cardboard or flammable or combustible liquids. Cylinders will not be kept in unventilated enclosures.
 - Empty cylinders will have valves closed tightly
 - Fuel gas cylinders, when stored in buildings, are limited to a total of 2,000 cubic feet (gas) or 300 lbs (liquid) except where a special storage room has been provided.
 - Acetylene cylinders must be stored with the valve end up at all times
- Oxygen Cylinders:
 - Will not be stored near highly combustible materials including oil and grease
 - Oxygen cylinders in storage will be separated from fuel gas cylinders by a minimum distance of 20 feet or by a one hour fire resistance rated barrier, five feet high
 - Gages used in oxygen service will be marked "Use No Oil"
- Fuel Gas Cylinders:
 - Will always be placed with the valve end up
 - LPG cylinders will never be positioned upside down on the protective ring
 - Acetylene valves will be opened only $\frac{3}{4}$ to 1 $\frac{1}{2}$ turn only
- Torches, Regulators and Hoses:
 - Torches, regulators and hoses will be approved for the gas service in which it is used
 - Equipment will be stored where it is protected from damage

- Torches, regulators and hoses will be inspected prior to each use. Defective or damaged equipment will not be used in our facility.
- Backflow prevention will always be used to prevent accidental mixing of gas in the hoses, regulators and cylinders
- Operation:
 - Welding and cutting locations will be designed, installed and maintained to prevent fires and to protect personnel from accidental exposure to hazardous rays from operations. When welding and cutting is performed outside of designated locations, a hot work permit will be issued.
 - Hoses will be routed to reduce to the extent possible the potential for trip and fall accidents
 - Cylinder valves and fittings will be kept clear of accumulations of dirt, oil, grease and other contaminants
 - Cylinders not equipped with a permanent valve hand wheel will have the valve wrench or key on the valve when in use
 - Valves will be opened and closed slowly
 - Cylinders will be handled carefully, in a manner to prevent damage
 - Cylinder valves will be cracked and immediately closed while the operator stands to the side. This procedure will be conducted well away from ignition sources.
 - Cylinders will not be used as rollers
 - If a cylinder valve can not be opened by hand, a tool will not be used to beat on or force the valve.
 - Cylinders will be positioned far enough away from the work so that they are not exposed to radiant heat, flames, sparks or slag
 - We will never mix gasses in cylinders or tamper with cylinder safety devices
 - If a cylinder is found leaking it will be removed to a safe outside location and the supplier will be contacted
 - Hoses will be bled and torch valves closed and cylinder valves closed whenever cutting or welding operations are suspended for a significant period of time such as during lunch or over night.
 - Air or oxygen will not be mixed with fuel gas prior to the torch or burner

Arc Welding

- Electrical welding equipment will be designed and installed to meet all atmospheric conditions and to meet all required codes applicable to our facility
- Welding equipment manufacturer installation and use requirements will be met for all of our equipment
- Voltage Limits:
 - Alternating current manual arc welding and cutting: 80 volts
 - Alternating current automatic arc welding and cutting: 100 volts
 - Direct current manual and automatic welding and cutting: 100 volts
 - If processes require high voltages, precautions will be taken to prevent accidental contact by personnel
- All energized parts of welders will be enclosed or insulated
- Excess moisture that could contribute to shocks will not be allowed
- Electrical conduit will not be used as a ground. A known earth ground path, as close as possible to the welding location, will be used.
- Operation:
 - Welding and cutting locations will be designed, installed and maintained to prevent fires and to protect personnel from accidental exposure to hazardous rays from operations. When welding and cutting is performed outside of designated locations, a hot work permit will be issued.

- Cables will be routed to reduce to the extent possible the potential for trip and fall accidents
- Prior to use all equipment will be inspected including all connections on the welding machine. Damaged or defective equipment will not be used by our company.
- Cables with damaged insulation or bare conductors will not be used. Cable splices are not allowed within 10 feet of the electrode holder.
- The cable will not be coiled or looped the cable around any part of her/his body
- Cables will be spread out prior to welding to prevent them from overheating
- When not in use the electrode will be removed from the holder and the holder placed where it will not make accidental contact with people or equipment

Personnel Protective Equipment

- Our facility will determine if flame retardant garments are required for our operation and document these requirements in our facility personnel protective equipment assessment
- Personnel will be encouraged to wear natural fiber clothing with long sleeved shirts to protect against the harmful effects of weld rays
- Helmets or hand shields will be used for all arc welding
- Goggles with or without a face shield or other suitable eye protection will be required for gas welding or cutting
- Goggles with or without a face shield will be required for brazing operations
- Selection of the proper shade lens is as follows:

Welding operation	Shade No.
Shielded metal-arc welding - 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	10
Gas-shielded arc welding (nonferrous) - 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	11
Gas-shielded arc welding (ferrous) - 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	12
Shielded metal-arc welding: 3/16-, 7/32-, 1/4-inch electrodes	12
5/16 -, 3/8-inch electrodes	14
Atomic hydrogen welding	10-14
Carbon arc welding	14
Soldering	2
Torch brazing	3 or 4
Light cutting, up to 1 inch	3 or 4
Medium cutting, 1 inch to 6 inches	4 or 5
Heavy cutting, 6 inches and over	5 or 6
Gas welding (light) up to 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

NOTE: In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter or lens that absorbs the yellow or sodium line in the visible light of the operation.

Training

- All personnel will be trained prior to assignment to welding, cutting or brazing operations
- Training will consist of:
 - Fire prevention and fire protection
 - Hot work permit procedures (if applicable)
 - Proper cylinder handling and operation (if applicable)

- PPE requirements
- Equipment operation
- Emergency procedures
- Retraining or additional training will be provided when:
 - Observation reveals that an individual or group of workers exhibits a need
 - Whenever equipment or procedures changes

Revision History Record:

Revision Number	Section	Revised By	Description
0	NA	NA	Original document.

Appendix A

PPE Hazard Assessment Form

PERSONAL PROTECTIVE EQUIPMENT – HAZARD ASSESSMENT FORM

Job Classification: _____

HEAD HAZARD	Tasks that can cause head hazards include: Working below other workers who are using tools and materials, which could fall, working on energized electrical equipment, working with chemicals and working under machinery or processes which might cause materials to fall.			
CIRCLE ALL HAZARDS THAT ARE OBSERVED:				
Chemical Splash	Burn	Electric Shock	Impact	Heat
Dust				NO HAZARD

Description of hazards: _____

EYE HAZARD	Tasks that can cause eye hazards include: Working with acids and chemicals, chipping, grinding, furnace operations, sanding, welding, and woodworking.			
CIRCLE ALL HAZARDS THAT ARE OBSERVED:				
Chemical Splash	Burn	Electric Shock	Impact	Heat
Dust	Light Radiation	Flying Fragments	Furnace	Welding
Brazing	Mists	Fumes		NO HAZARD

Description of hazards: _____

HAND HAZARD	Tasks that can cause hand hazards include: Cutting materials, working with chemicals and hot objects.			
CIRCLE ALL HAZARDS THAT ARE OBSERVED:				
Chemical Splash	Burn	Electric Shock	Impact	Sharp Objects
				NO HAZARD

Description of hazards: _____

FOOT HAZARD	Tasks that can cause foot hazards include: Carrying or handling materials that could be dropped, performing manual material handling and working with chemicals.			
CIRCLE ALL HAZARDS THAT ARE OBSERVED:				
Chemical Splash	Burn	Electric Shock	Impact	Sharp Objects
Rolling Objects	Compression			NO HAZARD

Description of hazards: _____

RESPIRATORY HAZARD		Tasks that can cause respiratory hazards include: Spraying, dipping, welding, cutting and working with chemicals.		
CIRCLE ALL HAZARDS THAT ARE OBSERVED:				
Chemical Splash	Burn	Welding	Dipping	Cutting
				NO HAZARD

Description of hazards: _____

NOISE HAZARD		Tasks that cause employees to be exposed to noise levels exceeding 85 decibels, over an 8 hour shift.		
CIRCLE ALL HAZARDS THAT ARE OBSERVED:				
Noise 85-90 db	Noise 90 db & higher			NO HAZARD

Description of hazards: _____

PPE Required: _____

Completion Date: _____

Completed By: _____