



SECTION 1 – SAFETY PRECAUTIONS – READ BEFORE USING

 Protect yourself and others from injury—read, follow, and save these important safety precautions and operating instructions.

1-1. Symbol Usage

 **DANGER!** – Indicates a hazardous situation which, if not avoided, will result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.

 Indicates a hazardous situation which, if not avoided, could result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.


NOTICE – Indicates statements not related to personal injury.


 Indicates special instructions.





This group of symbols means Warning! Watch Out! ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid these hazards.


1-2. Welding, Cutting, Brazing, And Heating Hazards

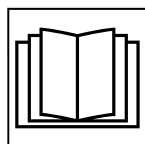
 The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard. The safety information given below is only a summary of the more complete safety information found in the Principal Safety Standards. Read and follow all Safety Standards.

 Only qualified persons should install, operate, maintain, and repair this equipment. A qualified person is defined as one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project and has received safety training to recognize and avoid the hazards involved.

 During operation, keep everybody, especially children, away.

 Do not use this equipment unless you are trained in its proper use or are under competent supervision. Follow the procedures described in this manual every time you use the equipment. Failure to follow these instructions can cause fire, explosion, asphyxiation, property damage, or personal injury. This equipment must be used in accordance with all Federal, State, and local regulations as well as DOT (Department of Transportation) and CGA (Compressed Gas Association) regulations. Contact your gas supplier for more information on the proper use of compressed gases.

 In this document, the phrase "welding and cutting" also refers to other oxy-fuel operations like brazing and heating.



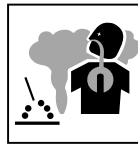
READ INSTRUCTIONS.

- Read and follow all labels and the Owner's Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.
- Use only genuine replacement parts from the manufacturer.
- Perform installation, maintenance, and service according to the Owner's Manuals, industry standards, and national, state, and local codes.



HOT PARTS can burn.

- Do not touch hot parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.



FUMES AND GASES can be hazardous.

Welding and cutting produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- Ventilate the work area and/or use local forced ventilation at the flame to remove welding and cutting fumes and gases. Some gases (natural gas and acetylene) are lighter than air and will collect in high areas. Other gases (propane and butane) are heavier than air and will collect in low areas. Heavier-than-air gases are more difficult to diffuse and are more likely to accumulate. The recommended way to determine adequate ventilation is to sample for the composition and quantity of fumes and gases to which personnel are exposed.
- If ventilation is poor, wear an approved air-supplied respirator.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer's instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, and metals.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watchperson nearby. Welding and cutting fumes and gases can displace air and lower the oxygen level, causing injury or death. Be sure the breathing air is safe. Test atmospheres in confined spaces for explosive and toxic gases before using oxy-fuel equipment.
- Do not weld or cut in locations near degreasing, cleaning, or spraying operations. The heat from welding or cutting flame can react with vapors to form highly toxic and irritating gases.
- Do not weld or cut on coated metals, such as galvanized, lead, or cadmium-plated steel unless the coating is removed from the affected area, the area is well ventilated, and while the operator is wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded or cut.
- Do not weld or cut on sealed air conditioning or refrigeration systems unless all refrigerants have been removed from the system.



LIGHT RAYS can burn eyes and skin.

Light rays from the welding and cutting process produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin. Sparks fly off from the weld.

- Wear approved face protection fitted with a proper shade of filter lenses to protect your face and eyes from light rays and sparks when welding, cutting, or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).
- Wear welding goggles, or wear welding helmet/welding face shield over approved goggles/safety glasses with side shields.

- Use protective screens or barriers to protect others from flash, glare and sparks; warn others not to watch the welding or cutting.
- Wear body protection made from leather or flame-resistant clothing (FRC). Body protection includes oil-free clothing such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.

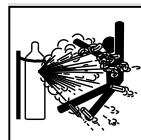


WELDING AND CUTTING can cause fire or explosion.

Welding and cutting on closed containers, such as tanks, drums, or pipes, can cause them to blow up. Sparks can fly off from the welding or cutting operations. The torch flame, flying sparks, hot workpiece, and hot equipment can cause fires and burns. Check and be sure the area is safe before doing any welding or cutting.

- Do not use this welding and cutting equipment with gases and pressures other than those for which it is intended. Oxygen is not flammable; however, the presence of pure oxygen will drastically increase the speed and force with which burning takes place. Oxygen must never be allowed to contact grease, oil, or other petroleum-based substances; therefore, be sure there is no oil or grease on the regulator, cylinder, valves, or equipment. Do not use petroleum-based pipe sealants. Do not use sealants on metal-to-metal seals, such as hose and CGA cylinder connections; use PTFE-based sealant (PTFE tape) on pipe threads. Do not use or store near excessive heat (above 125° F/51.5° C) or open flame. Do not refer to oxygen as air and do not use oxygen as a substitute for compressed air. Do not use oxygen to clean clothes or work area, for ventilation, or to operate pneumatic tools. Open oxygen cylinder valves slowly. Be sure regulator adjusting handle is in the full out (off) position before opening oxygen cylinder valve.
- Inspect all equipment before use. Do not use damaged, defective, or improperly adjusted welding and cutting equipment. Make sure levers and valves work properly, threads on equipment are clean (no grease or oil) and not deformed, gauges are intact and easy to read, regulator is clean and free of oil or dirt, and fittings are properly sized for the cylinder. Make sure hoses are clean (no grease or oil) and ferrules are properly installed so the fitting does not slip inside the hose. Be sure all connections are tight.
- It is recommended that a reverse-flow check valve or a flashback arrestor be installed between the torch handle and the regulator. Check valves do not prevent the propagation of a flame upstream (flashback) but are designed to prevent the unintentional backflow of gases into the cutting attachment, torch, hoses, or regulator which could cause an explosion or fire. A flashback arrestor can be installed on the torch handle or regulator outlet instead of a check valve. Smith flashback arrestors have a reverse flow check valve and prevent the propagation of a flame upstream. If a flashback arrestor is installed, a check valve is not necessary. Using a flashback arrestor and a check valve can reduce gas flow and affect torch operation. To help prevent the reverse flow of gases, be sure the cylinders contain enough gas to complete the work.
- Understand the properties and applications of a gas, and how to safely use a gas, before placing it in service.
- Perform work only in an area with a fireproof floor (concrete). Do not heat concrete because it can expand and explode violently.
- Perform work on a fireproof surface. Use heat resistant shields to protect nearby walls and flooring.
- Do not use if grease or oil is present on equipment or if equipment is damaged. Have equipment cleaned/repared by a qualified person.
- Do not open a cylinder valve quickly or the regulator can be damaged and cause a fire.
- Do not open acetylene cylinder valve more than 1–1/2 turns. (For all gases except acetylene, open cylinder valve fully to backseat the cylinder valve.) Keep cylinder wrench on the cylinder for quick shut-off.
- Do not slightly open or "crack" fuel cylinder valve to blow debris from the valve outlet. Remove the debris using nitrogen, air, or a clean, oil-free rag.
- Always purge gas from the system before lighting torch. Purge gas in a well-ventilated area and away from flame or sparks.

- Keep torch flame or sparks away from cylinder, regulator, and gas hose.
- Use only the gases recommended by the manufacturer of the oxy-fuel equipment being used.
- Never light a torch with matches or a lighter. Always use a striker.
- Do not use acetylene above 15 psi (103 kPa) flowing. It is acceptable to use acetylene regulators that indicate a static pressure up to 22 psi (151 kPa).
- Do not withdraw acetylene from a cylinder at a rate exceeding 1/7 of the cylinder capacity per hour (50 SCFH for a 350 ft³ cylinder). Maximum withdrawal rate for a half-full 100 lb propane cylinder at 70°F is 75 SCFH (2124 lph).
- When required flows (SCFH) exceed the recommended withdrawal rate from one cylinder, then additional cylinders must be manifolded to provide safe and efficient operation.
- When using liquid oxygen, tips may require greater gas volume than a single cylinder is capable of producing. External evaporators or manifolding multiple cylinders may be necessary to supply sufficient gas flows.
- Do not use long gas hoses or hoses with multiple connections because they restrict gas flow and reduce gas pressure. These conditions can cause backfires and flashbacks, and reduce equipment efficiency.
- Do not use torch if you smell gas. Check oxy-fuel system for leaks with an approved leak detection solution or leak detector. Never test for gas leaks with a flame.
- Remove all flammables within 35 ft (10.7 m) of the welding or cutting operation. If this is not possible, tightly cover them with approved covers.
- Do not weld or cut where flying sparks can strike flammable material.
- Protect yourself and others from flying sparks and hot metal.
- Be alert that welding and cutting sparks and hot materials from welding and cutting can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that welding or cutting on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not cut or weld on tire rims or wheels. Tires can explode if heated. Repaired rims and wheels can fail. See OSHA 29 CFR 1910.177 listed in Safety Standards.
- Do not weld or cut on containers that have held combustibles, or on closed containers such as tanks, drums, or pipes unless they are properly prepared according to AWS F4.1 (see Safety Standards).
- Do not weld or cut where the atmosphere can contain flammable dust, gas, or liquid vapors (such as gasoline).
- Wear body protection made from leather or flame-resistant clothing (FRC). Body protection includes oil-free clothing such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
- Do not use fuel gases to clean clothes or work area.
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding or cutting.
- After completion of work, inspect area to ensure it is free of sparks, glowing embers, and flames.
- Follow requirements in OSHA 1910.252 (a) (2) (iv) and NFPA 51B for hot work and have a fire watcher and extinguisher nearby.



CYLINDERS can explode if damaged.

Compressed gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding or cutting process, be sure to treat them carefully.

- Protect compressed gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flames, and sparks.

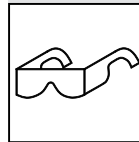
- Install cylinders in an upright position by securing to a stationary support or cylinder rack to prevent falling or tipping. Do not lay acetylene cylinders on their sides or acetone will flow out of the cylinder and damage the equipment.
- Keep cylinders away from any arc welding, cutting, or other electrical circuits.
- Never drape a welding or cutting torch over a gas cylinder.
- Never weld or cut on a pressurized cylinder - explosion will result.
- Use only correct compressed gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition. Do not use compressed gas cylinder unless an approved gas regulator is attached to the gas valve.
- Turn face away from valve outlet when opening cylinder valve. Do not stand in front of or behind the regulator when opening the valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Use the proper equipment, correct procedures, and sufficient number of persons to lift, move, and transport cylinders.
- Store compressed gas and oxygen cylinders in separate locations.
- Store empty cylinders with valves closed and caps in place.

- Do not modify or repair cylinders or valves. Store leaking acetylene cylinders outdoors in a safe area. Identify leaking cylinders and return them to the supplier.
- Dispose of used disposable cylinders according to the manufacturer's recommendations. Do not throw cylinders in fire.
- Follow instructions provided by the gas supplier and on compressed gas cylinders, associated equipment, and in Compressed Gas Association (CGA) publication P-1 listed in Safety Standards.



BUILDUP OF GAS can injure or kill.

- Shut off compressed gas supply when not in use.
- Always ventilate confined spaces or use approved air-supplied respirator.



FLYING METAL or DIRT can injure eyes.

- Welding, cutting, chipping, wire brushing, and grinding cause sparks and flying metal.
- Wear welding goggles, or wear welding helmet/welding face shield over approved goggles/safety glasses with side shields.

1-3. California Proposition 65 Warnings

⚠ WARNING – This product can expose you to chemicals including lead, which are known to the state of California to cause cancer and birth defects or other reproductive harm.

For more information, go to www.P65Warnings.ca.gov.

1-4. Principal Safety Standards

Safety in Welding, Cutting, and Allied Processes, American Welding Society standard ANSI Standard Z49.1. Website: www.aws.org.

Safe Practices for the Preparation of Containers and Piping for Welding and Cutting, American Welding Society Standard AWS F4.1. Website: www.aws.org.

Recommended Practices for Safe Oxyfuel Gas Cutting Torch Operation, American Welding Society Standard C4.2/C4.2M, and *Recommended Practices for Safe Oxyfuel Gas Heating Torch Operation*, American Welding Society Standard C4.3/C4.3M. Website: <http://www.aws.org>

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1 from Compressed Gas Association. Website: www.cganet.com.

Acetylene CGA Pamphlet G-1 from Compressed Gas Association. Website: www.cganet.com.

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2 from Canadian Standards Association. Website: www.csagroup.org.

Safe Practice For Occupational And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute. Website: safetyequipment.org.

Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, NFPA Standard 51B from National Fire Protection Association. Website: www.nfpa.org.

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910.177 Subpart N, Part 1910 Subpart Q, and Part 1926, Subpart J. Website: www.osha.gov.

OSHA *Important Note Regarding the ACGIH TLV, Policy Statement on the Uses of TLVs and BEIs*. Website: www.osha.gov.

Applications Manual for the Revised NIOSH Lifting Equation from the National Institute for Occupational Safety and Health (NIOSH). Website: www.cdc.gov/NIOSH.

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