

BGSU

Bowling Green State University

Hot Work Program

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INTRODUCTION

Policy Statement

It is Bowling Green State University's policy to comply with the occupational safety and health standards of the Ohio Public Employees Risk Reduction Act and all Applicable Federal, State and Local rules, regulations and directives."

Approved October 7, 1994
Board of Trustees

Forward

In 1970, the United States Congress established the right of workers to have "safe and healthful working conditions" through the Occupational Safety and Health Act. This act created the Occupational Safety and Health Administration (OSHA). In July, 1994 the state of Ohio adopted and incorporated, by reference, many of the Federal OSHA standards through the Public Employee Risk Reduction Act, Ohio Revised Code 4167.07. This Act and its subsequent rules (Ohio Administrative Code 4167-3-01) required Bowling Green State University and other state institutions to comply with all applicable OSHA standards.

Bowling Green State Universities Hot Work Program has been established to comply with Ohio's Public Employee Risk Reduction Act, the OSHA Welding, Cutting and Brazing standard (29 CFR 1910.Subpart Q), and the NFPA standard 51B.

Objective

The objective of this program is to establish requirements for work involving burning, welding or similar operations that are capable of initiating fires or explosions to minimize the probability of property loss and personal injury. This program shall be used in conjunction with other BGSU policies and procedures involving the protection of workers in the work place.

Applicability

This program applies to all university employees involved in hot work. Hot work is any work involving burning, welding, or similar operations that are capable of initiating fires or explosions. This program shall cover the following hot work processes:

- Welding and Allied Processes
- Heat Treating
- Grinding
- Thawing Pipe
- Powder-Driven Fasteners
- Hot Riveting
- Similar Application Producing a Spark, Flame or Heat

Responsibilities

Occupational Safety and Health Specialist is responsible for

- coordinating the Hot Work Program;
- assisting departments and areas with training;
- maintaining copies of the hot work permits and;
- updating and evaluating BGSU's Hot Work Program.

Fire Safety Officer is responsible for

- assisting in determining the suitability of designated areas for hot work and;
- performing fire extinguisher training.

Office of Design and Construction is responsible for

- advising contractors about flammable materials or hazardous conditions of which they may not be aware and ensuring that they are familiar with the provisions of NFPA 51B and 29 CFR 1910.252 and;
- including hot work as an agenda item in the pre-construction meeting, at which time, Environmental Health and Safety representatives will provide a copy of the BGSU Hot Work Program and answer questions.

Outside Contractors are responsible for

- following the provisions of NFPA 51B and 29 CFR 1910.252.

Management (Department Chairpersons and Directors) are responsible for

- providing employees with adequate training including the inherent risks involved, the emergency procedures in the event of a fire, instructions on all equipment and processes, as well as the provisions of this program;
- recognizing its responsibility for the safe usage of cutting and welding equipment on BGSU property and ensuring only approved equipment is used;
- establishing permissible areas for hot work and procedures for cutting and welding in other areas;
- designating a permit authorizing individual (PAI);
- advising contractors about flammable materials or hazardous conditions of which they may not be aware and ensuring that they are familiar with the provisions of NFPA 51B and 29 CFR 1910.252 and;
- providing fire extinguishing equipment.

Permit Authorizing Individual (PAI) is responsible for

- the safe operation of hot work activities;
- inspecting the area before cutting or welding is permitted, determining site specific hazards, and issuing hot work permits;
- ensuring the protection of combustibles from ignition sources;
- determining that fire protection and extinguishing equipment is properly located at the site;
- making sure a fire watch is available at the site and;
- where a fire watch is not required, making a final check up a ½ hour after the completion of hot work to detect and extinguish possible smoldering fires.

Fire Watch is responsible for

- being aware of the inherent hazards of the work site and of the hot work;
- ensure that safe conditions are maintained;
- have the authority to stop the hot work if unsafe conditions develop;
- having fire extinguishing equipment, as well as attending required training;
- sounding and being familiar with alarm procedures in the facilities in the case of an uncontrolled fire and;
- watching for fires in all exposed areas, during hot work operations and for at least ½ hour after completion, and trying to extinguish them only when they are within the scope of their training and equipment.

Supervisors are responsible for

- attending supervisor training offered by Environmental Health and Safety;
- ensuring all employees who perform hot work are trained on the Hot Work Program and it's requirements;
- safe handling and use of equipment, as well as determining any combustible or hazardous areas that are present in the work area;
- protecting combustibles from ignition by having the work moved to a location free from combustibles, moving combustibles to a safe distance, or properly shielding against ignition;
- seeing that Hot Work is not scheduled to be performed during operations that might expose combustibles to ignition;
- obtaining a hot work permit from the PAI and determining that the hot work operator secures his approval that conditions are safe before performing any hot work;
- ensure that fire protection and extinguishing equipment is properly located at the site and employees are trained in their use;
- making a fire watch available if needed;
- enforcing BGSU's Hot Work Program by ensuring all employees under their direction comply with all facets of the Hot Work Program and;
- providing a copy of the Hot Work Program to employees upon their request.

Employees (Hot Work Operators) are responsible for

- completely adhering to the requirements of this program and attending required training;
- understanding the emergency procedures in the event of a fire and shall have an awareness of the inherent risks involved;
- having the PAI's and supervisor's approval before starting the hot work operations;
- stopping hot work operations and notifying management, the area supervisor or the PAI if an unsafe condition occurs and;
- sending completed hot work permits to Environmental Health and Safety.

Program Enforcement

A violation of a University employee's responsibility must be reported to the employee's immediate supervisor for appropriate action.

WELDING AREAS

Hot work can be performed in two types of areas, designated areas and permit required areas. The designated areas can be areas in the shop that have been approved for hot work. These areas must be of fire resistant or of noncombustible construction. The second type of area is the permit-required area. The permit-required area requires a permit and is an area that shall be made safe by removing or protecting combustibles from ignition sources.

The following is a list of non-permissible welding areas:

- Areas not authorized by management.
- Sprinklered buildings while such protection is impaired.
- In the presence of an explosive atmosphere including improperly prepared drums that once contained flammable materials.
- Areas near storage of large quantities of exposed, readily ignitable materials.

Hot work shall not be attempted on:

- A partition, wall, ceiling or roof that has a combustible covering or insulation, or on walls or partitions of combustible sandwich-type panel construction.
- Pipes or other metal that is in contact with combustible walls, partitions, ceilings or roofs shall not be done if the work is close enough to cause ignition by conduction.

FIRE WATCH

Fire Watch

A fire watch (refer to the responsibilities section) is required when hot work is performed in a location where other than minor fires might develop or when any of the following conditions exist:

- Combustible materials in building construction or contents are closer than 35 ft (11m) to the point of operation.
- Combustible materials are more than 35 ft (11m) away, but are easily ignited by sparks.
- Wall or floor openings within a 35 ft (11m) radius expose combustible materials in adjacent areas, including concealed spaces in walls or floors.
- Combustible materials are adjacent to the opposite side of partitions, walls, ceilings, or roofs and are likely to be ignited.

A fire watch shall be maintained for at least a ½ hour after completion of hot work operation in order to detect and extinguish smoldering fires. More than one fire watch shall be required if combustible materials that could be ignited by the hot work cannot be directly observed by only one fire watch.

HOT WORK PERMIT

If hot work is to occur in a location other than that of a designated area, a written hot work permit is to be obtained from the PAI. The hot work permit must be displayed at the job site and at the conclusion of the shift, the permit shall be removed and sent to Environmental Health and Safety. Cutting and welding shall be permitted only in areas that are or have been made fire safe. The hot work permit is only good for one shift and the following conditions must be completed and verified by the PAI. The PAI must also inspect the area at least once per day while the hot work permit is in effect to ensure the area is fire safe.

General requirements

- ✓ Hot work equipment being used is in satisfactory operating condition and in good repair.

Requirements within 35 ft (11 m) of hot work operations

- ✓ The area is free from flammable liquids and combustible material or the work must be moved to an area free from combustibles.
- ✓ Combustibles that can not be moved are shielded or protected against ignition.
- ✓ Combustion materials on the floor, have been swept for a radius of 35 ft (11m).
- ✓ Combustible floors have been kept wet down, covered with damp sand, or protected by shielding; personnel operating arc welding or cutting are protected from possible shock.
- ✓ Edges of covers at the floor are tight to prevent sparks from going under them.

Work on Walls or ceilings/enclosed equipment

- ✓ Where hot work is done near combustible walls, partitions, ceilings or roofs, fire resistant shields or guards are used. Remove combustibles away from opposite side or adjacent structures.
- ✓ Openings or cracks in the walls, partitions, ceilings or roofs of combustible material, have been protected with fire-retardant shields or guards.
- ✓ If hot work is done in close proximity to a sprinkler head, a wet rag is placed over the head and then removed at the conclusion of the welding or cutting operation. Special precaution should be taken to prevent accidental operation of the automatic fire detection or suppression system.
- ✓ Ducts and conveyor systems that might carry sparks to distant combustibles are protected or shut down.

Fire watch/hot work area monitoring

- ✓ A trained and equipped fire watch is provided for the duration of work and at least 30 minutes after completion of work, including breaks.
- ✓ Fully charged and operable fire extinguishers are in the immediate work area.
- ✓ Nearby personnel are suitably protected against heat, sparks, slag and so on.
- ✓ After welding is complete, some means of warning that the metal is hot must be provided.

TRAINING

Training

Hot Work₁

This training session is provided by Environmental Health and Safety and is intended for supervisors. The following information will be covered:

- the importance of safe hot work procedures;
- a summary of the OSHA Welding, Cutting, and Brazing standard (29 CFR 1910.252) and of the NFPA 51B standard;
- an overview of BGSU's written Hot Work Program and;
- an explanation of how Environmental Health and Safety can assist departments.

Hot Work₂

This training session is provided by Environmental Health and Safety and is intended for supervisors and employees who perform hot work operations. The following information will be covered:

- the inherent risks involved;
- the emergency procedures in the event of a fire;
- instructions on all equipment and processes and;
- the provisions of this program.

OTHER PRECAUTIONS

Confined Spaces

The following precautions are in addition to the requirements of a confined space entry program and must be followed when performing hot work in a confined space:

- To prevent accidental contact, when arc welding is to be suspended for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders carefully located so that accidental contact cannot occur and the machine be disconnected from the power source.
- In order to eliminate the possibility of gas escaping through leaks or improperly closed valves, when gas welding or cutting, the torch valves shall be closed and the gas supply to the torch positively shut off at some point outside the confined space area whenever the torch is not to be used for a substantial period of time, such as during lunch hour or overnight. Where practical, the torch and hose shall also be removed from the confined space.
- When welding or cutting is being performed in any confined space, the gas cylinders and welding machines shall be left on the outside. Before operations are started, heavy portable equipment mounted on wheels shall be securely blocked to prevent accidental movement.

Personal Protection

Personal Protective Equipment, Health Protection and Ventilation requirements will be identified in BGSU's personal protective equipment hazard assessment. The following must also be practiced for fall protection:

- A welder working on platforms, scaffolds, or runways shall be protected against falling by the use of railings, life lines, or some other equally effective means.
- Welders shall also place welding cables and other equipment so that they are clear of passageways, ladders and stairways.

REFERENCES

1. Bowling Green State University. Lockout Tagout Program.
2. Occupational Safety and Health Administration. Welding, Burning, and Brazing, 1910 Subpart Q.
3. National Fire Protection Association. Standard for Fire Prevention During Welding, Cutting and Other Hot Work, NFPA 51B.

APPENDIX A – HOT WORK PERMIT



HOT WORK PERMIT



BEFORE STARTING HOT WORK, ENSURE ALL SAFETY PRECAUTIONS ARE IN PLACE. MAKE SURE AN APPROPRIATE FIRE EXTINGUISHER IS READILY AVAILABLE.

This permit is required for hot work operations, in a location other than that of a designated area. This includes work involving burning, welding and allied processes, heat treating, grinding, thawing pipe, powder driven fasteners, hot riveting and similar operations that produce a spark, flame or heat. This permit applies to only this job, in the area specified, during the time and date noted.

Instructions	Precaution and Safeguard Checklist
Supervisor: 1. Complete PRECAUTION AND SAFEGUARD CHECKLIST at right. 2. Complete and post this form. 3. Verify fire watch. 4. Send completed permit to: Environmental Health and Safety 102 College Park Office Building	<input type="checkbox"/> Hot work equipment is in satisfactory operating condition and in good repair. <input type="checkbox"/> Fully charged and operable fire extinguishers are provided in the immediate work area. Requirements within 35 ft (11m) of hot work <input type="checkbox"/> The area is free from flammable liquids and combustible material. Combustibles that can not be moved are shielded or protected against ignition <input type="checkbox"/> Combustible materials on the floor have been swept for a radius of 35 ft (11m). <input type="checkbox"/> Combustible floors have been kept wet down, covered with damp sand, or protected by shielding; personnel operating arc welding or cutting are protected from shock. <input type="checkbox"/> Edges of covers at the floor are tight to prevent sparks from going under them. Work on walls or ceilings/enclosed equipment <input type="checkbox"/> Where hot work is done near combustible walls, partitions, ceilings or roofs, fire resistant shields or guards are used. Remove combustibles away from side or adjacent structures. <input type="checkbox"/> Openings or cracks in the walls, partitions, ceilings or roofs of combustible material, have been protected with fire-retardant shields or guards. <input type="checkbox"/> If hot work is done in close proximity to a sprinkler head, a wet rag is placed over the head and removed after completion. <input type="checkbox"/> Ducts and conveyor systems that might carry sparks to distant combustibles are protected or shut down. Fire Watch <input type="checkbox"/> A trained and equipped fire watch is provided during operations and at least 30 minutes after, including breaks. <input type="checkbox"/> Nearby personnel are suitable protected against heat, sparks, slag and so on. <input type="checkbox"/> After welding is complete some means of warning that the metal is hot must be provided.
Permit Information	
Hot work done by: <input type="checkbox"/> Employee <input type="checkbox"/> Contractor	
Permit number	
Location/Building/Floor	
Work to be done	
Signature of person doing job	
Permit Authorizing Individual (PAI) signature I have verified that the above location has been inspected and the required precautions and safeguards items on the checklist to the right have been taken to prevent fire. Permission is authorized for work.	
Permit expires Date Time	
Final check Date Time	

APPENDIX B – OXYGEN-FUEL GAS WELDING AND CUTTING

Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	Q
• Subpart Title:	Welding, Cutting, and Brazing
• Standard Number:	<u>1910.253</u>
• Title:	Oxygen-fuel gas welding and cutting.

1910.253(a)

General requirements. -

1910.253(a)(1)

Flammable mixture. Mixtures of fuel gases and air or oxygen may be explosive and shall be guarded against. No device or attachment facilitating or permitting mixtures of air or oxygen with flammable gases prior to consumption, except at the burner or in a standard torch, shall be allowed unless approved for the purpose.

1910.253(a)(2)

Maximum pressure. Under no condition shall acetylene be generated, piped (except in approved cylinder manifolds) or utilized at a pressure in excess of 15 psig (103 kPa gauge pressure) or 30 psia (206 kPa absolute). (The 30 psia (206 kPa absolute) limit is intended to prevent unsafe use of acetylene in pressurized chambers such as caissons, underground excavations or tunnel construction.) This requirement is not intended to apply to storage of acetylene dissolved in a suitable solvent in cylinders manufactured and maintained according to U.S. Department of Transportation requirements, or to acetylene for chemical use. The use of liquid acetylene shall be prohibited.

1910.253(a)(3)

Apparatus. Only approved apparatus such as torches, regulators or pressure-reducing valves, acetylene generators, and manifolds shall be used.

1910.253(a)(4)

Personnel. Workmen in charge of the oxygen or fuel-gas supply equipment, including generators, and oxygen or fuel-gas distribution piping systems shall be instructed and judged competent by their employers for this important work before being left in charge. Rules and instructions covering the operation and maintenance of oxygen or fuel-gas supply equipment including generators, and oxygen or fuel-gas distribution piping systems shall be readily available.

1910.253(b)

Cylinders and containers -

1910.253(b)(1)

Approval and marking.

1910.253(b)(1)(i)

All portable cylinders used for the storage and shipment of compressed gases shall be constructed and maintained in accordance with the regulations of the U.S. Department of Transportation, 49 CFR Parts 171-179.

1910.253(b)(1)(ii)

Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or the trade name of the gas. Such marking shall be by means of stenciling, stamping, or labeling, and shall not be readily removable. Whenever practical, the marking shall be located on the shoulder of the cylinder. This method conforms to the American National Standard Method for Marking Portable Compressed Gas Containers to Identify the Material Contained, ANSI Z48.1-1954, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(b)(1)(iii)

Compressed gas cylinders shall be equipped with connections complying with the American National Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections, ANSI B57.1-1965, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(b)(1)(iv)

All cylinders with a water weight capacity of over 30 pounds (13.6 kg) shall be equipped with means of connecting a valve protection cap or with a collar or recess to protect the valve.

1910.253(b)(2)

Storage of cylinders-general.

1910.253(b)(2)(i)

Cylinders shall be kept away from radiators and other sources of heat.

1910.253(b)(2)(ii)

Inside of buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location, at least 20 (6.1 m) feet from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage spaces shall be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons. Cylinders shall not be kept in unventilated enclosures such as lockers and cupboards.

1910.253(b)(2)(iii)

Empty cylinders shall have their valves closed.

1910.253(b)(2)(iv)

Valve protection caps, where cylinder is designed to accept a cap, shall always be in place, hand-tight, except when cylinders are in use or connected for use.

1910.253(b)(3)

Fuel-gas cylinder storage. Inside a building, cylinders, except those in actual use or attached ready for use, shall be limited to a total gas capacity of 2,000 cubic feet (56 m³) or 300 pounds (135.9 kg) of liquefied petroleum gas.

1910.253(b)(3)(i)

For storage in excess of 2,000 cubic feet (56 m³) total gas capacity of cylinders or 300 pounds (135.9 kg) of liquefied petroleum gas, a separate room or compartment conforming to the requirements specified in paragraphs (f)(6)(i)(H) and (f)(6)(i)(I) of this section shall be provided, or cylinders shall be kept outside or in a special building. Special buildings, rooms or compartments shall have no open flame for heating or lighting and shall be well ventilated. They may also be used for storage of calcium carbide in quantities not to exceed 600 (271.8 kg) pounds, when contained in metal containers complying with paragraphs (g)(1)(i) and (g)(1)(ii) of this section.

1910.253(b)(3)(ii)

Acetylene cylinders shall be stored valve end up.

1910.253(b)(4)

Oxygen storage.

1910.253(b)(4)(i)

Oxygen cylinders shall not be stored near highly combustible material, especially oil and grease; or near reserve stocks of carbide and acetylene or other fuel-gas cylinders, or near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.

1910.253(b)(4)(ii)

Oxygen cylinders stored in outside generator houses shall be separated from the generator or carbide storage rooms by a noncombustible partition having a fire-resistance rating of at least 1 hour. This partition shall be without openings and shall be gastight.

1910.253(b)(4)(iii)

Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet (6.1 m) or by a noncombustible barrier at least 5 feet (1.5 m) high having a fire-resistance rating of at least one-half hour.

1910.253(b)(4)(iv)

Where a liquid oxygen system is to be used to supply gaseous oxygen for welding or cutting and the system has a storage capacity of more than 13,000 cubic feet (364 m³) of oxygen (measured at 14.7 psia (101 kPa) and 70 deg. F (21.1 deg. C)), connected in service or ready for service, or more than 25,000 cubic feet (700 m³) of oxygen (measured at 14.7 psia (101 kPa) and 70 deg. F (21.1 deg. C)), including unconnected reserves on hand at the site, it shall comply with the provisions of the Standard for Bulk Oxygen Systems at Consumer Sites, NFPA No. 566-1965, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(b)(5)

Operating procedures.

1910.253(b)(5)(i)

Cylinders, cylinder valves, couplings, regulators, hose, and apparatus shall be kept free from oily or greasy substances. Oxygen cylinders or apparatus shall not be handled with oily hands or gloves. A jet of oxygen must never be permitted to strike an oily surface, greasy clothes, or enter a fuel oil or other storage tank.

1910.253(b)(5)(ii)

1910.253(b)(5)(ii)(A)

When transporting cylinders by a crane or derrick, a cradle, boat, or suitable platform shall be used. Slings or electric magnets shall not be used for this purpose. Valve-protection caps, where cylinder is designed to accept a cap, shall always be in place.

1910.253(b)(5)(ii)(B)

Cylinders shall not be dropped or struck or permitted to strike each other violently.

1910.253(b)(5)(ii)(C)

Valve-protection caps shall not be used for lifting cylinders from one vertical position to another. Bars shall not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed; the use of warm (not boiling) water is recommended. Valve-protection caps are designed to protect cylinder valves from damage.

1910.253(b)(5)(ii)(D)

Unless cylinders are secured on a special truck, regulators shall be removed and valve-protection caps, when provided for, shall be put in place before cylinders are moved.

1910.253(b)(5)(ii)(E)

Cylinders not having fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while these cylinders are in service. In multiple cylinder installations only one key or handle is required for each manifold.

1910.253(b)(5)(ii)(F)

Cylinder valves shall be closed before moving cylinders.

1910.253(b)(5)(ii)(G)

Cylinder valves shall be closed when work is finished.

1910.253(b)(5)(ii)(H)

Valves of empty cylinders shall be closed.

1910.253(b)(5)(ii)(I)

Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them, or fire-resistant shields shall be provided.

1910.253(b)(5)(ii)(J)

Cylinders shall not be placed where they might become part of an electric circuit. Contacts with third rails, trolley wires, etc., shall be avoided. Cylinders shall be kept away from radiators, piping systems, layout tables, etc., that may be used for grounding electric circuits such as for arc welding machines. Any practice such as the tapping of an electrode against a cylinder to strike an arc shall be prohibited.

1910.253(b)(5)(ii)(K)

Cylinders shall never be used as rollers or supports, whether full or empty.

1910.253(b)(5)(ii)(L)

The numbers and markings stamped into cylinders shall not be tampered with.

1910.253(b)(5)(ii)(M)

No person, other than the gas supplier, shall attempt to mix gases in a cylinder. No one, except the owner of the cylinder or person authorized by him, shall refill a cylinder.

1910.253(b)(5)(ii)(N)

No one shall tamper with safety devices in cylinders or valves.

1910.253(b)(5)(ii)(O)

Cylinders shall not be dropped or otherwise roughly handled.

1910.253(b)(5)(ii)(P)

Unless connected to a manifold, oxygen from a cylinder shall not be used without first attaching an oxygen regulator to the cylinder valve. Before connecting the regulator to the cylinder valve, the valve shall be opened slightly for an instant and then closed. Always stand to one side of the outlet when opening the cylinder valve.

1910.253(b)(5)(ii)(Q)

A hammer or wrench shall not be used to open cylinder valves. If valves cannot be opened by hand, the supplier shall be notified.

1910.253(b)(5)(ii)(R)

1910.253(b)(5)(ii)(R)(1)

Cylinder valves shall not be tampered with nor should any attempt be made to repair them. If trouble is experienced, the supplier should be sent a report promptly indicating the character of the trouble and the cylinder's serial number. Supplier's instructions as to its disposition shall be followed.

1910.253(b)(5)(ii)(R)(2)

Complete removal of the stem from a diaphragm-type cylinder valve shall be avoided.

1910.253(b)(5)(iii)

1910.253(b)(5)(iii)(A)

Fuel-gas cylinders shall be placed with valve end up whenever they are in use. Liquefied gases shall be stored and shipped with the valve end up.

1910.253(b)(5)(iii)(B)

Cylinders shall be handled carefully. Rough handling, knocks, or falls are liable to damage the cylinder, valve or safety devices and cause leakage.

1910.253(b)(5)(iii)(C)

Before connecting a regulator to a cylinder valve, the valve shall be opened slightly and closed immediately. The valve shall be opened while standing to one side of the outlet; never in front of it. Never crack a fuel-gas cylinder valve near other welding work or near sparks, flame, or other possible sources of ignition.

1910.253(b)(5)(iii)(D)

Before a regulator is removed from a cylinder valve, the cylinder valve shall be closed and the gas released from the regulator.

1910.253(b)(5)(iii)(E)

Nothing shall be placed on top of an acetylene cylinder when in use which may damage the safety device or interfere with the quick closing of the valve.

1910.253(b)(5)(iii)(F)

If cylinders are found to have leaky valves or fittings which cannot be stopped by closing of the valve, the cylinders shall be taken outdoors away from sources of ignition and slowly emptied.

1910.253(b)(5)(iii)(G)

A warning should be placed near cylinders having leaking fuse plugs or other leaking safety devices not to approach them with a lighted cigarette or other source of ignition. Such cylinders should be plainly tagged; the supplier should be promptly notified and his instructions followed as to their return.

1910.253(b)(5)(iii)(H)

Safety devices shall not be tampered with.

1910.253(b)(5)(iii)(I)

Fuel-gas shall never be used from cylinders through torches or other devices equipped with shutoff valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.

1910.253(b)(5)(iii)(J)

The cylinder valve shall always be opened slowly.

1910.253(b)(5)(iii)(K)

An acetylene cylinder valve shall not be opened more than one and one-half turns of the spindle, and preferably no more than three-fourths of a turn.

1910.253(b)(5)(iii)(L)

Where a special wrench is required it shall be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of emergency. In the case of manifolded or coupled cylinders at least one such wrench shall always be available for immediate use.

1910.253(c)

Manifolding of cylinders -

1910.253(c)(1)

Fuel-gas manifolds.

1910.253(c)(1)(i)

Manifolds shall be approved either separately for each component part or as an assembled unit.

1910.253(c)(1)(ii)

Except as provided in paragraph (c)(1)(iii) of this section fuel-gas cylinders connected to one manifold inside a building shall be limited to a total capacity not exceeding 300 pounds (135.9 kg) of liquefied petroleum gas or 3,000 cubic feet (84 m³) of other fuel-gas. More than one such manifold with connected cylinders may be located in the same room provided the manifolds are at least 50 feet (15 m) apart or separated by a noncombustible barrier at least 5 feet (1.5 m) high having a fire-resistance rating of at least one-half hour.

1910.253(c)(1)(iii)

Fuel-gas cylinders connected to one manifold having an aggregate capacity exceeding 300 pounds (135.9 kg) of liquefied petroleum gas or 3,000 cubic feet (84 m³) of other fuel-gas shall be located outdoors, or in a separate building or room constructed in accordance with paragraphs (f)(6)(i)(H) and (f)(6)(i)(I) of this section.

1910.253(c)(1)(iv)

Separate manifold buildings or rooms may also be used for the storage of drums of calcium carbide and cylinders containing fuel gases as provided in paragraph (b)(3) of this section. Such buildings or rooms shall have no open flames for heating or lighting and shall be well-ventilated.

1910.253(c)(1)(v)

High-pressure fuel-gas manifolds shall be provided with approved pressure regulating devices.

1910.253(c)(2)

High-pressure oxygen manifolds (for use with cylinders having a Department of Transportation service pressure above 200 psig (1.36 MPa)).

1910.253(c)(2)(i)

Manifolds shall be approved either separately for each component part or as an assembled unit.

1910.253(c)(2)(ii)

Oxygen manifolds shall not be located in an acetylene generator room. Oxygen manifolds shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet (6.1 m) or by a noncombustible barrier at least 5 feet (1.5 m) high having a fire-resistance rating of at least one-half hour.

1910.253(c)(2)(iii)

Except as provided in paragraph (c)(2)(iv) of this section, oxygen cylinders connected to one manifold shall be limited to a total gas capacity of 6,000 cubic feet (168 m³). More than one such manifold with connected cylinders may be located in the same room provided the manifolds are at least 50 feet (15 m) apart or separated by a noncombustible barrier at least 5 feet (1.5 m) high having a fire-resistance rating of at least one-half hour.

1910.253(c)(2)(iv)

An oxygen manifold, to which cylinders having an aggregate capacity of more than 6,000 cubic feet (168 m³) of oxygen are connected, should be located outdoors or in a separate noncombustible building. Such a manifold, if located inside a building having other occupancy, shall be located in a separate room of noncombustible construction having a fire-resistance rating of at least one-half hour or in an area with no combustible material within 20 feet (6.1 m) of the manifold.

1910.253(c)(2)(v)

An oxygen manifold or oxygen bulk supply system which has storage capacity of more than 13,000 cubic feet (364 m³) of oxygen (measured at 14.7 psia (101 kPa) and 70 deg. F (21.1 deg. C)), connected in service or ready for service, or more than 25,000 cubic feet (700 m³) of oxygen (measured at 14.7 psia (101 kPa) and 70 deg. F (21.1 deg. C)), including unconnected reserves on hand at the site, shall comply with the provisions of the Standard for Bulk Oxygen Systems at Consumer Sites, NFPA No. 566-1965.

1910.253(c)(2)(vi)

High-pressure oxygen manifolds shall be provided with approved pressure-regulating devices.

1910.253(c)(3)

Low-pressure oxygen manifolds (for use with cylinders having a Department of Transportation service pressure not exceeding 200 psig (1.36 MPa)).

1910.253(c)(3)(i)

Manifolds shall be of substantial construction suitable for use with oxygen at a pressure of 250 psig (1.7 MPa). They shall have a minimum bursting pressure of 1,000 psig (6.8 MPa) and shall be protected by a safety relief device which will relieve at a maximum pressure of 500 psig (3.4 MPa). DOT-4L200 cylinders have safety devices which relieve at a maximum pressure of 250 psig (1.7 MPa) (or 235 psig (1.6 MPa) if vacuum insulation is used).

1910.253(c)(3)(ii)

Hose and hose connections subject to cylinder pressure shall comply with paragraph (e)(5) of this section. Hose shall have a minimum bursting pressure of 1,000 psig (6.8 MPa).

1910.253(c)(3)(iii)

The assembled manifold including leads shall be tested and proven gas-tight at a pressure of 300 psig (2.04 MPa). The fluid used for testing oxygen manifolds shall be oil-free and not combustible.

1910.253(c)(3)(iv)

The location of manifolds shall comply with paragraphs (c)(2)(ii), (c)(2)(iii), (c)(2)(iv), and (c)(2)(v) of this section.

1910.253(c)(3)(v)

The following sign shall be conspicuously posted at each manifold:

Low-Pressure Manifold
Do Not Connect High-Pressure Cylinders
Maximum Pressure - 250 psig (1.7 MPa)

1910.253(c)(4)

Portable outlet headers.

1910.253(c)(4)(i)

Portable outlet headers shall not be used indoors except for temporary service where the conditions preclude a direct supply from outlets located on the service piping system.

1910.253(c)(4)(ii)

Each outlet on the service piping from which oxygen or fuel-gas is withdrawn to supply a portable outlet header shall be equipped with a readily accessible shutoff valve.

1910.253(c)(4)(iii)

Hose and hose connections used for connecting the portable outlet header to the service piping shall comply with paragraph (e)(5) of this section.

1910.253(c)(4)(iv)

Master shutoff valves for both oxygen and fuel-gas shall be provided at the entry end of the portable outlet header.

1910.253(c)(4)(v)

Portable outlet headers for fuel-gas service shall be provided with an approved hydraulic back-pressure valve installed at the inlet and preceding the service outlets, unless an approved pressure-reducing regulator, an approved back-flow check valve, or an approved hydraulic back-pressure valve is installed at each outlet. Outlets provided on headers for oxygen service may be fitted for use with pressure-reducing regulators or for direct hose connection.

1910.253(c)(4)(vi)

Each service outlet on portable outlet headers shall be provided with a valve assembly that includes a detachable outlet seal cap, chained or otherwise attached to the body of the valve.

1910.253(c)(4)(vii)

Materials and fabrication procedures for portable outlet headers shall comply with paragraphs (d)(1), (d)(2), and (d)(5) of this section.

1910.253(c)(4)(viii)

Portable outlet headers shall be provided with frames which will support the equipment securely in the correct operating position and protect them from damage during handling and operation.

1910.253(c)(5)

Manifold operating procedures.

1910.253(c)(5)(i)

Cylinder manifolds shall be installed under the supervision of someone familiar with the proper practices with reference to their construction and use.

1910.253(c)(5)(ii)

All manifolds and parts used in methods of manifolding shall be used only for the gas or gases for which they are approved.

1910.253(c)(5)(iii)

When acetylene cylinders are coupled, approved flash arresters shall be installed between each cylinder and the coupler block. For outdoor use only, and when the number of cylinders coupled does not exceed three, one flash arrester installed between the coupler block and regulator is acceptable.

1910.253(c)(5)(iv)

The aggregate capacity of fuel-gas cylinders connected to a portable manifold inside a building shall not exceed 3,000 cubic feet (84 m³) of gas.

1910.253(c)(5)(v)

Acetylene and liquefied fuel-gas cylinders shall be manifolded in a vertical position.

1910.253(c)(5)(vi)

The pressure in the gas cylinders connected to and discharged simultaneously through a common manifold shall be approximately equal.

1910.253(d)

Service piping systems –

1910.253(d)(1)

Materials and design.

1910.253(d)(1)(i)

1910.253(d)(1)(i)(A)

Piping and fittings shall comply with section 2, Industrial Gas and Air Piping Systems, of the American National Standard Code for Pressure Piping ANSI B31.1-1967, which is incorporated by reference as specified in Sec. 1910.6, insofar as it does not conflict with paragraph (d)(1)(i)(A)(1) and (d)(1)(i)(A)(2) of this section:

1910.253(d)(1)(i)(A)(1)

Pipe shall be at least Schedule 40 and fittings shall be at least standard weight in sizes up to and including 6-inch nominal.

1910.253(d)(1)(i)(A)(2)

Copper tubing shall be Types K or L in accordance with the Standard Specification for Seamless Copper Water Tube, ASTM B88-66a, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(d)(1)(i)(B)

Piping shall be steel, wrought iron, brass or copper pipe, or seamless copper, brass or stainless steel tubing, except as provided in paragraph (d)(1)(ii) and (d)(1)(iii) of this section.

1910.253(d)(1)(ii)
1910.253(d)(1)(ii)(A)

Oxygen piping and fittings at pressures in excess of 700 psi (4.8 MPa), shall be stainless steel or copper alloys.

1910.253(d)(1)(ii)(B)

Hose connections and hose complying with paragraph (e)(5) of this section may be used to connect the outlet of a manifold pressure regulator to piping providing the working pressure of the piping is 250 psi (1.7 MPa) or less and the length of the hose does not exceed 5 feet (1.5 m). Hose shall have a minimum bursting pressure of 1,000 psig (6.8 MPa).

1910.253(d)(1)(ii)(C)

When oxygen is supplied to a service piping system from a low-pressure oxygen manifold without an intervening pressure regulating device, the piping system shall have a minimum design pressure of 250 psig (1.7 MPa). A pressure regulating device shall be used at each station outlet when the connected equipment is for use at pressures less than 250 psig (1.7 MPa).

1910.253(d)(1)(iii)
1910.253(d)(1)(iii)(A)

Piping for acetylene or acetylenic compounds shall be steel or wrought iron.

1910.253(d)(1)(iii)(B)

Unalloyed copper shall not be used for acetylene or acetylenic compounds except in listed equipment.

1910.253(d)(2)

Piping joints.

1910.253(d)(2)(i)

Joints in steel or wrought iron piping shall be welded, threaded or flanged. Fittings, such as ells, tees, couplings, and unions, may be rolled, forged or cast steel, malleable iron or nodular iron. Gray or white cast iron fittings are prohibited.

1910.253(d)(2)(ii)

Joints in brass or copper pipe shall be welded, brazed, threaded, or flanged. If of the socket type, they shall be brazed with silver-brazing alloy or similar high melting point (not less than 800 deg. F (427 deg. C)) filler metal.

1910.253(d)(2)(iii)

Joints in seamless copper, brass, or stainless steel tubing shall be approved gas tubing fittings or the joints shall be brazed. If of the socket type, they shall be brazed with silver-brazing alloy or similar high melting point (not less than 800 deg. F (427 deg. C)) filler metal.

1910.253(d)(3)

Installation.

1910.253(d)(3)(i)

Distribution lines shall be installed and maintained in a safe operating condition.

1910.253(d)(3)(ii)

All piping shall be run as directly as practicable, protected against physical damage, proper allowance being made for expansion and contraction, jarring and vibration. Pipe laid underground in earth shall be located below the frost line and protected against corrosion. After assembly, piping shall be thoroughly blown out with air, nitrogen, or carbon dioxide to remove foreign materials. For oxygen piping, only oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used.

1910.253(d)(3)(iii)

Only piping which has been welded or brazed shall be installed in tunnels, trenches or ducts. Shutoff valves shall be located outside such conduits. Oxygen piping may be placed in the same tunnel, trench or duct with fuel-gas pipelines, provided there is good natural or forced ventilation.

1910.253(d)(3)(iv)

Low points in piping carrying moist gas shall be drained into drip pots constructed so as to permit pumping or draining out the condensate at necessary intervals. Drain valves shall be installed for this purpose having outlets normally closed with screw caps or plugs. No open end valves or petcocks shall be used, except that in drips located out of doors, underground, and not readily accessible, valves may be used at such points if they are equipped with means to secure them in the closed position. Pipes leading to the surface of the ground shall be cased or jacketed where necessary to prevent loosening or breaking.

1910.253(d)(3)(v)

Gas cocks or valves shall be provided for all buildings at points where they will be readily accessible for shutting off the gas supply to these buildings in any emergency. There shall also be provided a shutoff valve in the discharge line from the generator, gas holder, manifold or other source of supply.

1910.253(d)(3)(vi)

Shutoff valves shall not be installed in safety relief lines in such a manner that the safety relief device can be rendered ineffective.

1910.253(d)(3)(vii)

Fittings and lengths of pipe shall be examined internally before assembly and, if necessary freed from scale or dirt. Oxygen piping and fittings shall be washed out with a suitable solution which will effectively remove grease and dirt but will not react with oxygen. Hot water solutions of caustic soda or trisodium phosphate are effective cleaning agents for this purpose.

1910.253(d)(3)(viii)

Piping shall be thoroughly blown out after assembly to remove foreign materials. For oxygen piping, oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used. For other piping, air or inert gas may be used.

1910.253(d)(3)(ix)

When flammable gas lines or other parts of equipment are being purged of air or gas, open lights or other sources of ignition shall not be permitted near uncapped openings.

1910.253(d)(3)(x)

No welding or cutting shall be performed on an acetylene or oxygen pipeline, including the attachment of hangers or supports, until the line has been purged. Only oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used to purge oxygen lines.

1910.253(d)(4)

Painting and signs.

1910.253(d)(4)(i)

Underground pipe and tubing and outdoor ferrous pipe and tubing shall be covered or painted with a suitable material for protection against corrosion.

1910.253(d)(4)(ii)

Aboveground piping systems shall be marked in accordance with the American National Standard Scheme for the Identification of Piping Systems, ANSI A13.1-1956, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(d)(4)(iii)

Station outlets shall be marked to indicate the name of the gas.

1910.253(d)(5)

Testing.

1910.253(d)(5)(i)

Piping systems shall be tested and proved gastight at 1 1/2 times the maximum operating pressure, and shall be thoroughly purged of air before being placed in service. The material used for testing oxygen lines shall be oil free and noncombustible. Flames shall not be used to detect leaks.

1910.253(d)(5)(ii)

When flammable gas lines or other parts of equipment are being purged of air or gas, sources of ignition shall not be permitted near uncapped openings.

1910.253(e)

Protective equipment, hose, and regulators –

1910.253(e)(1)

General. Equipment shall be installed and used only in the service for which it is approved and as recommended by the manufacturer.

1910.253(e)(2)

Pressure relief devices. Service piping systems shall be protected by pressure relief devices set to function at not more than the design pressure of the systems and discharging upwards to a safe location.

1910.253(e)(3)

Piping protective equipment.

1910.253(e)(3)(i)

The fuel-gas and oxygen piping systems, including portable outlet headers shall incorporate the protective equipment shown in Figures Q-1, Q-2, and Q-3.

When only a portion of a fuel-gas system is to be used with oxygen, only that portion need comply with this paragraph (e)(3)(i).

(For Figures Q-1, Q-2, and Q-3, [Click Here](#))

1910.253(e)(3)(ii)

Approved protective equipment (designated P(F) in Figs. Q-1, Q-2, and Q-3) shall be installed in fuel-gas piping to prevent:

1910.253(e)(3)(ii)(A)

Backflow of oxygen into the fuel-gas supply system;

1910.253(e)(3)(ii)(B)

Passage of a flash back into the fuel-gas supply system; and

1910.253(e)(3)(ii)(C)

Excessive back pressure of oxygen in the fuel-gas supply system. The three functions of the protective equipment may be combined in one device or may be provided by separate devices.

1910.253(e)(3)(ii)(C)(1)

The protective equipment shall be located in the main supply line, as in Figure Q-1 or at the head of each branch line, as in Figure Q-2 or at each location where fuel-gas is withdrawn, as in Figure Q-3. Where branch lines are of 2-inch pipe size or larger or of substantial length, protective equipment (designated as P(F)) shall be located as shown in either Q-2 and Q-3.

1910.253(e)(3)(ii)(C)(2)

Backflow protection shall be provided by an approved device that will prevent oxygen from flowing into the fuel-gas system or fuel from flowing into the oxygen system (see S(F), Figs. Q-1 and Q-2)

1910.253(e)(3)(ii)(C)(3)

Flash-back protection shall be provided by an approved device that will prevent flame from passing into the fuel-gas system.

1910.253(e)(3)(ii)(C)(4)

Back-pressure protection shall be provided by an approved pressure-relief device set at a pressure not greater than the pressure rating of the backflow or the flashback protection device, whichever is lower. The pressure-relief device shall be located on the downstream side of the backflow and flashback protection devices. The vent from the pressure-relief device shall be at least as large as the relief device inlet and shall be installed without low points that may collect moisture. If low points are unavoidable, drip pots with drains closed with screw plugs or caps shall be installed at the low points. The vent terminus shall not endanger personnel or property through gas discharge; shall be located away from ignition sources; and shall terminate in a hood or bend.

1910.253(e)(3)(iii)

If pipeline protective equipment incorporates a liquid, the liquid level shall be maintained, and a suitable antifreeze may be used to prevent freezing.

1910.253(e)(3)(iv)

Fuel gas for use with equipment not requiring oxygen shall be withdrawn upstream of the piping protective devices.

1910.253(e)(4)

Station outlet protective equipment.

1910.253(e)(4)(i)

A check valve, pressure regulator, hydraulic seal, or combination of these devices shall be provided at each station outlet, including those on portable headers, to prevent backflow, as shown in Figures Q-1, Q-2, and Q-3 and designated as S(F) and S(O).

1910.253(e)(4)(ii)

When approved pipeline protective equipment (designated P(F)) is located at the station outlet as in Figure Q-3, no additional check valve, pressure regulator, or hydraulic seal is required.

1910.253(e)(4)(iii)

A shutoff valve (designated V(F) and V(O)) shall be installed at each station outlet and shall be located on the upstream side of other station outlet equipment.

1910.253(e)(4)(iv)

If the station outlet is equipped with a detachable regulator, the outlet le regulator, the outlet shall terminate in a union connection that complies with the Regulator Connection Standards, 1958, Compressed Gas Association, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(e)(4)(v)

If the station outlet is connected directly to a hose, the outlet shall terminate in a union connection complying with the Standard Hose Connection Specifications, 1957, Compressed Gas Association, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(e)(4)(vi)

Station outlets may terminate in pipe threads to which permanent connections are to be made, such as to a machine.

1910.253(e)(4)(vii)

Station outlets shall be equipped with a detachable outlet seal cap secured in place. This cap shall be used to seal the outlet except when a hose, a regulator, or piping is attached.

1910.253(e)(4)(viii)

Where station outlets are equipped with approved backflow and flashback protective devices, as many as four torches may be supplied from one station outlet through rigid piping, provided each outlet from such piping is equipped with a shutoff valve and provided the fuel-gas capacity of any one torch does not exceed 15 cubic feet (0.42 m³) per hour. This paragraph (e)(4)(viii) does not apply to machines.

1910.253(e)(5)

Hose and hose connections.

1910.253(e)(5)(i)

Hose for oxy-fuel gas service shall comply with the Specification for Rubber Welding Hose, 1958, Compressed Gas Association and Rubber Manufacturers Association, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(e)(5)(ii)

When parallel lengths of oxygen and acetylene hose are taped together for convenience and to prevent tangling, not more than 4 inches (10.2 cm) out of 12 inches (30.5 cm) shall be covered by tape.

1910.253(e)(5)(iii)

Hose connections shall comply with the Standard Hose Connection Specifications, 1957, Compressed Gas Association.

1910.253(e)(5)(iv)

Hose connections shall be clamped or otherwise securely fastened in a manner that will withstand, without leakage, twice the pressure to which they are normally subjected in service, but in no case less than a pressure of 300 psi (2.04 MPa). Oil-free air or an oil-free inert gas shall be used for the test.

1910.253(e)(5)(v)

Hose showing leaks, burns, worn places, or other defects rendering it unfit for service shall be repaired or replaced.

1910.253(e)(6)

Pressure-reducing regulators.

1910.253(e)(6)(i)

Pressure-reducing regulators shall be used only for the gas and pressures for which they are intended. The regulator inlet connections shall comply with Regulator Connection Standards, 1958, Compressed Gas Association.

1910.253(e)(6)(ii)

When regulators or parts of regulators, including gages, need repair, the work shall be performed by skilled mechanics who have been properly instructed.

1910.253(e)(6)(iii)

Gages on oxygen regulators shall be marked "USE NO OIL."

1910.253(e)(6)(iv)

Union nuts and connections on regulators shall be inspected before use to detect faulty seats which may cause leakage of gas when the regulators are attached to the cylinder valves.

1910.253(f)

Acetylene generators –

1910.253(f)(1)

Approval and marking.

1910.253(f)(1)(i)

Generators shall be of approved construction and shall be plainly marked with the maximum rate of acetylene in cubic feet per hour for which they are designed; the weight and size of carbide necessary for a single charge; the manufacturer's name and address; and the name or number of the type of generator.

1910.253(f)(1)(ii)

Carbide shall be of the size marked on the generator nameplate.

1910.253(f)(2)

Rating and pressure limitations.

1910.253(f)(2)(i)

The total hourly output of a generator shall not exceed the rate for which it is approved and marked. Unless specifically approved for higher ratings, carbide-feed generators shall be rated at 1 cubic foot (0.028 m³) per hour per pound of carbide required for a single complete charge.

1910.253(f)(2)(ii)

Relief valves shall be regularly operated to insure proper functioning. Relief valves for generating chambers shall be set to open at a pressure not in excess of 15 psig (103 kPa gauge pressure). Relief valves for hydraulic back pressure valves shall be set to open at a pressure not in excess of 20 psig (137 kPa gauge pressure).

1910.253(f)(2)(iii)

Nonautomatic generators shall not be used for generating acetylene at pressures exceeding 1 psig (7 kPa gauge pressure), and all water overflows shall be visible.

1910.253(f)(3)

Location. The space around the generator shall be ample for free, unobstructed operation and maintenance and shall permit ready adjustment and charging.

1910.253(f)(4)

Stationary acetylene generators (automatic and Nonautomatic).

1910.253(f)(4)(i)

-

1910.253(f)(4)(i)(A)

The foundation shall be so arranged that the generator will be level and so that no excessive strain will be placed on the generator or its connections. Acetylene generators shall be grounded.

1910.253(f)(4)(i)(B)

Generators shall be placed where water will not freeze. The use of common salt (sodium chloride) or other corrosive chemicals for protection against freezing is not permitted. (For heating systems see paragraph (f)(6)(iii) of this section.)

1910.253(f)(4)(i)(C)

Except when generators are prepared in accordance with paragraph (f)(7)(v) of this section, sources of ignition shall be prohibited in outside generator houses or inside generator rooms.

1910.253(f)(4)(i)(D)

Water shall not be supplied through a continuous connection to the generator except when the generator is provided with an adequate open overflow or automatic water shutoff which will effectively prevent overflowing of the generator. Where a noncontinuous connection is used, the supply line shall terminate at a point not less than 2 inches (5 cm) above the regularly provided opening for filling so that the water can be observed as it enters the generator.

1910.253(f)(4)(i)(E)

Unless otherwise specifically approved, generators shall not be fitted with continuous drain connections leading to sewers, but shall discharge through an open connection into a suitably vented outdoor receptacle or residue pit which may have such connections. An open connection for the sludge drawoff is desirable to enable the generator operator to observe leakage of generating water from the drain valve or sludge cock.

1910.253(f)(4)(ii)

1910.253(f)(4)(ii)(A)

Each generator shall be provided with a vent pipe.

1910.253(f)(4)(ii)(B)

The escape or relief pipe shall be rigidly installed without traps and so that any condensation will drain back to the generator.

1910.253(f)(4)(ii)(C)

The escape or relief pipe shall be carried full size to a suitable point outside the building. It shall terminate in a hood or bend located at least 12 feet (3.7 m) above the ground, preferably above the roof, and as far away as practicable from windows or other openings into buildings and as far away as practicable from sources of ignition such as flues or chimneys and tracks used by locomotives. Generating chamber relief pipes shall not be inter-connected but shall be separately led to the outside air. The hood or bend shall be so constructed that it will not be obstructed by rain, snow, ice, insects, or birds. The outlet shall be at least 3 feet (0.9 m) from combustible construction.

1910.253(f)(4)(iii)

1910.253(f)(4)(iii)(A)

Gas holders shall be constructed on the gasometer principle, the bell being suitably guided. The gas bell shall move freely without tendency to bind and shall have a clearance of at least 2 inches (5 cm) from the shell.

1910.253(f)(4)(iii)(B)

The gas holder may be located in the generator room, in a separate room or out of doors. In order to prevent collapse of the gas bell or infiltration of air due to a vacuum caused by the compressor or booster pump or cooling of the gas, a compressor or booster cutoff shall be provided at a point 12 inches (0.3 m) or more above the landing point of the bell. When the gas holder is located indoors, the room shall be ventilated in accordance with paragraph (f)(6)(ii) of this section and heated and lighted in accordance with subdivisions (f)(6)(iii) and (f)(6)(iv) of this section.

1910.253(f)(4)(iii)(C)

When the gas holder is not located within a heated building, gas holder seals shall be protected against freezing.

1910.253(f)(4)(iii)(D)

Means shall be provided to stop the generator-feeding mechanism before the gas holder reaches the upper limit of its travel.

1910.253(f)(4)(iii)(E)

When the gas holder is connected to only one generator, the gas capacity of the holder shall be not less than one-third of the hourly rating of the generator.

1910.253(f)(4)(iii)(F)

If acetylene is used from the gas holder without increase in pressure at some points but with increase in pressure by a compressor or booster pump at other points, approved piping protective devices shall be installed in each supply line. The low-pressure protective device shall be located between the gas holder and the shop piping, and the medium-pressure protective device shall be located between the compressor or booster pump and the shop piping (see Figure Q-4). Approved protective equipment (designated P(F)) is used to prevent: Backflow of oxygen into the fuel-gas supply system; passage of a flashback into the fuel-gas supply system; and excessive back pressure of oxygen in the fuel-gas supply system. The three functions of the protective equipment may be combined in one device or may be provided by separate devices.

(For Figure Q-4, [Click Here](#))

1910.253(f)(4)(iv)

1910.253(f)(4)(iv)(A)

The compressor or booster system shall be of an approved type.

1910.253(f)(4)(iv)(B)

Wiring and electrical equipment in compressor or booster pump rooms or enclosures shall conform to the provisions of Subpart S of this part for Class I, Division 2 locations.

1910.253(f)(4)(iv)(C)

Compressors and booster pump equipment shall be located in well-ventilated areas away from open flames, electrical or mechanical sparks, or other ignition sources.

1910.253(f)(4)(iv)(D)

Compressor or booster pumps shall be provided with pressure relief valves which will relieve pressure exceeding 15 psig (103 kPa gauge pressure) to a safe outdoor location as provided in paragraph (f)(4)(ii) of this section, or by returning the gas to the inlet side or to the gas supply source.

1910.253(f)(4)(iv)(E)

Compressor or booster pump discharge outlets shall be provided with approved protective equipment. (See paragraph (e) of this section.)

1910.253(f)(5)

Portable acetylene generators.

1910.253(f)(5)(i)

1910.253(f)(5)(i)(A)

All portable generators shall be of a type approved for portable use.

1910.253(f)(5)(i)(B)

Portable generators shall not be used within 10 feet (3 m) of combustible material other than the floor.

1910.253(f)(5)(i)(C)

Portable generators shall not be used in rooms of total volume less than 35 times the total gas-generating capacity per charge of all generators in the room. Generators shall not be used in rooms having a ceiling height of less than 10 feet (3 m). (To obtain the gas-generating capacity in cubic feet per charge, multiply the pounds of carbide per charge by 4.5.)

1910.253(f)(5)(i)(D)

Portable generators shall be protected against freezing. The use of salt or other corrosive chemical to prevent freezing is prohibited.

1910.253(f)(5)(ii)

1910.253(f)(5)(ii)(A)

Portable generators shall be cleaned and recharged and the air mixture blown off outside buildings.

1910.253(f)(5)(ii)(B)

When charged with carbide, portable generators shall not be moved by crane or derrick.

1910.253(f)(5)(ii)(C)

When not in use, portable generators shall not be stored in rooms in which open flames are used unless the generators contain no carbide and have been thoroughly purged of acetylene. Storage rooms shall be well ventilated.

1910.253(f)(5)(ii)(D)

When portable acetylene generators are to be transported and operated on vehicles, they shall be securely anchored to the vehicles. If transported by truck, the motor shall be turned off during charging, cleaning, and generating periods.

1910.253(f)(5)(ii)(E)

Portable generators shall be located at a safe distance from the welding position so that they will not be exposed to sparks, slag, or misdirection of the torch flame or overheating from hot materials or processes.

1910.253(f)(6)

Outside generator houses and inside generator rooms for stationary acetylene generators.

1910.253(f)(6)(i)

1910.253(f)(6)(i)(A)

No opening in any outside generator house shall be located within 5 feet (1.5 m) of any opening in another building.

1910.253(f)(6)(i)(B)

Walls, floors, and roofs of outside generator houses shall be of noncombustible construction.

1910.253(f)(6)(i)(C)

When a part of the generator house is to be used for the storage or manifold of oxygen cylinders, the space to be so occupied shall be separated from the generator or carbide storage section by partition walls continuous from floor to roof or ceiling, of the type of construction stated in paragraph (f)(6)(i)(H) of this section. Such separation walls shall be without openings and shall be joined to the floor, other walls and ceiling or roof in a manner to effect a permanent gas-tight joint.

1910.253(f)(6)(i)(D)

Exit doors shall be located so as to be readily accessible in case of emergency.

1910.253(f)(6)(i)(E)

Explosion venting for outside generator houses and inside generator rooms shall be provided in exterior walls or roofs. The venting areas shall be equal to not less than 1 square foot (0.09 m²) per 50 cubic feet (1.4 m³) of room volume and may consist of any one or any combination of the following:

Walls of light, noncombustible material preferably single-thickness, single-strength glass; lightly fastened hatch covers; lightly fastened swinging doors in exterior walls opening outward; lightly fastened walls or roof designed to relieve at a maximum pressure of 25 pounds per square foot (0.001 MPa).

1910.253(f)(6)(i)(F)

The installation of acetylene generators within buildings shall be restricted to buildings not exceeding one story in height; Provided, however, that this will not be construed as prohibiting such installations on the roof or top floor of a building exceeding such height.

1910.253(f)(6)(i)(G)

Generators installed inside buildings shall be enclosed in a separate room.

1910.253(f)(6)(i)(H)

The walls, partitions, floors, and ceilings of inside generator rooms shall be of noncombustible construction having a fire-resistance rating of at least 1 hour. The walls or partitions shall be continuous from floor to ceiling and shall be securely anchored. At least one wall of the room shall be an exterior wall.

1910.253(f)(6)(i)(I)

Openings from an inside generator room to other parts of the building shall be protected by a swinging type, self-closing fire door for a Class B opening and having a rating of at least 1 hour. Windows in partitions shall be wired glass and approved metal frames with fixed sash. Installation shall be in accordance with the Standard for the Installation of Fire Doors and Windows, NFPA 80-1970, which is incorporated by reference as specified in Sec. 1910.6.

1910.253(f)(6)(ii)

Inside generator rooms or outside generator houses shall be well ventilated with vents located at floor and ceiling levels.

1910.253(f)(6)(iii)

Heating shall be by steam, hot water, enclosed electrically heated elements or other indirect means. Heating by flames or fires shall be prohibited in outside generator houses or inside generator rooms, or in any enclosure communicating with them.

1910.253(f)(6)(iv)

1910.253(f)(6)(iv)(A)

Generator houses or rooms shall have natural light during daylight hours. Where artificial lighting is necessary it shall be restricted to electric lamps installed in a fixed position. Unless specifically approved for use in atmospheres containing acetylene, such lamps shall be provided with enclosures of glass or other noncombustible material so designed and constructed as to prevent gas vapors from reaching the lamp or socket and to resist breakage. Rigid conduit with threaded connections shall be used.

1910.253(f)(6)(iv)(B)

Lamps installed outside of wired-glass panels set in gas-tight frames in the exterior walls or roof of the generator house or room are acceptable.

1910.253(f)(6)(v)

Electric switches, telephones, and all other electrical apparatus which may cause a spark, unless specifically approved for use inside acetylene generator rooms, shall be located outside the generator house or in a room or space separated from the generator room by a gas-tight partition, except that where the generator system is designed so that no carbide fill opening or other part of the generator is open to the generator house or room during the operation of the generator, and so that residue is carried in closed piping from the residue discharge valve to a point outside the generator house or room, electrical equipment in the generator house or room shall conform to the provisions of Subpart S of this part for Class I, Division 2 locations.

1910.253(f)(7)

Maintenance and operation.

1910.253(f)(7)(i)

Unauthorized persons shall not be permitted in outside generator houses or inside generator rooms.

1910.253(f)(7)(i)(A)

Operating instructions shall be posted in a conspicuous place near the generator or kept in a suitable place available for ready reference.

1910.253(f)(7)(i)(B)

When recharging generators the order of operations specified in the instructions supplied by the manufacturer shall be followed.

1910.253(f)(7)(i)(C)

In the case of batch-type generators, when the charge of carbide is exhausted and before additional carbide is added, the generating chamber shall always be flushed out with water, renewing the water supply in accordance with the instruction card furnished by the manufacturer.

1910.253(f)(7)(i)(D)

The water-carbide residue mixture drained from the generator shall not be discharged into sewer pipes or stored in areas near open flames. Clear water from residue settling pits may be discharged into sewer pipes.

1910.253(f)(7)(ii)

The carbide added each time the generator is recharged shall be sufficient to refill the space provided for carbide without ramming the charge. Steel or other ferrous tools shall not be used in distributing the charge.

1910.253(f)(7)(iii)

Generator water chambers shall be kept filled to proper level at all times except while draining during the recharging operation.

1910.253(f)(7)(iv)

Whenever repairs are to be made or the generator is to be charged or carbide is to be removed, the water chamber shall be filled to the proper level.

1910.253(f)(7)(v)

Previous to making repairs involving welding, soldering, or other hot work or other operations which produce a source of ignition, the carbide charge and feed mechanism shall be completely removed. All acetylene shall be expelled by completely flooding the generator shell with water and the generator shall be disconnected from the piping system. The generator shall be kept filled with water, if possible, or positioned to hold as much water as possible.

1910.253(f)(7)(vi)

Hot repairs shall not be made in a room where there are other generators unless all the generators and piping have been purged of acetylene.

1910.253(g)

Calcium carbide storage –

1910.253(g)(1)

Packaging.

1910.253(g)(1)(i)

Calcium carbide shall be contained in metal packages of sufficient strength to prevent rupture. The packages shall be provided with a screw top or equivalent. These packages shall be constructed water- and air-tight. Solder shall not be used in such a manner that the package would fail if exposed to fire.

1910.253(g)(1)(ii)

Packages containing calcium carbide shall be conspicuously marked "Calcium Carbide - Dangerous If Not Kept Dry" or with equivalent warning.

1910.253(g)(1)(iii)

Caution: Metal tools, even the so-called spark resistant type may cause ignition of an acetylene and air mixture when opening carbide containers.

1910.253(g)(1)(iv)

Sprinkler systems shall not be installed in carbide storage rooms.

1910.253(g)(2)

Storage indoors.

1910.253(g)(2)(i)

Calcium carbide in quantities not to exceed 600 pounds (272.2 kg) may be stored indoors in dry, waterproof, and well-ventilated locations.

1910.253(g)(2)(i)(A)

Calcium carbide not exceeding 600 pounds (272.2 kg) may be stored indoors in the same room with fuel-gas cylinders.

1910.253(g)(2)(i)(B)

Packages of calcium carbide, except for one of each size, shall be kept sealed. The seals shall not be broken when there is carbide in excess of 1 pound (0.5 kg) in any other unsealed package of the same size of carbide in the room.

1910.253(g)(2)(ii)

Calcium carbide exceeding 600 pounds (272.2 kg) but not exceeding 5,000 pounds (2,268 kg) shall be stored:

1910.253(g)(2)(ii)(A)

In accordance with paragraph (g)(2)(iii) of this section.

1910.253(g)(2)(ii)(B)

In an inside generator room or outside generator house; or

1910.253(g)(2)(ii)(C)

In a separate room in a one-story building which may contain other occupancies, but without cellar or basement beneath the carbide storage section. Such rooms shall be constructed in accordance with paragraphs (f)(6)(i)(H) and (f)(6)(i)(I) of this subdivision and ventilated in accordance with paragraph (f)(6)(ii) of this section. These rooms shall be used for no other purpose.

1910.253(g)(2)(iii)

Calcium carbide in excess of 5,000 pounds (2,268 kg) shall be stored in one-story buildings without cellar or basement and used for no other purpose, or in outside generator houses. If the storage building is of noncombustible construction, it may adjoin other one-story buildings if separated therefrom by unpierced firewalls; if it is detached less than 10 feet (3 m) from such building or buildings, there shall be no opening in any of the mutually exposing sides of such buildings within 10 feet (3 m). If the storage building is of combustible construction, it shall be at least 20 feet (6.1 m) from any other one- or two-story building, and at least 30 feet (9.1 m) from any other building exceeding two stories.

1910.253(g)(3)

Storage outdoors.

1910.253(g)(3)(i)

Calcium carbide in unopened metal containers may be stored outdoors.

1910.253(g)(3)(ii)

Carbide containers to be stored outdoors shall be examined to make sure that they are in good condition. Periodic reexaminations shall be made for rusting or other damage to a container that might affect its water or air tightness.

1910.253(g)(3)(iii)

The bottom tier of each row shall be placed on wooden planking or equivalent, so that the containers will not come in contact with the ground or ground water.

1910.253(g)(3)(iv)

Containers of carbide which have been in storage the longest shall be used first.

[55 FR 13696, Apr. 11, 1990, as amended at 55 FR 32015, Aug. 6, 1990; 55 FR 46053, Nov. 1, 1990; 61 FR 9227, March 7, 1996]

APPENDIX C – ARC WELDING AND CUTTING

Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	Q
• Subpart Title:	Welding, Cutting, and Brazing
• Standard Number:	<u>1910.254</u>
• Title:	Arc welding and cutting.

1910.254(a)

General -

1910.254(a)(1)

Equipment selection. Welding equipment shall be chosen for safe application to the work to be done as specified in paragraph (b) of this section.

1910.254(a)(2)

Installation. Welding equipment shall be installed safely as specified by paragraph (c) of this section.

1910.254(a)(3)

Instruction. Workmen designated to operate arc welding equipment shall have been properly instructed and qualified to operate such equipment as specified in paragraph (d) of this section.

1910.254(b)

Application of arc welding equipment -

1910.254(b)(1)

General. Assurance of consideration of safety in design is obtainable by choosing apparatus complying with the Requirements for Electric Arc-Welding Apparatus, NEMA EW-1-1962, National Electrical Manufacturers Association or the Safety Standard for Transformer-Type Arc-Welding Machines, ANSI C33.2-1956, Underwriters' Laboratories, both of which are incorporated by reference as specified in Sec. 1910.6.

1910.254(b)(2)

Environmental conditions.

1910.254(b)(2)(i)

Standard machines for arc welding service shall be designed and constructed to carry their rated load with rated temperature rises where the temperature of the cooling air does not exceed 40 deg. C. (104 deg. F.) and where the altitude does not exceed 3,300 feet (1,005.8 m), and shall be suitable for operation in atmospheres containing gases, dust, and light rays produced by the welding arc.

1910.254(b)(2)(ii)

Unusual service conditions may exist, and in such circumstances machines shall be especially designed to safely meet the requirements of the service. Chief among these conditions are:

1910.254(b)(2)(ii)(A)

Exposure to unusually corrosive fumes.

1910.254(b)(2)(ii)(B)

Exposure to steam or excessive humidity.

1910.254(b)(2)(ii)(C)

Exposure to excessive oil vapor.

1910.254(b)(2)(ii)(D)

Exposure to flammable gases.

1910.254(b)(2)(ii)(E)

Exposure to abnormal vibration or shock.

1910.254(b)(2)(ii)(F)

Exposure to excessive dust.

1910.254(b)(2)(ii)(G)

Exposure to weather.

1910.254(b)(2)(ii)(H)

Exposure to unusual seacoast or shipboard conditions.

1910.254(b)(3)

Voltage. The following limits shall not be exceeded:

1910.254(b)(3)(i)

Alternating-current machines

1910.254(b)(3)(i)(A)

Manual arc welding and cutting - 80 volts.

1910.254(b)(3)(i)(B)

Automatic (machine or mechanized) arc welding and cutting - 100 volts.

1910.254(b)(3)(ii)

Direct-current machines

1910.254(b)(3)(ii)(A)

Manual arc welding and cutting - 100 volts.

1910.254(b)(3)(ii)(B)

Automatic (machine or mechanized) arc welding and cutting - 100 volts.

1910.254(b)(3)(iii)

When special welding and cutting processes require values of open circuit voltages higher than the above, means shall be provided to prevent the operator from making accidental contact with the high voltage by adequate insulation or other means.

1910.254(b)(3)(iv)

For a.c. welding under wet conditions or warm surroundings where perspiration is a factor, the use of reliable automatic controls for reducing no load voltage is recommended to reduce the shock hazard.

1910.254(b)(4)

Design.

1910.254(b)(4)(i)

A controller integrally mounted in an electric motor driven welder shall have capacity for carrying rated motor current, shall be capable of making and interrupting stalled rotor current of the motor, and may serve as the running overcurrent device if provided with the number of overcurrent units as specified by Subpart S of this part.

1910.254(b)(4)(ii)

On all types of arc welding machines, control apparatus shall be enclosed except for the operating wheels, levers, or handles.

1910.254(b)(4)(iii)

Input power terminals, tap change devices and live metal parts connected to input circuits shall be completely enclosed and accessible only by means of tools.

1910.254(b)(4)(iv)

Terminals for welding leads should be protected from accidental electrical contact by personnel or by metal objects i.e., vehicles, crane hooks, etc. Protection may be obtained by use of: Dead-front receptacles for plug connections; recessed openings with nonremovable hinged covers; heavy insulating sleeving or taping or other equivalent electrical and mechanical protection. If a welding lead terminal which is intended to be used exclusively for connection to the work is connected to the grounded enclosure, it must be done by a conductor at least two AWG sizes smaller than the grounding conductor and the terminal shall be marked to indicate that it is grounded.

1910.254(b)(4)(v)

No connections for portable control devices such as push buttons to be carried by the operator shall be connected to an a.c. circuit of higher than 120 volts. Exposed metal parts of portable control devices operating on circuits above 50 volts shall be grounded by a grounding conductor in the control cable.

1910.254(b)(4)(vi)

Auto transformers or a.c. reactors shall not be used to draw welding current directly from any a.c. power source having a voltage exceeding 80 volts.

1910.254(c)

Installation of arc welding equipment -

1910.254(c)(1)

General. Installation including power supply shall be in accordance with the requirements of Subpart S of this part.

1910.254(c)(2)

Grounding.

1910.254(c)(2)(i)

The frame or case of the welding machine (except engine-driven machines shall be grounded under the conditions and according to the methods prescribed in Subpart S of this part.

1910.254(c)(2)(ii)

Conduits containing electrical conductors shall not be used for completing a work-lead circuit. Pipelines shall not be used as a permanent part of a work-lead circuit, but may be used during construction, extension or repair providing current is not carried through threaded joints, flanged bolted joints, or caulked joints and that special precautions are used to avoid sparking at connection of the work-lead cable.

1910.254(c)(2)(iii)

Chains, wire ropes, cranes, hoists, and elevators shall not be used to carry welding current.

1910.254(c)(2)(iv)

Where a structure, conveyor, or fixture is regularly employed as a welding current return circuit, joints shall be bonded or provided with adequate current collecting devices.

1910.254(c)(2)(v)

All ground connections shall be checked to determine that they are mechanically strong and electrically adequate for the required current.

1910.254(c)(3)

Supply connections and conductors.

1910.254(c)(3)(i)

A disconnecting switch or controller shall be provided at or near each welding machine which is not equipped with such a switch or controller mounted as an integral part of the machine. The switch shall be in accordance with Subpart S of this part. Overcurrent protection shall be provided as specified in Subpart S of this part. A disconnect switch with overload protection or equivalent disconnect and protection means, permitted by Subpart S of this part, shall be provided for each outlet intended for connection to a portable welding machine.

1910.254(c)(3)(ii)

For individual welding machines, the rated current-carrying capacity of the supply conductors shall be not less than the rated primary current of the welding machines.

1910.254(c)(3)(iii)

For groups of welding machines, the rated current-carrying capacity of conductors may be less than the sum of the rated primary currents of the welding machines supplied. The

conductor rating shall be determined in each case according to the machine loading based on the use to be made of each welding machine and the allowance permissible in the event that all the welding machines supplied by the conductors will not be in use at the same time.

1910.254(c)(3)(iv)

In operations involving several welders on one structure, d.c. welding process requirements may require the use of both polarities; or supply circuit limitations for a.c. welding may require distribution of machines among the phases of the supply circuit. In such cases no load voltages between electrode holders will be 2 times normal in d.c. or 1, 1.41, 1.73, or 2 times normal on a.c. machines. Similar voltage differences will exist if both a.c. and d.c. welding are done on the same structure.

1910.254(c)(3)(iv)(A)

All d.c. machines shall be connected with the same polarity.

1910.254(c)(3)(iv)(B)

All a.c. machines shall be connected to the same phase of the supply circuit and with the same instantaneous polarity.

1910.254(d)

Operation and maintenance -

1910.254(d)(1)

General. Workmen assigned to operate or maintain arc welding equipment shall be acquainted with the requirements of this section and with 1910.252 (a), (b), and (c) of this part; if doing gas-shielded arc welding, also Recommended Safe Practices for Gas-Shielded Arc Welding, A6.1-1966, American Welding Society, which is incorporated by reference as specified in Sec. 1910.6.

1910.254(d)(2)

Machine hook up. Before starting operations all connections to the machine shall be checked to make certain they are properly made. The work lead shall be firmly attached to the work; magnetic work clamps shall be freed from adherent metal particles of spatter on contact surfaces. Coiled welding cable shall be spread out before use to avoid serious overheating and damage to insulation.

1910.254(d)(3)

Grounding. Grounding of the welding machine frame shall be checked. Special attention shall be given to safety ground connections of portable machines.

1910.254(d)(4)

Leaks. There shall be no leaks of cooling water, shielding gas or engine fuel.

1910.254(d)(5)

Switches. It shall be determined that proper switching equipment for shutting down the machine is provided.

1910.254(d)(6)

Manufacturers' instructions. Printed rules and instructions covering operation of equipment supplied by the manufacturers shall be strictly followed.

1910.254(d)(7)

Electrode holders. Electrode holders when not in use shall be so placed that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks.

1910.254(d)(8)

Electric shock. Cables with splices within 10 feet (3 m) of the holder shall not be used. The welder should not coil or loop welding electrode cable around parts of his body.

1910.254(d)(9)

Maintenance.

1910.254(d)(9)(i)

The operator should report any equipment defect or safety hazard to his supervisor and the use of the equipment shall be discontinued until its safety has been assured. Repairs shall be made only by qualified personnel.

1910.254(d)(9)(ii)

Machines which have become wet shall be thoroughly dried and tested before being used.

1910.254(d)(9)(iii)

Cables with damaged insulation or exposed bare conductors shall be replaced. Joining lengths of work and electrode cables shall be done by the use of connecting means specifically intended for the purpose. The connecting means shall have insulation adequate for the service conditions.

[55 FR 13709, Apr. 11, 1990; 61 FR 9227, March 7, 1996]

APPENDIX D – RESISTANCE WELDING

Part Number:	1910
• Part Title:	Occupational Safety and Health Standards
• Subpart:	Q
• Subpart Title:	Welding, Cutting, and Brazing
• Standard Number:	<u>1910.255</u>
• Title:	Resistance welding.

1910.255(a)

General -

1910.255(a)(1)

Installation. All equipment shall be installed by a qualified electrician in conformance with Subpart S of this part. There shall be a safety-type disconnecting switch or a circuit breaker or circuit interrupter to open each power circuit to the machine, conveniently located at or near the machine, so that the power can be shut off when the machine or its controls are to be serviced.

1910.255(a)(2)

Thermal protection. Ignitron tubes used in resistance welding equipment shall be equipped with a thermal protection switch.

1910.255(a)(3)

Personnel. Workmen designated to operate resistance welding equipment shall have been properly instructed and judged competent to operate such equipment.

1910.255(a)(4)

Guarding. Controls of all automatic or air and hydraulic clamps shall be arranged or guarded to prevent the operator from accidentally activating them.

1910.255(b)

Spot and seam welding machines (nonportable) -

1910.255(b)(1)

Voltage. All external weld initiating control circuits shall operate on low voltage, not over 120 volts, for the safety of the operators.

1910.255(b)(2)

Capacitor welding. Stored energy or capacitor discharge type of resistance welding equipment and control panels involving high voltage (over 550 volts) shall be suitably insulated and protected by complete enclosures, all doors of which shall be provided with suitable interlocks and contacts wired into the control circuit (similar to elevator interlocks). Such interlocks or contacts shall be so designed as to effectively interrupt power and short circuit all capacitors when the door or panel is open. A manually operated switch or suitable positive device shall be installed, in addition to the mechanical interlocks or contacts, as an added safety measure assuring absolute discharge of all capacitors.

1910.255(b)(3)

Interlocks. All doors and access panels of all resistance welding machines and control panels shall be kept locked and interlocked to prevent access, by unauthorized persons, to live portions of the equipment.

1910.255(b)(4)

Guarding. All press welding machine operations, where there is a possibility of the operator's fingers being under the point of operation, shall be effectively guarded by the use of a device such as an electronic eye safety circuit, two hand controls or protection similar to that prescribed for punch press operation, 1910.217. All chains, gears, operating bus linkage, and belts shall be protected by adequate guards, in accordance with 1910.219 of this part.

1910.255(b)(5)

Shields. The hazard of flying sparks shall be, wherever practical, eliminated by installing a shield guard of safety glass or suitable fire-resistant plastic at the point of operation. Additional shields or curtains shall be installed as necessary to protect passing persons from flying sparks. (See 1910.252(b)(2)(i)(C) of this section.)

1910.255(b)(6)

Foot switches. All foot switches shall be guarded to prevent accidental operation of the machine.

1910.255(b)(7)

Stop buttons. Two or more safety emergency stop buttons shall be provided on all special multipot welding machines, including 2-post and 4-post weld presses.

1910.255(b)(8)

Safety pins. On large machines, four safety pins with plugs and receptacles (one in each corner) shall be provided so that when safety pins are removed and inserted in the ram or platen, the press becomes inoperative.

1910.255(b)(9)

Grounding. Where technically practical, the secondary of all welding transformers used in multispot, projection and seam welding machines shall be grounded. This may be done by permanently grounding one side of the welding secondary current circuit. Where not technically practical, a center tapped grounding reactor connected across the secondary or the use of a safety disconnect switch in conjunction with the welding control are acceptable alternates. Safety disconnect shall be arranged to open both sides of the line when welding current is not present.

1910.255(c)

Portable welding machines -

1910.255(c)(1)

Counterbalance. All portable welding guns shall have suitable counterbalanced devices for supporting the guns, including cables, unless the design of the gun or fixture makes counterbalancing impractical or unnecessary.

1910.255(c)(2)

Safety chains. All portable welding guns, transformers and related equipment that is suspended from overhead structures, eye beams, trolleys, etc. shall be equipped with safety chains or cables. Safety chains or cables shall be capable of supporting the total shock load in the event of failure of any component of the supporting system.

1910.255(c)(3)

Clevis. Each clevis shall be capable of supporting the total shock load of the suspended equipment in the event of trolley failure.

1910.255(c)(4)

Switch guards. All initiating switches, including retraction and dual schedule switches, located on the portable welding gun shall be equipped with suitable guards capable of preventing accidental initiation through contact with fixturing, operator's clothing, etc. Initiating switch voltage shall not exceed 24 volts.

1910.255(c)(5)

Moving holder. The movable holder, where it enters the gun frame, shall have sufficient clearance to prevent the shearing of fingers carelessly placed on the operating movable holder.

1910.255(c)(6)

Grounding. The secondary and case of all portable welding transformers shall be grounded. Secondary grounding may be by center tapped secondary or by a center tapped grounding

reactor connected across the secondary.

1910.255(d)

Flash welding equipment -

1910.255(d)(1)

Ventilation and flash guard. Flash welding machines shall be equipped with a hood to control flying flash. In cases of high production, where materials may contain a film of oil and where toxic elements and metal fumes are given off, ventilation shall be provided in accordance with 1910.252(c) of this section.

1910.255(d)(2)

Fire curtains. For the protection of the operators of nearby equipment, fire-resistant curtains or suitable shields shall be set up around the machine and in such a manner that the operators movements are not hampered.

1910.255(e)

Maintenance. Periodic inspection shall be made by qualified maintenance personnel, and a certification record maintained. The certification record shall include the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, for the equipment inspected. The operator shall be instructed to report any equipment defects to his supervisor and the use of the equipment shall be discontinued until safety repairs have been completed.

[39 FR 23502, June 27, 1974, as amended at 40 FR 18426, Apr. 28, 1975; 55 FR 13710, Apr. 11, 1990]