

SAFE PRACTICES IN

**OXY-FUEL
WELDING
& CUTTING**



CONCOA
PRECISION GAS CONTROLS

CERTIFIED ISO 9001:2000

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INTRODUCTION

We learn by experience. Learning safety through personal experience is harmful, wasteful, and unwise. Let the experience of others teach you.

This manual describes safe practices developed from experience in using welding and cutting equipment. Continuous research, development, and field experience result in reliable equipment and safe installation, operation, and servicing practices. Accidents occur because of improper equipment use or maintenance. Some safe practices are based on common sense, others may require technical volumes to explain. In any event, rules should be followed.

Read and understand these safe practices before attempting to install, operate or service the equipment. Comply, as applicable, to the practices for particular equipment used, and their instruction manuals for personal safety and the safety of others.

Failure to observe these safe practices may cause serious injury or death. Habitual safety promotes confident equipment use.

Responsibilities of installer, user, and serviceman. Only a competent person, experienced with such equipment should install, operate, and maintain the equipment.

These safe practices are divided into two sections: I. General Precautions, common to arc and oxyfuel welding and cutting; and II. Oxyfuel Gas Welding and Cutting.

Reference Standards: Additional information regarding welding and cutting safe practices can be found in Standards and Pamphlets published by ANSI, NFPA, AWS, and CGA listed on page 24.

The National Electrical Code, Occupational Safety and Health Administration and local industrial codes also provide mandatory requirements for equipment installation, use, and service.

I. GENERAL PRECAUTIONS FOR THE PREVENTION OF:

1.1 Burns

- 1.1.1 **Wear Protective clothing** -- gauntlet gloves, hat, and high safety toe shoes. Keep shirt collar and pocket flaps buttoned and wear cuffless trousers to prevent entry of sparks and slag.
- 1.1.2 **Wear safety goggles or glasses** with side shields, appropriate filter lenses or plates (protected by clear cover glass). This is a **MUST** for welding or cutting (and chipping), to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. For eye protection see ANSI Z 87.1.
- 1.1.3 **Do not wear oily or greasy clothing** while welding or cutting. They are readily ignited by sparks.
- 1.1.4 **Hot metal** such as welding rod, electrode stubs and work pieces should never be handled without gloves.

- 1.1.5 **Medical first aid and eye treatment.** First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close-by for immediate treatment of flash burns of the eyes and skin burns.
- 1.1.6 **Wear ear protection** when working overhead or in a confined space. A hard hat should be worn when others work overhead. See OSHA for allowable noise levels and hearing protection.
- 1.1.7 **Do not use flammable hair products** when welding or cutting. Vapors from such products are usually combustible and are easily ignited by sparks. Suitable head protection is required.

1.2 Hazardous Fume Accumulation

- 1.2.1 **Adequate ventilation.** Ventilate as needed to prevent harmful accumulations of fumes and smoke that may be produced by welding and cutting. Consult ANSI Standard Z49-1 (listed in “Reference Sources”) for detailed ventilation requirements. **NEVER USE OXYGEN TO VENTILATE THE WORK AREA.** See ANSI Z.49.1.
- 1.2.2 **Lead-, Cadmium-, Zinc-, Mercury-, and Beryllium-bearing** and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied

respirator. For beryllium, both must be used.

- 1.2.3 **Metals coated** with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the work area is well ventilated, or the operator wears an air-supplied respirator.
- 1.2.4 **Work in a confined space** only while it's being ventilated, or when wearing an air-supplied respirator. Do **NOT** use oxygen for ventilation.
- 1.2.5 **Gas leaks in a confined space**, shut OFF gas supply at source and remove the welding and cutting equipment to avoid accidental release of gases into the space should down stream valves be opened inadvertently or closed improperly.
- 1.2.6 **Vapors from chlorinated solvents** can be decomposed by the heat of the arc (or flame) to form **PHOSGENE**, a highly toxic gas, and other lung- and eye-irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene, perchlorethylene and other chlorinated solvent vapors to form phosgene. **DO NOT WELD** or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where radiant energy can penetrate to atmospheres containing even minute amounts of the solvent vapors.

1.3 Fires and Explosions

1.3.1 **Causes of fire** and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits. Do not attempt to install or use equipment before receiving proper training, and reading and understanding equipment instructions. Fire or explosion can occur if the equipment is improperly installed, repaired or used. Repairs must be made by qualified persons.

Be Aware That: flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

TO PREVENT FIRES AND EXPLOSIONS:

1.3.2 **Keep equipment clean and operable**, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

1.3.3 **Obtain hot work permit** from the supervisor to ensure that adequate precautions have been taken before the welding and cutting operations are started.

1.3.4 **If combustibles are in area**, do **NOT** weld or cut. Move the work, if practical, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least

35 feet away, out of reach of sparks and heat; or protect against ignition with suitable snug-fitting, fire-resistant shields.

- 1.3.5 **Walls touching combustibles** on opposite sides should not be welded on (or cut). Walls, ceiling, and floor near work should be protected by heat-resistant shields.
- 1.3.6 **Fire watcher** must be standing by with suitable fire extinguishing equipment during and following welding or cutting if:
 - a. **combustibles** (including building construction) are within 35 feet.
 - b. **combustibles** are further than 35 feet but can be ignited by sparks.
 - c. **openings** (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks.
 - d. **combustibles** adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.
- 1.3.7 **After work is done**, check that area is free of sparks, glowing embers, and flames.
- 1.3.8 **An empty container or piping that held combustibles**, or can produce flammable vapors when heated, must never be welded on or cut, unless it has first been cleaned and prepared as described in AWS Bulletin F4.1, (listed in “Reference Sources.”) This includes: a thorough steam or caustic cleaning (or a solvent or

water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in F4.1. Water-filling just below working level may substitute for inerting in some instances, making sure that the space above the water level is vented to prevent a pressure buildup in the container as it is being heated.

1.3.9 A container with unknown contents should be cleaned (see paragraph above). Do **NOT** depend on sense of smell or sight to determine if it is safe to weld or cut.

1.3.10 Hollow castings or containers must be vented before welding or cutting. They can explode when heated.

1.3.11 Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

1.4 Compressed Gases and Compressed Gas Equipment

1.4.1 Standard precautions. Comply with precautions in this manual and those detailed in CGA Standard P-1, SAFE HANDLING OF COMPRESSED GASES IN CONTAINERS, (listed in "Reference Sources," page 24).

1.4.2 Pressure regulators

a. Never withdraw gas from a cylinder or pipeline except through an approved pressure reducing regulator.

- b. **Regulator relief valve** is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.
- c. **Never connect a regulator** to a cylinder containing gas other than that for which the regulator was designed.
- d. **Never use a regulator** that has loose or damaged parts, or is in questionable condition. Under pressure, gas can dangerously propel loose parts.
- e. **Remove regulator from cylinder** when transporting unsecured on a cart not designed for such purpose.
- f. **Remove faulty regulator** from service immediately for repair (first close the cylinder valve and drain the residual gas from the regulator.)

The following symptoms indicate a faulty regulator:

Leaks - if gas leaks externally.

Excessive creep - if the regulator delivery pressure continues to rise with downstream valve closed.

Faulty gauge - if gauge pointer does not move off “stop” pin when pressurized, nor return to “stop” pin after pressure release.

g. Repair. Do NOT attempt repair. Send faulty regulators to manufacturer's designated repair center. Special techniques, tools and tests are used by personnel trained in these procedures.

1.4.3 Cylinders must be handled carefully to prevent leaks and damages to their walls, valves, or safety devices:

- a. Avoid electrical circuit contact** with cylinders including third rails, electrical wires, or welding circuits. They can produce arcs that may damage the cylinder wall, causing a possibly serious accident. Never strike an arc on a cylinder.
- b. ICC or DOT/UN marking** must be on each cylinder.
- c. Identifying gas content.** Use only cylinders with name of gas marked on them; do not rely on color of cylinder to identify contents. Notify supplier if content of cylinder is not clearly identifiable. **NEVER DEFACE** or alter name, number, or other markings on a cylinder. It is illegal and hazardous.
- d. Empties:** Leave a little gas in cylinder (10 - 25 PSIG). Keep valve closed; replace caps securely; mark "MT"; keep them separate from **FULLS** and return promptly.
- e. Prohibited use.** Never use a cylinder or its contents for other than its intended use. **NEVER** use as a support, roller, or clothes rack.

- f. **Secure from falling.** Always chain or secure cylinders upright when a regulator (and hose) are connected to it.
- g. **Passageways and work areas.** Keep cylinders clear of areas where they may be struck or knocked over.
- h. **Transporting cylinders.** With a crane, use a secure support such as a platform or cradle designed for the purpose. Do **NOT** lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.
- i. **Do NOT expose cylinders** to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F.
- j. **Protect cylinders,** particularly valves from bumps, falls, falling objects, and weather. Keep caps securely tightened on cylinders not in use or being moved.
- k. **Stuck valve.** Do **NOT** use a hammer or metal wrench (except special key for acetylene) to open a cylinder valve that cannot be opened by hand. Notify your supplier.
- l. **Mixing gases.** Never try to mix any gases in a cylinder.
- m. **Do NOT try to refill** any cylinder yourself.
- n. **Cylinder fittings should never** be modified or used for other than their intended purpose.
- o. **Do NOT drop cylinders.**

1.4.4 Hoses

- a. **Prohibited use.** Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.
Use RMA-CGA Grade T hose for fuel gas (including acetylene) to prevent hose failures. Grades R and RM are for use with acetylene only.
- b. **Use ferrules or clamps** designed for the hose (not ordinary wire or other substitute) to connect hoses to fittings.
- c. **No copper tubing splices.** Use only standard brass fittings to splice hose.
- d. **Avoid long runs** to prevent kinks and abuse. Suspend hose off ground or protect it from damage by vehicles, sparks, slag or open flames.
- e. **Coil excess hose** to prevent kinks and tangles. Do not drape coiled hoses around cylinders.
- f. **Examine hose regularly** for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.
- g. **Repair leaky or worn hose** by cutting out damaged area and splicing (as described in 1.4.4c, above). Do **NOT** use tape.

1.4.5 Proper Connections

- a. **Clean cylinder valve outlet** of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, fuel gas and other flammable gases, crack valve momentarily, pointing outlet away from people and sourcing of ignition. For hydrogen and other fuel gases, wipe with a clean, lintless cloth.
- b. **Match regulator to cylinder.** Before connecting, be sure the regulator label and cylinder marking agree, and the regulator inlet and cylinder outlet connections are proper for the intended service.
- c. **Tighten connections.** When assembling threaded connections, clean seats where necessary. Do not use pipe compound or lubricant. Tighten but do not force connection. If connection leaks, close cylinder valve, depressurize line. Disassemble, clean, and retighten the valve. For metal-to-metal seating, use correct wrenches, available from your supplier. For O-ring connections, hand-tighten.
- d. **Adapters.** Avoid using adapters between cylinder and regulator, but if unavoidable, use a CGA adapter (available from your supplier). Use two wrenches to tighten adapter with both right and left hand threads.

- e. **Regulator outlet (or hose) connections** may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

1.4.6 Pressurizing Steps:

- a. **Drain regulator** of residual gas through the regulator outlet by turning adjusting screw clockwise before opening cylinder (or manifold) valves. Draining prevents high pressure seat from being exposed to heat of recompression resulting from pressurization of regulator. Leave adjusting screw engaged slightly on single-stage regulators.
- b. **Always stand to side of regulator** before opening cylinder valve.
- c. **Always open the cylinder valve** very slowly to prevent a rapid buildup of pressure within the regulator. After the full cylinder pressure is indicated on the regulator high pressure gauge, leave cylinder valve in the following position: For oxygen and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.
- d. **Use regulator pressure settings** recommended in manufacturer's charges (available from your supplier) for safe and efficient operation of welding and cutting

equipment. It will reduce backfiring and chance of flashbacks.

- e. **Check for leaks on first pressurization and regularly thereafter.** Use an oxygen approved leak detection solution. Bubbles indicate a leak. Clean off leak detection liquid.

OTHER

- 1.5 **User Responsibilities.** Remove leaky or defective equipment from service immediately and repair them only if recommended in equipment instruction manual. Send other for repair to manufacturer's designated repair center where special techniques, tools and tests are used by trained personnel. Refer to User Responsibility statement in equipment manual.
- 1.6 **Leaving Equipment Unattended.** Close gas supply at source and drain gas from the equipment.
- 1.7 **Rope Staging-Support** should not be used from welding or cutting operation; rope may burn.

II. OXYFUEL WELDING AND CUTTING SAFE PRACTICES

Oxyfuel equipment, properly used can safely weld, heat, and cut metals, but carelessness leads to such hazards as fire and explosions. The equipment mixes flammable fuel gases and oxygen under pressure to support a flame. Oxygen is not flammable, but vigorously accelerates combustion of fuel gases and

combustible material. Sparks, flying slag, fumes, hot metal, as well as the heat, are normally under control. The wise operator avoids unnecessary risks by protecting himself and other from accidents as described here and in referenced sources.

2.1 Comply with Precautions in subsections

1.1, 1.2 and 1.3.

2.2 Compressed Gas System

2.2.1 Comply with precautions in 1.4, with CGA pamphlet P-1 (see “Reference Sources” at rear) and with the following:

2.2.2 Safety Devices

- a. Approved protective equipment** shall be installed in fuel gas piping to prevent (1) backflow of oxygen into the fuel gas supply system, (2) passage of a flashback into the fuel gas supply system, and (3) development of back pressure in excess of the pressure rating of the system components.
- b. Reverse flow check valves** connected to torch inlets prevent backflow of unwanted gases into the hose attached to the torch. While check valves will prevent backflow, they should not be relied upon as a substitute for individually purging the hoses before lighting the torch. Check valves should be tested regularly to be sure that they will function reliably.
- c. For maximum safety** use flashback arrestors. CONCOA offers a line of flash arrestors to help prevent

and protect against flashback and backfires. However, no device can replace the necessity for safe operating practices and properly maintained oxyfuel torch equipment. CONCOA flashback arrestors are designed to enhance operating procedures and help protect personnel and equipment when these dangerous conditions exist.

2.2.3 Oxygen

- a. **Oxygen is NOT compressed air;** do NOT refer to it or use it as compressed air. Oxygen is not flammable but even materials that do not burn in air usually burn in oxygen. Those that burn slowly in air can ignite easily and burn violently in an oxygen enriched atmosphere.
- b. **Never use oxygen to ventilate** confined spaces. Use air to replace atmospheric oxygen consumed by welding or cutting.
- c. **Leaks should be avoided,** particularly in confined spaces.
- d. **Oxygen-enriched (over 23%) or oxygen-depleted (under 19%)** atmospheres should be avoided. Do NOT work in or create such a hazardous condition.
- e. **Oxygen saturated clothes.** It is dangerous to clean clothing with oxygen stream, or hang clothing on oxygen cylinders. Clothing

saturated with oxygen will burn intensely when ignited. Should clothing be permeated, do not weld, cut, light a cigarette, or start any kind of spark or flame for at least 20 minutes, or until clothing is aired.

- f. **Grease, oil, oil-bearing materials**, greasy gloves and rags, and other combustibles that can readily ignite in the presence of oxygen must be kept from any oxygen equipment.
- g. **Oxygen equipment** should not be contaminated by use in any other service. If equipment is used for other service, do not use it for oxygen.
- h. **Never use oxygen** as a substitute for air in sir-driven tools, in oil preheating burners, to start an internal combustion engine, to blow out pipelines, or to build pressure (as in a container).
- i. **Cylinder storage.** Keep oxygen cylinders at least 20 feet from fuel gas cylinders or other readily combustible materials particularly grease or oil (or separated by a five-foot noncombustible barrier having a fire resistance rating of at least ½ hour).
- j. **Never attempt to clean** an oxygen gauge that has been contaminated with oil. Replace it with a new oil-free gauge.

- k. **If liquid oxygen is used**, cylinders must be transported, stored and used in upright position to maintain gaseous state for safety devices, and to prevent liquid from reaching regulator.

2.2.4 Fuel Gas

- a. **Refer to fuel gas by its correct name.** Say Acetylene, MAPP[®] Gas, etc., not GAS.
- b. **LP and MAPP[®] Gas cylinders** must be transported, stored and used in upright position to maintain gaseous state for safety devices, and to prevent liquid from reaching regulator.
- c. **Acetylene cylinders** must be transported, stored, and used in upright position to avoid discharge of acetone with the gas during use.
- d. **Cylinder valve leak.** Immediately close valve on fuel gas cylinder if open. If valve still leaks or the fuse plug (or other relief device) or the cylinder itself leaks:
 1. Immediately, remove cylinder outdoors, away from possible source of ignition.
 2. Tag cylinder, noting leak and its location.
 3. Post “No Smoking” warning sign in area.
 4. Notify cylinder supplier at once.
 5. Follow supplier’s instruction.

- e. **Acetylene cylinder wrench** should be left on an open cylinder valve and removed after closing valve. Use only approved wrench, available from cylinder supplier.
- f. **Acetylene withdrawal.** CGA 5.3.3.13 or G-1 call for a withdrawal rate “not to exceed 1/10 (one-tenth) of the capacity of the cylinder per hour during intermittent use. For full withdrawal of the contents of the cylinder on a continuous basis, the flow rate should be no more than 1/15 (one-fifteenth) of the capacity of the cylinder per hour.”
- g. **Never discharge fuel gas** near any flame, spark, or other source of ignition.

2.3 Torch

- 2.3.1 **Examine seating surface** of torch and connections before use for ear and damage. Worn or damaged parts should be replaced.
- 2.3.2 **Repair.** Do not attempt repair of torches (or regulators). If faulty, send them for repair to manufacturer’s designated repair center where special techniques, tools and tests are used by trained personnel. See User Responsibility Statement in equipment manuals.
- 2.3.3 **Torch is not a hammer.** Never use it to chip slag. Such misuse can distort torch or tip to create hazards. Use appropriate tool for the job.

- 2.3.4 **Torch tip cleaning** should be done only with specifically-designed cleaners available from your supplier. Clean tip orifices from inside to avoid enlarging or damaging the exit holes.
- 2.3.5 **Valve stem leak.** Close outlet valve. Tighten packing nut or repack the valve. Use only packing supplied by manufacturer. If seating device is an O-ring, discard it for a new O-ring.
- 2.4 **Adjusting Pressures.** With torch valve closed, turn regulator adjusting screws clockwise until each delivery gauge shows pressure slightly higher than that recommended in manufacturer's chart (1.4.6d). Do not exceed 15 PSIG of acetylene pressure for any purpose.
- 2.5 **Lighting Torch**
- 2.5.1 **Purge lines** daily before lighting to remove air and other contaminants from hoses. Open each torch valve in turn long enough for the pure gas to purge out any gas mixtures. Shut one valve before opening the other. Do NOT purge in a confined space, in the presence of flame or other source of ignition, or toward people.
- 2.5.2 **Point tip away** from yourself and others when lighting and using torch.
- 2.5.3 **Use sparklighter or pilot light** to light torch. Do NOT use matches or cigarette lighter, hand burns may result.

2.5.4 **Light as follows:** Open fuel valve and ignite gases flowing from tip. Adjust fuel valve for full flow without blowing off. Adjust oxygen valve to desired flame.

2.6 Shutdown

2.6.1 Extinguishing Flame:

- a. **Close oxygen** and (without delay) fuel torch valves tightly.
- b. **Check for gas leak** from tip or valves.
- c. **Leave torch in safe position** to prevent accidental dislodging that may open valves or cause damage.

2.6.2 Leaving Equipment unattended (lunch or overnight):

- a. **Extinguish flame** by closing torch valves.
- b. **Close cylinder valves.**

2.6.3 Leaving equipment unattended (over weekend or longer):

- a. **Extinguish flame** by closing torch valves and close cylinder valve.
- b. **Drain gas from regulators** by opening torch valves, venting gases in safe direction, then closing valves one at a time. If in public area, disconnect and store equipment to prevent unauthorized or accidental use, which may create a hazard.
- c. **Purge lines** before lighting or reuse.

2.6.4 **Do not store** compressed gas cylinders (especially with connected equipment) in unventilated cabinets, vehicles or other confined spaces. Gas leaks are

a result of improperly closed valves or loosened connections and can cause accumulation in the unventilated area, creating a combustible mixture of gases. This mixture will explode when ignited or can reduce the oxygen content in the breathing air to cause possible asphyxiation.

2.7 Backfires and Flashbacks

2.7.1 Backfire and its causes. A backfire is a loud noise produced by the explosion of gases at the cutting or welding tip usually following a minor flashback of the flame, extinguishment, and re-ignition at the tip. Repeated backfire can cause tip to overheat and eventually cause a sustained flashback. Causes are:

- a. Bringing tip too close to work or touching it.**
- b. Foreign particles entering tip and impeding gas flow.**
- c. Overheated tip, such as caused by working in corners.**
- d. Trying to operate with incorrect or too low a gas flow.**

2.7.2 Backfire remedy. If torch does not stay lit, close oxygen gas and fuel gas valves - in that order. Relight fuel gas with sparklighter only, NOT MATCHES OR CIGARETTE LIGHTER, and NOT over hot work. If stable flame is not obtained by adding oxygen, close torch valves, check tip cleanliness and regulator settings, purge, and relight.

2.7.3 Flashback and its causes. A flashback is a burning back of the flame into the tip, or into or through the torch. It is also called a sustained burning in tip or torch. A flashback can be caused by faulty or misused equipment. If it doesn't cause fire or hose rupture, then it may produce a hissing or squealing due to burning inside torch or tip (usually at the mixer). Examples of faulty or misused equipment are:

- a. **Failure to purge.**
- b. **Incorrect pressures.**
- c. **Distorted or loose tips or adapter seats.**
- d. **Kinked hoses.**
- e. **Clogged tip or torch orifices.**
- f. **Overheated tip or torch.**

2.7.4 To stop a flashback:

- a. **Do NOT touch** any parts of the tip, mixer, or extension that may be hot.
- b. **When squealing sound is heard:** the internal combustion must be extinguished immediately by shutting off torch fuel gas and oxygen valves in that order. Wait a **MOMENT, OR UNTIL NO SQUEALING** is heard on reopening fuel gas valve, then relight.
- c. **When squealing is not heard** (and flashback is indicated by flow of hot gases from tip): flame is inside the torch. Immediately shut off cylinder valves and wait. After

five minutes, if torch, regulator, and cylinder are cool, disconnect equipment and inspect torch and regulator for inner damage.

NOTE:

CONCOA offers a line of flash arrestors to help prevent and protect against flashbacks and backfires. No device can replace the necessity for safe operating practices and properly maintained oxyfuel torch equipment. CONCOA flashback arrestors are designed to enhance operating procedures and help protect personnel and equipment when these dangerous conditions exist.

Check Valves prevent the reverse flow of mixed gases. Regulator Check Valves "B" size 830 4199 Oxy. 830 4200 Fuel. Torch Check Valves "B" size 831 4146 Oxy., 831 4138 Fuel.

**FOR MAXIMUM SAFETY USE FLASHBACK
ARRESTORS**

**Regulator Mounted
Model-78 Resettable**

**801 0786 "B" Size for Oxygen
801 0789 "B" Size for Fuel Gas**

**Regulator Mounted
Model 53**

**801-0536 "B" Size for Oxygen
801 0539 "B" Size for Fuel Gas**

**Torch Mounted
Model 460**

**801 1466 "B" Size for Oxygen
801-1469 "B" Size for Fuel Gas**

REFERENCE SOURCES

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, P.O. Box 351040, Miami, FL 33135.
2. ANSI Standard Z87.1, PRACTICE FOR OCCUPATIONAL AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018.
3. American Welding Society Bulletin F4.1-80, RECOMMENDED SAFE PRACTICES FOR WELDING AND CUTTING CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable same as item 1.
4. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING AND CUTTING, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
5. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable same as item 4.
6. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CONTAINERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Hwy., Arlington, VA 22202.

7. OSHA Standard 29 CFR, Part 1910, Subpart Q, WELDING, CUTTING AND BRAZING, obtainable from U.S. Government Printing Office, Washington, DC 20402

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**SAFE PRACTICES IN
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