## Cal/OSHA Gas Systems for Welding

1. **Purpose**

To establish requirements for safe welding practices.

1. **Oxygen - Fuel Gas Apparatus**

Oxygen-fuel gas welding depends on the heat produced by the combustion of a fuel gas in the presence of oxygen. The equipment is relatively portable and does not require an electric power source. Basic equipment consists of a cylinder of oxygen, a cylinder of fuel gas, two regulators, two hoses and a welding torch. The regulators are used to reduce the pressure of the gas in the cylinder to the required work pressure. Other protective equipment (safety check valve) in the piping system prevents the backflow of oxygen into the fuel gas system, stops a flash from entering the fuel gas system, and prevents an excess of pressure from oxygen in the fuel gas system. These devices help to prevent fires and explosions and are basic and permanent parts of the apparatus.

1. **Safe Handling of Cylinders**

Explosions of fuel gas or oxygen cylinders are not common occurrences due in part to the healthy regard that workers have developed for the disastrous consequences of unsafe handling procedures.

Cylinders must be stored in dry well ventilated areas where they are not likely struck or knocked over. They should be secured "upright" by some substantial (chain, heavy wire, etc.) means so they will not fall. Welding fuel-gas cylinders shall be placed with valve end up while in use or when in transport. Liquefied gases shall be stored and shipped with the valve end up. They should never be stored near stairways, gangways, or elevators. Keep sources of ignition at least 20 feet away from the storage area. Store oxygen and fuel gas cylinders separately (at least 20 feet apart or by a noncombustible barrier 5 feet high) and do not store oxygen with reserve stocks of carbides or other combustible materials. It is particularly important not to store oxygen cylinders in the same area as oil, grease or other petroleum products. CONTACT BETWEEN OXYGEN AND ANY PETROLEUM BASED PRODUCTS CAN RESULT IN FIRE AND EXPLOSION.

Always attach the valve protection cap (hand tight) when the cylinder is not being used. The cap is designed to protect the valve from damage that could cause the sudden release of the contents of the cylinder.

Make sure the cylinder is clearly marked with their contents, i.e. oxygen, acetylene, etc. When a cylinder is emptied, make it EMPTY or M T.

Cylinders with leaking fuse plugs or other leaking safety devices of any kind shall be tagged in such a manner that it is visible at eye level from all directions. The safety department and supplier of the gas cylinder must be notified immediately. A baracade must be placed around the cylinder that include signage in all approachable directions that reads, “Danger, Leaking Cylinder, No Entry and No Smoking.”

1. **Valve Examination and Regulators**

Use the proper wrench when attaching the regulator to the cylinder. DO NOT use a pipe wrench or a pair of pliers. If the valve is equipped with a hand wheel do not attempt to open or close it with a hammer.

Before connecting a regulator to a cylinder valve, the valve shall be opened slightly and closed immediately. Make sure to stand to the side as you perform this action and do not look into the cylinder valve while performing this action.

Watch the needle of the regulator after the torch valves have been closed. If it begins to creep upward replace the regulator immediately. DO NOT try to repair regulators or torches. Repair work should be done by a qualified person.

1. **Connections and Hoses**

Replace hoses that have leaks, burns, or worn places. Cut out the damaged section and splice the two cuts together. DO NOT attempt to repair hoses with tape. You can test for leaks by submerging the hose in water and looking for bubbles. Leaks in connections and hoses can also be detected by painting on a leak test solution of soapy water and checking for bubbles. Never test for leaks by using a flame.

Use only approved bronze or brass fittings. When making up connections do not use white lead, grease, pipefitting compounds or other petroleum products.

Make sure that the hoses are not placed where they can be walked on, driver over, cut or otherwise damaged. DO NOT expose them to heat, sparks, oil or grease.

1. **Color Code the Hoses**

All welding gas hoses used in the operation should conform to the following color code schedule:

* GREEN.......….OXYGEN
* RED........…….ACETYLENE
* BLACK.......…..AIR/INERT GAS

1. **Fire Protection**

Misuse of portable welding equipment is a frequent cause of industrial fires. Stationary equipment is less hazardous because it is usually located in an area designed with fire prevention in mind. Portable equipment can be carried to almost any location on the job and improper use of the equipment can result in a fire and/or explosion.

Do not allow welding in areas that have not been made fire safe.

1. **Before Beginning Welding Operations**

* Clear the floor of paper, wood shavings and other flammable materials for a space of 35 feet. Move other flammable materials at least 35 feet from the work area, or cover them with fire resistant shields.
* Cover the cracks and openings in the floor to prevent sparks from falling through to the lower floors. If it isn't possible to do this, check the lower floor and make sure there are no combustibles, which could be exposed to, sparks.
* When possible move the work to be welded to a safe location.
* Cover wooden floors with a fire resistant material.
* Cover nearby combustible walls and partitions with fire resistant shields. If the walls area made of metal, remove the combustible material from the other side. If they cannot be removed, station a "fire watch".
* Shut down ventilation and close ducts if there is a chance they could transmit sparks to other areas in the plant.
* Maintain a "fire watch" during the work and for 1/2 hour after the work is completed.
* Train "fire watchers" in the proper use of fire extinguishing equipment and how to sound alarms.
* Provide fire extinguishers or sprinkler systems in welding areas. Portable welding equipment should be equipped with an extinguisher.

1. **Personal Protective Equipment**

Personal protective gear for welders is required to protect the operator’s eyes from radiation and to protect the operator from hot weld slag.

Sunglasses or colored glass will not provide sufficient protection against radiation. Specially designed helmets equipped with filter plates to protect against ultraviolet, infrared and visible radiation must be worn when arc welding.

Cover bare skin to protect against both sparks and radiation. Woolen clothing gives better protection than cotton because it is less flammable. If cotton clothing is worn it should be treated chemically to reduce flammability. Clothing should be free of grease and oil and other substances that may burn. Do not wear clothing with cuffs or pockets where sparks can lodge. Flameproof gauntlet gloves, a leather or asbestos apron and high top shoes provide good protection against sparks and hot slag.

1. **Hazards**

* Foot injuries that result from objects that drop or fall onto the foot while handling, moving or working with heavy materials.
* Eye injuries, particularly flash burn that could occur when looking at arc welding operations without benefit of eye protection.
* Foreign particle in eye injuries that result from flying or falling particles generated during production operations.
* Burns to hands, fingers, arms and body from accidental contact with hot surfaces during or after welding or cutting operations.
* Fire or possible explosion damage to the plant and equipment because of faulty torch, gas fuel leaks, or improper operation of the torch.
* Burns resulting from contact with open flame or slag during cutting operations and from accidental contact with hot material or scrap produced during operation.
* Eye injury caused by looking at point of operation without protective eye shields.
* Caught in or between and struck by accidents caused when handling moving materials to be cut or when removing materials after the cutting operation is performed.
* Hearing impairment that results from prolonged exposure to high noise levels without benefit of hearing protection.
* Head injuries that may occur when there is a possibility of falling or flying objects or bumping into suspended or traveling stock. Irritation or damage to your respiratory system that result from inhalation of weld fumes.

1. **Safe Job Procedure**

* Wear safety glasses in all production areas of plant. Small foreign particles area generated throughout the weld shop department, and these particles could enter the eye causing severe eye irritation. For this reason, it is essential that eye protection be worn.
* Wear safety-toe shoes in all production areas. The shoes worn in the weld department should provide adequate protection against heavy objects that could fall or drop. Canvas covered shoes and/or sandals are not permitted in work areas of the plant.
* Hearing protection, insert plugs or muffs, must be worn in all areas of the department where high noise levels are generated.
* For arc welding, approved hoods with shaded lenses adequate for the type of welding being done must be worn. It is also necessary to wear goggles under hoods to protect the eyes when chipping or grinding after the weld operation.
* Adequate gloves must be worn to protect against burns or cuts while performing work in the weld department. It is recommended that leather gloves be worn to provide protection against the hot surfaces and sharp edges that are basic to our operation.
* Wear adequate clothing for this type of operation. Synthetic shirts and pants should not be worn since some of these area highly combustible and can burn with even a slight spark. Heavy cotton shirts with long sleeves, buttoned at the wrist, are preferred. Padded leather aprons or similar protection is recommended for welders.
* When welding operations produce irritating or noxious fumes, you must wear a disposable filter mask.
* Know the correct procedure for setting up the cutting operation, turning on the torch and completing the cut before attempting to use the torch-cutting machine. If you have questions on proper set-up, ask your supervisor.
* Inspect the torch body, gauges, and hose for damage or defects before making any cuts. Report gas and oxygen leaks immediately for repairs.
* Keep oil and grease away from all oxygen valve connections, hoses and gauges.
* Make sure all hose and torch body connections are tight and not cross threaded. Remember that gas hose connections have left-handed threads. Never interchange oxygen with gas hose.
* When setting up for a cut, visually check for congestion, combustibles, and other conditions that could impair the safety of the operation.
* Wear proper protective equipment when working on torch cutting operations. Properly tinted safety glasses with side shields, safety shoes, gloves and clothing suitable for this job must be worn. DO NOT wear clothing with synthetic materials that can burn rapidly when exposed to sparks.
* Be alert for leaks when opening natural gas valves. If a strong odor of gas is present, shut the system off and check out the problem.
* When lighting the torch, open the torch fuel gas valve one-half turn. Reduce the fuel pressure to get rid of black smoke. Open the torch oxygen valve to get the proper flame. If torch backfires, try relighting. If there is another flashback, stop using the torch and get it inspected.
* During cutting, keep hands and arms out of the scrap fall area and be alert for sparks during the operation.
* When torch-cutting lead painted steel or galvanized materials, wear a respirator.
* Make sure that a fire extinguisher is readily available during cutting operations. The fire extinguisher should be located in close proximity and easily accessible.
* After making the cut, turn off torch valves and fuel/oxygen supply. Mark all hot materials with the work "HOT" if other employees are working close to this operation.
* Make sure work area is clean and ready for next operation after completing work or at the end of the shift.

1. **Metal Inert Gas Welding**

* Secure inert gas cylinders in upright position at all times. DO NOT leave bottles unsecured since they could fall over causing injury to others or property damage.
* Caps must be kept on gas cylinders not hooked up to regulators. Never store gas cylinders without the cap being secure.
* Exercise good lifting techniques when lifting electrode wire onto spools. The wire is heavy, so lift it with slightly bent knees, keep the back nearly straight. DO NOT bend at the waist to pick spools up.
* Check regulator, gas flow settings before starting weld. Make sure that gas line connections are tight and that the regulator is properly adjusted. DO NOT use regulators that are in damaged condition. Have them repaired.
* Exercise caution when changing inert gas bottles. The bottles are heavy so good material-handling techniques must be used. Always be extra careful with fuel bottles that do not have protective caps in place. The bottle must be secured before removing the protective cap.
* Check torch body and electrode holder for defects prior to starting to weld. Damaged insulation hoses or other noticeable defects should be reported.
* Never look directly at work when striking an arc without adequate eye protection. Always be alert to the danger of flash burns to yourself and others. Remember, arc welding produces infrared and ultraviolet rays that can easily burn unprotected eyes.
* Prior to starting weld, be sure that wire electrode spool is not binding.

1. **Toxic Substances May Be Present While Welding**

When hazardous substances are used as base metals, fluxes, plating or filter metals, local exhaust ventilation must be used. Beryllium, cadmium, chromium, fluorides, lead, mercury, zinc, or any inert gas metal arc welding, and oxygen cutting of stainless steel, all require the use of local exhaust ventilation to bring toxic concentrations within the Permissible Exposure Limit (PEL). If it is not possible to supply adequate ventilation, use supplied air respirators.

Remove coatings along the line of the weld (lead paint, galvanize, coal tar pitch, plastic, etc.) so they can't burn. Clean all work which has been degreased, and do not operate electric arc welding equipment near a degreasing operation. The degreasing agents trichlorethylene and perchlorethylene (or any other agent) decompose when exposed to the arc and can irritate the eyes and respiratory tract.

1. **Welding in Confined Spaces**

The threat posed by toxic gases, fumes, and dust is intensified when the welding work is done in a confined space.

Concentrations of toxic substances can rapidly reach hazardous levels without adequate ventilation.

Compressed cylinders for welding procedures are never to be brought into a confined space. If welding in a confined space is required, appropriate hoses must be used.

OSHA regulations governing work in confined spaces require that the area be adequately ventilated and free from flammable or explosive substances. No welding or cutting may take place until the atmosphere has been tested and shown not to be dangerous or likely to become dangerous.

Workers in the confined space must be equipped with a safety belt and lifeline. A trained worker with approved respiratory equipment must remain on "standby" outside the confined space ready to provide assistance in case of emergency.

REFER TO THE CONFINED SPACE ENTRY PROGRAM FOR COMPLETE DETAILS

1. **Training**

Only trained employees, by a qualified person, may be in charge of the oxygen or fuel-gas supply equipment including generators, and oxygen or fuel-gas distribution piping systems.

This training must be documented and approved by management.