

**WELDING, CUTTING,
BRAZING,
COMPRESSED
AIR & GAS
CYLINDERS**

Hot Work

Steingass Mechanical Contracting, Inc.
754 Progress Drive
Medina, Ohio 44256
(330) 725-6090

PROGRAM ELEMENTS

- 1) Compressed Gas Cylinders**
- 2) Gas Welding and Cutting**
- 3) Arc Welding and Cutting**
- 4) Fire Prevention**
- 5) Personal Protective Equipment**
- 6) Ventilation and Protection in Welding, Cutting and Heating**
- 7) Signs and Labels**
- 8) Special Conditions and Applications**
- 9) Maintenance**
- 10) Training**

INTRODUCTION

COMPRESSED GAS CYLINDERS, WELDING AND CUTTING

REGULATORY AUTHORITY FOR IMPLEMENTATION OF COMPRESSED GAS CYLINDERS, WELDING AND CUTTING

The Occupational Safety and Health Act under 29 CFR 1926 Subpart J, establishes requirements relating to Compressed Gas Cylinders, Welding and Cutting. In response to the regulatory mandate, Steingass Mechanical Contracting, Inc. has developed and will maintain the Compressed Gas Cylinders, Welding and Cutting Program to provide proper and safe procedures for all applicable employees.

PURPOSE

This document is primarily intended to establish guidelines to be followed whenever any employee(s) work with compressed gas cylinders and/or welding and cutting equipment. In addition, it is intended to outline uniform methods of protecting, training, operation and maintenance practices to ensure these are communicated to and understood by the affected employees.

RESPONSIBILITY

Steingass Mechanical Contracting, Inc. shall instruct all appropriate employees in the safety significance of the Compressed Gas Cylinders, Welding and Cutting Program. In addition, Steingass Mechanical Contracting, Inc. considers these requirements to be of critical importance in helping to ensure that the applicable provisions of the Compressed Gas Cylinders, Welding and Cutting Program are known, understood, and strictly adhered to by all employees.

It shall be the responsibility of the Safety Director to continually monitor the Compressed Gas Cylinders, Welding and Cutting Program to ensure that all requirements of these procedures are being followed and that any deviations or inadequacies are corrected. Prior to any welding and/or cutting is permitted the area shall be inspected and a hot work permit is completed in writing granting authorization of welding and cutting operations.

- **See Appendix A – Hot Work Permit Cutting and Welding.**

COMPRESSED GAS CYLINDERS PROCEDURES

Transporting, Moving & Storing of Compressed Gas Cylinders

1. At all times when the cylinder is not in use, the valve protection caps must be in place and secure. When in use the proper use of gauges is required.
2. When cylinders are to be hoisted, they must be secured on a cradle, sling-board or pallet. No cylinders will be hoisted or transported by means of magnets or choker slings.
3. All cylinders must be moved by tilting and rolling them on their bottom edges.
At no time should they be intentionally dropped, struck, or permitted to strike each other.
4. During transportation of cylinders in vehicles, the cylinders must be **secured in a vertical position.**
5. At no time will the valve protection caps be used for lifting cylinders from one vertical position to another. Bars must not be used under valve protection caps to pry cylinders loose when frozen. **ONLY WARM WATER** can be used to thaw cylinders.
6. Unless the cylinders are in a special carrier intended for cylinders, regulators must be removed and valve protection caps put in place before cylinders are moved.
7. A special carrier intended for cylinders, chain or other steadying device must be used to keep cylinders from being knocked over while in use.
8. The cylinder valve must be closed when: work is finished; cylinders are empty or when cylinders are moved.
9. All compressed gas cylinders must be stored & secured in an **UPRIGHT** position at all times.
10. The acetylene and oxygen cylinders must be stored apart from one another by a minimum distance of 20 feet or by a 5-foot high non-combustible barrier.

Placing Cylinders

1. Cylinders must be kept far enough away from the actual welding or cutting operations so that sparks, hot slag or flame will not reach them. If this is not possible, fire resistant shields must be provided.
2. All cylinders must be placed where they cannot become part of an electrical circuit. It is prohibited to strike an electrode against a cylinder to strike an arc.
3. Fuel gas cylinders must be placed with valve end up whenever they are in use. The fuel gas cylinder must not be placed in any location where they would be subjected to open flame, hot metal or other sources of artificial heat.
4. **AT NO TIME WILL CYLINDERS CONTAINING OXYGEN, ACETYLENE OR OTHER FUEL GAS BE PERMITTED INTO CONFINED SPACES.**

Treatment of Cylinders

1. No cylinder will be permitted, whether full or empty, to be used as rollers or supports.
2. It is strictly forbidden to mix gases or refill a cylinder. The supplier of the cylinder must only do this.
3. **THE CONTENTS OF ANY CYLINDER SHOULD ONLY BE USED FOR PURPOSES INTENDED BY THE SUPPLIER.**
4. At no time during work operations are employees permitted to use a damaged or defective cylinder.

GAS WELDING AND CUTTING

1. Before a regulator to a cylinder valve is connected, the valve will be opened slightly and closed immediately. This action is termed **“cracking”** and is intended to clear the valve of dust or dirt that might otherwise enter the regulator. The employee cracking the valve will stand to one side of the outlet, **not in front of it.** The valve of a fuel gas cylinder **will not be cracked** where the gas could reach welding work, sparks, flame, or other possible sources of ignition.
2. The cylinder valve will always be opened slowly to prevent damage to the regulator. A special wrench will be left in position on the stem of the valve, while the cylinder is in use, so that the fuel gas flow can be shut off quickly in case of an emergency. In manifolded or coupled cylinder, a special wrench will always be available for immediate use.
3. Nothing is permitted to be placed on top of a fuel gas cylinder when in use that may damage the safety device or interfere with the quick closing of the valve in an emergency.
4. Before a regulator is removed from a cylinder valve, the cylinder will always be closed and the gas released from the regulator.
5. In the event a leak is found around the valve stem, the valve will be closed and the gland nut tightened. If this does not stop the leak; the use of the cylinder will be discontinued, properly tagged and immediately removed from the work area. In the event fuel gas should leak from the cylinder valve, rather than from the valve stem and the gas cannot be shut off, the cylinder will be properly tagged and removed from the work area.

Fuel Gas and Oxygen Manifolds

1. Fuel gas and oxygen manifolds will bear the name of the substance it contains. Letters at least 1-inch high will either be painted on the manifold or on a sign that can be permanently attached.
2. Fuel gas and oxygen manifolds will be placed in safe, well ventilated and accessible locations.

AT NO TIME SHOULD FUEL GAS AND OXYGEN BE PERMITTED WITHIN ENCLOSED SPACES.

3. Manifold hose connections, including both ends of the supply hose that lead to the manifold, will be such that the hose cannot be interchanged between fuel gas and oxygen manifolds and supply header connections. **ADAPTERS MUST NOT BE USED TO PERMIT THE INTERCHANGE OF HOSE.** Hose connections will be kept free of grease and oil.
4. When not in use, all manifold and header hose connections will be capped.
5. Placing anything on top of a manifold, which will damage the manifold or interfere with the quick closing of the valves, is not permitted.

Hoses

1. Fuel hoses and oxygen hoses must be easily distinguishable from each other. The contrast may be made by different colors or by surface characteristics readily distinguishable by the sense of touch. Oxygen and fuel gas hoses will not be interchangeable. Any signal hose having more than one gas passage will not be used.
2. In the event that 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 in order not to interfere with distinguishing colors.
3. All hoses in use, carrying acetylene, oxygen, and natural or manufactured fuel gas or any gas or substance, which may ignite or enter into combustion, will be inspected at the beginning of each working shift. Any defective hose will be removed from service.
4. All hose couplings will be of the type that cannot be unlocked or disconnected by means of a straight pull without rotary motion.
5. All hoses, cables and other equipment will be kept clear of passageways, ladders and stairs.

Torches

1. All clogged torch tip openings will be cleaned with suitable cleaning wires, drills or other devices designed for this purpose.
2. Torches in use will be inspected at the beginning of each work shift for leaking at shutoff valves, hose couplings and tip connections. Any defective torch will not be used.
3. Torches will be lighted with friction lighter or any other approved devices.
AT NO TIME IS IT PERMITTED TO LIGHT A TORCH WITH MATCHES OR OTHER HOT WORK.
4. **All torches will be equipped with flashback arrestors.**

ARC WELDING AND CUTTING

Manual Electrode Holders

1. Only manual electrode holders which are specifically designed for arc welding and cutting, and are of a capacity capable of safely handling the maximum rated current required by the electrodes, will be used.
2. Any current-carrying parts passing through the portion of the holder, which the arc welder or cutter grips in his/her hand, and the outer surfaces of the jaws of the holder, will be fully insulated against the maximum voltage, encountered to ground.

Welding Cables and Connectors

1. All arc welding and cutting cables will be of the completely insulated, flexible type, capable of handling the maximum current requirements of the work in progress, taking into account the duty cycle under which the arc welder or cutter is working.
2. Only cable free from repair or splices for a minimum distance of 10 feet from the cable end to which the electrode holder is connected will be used, except that cables with standard insulated connectors or with splices whose insulating quality is equal to that of the cable are permitted.
3. When it becomes necessary to connect or splice lengths of cable one to another, substantial insulated connectors of a capacity at least equivalent to that of the cable shall be used. If connections are effected by means of cable lugs, they will be securely fastened together to give good electrical contact, and the exposed metal parts of the lugs will be completely insulated.
4. Cables in need of repair shall not be used.

Ground Returns and Machine Guarding

1. A ground return cable will have a safe current carrying capacity equal to or exceeding the specified maximum output capacity of the arc welding or cutting unit, which it services. When a single ground return cable services more than one unit, its safe current-carrying capacity will equal or exceed the total specified maximum output capacities of all the units, which it services.
2. Pipelines containing gases or flammable liquids, or conduits containing electrical circuits, will not be used as a ground return.
3. When a structure or pipeline is employed as a ground return circuit, it will be determined that the required electrical contact exists at all joints. The generation of an arc, sparks, or heat at any point shall cause rejection of the structures as a ground circuit.
4. When a structure or pipeline is continuously employed as a ground return circuit, all joints will be bonded, and periodic inspections will be conducted to ensure that no condition of electrolysis or fire hazard exists by virtue of such use.
5. The frames of all arc welding and cutting machines will be grounded either through a third wire in the cable containing the circuit conductor or through a separate wire which is grounded at the source of the current. Grounding circuits, other than by means of the structure, will be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current to flow cause the fuse or circuit breaker to interrupt the current.
6. All ground connections will be inspected to ensure that they are mechanically strong and electrically adequate for the required current.

FIRE PREVENTION

1. All objects to be welded, cut or heated must be moved to a designated safe location. If the objects to be welded, cut or heated cannot be readily moved, then all movable fire hazards in the vicinity will be taken to a safe place or other wise protected.
2. When the object to be welded, cut can not be moved and if all the fire hazards can not be removed, then guards, shields or fire blankets shall be used to confine the heat, sparks and slog and to protect the immovable fire hazards. If this can not be accomplished, then the welding and cutting shall not be performed.
3. No welding, cutting or heating will be permitted where the application of flammable paints or the presence of other flammable compounds or heavy dust concentration creates a hazard.
4. The appropriate fire extinguishing equipment will be immediately available in the work area and maintained in a state of readiness for instant use. A fire watch will be in place while work is being performed and maintained at least one-half hour after the welding and cutting operation is completed.
5. When the welding, cutting or heating operations is such that the above are not sufficient, additional personnel will be assigned to guard against fire while the actual welding, cutting or heating operation is being performed and for a sufficient period of time after completion of the work, to ensure that no possibility of fire exists. Such personnel will be instructed as to the specific anticipated fire hazards and trained on fire fighting equipment provided.
6. When welding, cutting or heating is performed on walls, floors and ceilings, since direct penetration of sparks or heat transfer may introduce a fire hazard to an adjacent area, the same precautions must be taken on the opposite side, as are taken on the side on which the welding is being performed.

7. For the elimination of possible fire in enclosed spaces, as a result of gas escaping through leaking or improperly closed torch valves, the gas supply to the torch must positively shut off at a point outside the enclosed space. Whenever the torch is not to be used or whenever the torch is left unattended for a substantial period of time, such as during the lunch period, the gas supply to the torch will be positively shut off. Overnight and at the change of shifts, the torch and hose must be removed from the enclosed space. Open-end fuel gas and oxygen hoses will be immediately removed from enclosed spaces when they are disconnected from the torch or other gas-consuming device.
8. Except when the contents are being removed or transferred, drums, pails and other containers, which contain or have contained flammable liquids, will be kept closed. Empty containers will be removed to a safe area away from hot work operations or open flames.
9. Drum containers or hollow structures, which have contained toxic or flammable substances will, before welding, cutting or heating is undertaken on them, either be filled with water or thoroughly cleaned of such substances and ventilated and tested.
10. Before heat is applied to a drum, container or hollow structure, a vent or opening will be provided for the release of any built up pressure during the application of heat.
11. In the event that welding and/or cutting cannot be conducted safely, the welding and/or cutting shall not be performed.

PERSONAL PROTECTIVE EQUIPMENT

Welding, cutting and heating under normal conditions may be done without mechanical ventilation or respiratory equipment, but where, because of unusual physical or atmospheric conditions, an unsafe accumulation of contaminants exists. Suitable mechanical ventilation or respirator protective equipment will be provided as outlined in our Respirator Policy.

All employees performing any type of welding, cutting or heating will be protected by suitable eye protection, with appropriate helmets. ANSIP approved filter lens goggles, or hand shields. Other PPE used may include: flame resistant aprons, leggings, work boots, shoulder caps, skull caps, ear plugs, insulated gloves, etc.; as outlined in our Company Policy titled, **“Personal Protective Equipment.”**

First Aid Equipment shall be available at all times. As outlined in our Company Policy titled, “First Aid”.

VENTILATION AND PROTECTION IN WELDING, CUTTING AND HEATING

1. Mechanical ventilation will consist of either general mechanical ventilation or local exhaust systems.
2. General mechanical ventilation will be of sufficient capacity and so arranged in a way that will produce the number of air changes necessary to maintain welding fumes and smoke within safe limits.
3. Local exhaust ventilation will consist of freely movable hoods intended to be placed by the welder or burner as close as practicable to the work. The system will be of sufficient capacity and so arranged as to remove fumes and smoke at the source and keep the concentration in the breathing zone within safe limits.
4. Contaminated air exhausted from a working space must be discharged into the open air or otherwise clear of the source of intake air.
5. All replacement air must be clean and respirable.
6. Oxygen will not be used for ventilation purposes, comfort cooling, blowing dust from clothing or for cleaning the work area.

SIGNS AND LABELS

Lenses shall bare permanent distinctive markings by which the source and shade may be readily identified.

After welding operations are completed, the welder shall mark the hot metal or provide some other means of warning to other workers.

Any potentially hazardous materials used and/or created in or by welding or cutting operations shall be addressed in our Company's Hazard Communication Program.

All filler metals and fusible granular metals shall carry as a minimum, warning on tags, boxes, or other containers. In addition, this shall be addressed in our Company's Hazard Communication Program.

Brazing filler metals containing cadmium in significant amounts shall carry notices on tag, box, or other containers. And in addition, addressed in our Company's Hazard Communication Program.

Compressed gas cylinders shall be legibly marked for content and shall not be readily removable. And in addition, addressed in our Company's Hazard Communication Program.

Warnings will be placed near cylinders having leaky fuse plugs or other leaking safety devices.

Manifolds shall be marked to designate low pressure.

Fuel gas and oxygen manifolds shall bear the name of the substance they contain in **letters at least 1-inch high.**

Above ground piping systems shall be marked in accordance with American National Standard Scheme for the identification of piping systems.

Station outlets shall be marked to indicate name of gas.

Gages on oxygen regulators shall be marked **“Use No Oil.”**

SPECIAL CONDITIONS AND APPLICATIONS

Welding, Cutting, and Heating in way of Preservative Coatings

1. Before welding, cutting, or heating is commenced on any surface covered by a preservative coating whose flammability is not known, a test shall be made by a competent person to determine its flammability. Preservative coatings will be considered to be highly flammable when scrapings burn with extreme rapidity.
2. Precautions will be taken to prevent ignition of highly flammable hardened preservative coatings. When coatings are determined to be a highly flammable, they shall be stripped from the area to be heated to prevent ignition.
3. Protection against toxic preservative coatings:
 - a. In enclosed spaces, all surfaces covered shall be stripped of all toxic coatings for a distance of at least 4 inches from the area of heat application, or the employees will be protected by airline respirators required.
 - b. In the open air, a respirator will protect employees.
4. The preservative coatings will be removed a sufficient distance from the area to be heated to ensure that the temperature of the unstripped metal will not be appreciably raised. Artificial cooling of the metal surrounding the heating area may be used to limit the size of the area may be used to limit the size of the area required to be cleaned.

SPECIAL CONDITIONS AND APPLICATIONS

Welding, Cutting, and Heating in Confined Spaces

1. Either general mechanical or local exhaust ventilation meeting the requirements will be provided whenever welding, cutting or heating is performed in confined space.
2. When sufficient ventilation cannot be obtained without blocking the means of access, employees in the confined space shall be protected by air line respirators, in accordance with the requirements, and an employee on the outside of such a confined space shall be assigned to maintain communication with those working within it and to aid them in an emergency.
3. **Lifelines.** Where a welder must enter a confined space through a manhole or other small opening, means shall be provided for quickly removing him in case of an emergency. When safety belts and lifelines are used for this purpose they shall be so attached to the welder's body that his body cannot be jammed in a small exit opening. An attendant with a pre-planned rescue procedure shall be stationed outside to observe the welder at all times and be capable of putting operations into effect.

**PLEASE REVIEW OUR COMPANY'S CONFINED SPACE
POLICY.**

MAINTENANCE

On all construction sites frequently and regular inspections of the job site materials and equipment are made by competent persons. The operator shall report any machinery, tool or equipment which does not meet all applicable requirements and use will be discontinued. This equipment will be identified as unsafe by tagging or locking to render them inoperable, and/or physically removed from the job site. Repairs shall be made by qualified personnel only.

TRAINING

Steingass Mechanical Contracting, Inc. shall permit only trained and authorized personnel to operate welding and cutting equipment. Applicable employees and their supervisors will have the knowledge and understanding of the operational hazards associated with welding and cutting operations; hazards associated with the particular make and model of the equipment they are using.

Each certified welder or cutter will be evaluated annually to verify the welder or cutter has retained and uses the knowledge and skills to operate safely. If the evaluation shows that the welder or cutter is lacking the appropriate skills and knowledge, he/she will be removed until retraining is completed.

FIRE WATCH

All employees of **Steingass Mechanical Contracting, Inc.** are trained in the use of fire extinguisher equipment upon initial assignment and annually thereafter. (See **Steingass Mechanical Contracting, Inc.**'s, " Fire Extinguisher Policy".) Assigned fire watchers will be used prior to the work beginning and in addition they will familiarize themselves with the host facilities Emergency Action Plan and their system for sounding an alarm in the event of a fire.

Appendix A

HOT WORK PERMIT CUTTING AND WELDING

PERMIT NO. _____ DATE _____

GOOD THIS DATE ONLY

BUILDING/LOCATION: _____

GOOD THIS TIME PERIOD ONLY _____ TO _____

ACTUAL TIME: STARTED _____ FINISHED _____

WORK TO BE DONE:

EMPLOYEE
(PRINT) _____ SIGNATURE _____

COMPANY _____

* BEFORE THIS PERMIT CAN BE SIGNED, THE FOLLOWING STEPS MUST BE COMPLETED:

- Fire protection system(s) in service (sprinklers, CO₂, foam)
- Cutting and welding equipment in good condition.
- Floor/ground clean (and wet down when necessary).
- Combustibles at least 35 feet from welding area.
- Flammable liquids and other hazards removed from area.
- All floor and wall openings within 35 feet covered.

(Page 1)

- Non-combustible covers used to protect nearby combustibles and equipment.**
- Containers, tanks, ducts, and other enclosures cleaned and purged of Flammable vapors, liquids, dusts, and other hazardous materials.**
- Fire extinguishers or small standpipe fire hose provided.**
- All hazardous operations discontinued in area.**
- Fire watch should be present during, and at least one-half hour after, welding and burning has ceased.**
- Location of nearest fire alarm box identified.**

(Page 2)