

**WELDING SAFTEY**  
**J.A. Rosa Construction, LLC**

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**OXYGEN ACETYLENE WELDING AND CUTTING SAFETY**

10. Preliminary Safety Concerns

Welders, cutters, and their supervisor shall be trained in the safe operation of their equipment, safe welding/cutting practices, and welding/cutting respiratory and fire protection.

Workers, watchers, and the public shall be shielded from welding rays, flashes, sparks, molten metal, and slag. Employees performing welding, cutting, or heating shall be protected by PPE appropriate for the hazards. Respiratory, vision, and skin protection required in this Section shall follow applicable requirements of Section 1.10.

All welding and cutting equipment and operations shall be in accordance with standards and recommended practices of ANSI/ American Welding Society (AWS) Z49.1.

Understand the hazards of the specific materials being welded and the consumables used by consulting Safety Data Sheets (SDS) and referring to Rosa's Hazard Communication Program

Oxygen-acetylene welding generates welding fumes and gases that pose significant health risks if inhaled in hazardous concentrations. Toxic gases produced include carbon monoxide, ozone, nitrogen oxides, and hydrogen chloride.

Fumes (Particulates) include fine metal particles and metal oxides, such as iron oxide, manganese oxides, nickel compounds, hexavalent chromium (when welding stainless steel or chrome), cadmium oxides, and zinc oxide (from galvanized steel).

All operations shall be ventilated such that personnel exposures to hazardous concentrations of airborne contaminants are within acceptable limits.

<b>Substance</b>	<b>OSHA PEL</b>
General Welding Fumes	5 mg/m <sup>3</sup>
Lead	50 µg/m <sup>3</sup>
Cadmium	5 µg/m <sup>3</sup>
Zinc Oxide	5 mg/m <sup>3</sup>
Iron Oxide	10 mg/m <sup>3</sup>
Manganese	5 mg/m <sup>3</sup>
Chromium (VI)	5 µg/m <sup>3</sup>

Cable, hoses, and other equipment shall be kept clear of passageways, ladders, and stairways.

Welding, cutting, or heating operations that involve or generate fluorine or zinc compounds shall be performed in accordance with the following.

- a. In confined spaces, local mechanical exhaust ventilation or personal respiratory protection shall be used.
- b. In open spaces, sampling shall be performed to determine concentrations of fluorides or zinc compounds and the need for local exhaust ventilation or personal respiratory protection.

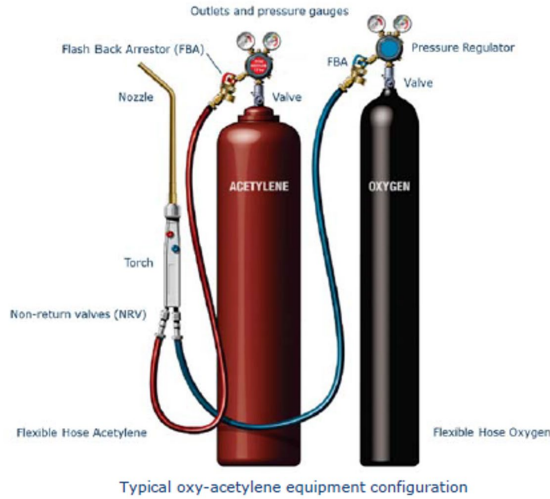
Arc and gas cutting. Oxygen cutting using either an iron powder or chemical flux, gas-shielded arc cutting, and plasma cutting shall employ local mechanical exhaust ventilation or other means adequate to remove the fumes generated.

## 10.2 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 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.

## 10.3 Safe Handling of Cylinders

Cylinders must be stored in dry well-ventilated areas where they are not likely to be struck or knocked over. They should be secured **"upright"** by some substantial (chain, heavy wire, etc.) means so they will not fall or tip overturning into a projectile 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 which could cause the sudden release of the contents of the cylinder.

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

#### 10.4 Valve Examination & 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.

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. A qualified person should do repair work.

#### 10.5 Connections and Hoses

Replace hoses which 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 evaluate 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.

Oxygen and fuel gas hoses shall not be interchangeable. A single hose that has more than one gas passage shall not be used.

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 off or otherwise damaged. Do not expose them to heat, sparks, oil, or grease.

#### 10.6 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**

## 10.7 Electric Arc Welding

Electric arc welding is a fusion process in which adjoining pieces of metal are melted together forming a joint which is as strong as the original metal. Heat is supplied by an electric arc drawn between the work and an electrode. There are two types of electrodes, Carbon, and Tungsten. The only function of a carbon or tungsten electrode is to carry current. As current is applied to the electrode the electrode melts supplying filter metal to the joint.

In addition to carrying current and supplying filter metal, these electrodes are coated with a substance which vaporizes as the electrode melts. The vapor which is formed provides a gaseous shield around the arc and the work which prevents the formation of oxides and nitrides in the weld metal. While vapor from the coating of the electrodes has not been identified as an occupational hazard, filler metals which are introduced to the joint as the electrode melts may contain cadmium, nickel, or fluorine compounds. In all instances precautions must be taken to avoid contact with the metal fumes or the flux itself.

OSHA regulations require that when the filler metal contains cadmium the containers must be labeled:

**WARNING**  
**CONTAINS CADMIUM**  
**POISONOUS FUMES MAY BE FORMED**  
**ON HEATING**

When fluxes contain fluorine compounds the containers must be labeled:

**CAUTION CONTAINS FLUORINE**

Adequate ventilation and/or respirators must be used to avoid breathing the fumes.

## 10.8 Welding Procedures

### 10.8.a 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.

### 10.8.b Before Beginning Welding Operations

Before conducting welding or cutting operations, the area shall be surveyed to ensure it is free of the following hazards:

- a. Proximate combustible materials,
- b. The presence or generation of potentially explosive atmospheres (flammable gases, vapors, liquids, or dusts), and the presence or nature of an oxygen-enriched atmosphere

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 wooden floors with fire-resistant material. Cover the cracks and openings in the floor to prevent sparks from falling through to the lower floors. If it is not possible to do this, check the lower floor and make sure there are no combustibles which could be exposed to sparks.

If possible, move the work to be welded to a safe location.

Cover nearby combustible walls and partitions with fire resistant shields. If the walls are made of metal, remove the combustible material from the other side. If they cannot be removed, station a "fire watch"<sup>1</sup>.

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.

Provide fire extinguishers or sprinkler systems in welding areas. Portable welding equipment should be equipped with an extinguisher.

## 10.9 Welding Equipment

Check both the weld lead cable and the work lead cable for damaged insulation and for exposed wires.

Check the electrode holders for loose or exposed connections. Do not splice weld lead within 10 feet of the holder. Replace it.

Do not coil the electrode cable around your body.

Check the composition of fluxes, rods, and coatings. If there is a potential hazard find out how to protect yourself.

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<sup>1</sup> The fire watch, is responsible for observing the work area, identifying potential fire hazards, and taking action to extinguish any fires that may occur, or calling for assistance if needed.

Ground both the frame of the welding equipment and the metal being welded. Do not attach the ground wires to pipes carrying gas or flammable liquids or to metal conduits carrying electrical wires. Ground as close to the machine as possible.

When floors are wet take precautions against shock.

Do not allow metal parts in contact with the electrode to touch your skin or wet clothing. Wear dry work gloves.

Do not cool electrode holders by putting them in water.

Electrically disconnect the welding equipment when changing electrodes in gas tungsten arc electrode holders.

### 10.10 Personal Protective Equipment

Personal protective gear for welders is required to protect the operators' 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 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. Specially treated Flame-Resistant Clothing should be worn. Clothing should be free of grease and oil and other substances which may burn. Do not wear clothing with cuffs or pockets where sparks can lodge. Flame proof gauntlet gloves, a leather apron and high-top shoes provide good protection against sparks and hot slag.

### 10.11 Weld Department / Personal Protective Equipment

#### 10.11.a Responsibility

1. It is recognized that no set of safe job procedures can cover all exposures where personal protective equipment may be needed. For this reason, we depend on your good judgment to wear the personal protective equipment that is necessary to protect your safety and health while on the job.
2. Each employee is also responsible for maintaining the personal protective equipment that is provided by the company for his or her protection.

#### 10.11.b Hazards

1. Foot injuries that result from objects that drop or fall onto the foot while

handling, moving, or working with heavy materials.

2. Eye injuries, particularly flash burn, which could occur when looking at arc welding operations without benefit of eye protection.
3. Foreign particle in eye injuries that result from flying or falling particles generated during production operations.
4. Burns to hands, fingers, arms, and body from accidental contact with hot surfaces during or after welding or cutting operations.
5. Hearing impairment that results from prolonged exposure to high noise levels without benefit of hearing protection.
6. 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 results from inhalation of weld fumes.

**10.11.c General Safety Procedure**

1. Wear safety glasses in all production areas of plant. Small foreign particles generated throughout the work area could enter the eye from any angle causing severe eye irritation, laceration, or blindness. For this reason, it is essential that eye protection be worn. Safety Green welding glasses come in different shades, ranging from shades 2.0, 3.0, 4.0, 5.0, 6.0, and 8.0. The lower the shade number, the lighter the lens, while the higher the number, the darker the lens.



2. Wear safety-toe shoes in all production areas. The shoes should provide adequate protection against heavy objects that could fall or drop, have a strong inner sole vamp, reenforced toe area. Canvas covered shoes and/or sandals are not permitted in work areas on any Rosa Construction site.
3. Hearing protection, insert plugs or muffs, must be worn in all areas of high noise levels above 85 dB are anticipated.
4. 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.
5. 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.
6. Wear adequate clothing for this type of operation. Synthetic shirts and pants should be worn since some of these items are 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.

7. When welding operations produce irritating or noxious fumes, you must wear a disposable filter mask.

## 10.12 Oxy Gas Torch Cutting

### 10.12.a Hazards

1. Fire or explosion damage to the site and equipment because of faulty torch, gas fuel leaks, or improper operation of the torch. Always inspect your equipment before use.
2. Burns resulting from contact with open flame or slag during cutting operations and from accidental contact with hot material or scrap produced during operation.
3. Eye injury caused by looking at point of operation without protective eye shields.
4. Caught in or between and struck by accidents caused when managing moving materials to be cut or when removing materials after the cutting operation is performed.

### 10.12.b Safety Procedure

1. 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.
2. Inspect the torch body, gauges, and hose for damage or defects before making any cuts. Report gas and oxygen leaks immediately for repairs.
3. Keep oil and grease away from all oxygen valve connections, hoses, and gauges.
4. Make sure all hose and torch body connections are tight and not cross-threaded. Remember that gas hose connections have left-handed threads. Never exchange oxygen with gas hose.
5. When setting up for a cut, visually check for congestion, combustibles, and other conditions that could impair the safety of the operation.
6. 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.
7. 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.
8. When lighting the torch, open the torch fuel gas valve one-half turn. Reduce the fuel

- pressure to get rid of black smoke. Open 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.
9. During cutting, keep hands and arms out of the scrap fall area and be alert for sparks during the operation.
  10. When torch cutting lead painted steel or galvanized materials, wear a respirator.
  11. Make sure that a fire extinguisher is readily available during cutting operations. The fire extinguisher should be in proximity and easily accessible.
  12. 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.
  13. Make sure work area is clean and ready for next operation after completing work or at the end of the shift.

#### **10.12.c Safety Tips**

1. By far the greatest exposure in the cutting operation is from burns because of a flame, hot materials, or slag. You must use good judgment in performing the operation and wearing the proper clothing and equipment to prevent these injury exposures.
2. Shaded safety glasses should be worn whenever torch cutting, to protect your eyes from burns.
3. Never permit flammable liquids or combustible materials to be located close to the cutting operation. The work area should be clean and uncongested.
4. Always be on the alert for pinch points caused by material being placed onto the torch table by hoist or manually. Never place your fingers into an area that could result in a crush injury because of something being dropped or moved.
5. Torch bodies and tips must be kept clean if they are going to do the right job. Always be sure that the tip and the torch body are in good condition. When lighting torches, do not use cigarettes, matches or cigarette lighters. The best method is to use the spark lighter.
6. Never exchange hoses on gas-oxygen welding equipment. If hose is damaged or defective, have it repaired or replaced.
7. Always on the alert for natural gas leaks. If strong odor of gas is present, shut down the system and check out the problem.
8. Always keep your mind on what you are doing when operating the torch cutting machine.

## 10.13 Arc Welding

### 10.13.a Hazards

1. Burns resulting from accidental contact with hot surface during welding operation or immediately after before materials have been cooled.
2. Flash burns to eyes resulting from looking at the arc too closely without proper eye protection.
3. Respiratory irritation resulting from breathing in fumes or particles generated through some welding operations.
4. Electric shock or burns because of accidental contact with electrical energy source.
5. Strains that result from manually moving material during the welding fit-up operation.

## 10.14 Safe Job Procedure

1. Proper protective clothing should be worn whenever performing arc welding operations. The following clothing is recommended:
  - A. Gauntlet gloves and aprons of leather should be worn as protection against radiated heat and sparks.
  - B. Shirt sleeves should be kept buttoned about the wrist with nothing in shirt pockets.
  - C. It is not advisable to wear low-cut shoes unless the ankles area covered with protective leggings. It is easy for sparks and hot flux particles to fly into open shoes, causing severe burns to feet.
  - D. Safety glasses with proper side shields and shaded lenses should be worn under arc helmets to protect against flying particles that area generated during cleaning operations.
  - E. Helmets or hand-held shields should be used whenever arc welding and the shields should contain the proper filter lenses and sheer protective glass cover.
2. Visually inspect protective equipment, particularly helmets and hand shields frequently for damage. If the equipment has a damaged shield or is badly cracked, it should be replaced.
3. Always check general safety of work area before starting operations. Be considerate of others working in the immediate area. If necessary, place suitable shields or screens around the operation to prevent your arc flash and ultra-violet rays from casing injury to other workers.

4. If welding on zinc or cadmium plated metals, wear a fume respirator specific for metal fumes.
5. Plan. Make sure that jig or worktable is ready for operations to be done. Good judgment should be used in setting up for the welding operation so that manual handling or moving parts to be welded is minimized. Be sure that all the tools and materials needed for the job are nearby, but not in the way.
6. Before starting welding operation, check all electrical connections. Be sure that the electrical connections are secure and attached to the work. The ground rod should be securely connected to work or to the work jig.
7. Keep work leads as short as possible to minimize damage and reduce trip hazards to yourself and others working in area. When laying out leads, be considerate of others who work or walk in the area, do not create tripping hazards with your equipment or welding leads.
8. Carefully examine the electrical insulation on holders and cable at the beginning of each shift. Badly worn or frayed insulation and damaged holders should be replaced or repaired. Report any unsafe condition to your supervisor.
9. Make sure electrode is clear of conductor before starting the work. If the electrode does touch ground, an accidental flash can result in injury to your eyes and the eyes of another. It is also important to keep yourself insulated from the ground or metal when changing electrodes.
10. Remove electrodes from holder when not in use.
11. Always shut off power source at machine and make sure that arc is not in contact with ground lead whenever leaving the work area.
12. Be alert about burn hazards. Always be watchful of others working in the area who may be burned because of heat generated from your welding operation. Be certain that material is cool before you touch it without gloves.
13. Good housekeeping is critical to safety in welding operations. Maintaining good housekeeping is an on-going job, but it is especially important in this operation.

### 10.15 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.

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 evaluated and shown not to be dangerous nor likely to become dangerous.

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

**REFER TO THE CONFINED SPACE ENTRY CHAPTER FOR COMPLETE DETAILS.**