WELDING, CUTTING AND HOT WORK

Doc. Type:	**Program**	Effective Date:	**5/1/2017**
Section:	**24**	Revision Number:	**01**
Status:	**Issued**	Last Revised:	**2/28/2018**

1. PURPOSE AND SCOPE

To define the personnel safety requirements for welding, cutting, or hot work operations, and to ensure compliance with Occupational Safety and Health Administration/Washington Industrial Safety and Health Act (OSHA 1926/DOSH WAC 296-155) requirements.

2. RESPONSIBILITIES

a. It is the responsibility of all **H2 Enterprises, LLC (H2)** employees to comply with the provisions of this procedure.

b. It is the responsibility of all **H2** supervisors and safety personnel to monitor and enforce the provisions of this procedure.

c. It is the responsibility of the ES&H Representative or their designee to issue and maintain a log of all permits.

3. GENERAL REQUIREMENTS

a. Employees that will be performing or will be involved in hot work operations will receive training on the hot work program requirements.

b. Equipment shall be used only for operations for which it is approved, and as recommended by the manufacturer.

c. Cutter, welders and their supervisors assigned to operate or maintain oxygen/fuel-gas supply equipment and resistance welding equipment shall be thoroughly instructed and trained in the safe use of such equipment and the safe use of the process.

d. Engineering controls shall be implemented to control hazards to the extent feasible.

e. Welding, Cutting, and Hot Work Permits shall be issued prior to any welding, cutting, or hot work operations being conducted.

f. Faulty or defective equipment shall not be used.

g. Person(s) holding a valid certificate of First Aid/CPR Training shall be available; First Aid supplies and equipment shall be accessible at the worksite.

4. GAS WELDING AND CUTTING/BURNING SAFETY

a. Fuel-gas hose and oxygen hose are easily distinguishable from each other. The contrast is made by different colors or by surface characteristics readily distinguishable by touch. Oxygen and fuel-gas hoses shall not be interchangeable. A single hose having more than one gas passage shall not be used.

b. All gas welding and cutting equipment shall be inspected at the beginning of each shift to identify the following:

   i. Leaking or damaged hose or hose couplings.

   ii. Leaking or damaged fuel-gas pressure regulators, gauges, related connections, and cylinders.

   iii. Leaking or damaged torch heads or shutoff valves and related connections.

   iv. Clogged tip openings.

c. When parallel sections of oxygen and fuel-gas hose are taped together, not more than 4 inches out of 12 inches shall be covered by tape.

d. Leaking or damaged cylinders shall be marked and removed from service.

e. All hose in use shall be inspected at the beginning of each working shift. Defective hose shall be removed from service.

f. Hoses, cables, and other equipment shall be kept clear of walkways, ladders, and stairs.

g. Clogged torch tip openings shall be cleaned with approved cleaning wires, drills, or other devices designed for this purpose.

h. Torches shall be ignited by friction lighters or other approved devices only. Matches, flame lighters, or hot work are not used to ignite torches.

i. Oxygen and fuel-gas pressure regulators, including related gauges, shall be in proper working order.

j. All oxygen cylinders and fittings shall be kept away from oil or grease. Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves. Oxygen shall not be directed at oily surfaces or greasy clothes, or used within a fuel oil or other storage tank or vessel.

k. Flash-back arrestors shall be installed on all oxygen and fuel-gas setups.

l. Torches and hoses shall be completely de-pressurized (bled) prior to storage, or at the end of each shift.

m. Torches and hoses shall not be stored in enclosed areas (e.g., gang boxes, lockers) while connected to cylinders.

n. Manuals containing rules and instructions covering the operation and maintenance of fuel-gas supply equipment and distribution piping systems shall be readily available on-site in the job trailer or with the equipment.

5. ARC WELDING AND CUTTING SAFETY

a. Electrode holders shall be designed for arc welding/cutting and are capable of safely handling the maximum rated current required. Electric welding equipment, including cables, shall meet the requirements of the National Electric Code. Welding practices shall comply with all applicable requirements.

b. Exposed current-carrying parts of electrode holders shall be insulated in a manner which provides full protection against electrical shock for operators of arc welders/cutters.

c. All arc welding/cutting cables are completely insulated and flexible, capable of handling the maximum current requirements of the work.

d. Only cable free from repair or splices for a minimum distance of 10 feet from the electrode holder is used. Cables with standard insulated connectors or splices with insulating quality that is equal to that of the cable may be permitted.

e. If it is necessary to splice lengths of cable, insulated connectors equivalent to that of the cable are used. If connections are made by cable lugs, they are securely fastened together and provide a good electrical contact. Exposed metal parts of the lugs are completely insulated.

f. If electrode holders are left unattended, the electrodes shall be removed and the holders placed so that they cannot make electrical contact with employees or conducting objects.

g. Electrode holders shall not be dipped in water (to do so may cause electric shock).

h. If employees will be performing arc welding operations in damp or high humidity conditions additional electrically resistant PPE such as rubber boots or pads will be used to protect against electric shock.

i. The power supply to the equipment shall be turned off whenever the arc welder or cutter leaves work or stops work for any appreciable length of time, or when the arc welding/cutting machine is to be moved.

j. Any faulty, damaged, or defective equipment shall be reported to the supervisor and tagged out of service (using a "Danger-Do Not Use" tag) until repaired by qualified personnel. Damaged cable must be repaired/protected by insulation equivalent to original capacity.

k. All arc welding/cutting operations shall be shielded by noncombustible or flameproof screens which will protect employees and other persons working in the vicinity from the direct ray of the arc.

l. Some arc cutting (i.e. arc air, thermos-cutters, etc.) and arc welding (i.e. TIG, MIG) can produce excessive concentrations of fumes and gases. Contact the ES&H Department to ensure adequate controls, based on conditions, type of material, rod

composition, etc. All gas shielded arc welding shall be done in accordance with the American Welding Society standard A6-1-1966.

6. STORAGE AND HANDLING OF COMPRESSED GAS CYLINDERS

a. Compressed gas cylinders shall be legibly marked with either the chemical or trade name of the gas. Such markings shall be stenciled, stamped, or labeled and are not easily removable. Cylinders must also be labeled if full or empty.

b. Compressed gas cylinders shall be equipped with approved connections.

c. Employees shall be trained on the proper use, handling, and storage of compressed gas cylinders. Always close the cylinder valve before attempting to stop leaks.

d. Cylinders that are no longer used shall be marked and removed. Cylinders must be visually inspected before, during, and after use.

e. Acetylene cylinders shall be stored in an upright position, valve end up.

f. Oxygen cylinders shall not be stored near oil or grease or other highly combustible/flammable materials.

g. Oxygen cylinders in storage shall be stored in an upright position and separated from fuel-gas cylinders by a minimum distance of 20 feet, or by a noncombustible barrier at least five (5) feet high and having a fire resistance rating of at least 1/2 hour.

h. Cylinders shall not be dropped, struck by objects, or permitted to strike against each other violently. Cylinder valves shall be closed before moving cylinders, at the end of the shift, or when work is finished.

i. All empty cylinder valves shall be closed.

j. Cylinders shall be kept far enough away from the actual welding/cutting operation so that sparks, hot slag, or flames will not reach them.

k. Cylinder valves shall be always opened slowly.

l. Acetylene cylinder valves shall not be opened more than one and one-half turns of the valve stem and preferably no more than three-fourths of a turn.

m. Where a special wrench is required, it shall be left in position on the stem of the valve while the cylinder is in use. In the case of manifolded or coupled cylinders, at least one such wrench shall be available for immediate use.

n. Regulators shall be inspected at the same time cylinders are visually inspected.

o. Regulators are removed, valve caps are in place, and valves closed when cylinders are transported by vehicles. All vehicles used to transport cylinders shall have a proper support rack installed.

p. A suitable cylinder truck, chain, or other steadying device shall be used to prevent cylinders from being knocked over while in use or storage. All cylinders will be secured at all times.

q. Cylinders shall not be placed where they may become part of an electric circuit. Tapping of an electrode against a cylinder to strike an arc is prohibited.

r. When Gas Cylinders are stored, moved or transported, the valve protection cap shall be in place.

s. When cylinders are hoisted, they shall be secured in an approved cage or basket.

t. An approved fire extinguisher shall be readily available in the event of fire.

u. Special precautions shall be taken when a cylinder cap cannot be removed. The cylinder shall be marked and removed by the vendor. Never attempt to mechanical means to remove a cap. You should be able to remove a cap by hand.

v. Cylinders shall be stored in a well-ventilated area.

w. Cylinders are stored in designated areas that are labeled for full and empty cylinders.

x. All cylinders shall be stored, transported, and used in an upright position. If the cylinder is not equipped with a valve wheel, a key shall be kept on the valve stem while in use.

7. PERSONAL PROTECTIVE EQUIPMENT

a. Eye and Face Protection

i. Welding helmets and hand shields shall be used during all arc welding/cutting operations, excluding submerged arc welding. Safety goggles and glasses (with side shields) are also worn during arc welding/cutting operations. The goggles or glasses may be either of clear or colored glass, depending upon the type of exposure in welding operations. Helpers or attendants wear proper eye protection.

ii. Safety goggles or glasses with side shields and suitable filter lenses shall be permitted for use during gas welding operations on light work, torch brazing, or inspection.

iii. All operators and attendants on resistance welding or brazing equipment will use face shields or goggles, depending on the particular job.

b. Protective Clothing

i. Except when engaged in light work, all welders shall wear flameproof gauntlet gloves.

ii. Flameproof aprons made of leather, or other suitable material, may also be desirable protection against radiated heat and sparks.

iii. Woolen clothing is preferable to cotton because it is not so easily ignited. Nylon clothing is not permitted for welding/cutting operations. All outer clothing, such as jumpers or overalls, should be reasonably free from oil or grease.

c. Respiratory Protective Equipment

i. When respiratory protective equipment is required, the written Respiratory Protection Program shall be adhered to.

1. Feasible engineering controls are insufficient to mitigate the hazards.
2. Room size (with special regard to ceiling height) is limited, or there are large amounts of welding/cutting and ventilation is limited.
3. Too many welders operating in an area at one time.
4. Potentially unsafe atmospheric conditions.
5. Too much heat generated.
6. Presence of hazardous fumes, gases or dusts of paints or metals having toxins (i.e. zinc, lead, cadmium or chromium) above the allowable limits.

8. MECHANICAL VENTILATION

For purposes of this section, mechanical ventilation shall meet the following requirements.

a. A. Mechanical ventilation consists of either general dilution systems or local exhaust systems.

b. General mechanical ventilation is of sufficient capacity and so arranged as to produce the number of air changes necessary to maintain welding fumes and smoke within safe limits.

c. Local exhaust ventilation consists of freely movable hoods intended to be placed by the welder or burner as close as practicable to the work. This system is of sufficient capacity and so arranged as to remove fumes and smoke at the source and keep the concentration of them within safe limits in the breathing zone.

d. Contaminated air exhausted from working spaces is discharged into the open air or otherwise clear of the source of intake air.

e. All makeup air (replacing that withdrawn) is clean and respirable.

f. Oxygen is not used for ventilation purposes, comfort cooling, blowing dust from clothing, or for cleaning the work area.

g. Specific requirements apply to materials (including welding rods and fluxes) containing zinc, lead, mercury, beryllium, cadmium, and stainless steel to be cut, heated, and/or welded. The ES&H Department should be consulted for appropriate methods and controls.

9. FIRE PROTECTION

a. When possible, objects to be welded, cut, or heated shall be moved to a designated safe location. If this is not possible, all movable fire hazards in the work space shall be taken to a safe place.

b. If the object to be welded, cut, or heated cannot be moved and all fire hazards cannot be removed (e.g., equipment, walls, floors, etc.), positive means shall be taken to confine the heat, sparks, and slag to protect the immovable fire hazards.

c. Welding, cutting, or hot work shall not be performed where the application of flammable paint, the presence of other flammable compounds, or heavy dust concentration create a possible hazard.

d. Openings or cracks in floors, walls, ducts, tanks, etc. shall be closed. Where openings or cracks cannot be closed, additional precautions shall be taken to prevent sparks from penetrating the openings. The same precautions shall be taken in the presence of open doorways and open or broken windows.

e. Approved fire extinguishing equipment shall be present in the immediate work area.

10. FIRE WATCH

A fire watch shall be required in all cases where a fire potential exists such as within 35 feet of combustible materials or any location where materials may easily ignite; at wall or floor openings or adjacent to the opposite side of metal partitions, ceilings or roofs.

a. A fire watch shall be maintained for at least 30 minutes after completion of welding/cutting operations so that possible smoldering fire can be detected and extinguished.

b. Fire watch personnel shall be instructed in the selection and use of appropriate fire extinguishers.

c. Fire watch personnel shall be familiar with facilities and the procedures to be followed in the event of a fire. They watch for fires in all exposed areas and attempt to extinguish fires only when obviously within the capacity of the equipment available.

d. The requirement for a fire watch may be waived when, after completion of the Welding, Cutting, and Hot Work Permit, it has been determined that there is NO POSSIBILITY OF SPARKS, SLAG, HOT MATERIAL, ETC. COMING INTO CONTACT WITH FLAMMABLE OR COMBUSTIBLE SOLIDS, VAPORS, LIQUIDS, OR RESIDUES.

11. WELDING, CUTTING AND HOT WORK PERMITS

a. Before any welding, cutting, or hot work is performed, the area shall be inspected by the supervisor or safety person who will determine precautions to be followed and grant authorization to proceed in the form of a written Welding, Cutting, and Hot Work Permit. If the requirements cannot be met then welding and cutting shall not be performed.

b. Welding, Cutting, and Hot Work Permits for temporary work locations (i.e., construction sites) shall be valid for a specific location for a specified period of time as deemed appropriate by the supervisor or safety person.

c. Welding, Cutting, and Hot Work Permits for permanent locations where welding, cutting, and hot work are an integral part of the day-to-day operations (fabrication shops, mechanical shops, etc.) are valid for a period of six (6) months from the date of issue. Prior to the end of that 6- month period, ES&H shall conduct an inspection of the workplace and the permit is reissued based upon the results of the inspection. (Any defects related to performance of welding, cutting, and hot work must be satisfactorily corrected before a permit is issued).

d. Permits issued by the supervisor must be approved by the ES&H Department

e. The expiration date of Welding, Cutting, and Hot Work Permits shall be recorded in the space provided at the bottom of the permit.

12. WELDING/CUTTING ON CONTAINERS

a. Used containers: No welding, cutting, or other hot work shall be performed on empty drums, barrels, tanks, or other containers until they have been cleaned thoroughly. (This is to ensure that there are no flammable materials present or any substances such as greases, tars, acids, etc. which might produce a hazard when subjected to heat.) Any connection to the drum or vessel shall be disconnected or blanked off.

b. Venting and Purging: All hollow spaces, cavities, or containers shall be ventilated to remove gases before preheating, cutting, or welding. Purging with inert gas is recommended.

13. WELDING, CUTTING AND HOT WORK IN CONFINED SPACES

a. Welding, thermal cutting, and hot work shall be performed in accordance with the requirements of Program Directive E. A Welding, Cutting, and Hot Work Permit shall be completed prior to the start of such work.

b. Welding, thermal cutting, or hot work shall not be initiated in a confined space until atmospheric tests have been performed for oxygen and flammables and the results indicate an acceptable atmosphere as follows:

i. Oxygen levels within the confined space are greater than 19.5 percent but less than 23.0 percent by volume.

ii. Combustible/flammable gases or vapors are at levels below 10 percent of their LEL.

c. Atmospheric oxygen and LEL testing of the confined space shall be conducted CONTINUOUSLY during welding, cutting, or hot work.

d. The flammable/combustible or toxic nature of any coating shall be determined before welding, cutting, or hot work is initiated in a confined space. Such coatings shall be removed from the location of the welding, cutting or hot work for a distance sufficient (at least 4 inches whenever possible) to prevent ignition or out-gassing (from temperature increase) of coating materials in the unstripped areas. If sufficient stripping is not possible, respiratory protection and/or ventilation shall be provided.

e. Whenever feasible, local exhaust shall be provided by the contractor to capture contaminants at the source and remove them from the atmosphere in the confined space. When adequate local exhaust is not feasible, appropriate respiratory protection shall be used.

f. Gas cylinders shall be secured outside of the confined space and are shut off at the valves when the equipment is not in use. Cylinders containing oxygen, acetylene, or other gases shall not be taken into confined spaces.

g. Gas welding hoses, torches, and related equipment shall be carefully inspected. Hoses with leaks are not used in or near a confined space.

h. When left unattended for extended periods of time, gas hoses and torches shall be removed from the confined space. Gas hoses need not be removed from confined spaces in radiation zones provided the hoses are disconnected from their source.

i. Electric arc welding machines shall not be taken inside a confined space unless absolutely necessary. Electric arc welding machines may be placed within a confined space ONLY with the following assurances:

i. Atmospheric testing and evaluation have demonstrated that there is no potential for flammable or oxygen enriched atmospheres.

ii. Placing the machine(s) in the confined space will not create an electrical shock hazard.

iii. Access/egress will not be obstructed.

iv. Ventilation will not be adversely affected.

v. Emergency rescue operations will not be hindered.

j. When electrode holders are left unattended or unused for a period of time (such as at breaks or lunch periods) the electrodes shall be removed from the holders, the

holders placed in a safe location or protected, and the power switch to the equipment turned off.

k. If unattended for extended periods of time (such as overnight), electrode holders, cables, and other equipment shall be removed from the space and the power supply to the equipment disconnected. This equipment need not be removed from confined spaces in radiation zones provided the equipment is disconnected from its source.

l. Extraneous flammable or combustible materials (such as scrap wood, paper, rope, rags, etc.) shall be removed from the confined space. Combustible materials which cannot be removed shall be adequately protected.

m. Suitable fire extinguishing equipment shall be provided based on the nature and extent of flammables or combustibles present and the fires which may be expected to occur.

    i. Carbon dioxide extinguishers are used ONLY after it has been determined through pre-job planning that discharge of carbon dioxide into the space is not likely to cause a hazard to workers.

    ii. Water extinguishers or water hoses equipped with fog nozzles or fog applicators are most suitable for hot work in the presence of ordinary (Class A) combustible materials or flammable residues or coatings.

14. MANIFOLDING OF CYLINDERS

a. Cylinder manifolds shall be installed under the supervision of an experienced person(s) and must comply with proper practices in construction and use.

b. All manifolds and parts shall be appropriate for the gases for which they are approved.

c. When acetylene cylinders are manifolded, approved flash arrestors shall be installed between each cylinder and the coupler block. One flash arrestor installed between the coupler block and regulator is acceptable for outdoor use only if the number of cylinders coupled does not exceed three.

d. Each cylinder lead shall be provided with a backflow check valve.