



**DEPARTMENT OF LABOR AND ECONOMIC OPPORTUNITY**  
**GENERAL INDUSTRY STANDARD**

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(as amended October 28, 1976) (as amended May 11, 1981) (as amended May 17, 1983)  
(as amended January 11, 1988) (as amended February 18, 1997) (**as amended June 5, 2013**)

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(By authority conferred on the director of the department of licensing and regulatory affairs  
by sections 16 and 21 of 1974 PA 154 and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4,  
and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

R 408.11203, R 408.11211, R 408.11213, R 408.11221, R 408.11222, R 408.11224, R 408.11241,  
R 408.11243, R 408.11262, R 408.11275, R 408.11293, and R 408.11294  
are of the Michigan Administrative Code are amended and R 408.11202 is added, as follows:

**PART 12, WELDING AND CUTTING**

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## GENERAL PROVISIONS

### R 408.11201. Scope.

**Rule 1201.** This part is intended to provide, in, about or around places of employment, reasonable safety to persons involved in welding, cutting, brazing, soldering and acetylene generating and to those exposed to these processes and the equipment and compressed gases used.

### R 408.11202 Adoption and referenced standards.

**Rule 1202.** (1) The following standards are adopted by reference in these rules and are available from Global Engineering Documents, 15 Inverness Way East, Englewood, Colorado, 80112, USA; telephone number: 1-800-854-7179; or at web-site: [www.global.ihs.com](http://www.global.ihs.com), at a cost as of the time of adoption of these rules, as stated in this rule:

(a) American National Standards Institute ANSI B31.1 "Industrial Gas and Air Piping Systems," 1967 edition. Cost: \$96.00.

(b) ANSI B57.1 "Compressed Gas Cylinder Valve Outlet and Inlet Connections," 1965 edition. Cost: \$29.00.

(c) American Petroleum Institute API 1104 "Standard for Welding Pipe Lines and Related Facilities," 1973 edition. Cost: \$125.00.

(d) API PSD 2201 "Welding or Hot Tapping on Equipment Containing Flammables," 1963 edition. Cost: \$125.00.

(e) American Society of Mechanical Engineers ASME A13.1 "Identification of Piping Systems," 1956 edition. Cost: \$60.00.

(2) The following standards are adopted by reference in these rules and are available from NFPA, 1 Batterymarch Park, Quincy, Massachusetts, USA, 02169-7471; telephone number: 1-617-770-3000; or at website: [www.nfpa.org](http://www.nfpa.org); at a cost as of the time of adoption of these rules as stated in this rule:

(a) National Fire Protection Association (NFPA) Standard 50 "Bulk Oxygen Systems," 1971 edition. Cost: \$27.00.

(b) NFPA 80 "Standard for the Installation of Fire Doors and Windows," 1974 edition. Cost: \$27.00.

(3) The following standard is adopted by reference in these rules, "The Fire Resistance Directory." This directory is available from Underwriters' Laboratory, 2600 NW Lake Road, Camas, Washington, 98607-8542, USA; telephone number: 1-877-854-3577; or at website: [www.ul.com/directories](http://www.ul.com/directories); at a cost as of the time of adoption of these rules of \$150.00.

(4) The standards adopted in these rules are available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48909-8143.

(5) Copies of the standards adopted in these rules may be obtained from the publisher or may be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

(6) The following standard is referenced in these rules, General Industry Safety Standard Part 33 'Personal Protective Equipment,' R 408.13301 to R 408.13398. Up to 5 copies of this standard may be obtained at no charge from the Michigan Department of Licensing and Regulatory Affairs, MIOSHA Regulatory Services Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48909-8143 or at website: [www.michigan.gov/mioshastandards](http://www.michigan.gov/mioshastandards). For quantities greater than 5, the cost, at the time of adoption of these rules, is 4 cents per page.

### R 408.11203. Definitions; A to C.

**Rule 1203.** (1) "AC" means alternating current.

(2) "Arc welding" means a process for joining metals by heating with an electric arc with or without the use of pressure with or without a filler material.

(3) "Brazing" means a process of joining metals without melting them with a filler metal melting above 800 degrees F.

(4) "Confined space" means a small or restricted space without proper life supporting atmosphere or in which mobility is restricted.

(5) "Cutting" means a process in which the severing or removing of metal is effected by the use of an arc or flame.

(6) "Cylinders" means containers for storing compressed gases manufactured, labeled, and periodically tested in accordance with specifications of the department of transportation regulations.

**R 408.11204. Definitions; D to N.**

**Rule 1204.** (1) "DC" means direct current.

(2) "Fire resistance" means the property of a material or assembly to withstand fire or give protection from it.

(3) "Gas welding" means a process for joining metals by heating with a gas flame with or without the use of pressure and with or without the use of a filler material.

(4) "Inert gas" means argon, carbon dioxide, helium or nitrogen gas.

(5) "Manifold" means an assembly of pipe and fittings to interconnect either single or multiple sources to single or multiple outlets.

(6) "Noncombustible" means having properties which do not support combustion.

**R 408.11205. Definitions; P to W.**

**Rule 1205.** (1) "Press welding machine" means a machine that utilizes 2 platens, 1 of which moves toward the other during the initial part of the machine cycle. It does not provide welding pressure. After 1 of the platens has moved to a stop position, the welding pressure required for the welding operation is applied by 1 or more air or hydraulic cylinders.

(2) "Psig" means pounds per square inch as measured by a gauge.

(3) "Resistance welding" means the joining of metals by the use of heat generated at the joint by the resistance to the flow of electric current and by the application of pressure.

(4) "Soldering" means a process of joining metals without melting them using a filler metal melting at 800 degrees Fahrenheit, 427 degrees centigrade, or below.

(5) "Spot welding" means a form of resistance welding in which the current and pressure are restricted to the spot of metal surfaces directly in contact between the electrodes.

(6) "Storage" means the storage of filled or empty cylinders not in use. An oxidizing and fuel gas cylinder or cylinders used as a unit shall not be considered to be in storage.

(7) "Water capacity" means the weight of water, as related to liquefied gas, of a volume equivalent to that of the cylinder.

(8) "Welder" means a person capable of performing a manual or semiautomatic welding operation.

(9) "Welding operator" means a person who operates a machine or automatic welding equipment.

**R 408.11211. Employer and employee responsibilities.**

**Rule 1211.** (1) An employer shall do all of the following:

(a) Give each employee training or a test before allowing him or her to use equipment for arc and gas welding and cutting.

(b) Provide face and eye protection and foot protection as prescribed in general industry safety standard Part 33 "Personal Protective Equipment," as referenced in R 408.11202.

(c) Provide other personal protective clothing or equipment, such as gloves, aprons, hearing protection devices, respirators, lifelines, safety belts, and lanyards required to protect the employee from injury likely to be caused by the assigned task of welding and cutting. Except for long sleeve shirts required to protect the employee from ultraviolet rays to the arms and ankle length trousers, the personal protective clothing and equipment shall be provided without expense to the employee.

(d) Provide to an employee, at no expense to the employee, protective devices such as, but not limited to, curtains, safety glasses, or face shields to reduce the risk of flash burn, sparks, and foreign bodies to all employees in the area.

(e) Provide ventilation where necessary to protect an employee against toxic materials as prescribed by the Michigan Occupational Safety and Health Administration (MIOSHA) standards.

(2) An employee shall comply with all of the following:

(a) Use welding and cutting equipment as trained and authorized.

(b) Use the protective equipment required by the employer or the hazard.

(c) Not tamper with safety devices.

(3) An employee in charge of the operation of oxygen or fuel-gas supply equipment, of oxygen or fuel-gas systems, including generators, shall be instructed and judged competent by the employer for this 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.

**R 408.11212. General requirements.**

**Rule 1212.** (1) A mixture of fuel gas with air or oxygen shall not be permitted except when consumed at a burner or torch.

(2) Only apparatus designed for use with fuel gas or oxygen shall be used for welding or cutting.

(3) The total volume of acetylene used per hour shall not exceed 1/7 of the total volume of the acetylene supply in the system.

(4) Liquid acetylene shall not be used.

(5) A cylinder to which a regulator is attached shall not be moved unless secured to a hand truck or powered truck designed or equipped for this purpose.

(6) A cylinder valve shall be closed in all of the following situations:

(a) When the cylinder is moved.

(b) When the work is finished or is left unattended during lunch, overnight, or for any other prolonged period.

(c) When the cylinder is empty.

(d) When the regulator is removed.

(7) Fuel gas shall not flow from a cylinder or manifold through a torch or other device equipped with a shut off valve unless the pressure is reduced by a regulator attached to the cylinder or manifold.

(8) An oxygen cylinder, cylinder valve, coupling regulator, hose, and apparatus shall be kept free from oily or greasy substances and shall not be handled with oily hands or gloves. Precautions shall be taken to prevent a jet of oxygen from striking an oily surface or greasy clothes or from entering a fuel, oil, or other storage tank.

(9) Oxygen shall not be used as a substitute for compressed air or for any other use, except for welding or cutting or life support procedures.

(10) Welders shall place welding cable and other equipment so that is clear of passageways, ladders, and stairways or it shall be protected against damage or hazards to an employee.

**CONFINED SPACES**

**R 408.11213. Working in confined spaces.**

**Rule 1213.** (1) When working in a confined space, the torch valves and the gas supply valve and oxygen valve outside the confined space shall be shut off during lunch, overnight, or for any other prolonged period. Where practicable, the torch and hose shall be removed from the confined space.

(2) When stick electrodes are used in a confined space, and welding is suspended during lunch, overnight, or for any other prolonged period, the electrode shall be removed from the holder and the machine shut off.

(3) The air in a confined space shall be tested with an approved device and purged, if necessary, before any entry. Ventilation shall be provided in the confined space when an employee is present.

(4) A cylinder or welding power source used in a confined space shall be placed and secured on the outside of the space where work is being performed.

(5) An employee who is trained in rescue procedures, and with such equipment as is necessary to effect a rescue, if needed, shall be stationed outside the confined space during welding or cutting operations. An employer shall ensure that an effective means of communication is established between employees in the confined space and the attendant. When safety belts and lifelines are used, they shall be provided and used as prescribed in general industry safety standard Part 33 "Personal Protective Equipment," as referenced in R 408.11202, and attached to the welder's body so that his or her body cannot be jammed in a small exit opening.

(6) After welding operations are completed in a confined space, a sign or other warning shall be used to mark the hot metal.

R 408.11214 Rescinded.

**CYLINDERS**

**R 408.11221. Cylinder marking.**

**Rule 1221.** (1) Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or 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.

(2) Unlabeled cylinders shall not be used.

(3) Empty cylinders shall be so marked at time of depletion.

**R 408.11222. Storage.**

**Rule 1222.** (1) An oxygen cylinder shall be stored not less than 20 feet from fuel gas cylinders or a highly combustible material, such as, but not limited to, oil, grease, excelsior, flammable gas, or a source of ignition, or shall be separated from the material by a noncombustible wall, not less than 5 feet (1.6 meters) high, having a fire-resistance rating of 1/2 hour. An oxygen cylinder shall not be stored in an acetylene generator compartment. The underwriters' laboratory fire resistance directory may be used as a guide to determine fire resistance, as adopted in R 408.11202.

(2) A cylinder shall be stored away from heat in excess of 125 degrees Fahrenheit.

(3) A cylinder, including an empty cylinder, which is in storage, being shipped, or has the regulator removed shall have the cap secured in place, if a cap is provided in the design, or shall be otherwise protected.

(4) Storage shall be set up to ensure first-in, first-out usage.

(5) A cylinder storage area shall be posted with the names of the individual gases stocked, and a warning shall be posted against tampering by an unauthorized employee. An assigned storage area shall be located where a cylinder will not be knocked over or struck by a passing or falling object.

(6) Where different gases are stored, they shall be grouped by types. Groupings shall separate the flammable gases from the oxidizing gases as in subrule (1) of this rule.

(7) A storage area for cylinders shall be well ventilated. A cylinder shall not be stored in basements or pits, except where ventilation as specified by the Michigan Occupational Safety and Health Administration (MIOSHA) standards is furnished to keep the area purged of any accumulation of gases.

(8) Storage of fuel gas in a building in 1 area within 100 feet (30 meters) of another fuel gas storage area and not protected by an automatic sprinkler system shall be limited to a total gas capacity of 2,000 cubic feet (56 cubic meters approximately) or 11.8 cubic feet (.33 cubic meters) of liquefied gas, which is 735 pounds (333 kilograms) water capacity. Storage in excess of this amount shall be in a separate room or compartment with an exterior wall and on the top floor of the building, outside, or in a special building. All walls, floors, and ceilings shall be constructed of noncombustible material having a fire-resistance rating of 1 hour. The walls shall be continuous from the floor to the ceiling and shall be securely anchored. The separate room, compartment, or special building shall have no open flame for heat or light and shall be well ventilated. Openings from the separate storage room to other parts of the building shall be protected by a self-closing fire door for a class B opening and shall have a fire-resistance rating of not less than 1 hour. Windows in partitions shall be wired glass and approved metal frames with a fixed sash. Installation shall be in accordance with NFPA 80 "Standard for the Installation of Fire Doors and Windows," 1974 edition, as adopted in R 408.11202.

(9) Where a liquid or gaseous oxygen system is used to supply gaseous oxygen for welding and cutting and the system has a storage capacity of more than 20,000 cubic feet (560 cubic meters), measured at 14.7 psia (101.34 kPa) and 70 degrees Fahrenheit (21.1 degrees Celsius), including unconnected reserves at the site, the system shall be as prescribed in NFPA 50 "Bulk Oxygen Systems," 1971 edition, as adopted in R 408.11202.

(10) A cylinder used for methylacetylene-propadiene, stabilized, shall be constructed of materials suitable for this fuel gas in the gaseous or liquid phases.

#### **R 408.11223. General rules for cylinders—I.**

**Rule 1223.** (1) A chain, bracket or other restraining device shall be used at all times to prevent cylinders from falling.

(2) Acetylene or liquefied gas cylinders shall not be placed on their sides but shall be stood valve end up.

(3) A cylinder shall not be dropped, dragged, rolled on its side or struck violently.

(4) A cylinder shall be lifted only by cradles or enclosed platforms when using a crane or hoisting device. Electromagnets, hooks, ropes or slings shall not be used.

(5) A frozen or ice-clogged valve shall be thawed either by warm air or use of warm water and dried before using. Boiling water or a flame shall not be used. Force shall not be applied to a valve or cap to loosen a cylinder frozen in place.

#### **R 408.11224. General rules for cylinders—II.**

**Rule 1224.** (1) Gases shall not be mixed within a cylinder except by the supplier.

(2) A cylinder shall not be placed where it will become a part of the electrical circuit by accidental grounding or where it may be burned by electric welding arc. A cylinder shall not be placed so that hot slag or flame will reach it or it shall be protected by a fire resistant shield. An electrode shall not be tapped against a cylinder to strike an arc.

(3) A regulator, gauge, or hose shall not be interchangeable between fuel gas, oxidizing gas or inert gas. Connections for compressed gas cylinders shall be as prescribed in ANSI B57.1 "Compressed Gas Cylinder Valve Outlet and Inlet Connections," 1965 edition, as adopted in R 408.11202.

(4) A cylinder valve shall be opened slightly for an instant and then closed before connecting to a regulator or manifold to clear the valve of dust and dirt. This shall not be done near a source of ignition. Pressure to a regulator shall be introduced by slowly opening the cylinder valve. An acetylene cylinder valve shall not be opened more than 1 1/2 turns of the spindle.

(5) Acetylene shall not be utilized or piped, except in cylinder manifolds, at a pressure in excess of 15 psig.

(6) Only the owner of the cylinder, if the owner is qualified, or a person trained, qualified, and authorized by the owner, shall refill a cylinder.

**R 408.11225. Cylinders; keys, handles, or wrenches; use as roller or support prohibited; repair; placing items on top prohibited.**

**Rule 1225.** (1) A cylinder without fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while in service. A multiple cylinder installation shall require only 1 key or handle for each manifold. A hammer shall not be used to open a cylinder valve or loosen a cap.

(2) A cylinder, whether full or empty, shall not be used as a roller or support.

(3) A leaking cylinder or a cylinder with a valve stuck open or a valve in need of repair shall be taken outdoors away from sources of ignition, slowly emptied, and tagged with a warning sign and the manufacturer or distributor shall be notified. Complete removal of the stem from the cylinder valve shall be avoided.

(4) Nothing shall be placed on top of a cylinder which would damage a safety device or interfere with the quick closing of the valve.

**MANIFOLDING**

**R 408.11231. Oxygen manifolding.**

**Rule 1231.** (1) An oxygen manifolding unit shall be located not less than 20 feet from combustible materials or separated by a noncombustible barrier, not less than 5 feet high, having a fire-resistance rating of at least 1/2 hour.

(2) An oxygen manifold shall not be located in acetylene generating rooms.

(3) Each container and manifold unit shall be labeled to show the name of the gas contained.

(4) Each manifold shall be provided with approved pressure regulation devices.

**R 408.11232. High-pressure oxygen manifolds.**

**Rule 1232.** (1) An oxygen high-pressure manifold shall be not more than 6,000 cubic feet, except as permitted in subrule (3) of this rule.

(2) More than 1 unit may be located in a room, but they shall be not less than 50 feet (16 meters) apart or separated by a noncombustible barrier not less than 5 feet (1.6 meters) high having a fire resistance of 1/2 hour.

(3) An oxygen high-pressure manifold with an aggregate of more than 6,000 cubic feet (170 cubic meters approximately) shall be located outdoors in a separate noncombustible building or, if located in a building that is otherwise occupied, the manifold shall be located in a separate room of noncombustible construction having a fire-resistance rating of 1/2 hour or in an area with no combustible material within 20 feet (6.1 meters) of the manifold.

(4) An oxygen manifold or oxygen bulk supply system with a storage capacity of more than 20,000 cubic feet (560 cubic meters), including unconnected reserves, shall be as prescribed in R 408.11222(9).

**R 408.11233. Low pressure oxygen manifolds.**

**Rule 1233.** (1) The operating pressure of a low pressure oxygen manifold shall be not more than 250 psig. The following sign shall be posted at each low pressure oxygen manifold:

LOW PRESSURE MANIFOLD: Do not connect high pressure cylinders. Maximum pressure – 250 psig
--

(2) A low pressure oxygen manifold shall have a minimum bursting pressure of 1,000 psig and shall be protected by a safety relief valve which will relieve at a maximum pressure of 500 psig. The safety relief vent shall discharge outside of the plant at a point away from a source of ignition and where reentry could not occur.

(3) A hose or hose connection subject to manifold pressure shall have a minimum bursting pressure of 1,000 psig.

(4) An assembled manifold including leads shall be tested and proved gas tight at a pressure of 300 psig (2070 kPa gage). The material used for testing oxygen manifolds shall be oil free and not combustible.

**R 408.11234. Fuel gas manifolding.**

**Rule 1234.** (1) Fuel gas connected to 1 manifold inside a building shall have a total gas capacity of not more than 3,000 cubic feet (85 cubic meters approximately) or 11.8 cubic feet (.33 cubic meters) of liquefied gas, which is 735 pounds (333 kilograms) water capacity. More than 1 manifold unit may be located in a room, but the manifolds shall be not less than 50 feet (16 meters) apart or be separated by a noncombustible barrier not less than 5 feet (1.6 meters) high having a fire-resistance rating of 1/2 hour.

(2) Fuel gas capacity of 1 manifold of more than 3,000 cubic feet (85 cubic meters approximately) or 11.8 cubic feet (.33 cubic meters) of liquefied gas, which is 735 pounds (333 kilograms) water capacity, is permissible in a separate room or compartment, as specified in R 408.11222(8), or located outside the building.

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

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

## MANIFOLDING - SERVICE PIPING

### R 408.11241. Piping material.

**Rule 1241.** (1) Piping for acetylene shall be limited to steel and ductile iron.

(2) Piping for other gases shall be compatible with the gas.

(3) Oxygen at pressures of more than 700 psig shall be run in stainless steel or copper alloy piping.

(4) Gray or white cast iron fittings shall not be used.

(5) Pipe and fittings shall be as prescribed in section 2 of the ANSI B31.1 "Industrial Gas and Air Piping Systems," 1967 edition, as adopted in R 408.11202, except for the following:

(a) Pipe shall be not less than schedule 40 and fittings not less than standard weight in sizes up to and including 6-inch nominal.

(b) Copper tubing shall be type K or L.

(6) A hose connection and hose complying with R 408.11233 may be used to connect the outlet of a manifold pressure regulator to piping if the working pressure of the piping is 250 p.s.i.g. or less, and the length of the hose does not exceed 5 feet.

### R 408.11242. Piping assembly.

**Rule 1242.** (1) All piping shall be run as directly as practicable, shall be protected against physical damage, and proper allowance shall be made for expansion and contraction, jarring, and vibration. Piping in a tunnel, trench, or duct shall be welded or brazed. Pipe laid underground in earth shall be located below the frost line and shall be protected from corrosion. Shutoff valves shall be located outside the conduits. Oxygen piping may be placed in the same tunnel, trench, or duct with fuel gas pipe lines if natural or forced ventilation is provided.

(2) 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. A drain valve shall be installed for this purpose, having an outlet normally closed with screw caps or plugs. Open end valves or petcocks shall not be used, except that, in drips located out of doors, underground, and not readily accessible, a valve may be used at such points if it is equipped with means to secure it in the closed position. A pipe leading to the surface of the ground shall be cased or jacketed where necessary to prevent loosening or breaking.

(3) A gas shutoff valve shall be provided at the pipe entrance to a building. There shall also be provided a shutoff valve in the discharge line from the generator, gas holder, manifold, or other source of supply. A shutoff valve shall not be installed in a manner that renders a safety relief device ineffective.

(4) Before assembly, piping and fittings shall be freed of scale and dirt. An oxygen line shall be washed out with a solution such as caustic soda or trisodium phosphate. After assembly, piping shall be blown out with oil-free air or oil-free inert gas.

(5) Loose dirt that may have been trapped in the pipe shall be blown out with oil-free air or oil-free inert gas.

(6) Pressure testing of a pipeline shall be done in a manner to protect an employee from injury due to blowing out of closures and other pressure restraining devices.

(7) A piping system shall be tested and proved gastight at 1 1/2 times the maximum operating pressure and shall be purged of air before being placed in service. The material used for testing oxygen lines shall be oil free and noncombustible. A flame shall not be used to detect leaks.

(8) Repairs on ferrous piping for other than inert gas lines shall be preceded by purging the lines, unless only nonsparking tools are used. When gas lines and other parts of a manifold system are being purged, a source of ignition shall not be permitted near the uncapped opening.

(9) Outdoor ferrous and all underground piping and fittings shall be covered or painted to protect against corrosion.

(10) A steel or wrought iron pipe joint shall be welded, threaded, or flanged.

(11) A brass or copper pipe joint shall be welded, brazed, threaded, or flanged. A seamless copper, brass, or stainless steel tubing joint shall be brazed or gas tubing fittings used. Where a socket type joint is used, it shall be brazed with silver brazing alloy or similar filler metal having a melting point not less than 800 degrees Fahrenheit.

### R 408.11243. Installation and identification of piping.

**Rule 1243.** (1) Above ground piping, station outlet, and section valves shall be identified as to contents by color or name, or both, as prescribed in ASME A13.1 "Identification of Piping Systems," 1956 edition, as adopted in R 408.11202.

(2) A cylinder manifold shall be installed under the supervision of an individual experienced in the proper practices with reference to its installation and use.

**R 408.11244. Station outlets.**

**Rule 1244.** (1) A station outlet shall be equipped with a shutoff valve for each torch supplied from it, designated  $V_F$  and  $V_O$  in FIGURE 1, located upstream of other station outlet equipment.

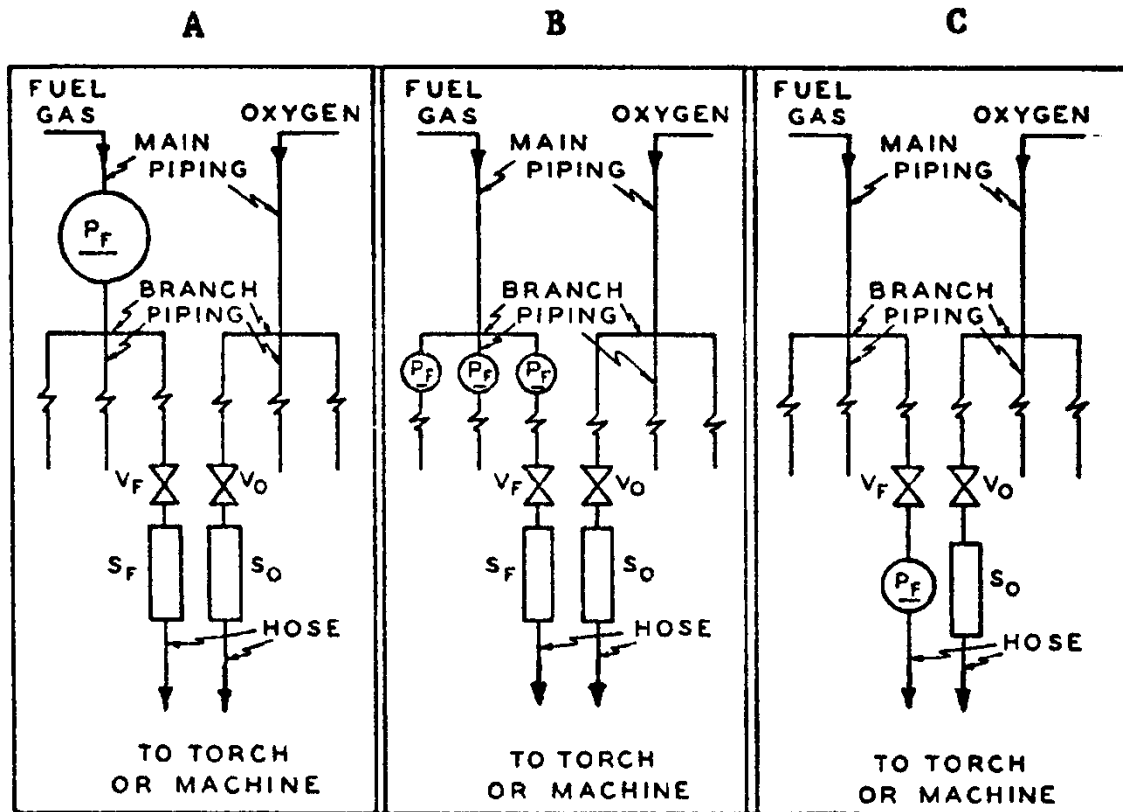
(2) A station outlet shall be provided backflow prevention devices, designated as  $S_F$  and  $S_O$  in FIGURE 1, at each station outlet, including those on a portable header, to prevent backflow, except where pipeline protection equipment, designated as  $P_F$  in FIGURE 1, C is located at the station outlet.

(3) A station outlet shall terminate with an approved union connection for a regulator or a hose, except that the outlet may terminate with pipe threads where a permanent connection is made, such as to a machine.

(4) Each station outlet shall be equipped with a detachable seal outlet cap, secured in place, which shall seal the outlet except when a hose, regulator, or piping is attached.

(5) The total volume of acetylene used per hour shall not exceed 1/7 of the total volume of the acetylene supply in the system.

FIGURE 1



LEGEND:

$P_F$	Protective equipment in fuel gas piping
$V_F$	Fuel gas station outlet valve
$V_O$	Oxygen station outlet valve
$S_F$	Backflow prevention device(s) at fuel gas station outlet
$S_O$	Backflow prevention device(s) at oxygen station outlet

**R 408.11245. Portable outlet headers.**

**Rule 1245.** (1) A portable outlet header shall not be used indoors, except where conditions preclude a direct supply from an outlet located on the service piping system.

(2) A master shut off valve shall be provided for oxygen and fuel gas at the entrance of the portable outlet header.

(3) A portable outlet header shall be provided the protective devices prescribed in R 408.11252.

(4) Each service outlet of a portable outlet header shall be provided with a valve assembly which includes a detachable outlet seal cap, chained or otherwise secured to the valve body.

(5) A portable outlet header shall be provided a frame which will support the equipment in position and protect it from damage during handling and operation.

(6) 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.

**PRESSURE DEVICES**

**R 408.11251. Pressure devices.**

**Rule 1251.** Pressure regulating and relief devices shall be provided and set to function at not more than the designed pressure and to discharge away from a source of ignition.

**PROTECTIVE DEVICES**

**R 408.11252. Protective devices.**

**Rule 1252.** (1) Protective equipment shall be installed in fuel gas piping 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. See P<sub>F</sub> in FIGURE 1.

(2) The 3 functions may be combined in 1 device or provided by separate devices.

(3) The protective equipment shall be located in the main supply line as shown in FIGURE 1, A. In addition, an employer may use protective equipment shown in FIGURE 1, B and C. Where a branch is sized 2 inches or more, the protective equipment P<sub>F</sub> shall be provided as prescribed in FIGURE 1, B or C.

(4) Backflow protection shall be provided by a device that will prevent fuel gas from flowing into the oxygen system or oxygen from flowing into the fuel-gas system. See FIGURE 1, A and B and P<sub>F</sub> in FIGURE 1, A, B, and C.

(5) A pressure relief device shall be set at a pressure not more than the pressure rating of the backflow or flash-back protection devices, whichever is lower, and shall be located on the downstream side of both of these devices. Its vent shall be as large as the inlet and terminate in a hood or bend away from a source of ignition. The vent 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. A shutoff valve shall not be installed in the vent line.

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

(7) Piping protective equipment incorporating a liquid shall have the level maintained. Antifreeze may be used to prevent freezing.

**HOSES AND REGULATORS**

**R 408.11253. Hoses and connections.**

**Rule 1253.** (1) Only approved hose and connections shall be used. A hose connection shall be fastened to withstand twice the working pressure without leaking, but not less than 300 psig (2070 kPa). Oil-free air or an oil-free inert gas shall be used for the test.

(2) Parallel lengths of hose taped together shall have not more than 4 inches out of each 12 covered by tape.

(3) Parallel hoses shall be color coded as follows:

(a) Red--fuel gases.

(b) Green--oxygen.

(c) Black--inert gas or air.

(4) A hose shall be repaired or replaced when it shows burns, leaks, worn places or other defects which could affect the safety of employees.

**R 408.11254. Regulators.**

**Rule 1254.** Regulators shall:

(a) Be used as specified in R 408.11224(3).

(b) Be inspected for faulty seats and repaired when found defective.

(c) Be repaired by authorized and trained personnel, or be returned to the supplier for calibration or repairs.

(d) Not be removed until the cylinder valve is closed and the regulator drained.

(e) Have gauges marked "Use No Oil" when used for oxygen.

## GENERAL FIRE RULES

### R 408.11261. Fire precautions.

**Rule 1261.** (1) Cutting and welding shall be done in designated areas free of flammable or conditions favorable to fire or explosion. If it is not practical to perform the work in a designated area, a person shall be assigned responsibility for fire safety of the job and shall take the following action after inspecting the job site and designating precautions to be taken:

(a) Move flammables a minimum of 35 feet (10.7 m) from the area, cover the flammables with a fire resistant covering, or schedule the work for a time when the flammables have been removed.

(b) Cover cracks in the floor or walls that are within 35 feet (10.7 m) of the welding or cutting process if they could pass sparks to other areas.

(c) Wet down wooden floors, except when laid over concrete, and provide a bucket or pan containing water or sand or cover with a fire resistant shield. Where the floor has been wet down, arc welding operators shall be protected from shock.

(d) Have appropriate portable fire extinguishers on hand for use by trained employees.

(e) If there is a possibility that a smoldering fire may have started, keep an observer at the scene of the work for at least 30 minutes after the welding or cutting has stopped.

(2) An observer shall be assigned whenever welding or cutting is done in an area where a fire could start or 1 of the following conditions exists:

(a) Appreciable combustible material in the building construction or contents less than 35 feet (10.7 m) from the point of operation.

(b) Appreciable combustible material more than 35 feet (10.7 m) away but easily ignited by spark.

(c) Wall or floor opening less than a 35 foot (10.7 m) radius from exposed combustible materials in adjacent areas including concealed spaces in walls and floors.

(d) Combustible material adjacent to the opposite side of a metal partition, wall, ceiling or roof which is likely to ignite by conduction or radiation.

(3) Welding and cutting by gas utility firms on live mains is exempt from this rule when the main is filled under positive pressure with natural or manufactured gas and air movers are used to ventilate areas where fumes might accumulate.

(4) Welding or cutting shall not be permitted in the following situations:

(a) In an area not authorized by management.

(b) In a sprinklered building while such protection is impaired unless a fire watch is provided.

(c) In the presence of an explosive atmosphere such as mixtures of flammable gases, vapors, liquids or dusts with air.

(d) In an area nearer than 35 feet of storage of large quantities of exposed, readily ignitable materials such as bulk sulfur, baled paper, or cotton.

(5) Conveyor and exhaust systems that might carry sparks to a distant combustible shall be protected or shut down.

### R 408.11262. Welding drums, barrels, tanks, or other containers.

**Rule 1262.** (1) Welding or cutting shall not be performed on drums, barrels, tanks, or other containers until they have been cleaned of all flammable combustible or toxic materials or fumes.

(2) All pipe lines or other connections to drums, barrels, or tanks shall be disconnected or blanked.

(3) Hollow spaces or cavities shall be vented and either filled with water or purged with an inert gas before preheating, cutting, or welding.

(4) An opening shall be maintained during welding and cutting to vent gases or vapors.

(5) The welded construction of a transmission pipeline shall be conducted in accordance with API 1104 "Standard for Welding Pipe Lines and Related Facilities," 1973 edition, as adopted in R 408.11202.

(6) The connection, by welding, of branches to a pipeline carrying a flammable substance shall be performed in accordance with API PSD 2201 "Welding or Hot Tapping on Equipment Containing Flammables," 1963 edition, as adopted in R 408.11202.

## ARC WELDING AND CUTTING

### R 408.11271. Arc welding machines.

**Rule 1271.** (1) An arc welding machine shall be capable of operating safely in the environment in which it is located. The design and construction shall enable the machine to carry its rated load with rated temperature rise where the temperature of the cooling air is not more than 104 degrees Fahrenheit and where the altitude is not more than 3,300 feet (1,000 m approx.).

(2) Where unusual service conditions, such as corrosive fumes, steam, oil vapor, flammable gases, vibration, shock, dust or weather exist, a specially designed machine shall be used.

### R 408.11272. Open circuit and no-load voltages of arc welding machine.

**Rule 1272.** (1) When an arc welding machine is operated without being connected to a load, the open circuit voltage shall not exceed the values shown in Table 1 when rated voltage is applied to the primary winding or when a generator type arc welding machine is operating at maximum rated no-load speed.

(2) When welding and cutting processes require values of open circuit voltages higher than 100, insulation or other means shall be provided to prevent the operator from making accidental contact with the high voltage.

(3) Equipment working through resistors from DC trolley voltages of 250 to 600 volts shall have a protective device for automatically disconnecting the power during arc off periods.

(4) Automatic control devices for reducing no-load voltage below 50 volts shall be provided where AC welding is to be done under wet conditions that could provide a shock hazard.

TABLE 1		
MAXIMUM OPEN CIRCUIT VOLTAGES OF WELDING MACHINES		
Welding Current	Max. Open Circuit (no-load) Voltage	
	Manual and Semiautomatic Machines	Automatic Machines
ac	80 rms	100 rms
dc > 10% Ripple Voltage	80 rms	100 average
dc < 10% Ripple Voltage	100 average	100 average

**R 408.11273. Design of arc welding machines.**

**Rule 1273.** (1) A controller integrally mounted in an electric motor driver welder shall have the capacity for carrying rated motor current and shall be capable of making and interrupting stalled rotor current of the motor.

(2) Control apparatus shall be enclosed except for the operating wheels, levers or handles. The handles and wheels shall be large enough to be grasped by a gloved hand.

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

(4) Welding lead terminals shall be protected from accidental electrical contact by personnel or metal objects. If a welding lead terminal normally used for connection to the work is connected to a grounded enclosure, it shall be done by a conductor at least 2 sizes smaller than the grounding conductor and it shall be so marked.

(5) Portable control devices, such as push buttons, shall not be connected to an AC circuit of more than 120 volts. Exposed metal parts of a portable control device operating above 50 volts shall be grounded.

(6) Auto transformers or AC reactors shall not be used to draw welding current directly from any AC power source having a voltage of more than 80 volts.

**R 408.11274. Installation.**

**Rule 1274.** (1) The frame or case of a welding machine shall be grounded unless the manufacturer does not recommend it.

(2) The work on which the operator welds shall be grounded by a grounded metal floor, platen, connection to a grounded building frame, or by a direct ground to the machine. A wire used for grounding a work piece shall be capable of carrying the full welding current.

(3) A conduit containing an electrical conductor shall not be used for completing a work-lead circuit.

(4) A pipeline in service shall not be used as a permanent part of a work-lead circuit, but may be used during construction, extension, or repair if current is not carried through threaded joints, flanged bolted joints, or caulked joints and if special precautions are used to avoid sparking at connection of the work-lead cable.

(5) Chains, wire ropes, cranes, hoists, and elevators used for carrying loads shall not be used to carry a welding current.

(6) A welding cable shall be protected against damage, entanglement, or contact with power supply or high tension wires.

(7) A welding machine not provided with a controller or disconnect switch as an integral part shall have a controller or disconnect switch with overload protection provided. A disconnect switch with overload protection or overload disconnect protection or equivalent shall be provided for each outlet used by a portable welding machine.

(8) The rated current carrying capacity of the supply conductors for individual machines shall be not less than the rated primary current for the welding machine. The rated current carrying capacity of conductors for a group of welding machines 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 if all the machines supplied by the conductor will not be in use at the same time.

(9) Where a welding machine is working sufficiently close to another machine so that a welding operator is likely to touch the exposed parts of more than 1 electrode holder simultaneously, the machine shall be connected so as to minimize shock hazard as follows:

(a) DC machines shall be connected with the same polarity.

(b) AC machines shall be connected to the same phase of the supply circuit and with the same instantaneous polarity.

**R 408.11275. Operation.**

**Rule 1275.** (1) Engine fuel, cooling water, or shielding gas shall not be allowed to leak.

(2) A welding machine shall be disconnected when being moved and turned off when not in use.

(3) Electrodes shall be retracted or removed when not in use. Electrode holders not in use shall be placed so that they cannot make electrical contact with an employee, fuel or gas tanks, or conducting objects.

(4) A welder shall not let live electrodes or holders touch his or her bare skin or damp clothing. When arc welding is performed in wet conditions or under a condition of high humidity, the welder shall be protected against electric shock.

(5) Electrode holders shall not be cooled by immersion in water.

(6) Welding shall not be permitted where fumes of chlorinated hydrocarbons are present unless specific ventilation and personal protective equipment is provided as specified by the Michigan Occupational Safety and Health Administration (MIOSHA) standards.

(7) Before starting an arc welding operation, the welder shall do all of the following:

(a) Make sure the work lead is secured to the work.

(b) Make sure the magnetic work clamps are free of spatter on the contact surfaces.

(c) Spread out the welding cable, if necessary, to prevent overheating and damage.

(d) Make sure grounding connections are secured to a good ground.

(e) Make sure the required switching equipment for shutting down the machine has been provided.

(8) A welder shall not curl or loop welding cable around his or her body.

**R 408.11276. Maintenance of arc welding machines.**

**Rule 1276.** (1) Spliced welding cable shall not be used within 10 feet (3.05 m) of an arc welding machine.

(2) Equipment in need of repair that constitutes a safety hazard shall not be used or put in use until repairs are made by a knowledgeable employee or outside service.

(3) Cut insulation on work and lead cable or exposed bare conductors of an arc welding machine shall be protected by electrical tape and made watertight or the conductor shall be replaced. Splices shall be made by insulated welded joints or pressure connectors.

(4) An arc welding machine which has become wet shall be thoroughly dried and tested before use.

## RESISTANCE WELDING

**R 408.11281. Resistance welding generally.**

**Rule 1281.** (1) An inspection shall be made of a resistance welding machine not less than yearly and records maintained of the findings and action taken. In addition, the operator shall report any defects to his or her supervisor. A defect which could cause injury shall be repaired before the machine is placed in operation.

(2) Each resistance welding operation shall be analyzed and safeguards and personal protective equipment shall be used where a hazard is found.

(3) The operator of a resistance welding machine and nearby employees shall be protected from flying sparks by shields, curtains, goggles, or a combination of a face shield and safety glasses as prescribed in R 408.11211.

(4) A resistance welding machine shall be installed by a qualified employee under the direction of a licensed electrician or supervised by a welding engineer.

(5) A disconnect switch, circuit breaker, or circuit interrupter shall be installed on or near the machine so that power can be shut off and locked out when the machine needs servicing.

(6) A pair of ignitron tubes used in resistance welding equipment shall be equipped with a thermal protection switch. When used in a series connected water line, a single switch shall be sufficient if related to the downstream tube.

(7) Controls for automatic, air, or hydraulic clamps and resistance machines shall be located or guarded to prevent accidental activation.

(8) A foot control for resistance welder, other than that used to apply weld pressure, shall be guarded to prevent accidental activation.

**R 408.11282. Nonportable spot and seam welding machines.**

**Rule 1282.** (1) An external weld initiating control circuit for a nonportable spot or seam welding machine shall operate at not more than 120 volts for stationary equipment and not more than 36 volts for portable equipment.

(2) Stored energy or capacitor discharge type of resistance welding equipment and control panels involving more than 500 volts (550 rms volts) shall be insulated and completely enclosed. Doors of this equipment and control panels shall be interlocked in a manner to interrupt the power and short circuit all capacitors when the door is opened. In addition to the mechanical interlock, a manually operated switch or equivalent device shall be installed to insure absolute discharge of the capacitors.

(3) The door and access panel of the resistance welding machine and its control panel accessible at production floor levels shall be kept locked or interlocked to prevent entry by unauthorized employees to energized portions of the equipment. A door or access panel shall be considered locked if a key or wrench is required to open it.

(4) Where an operator's fingers are inserted between the electrodes during operation of a press welding machine, a device or guard, such as but not limited to an electric eye, 2-hand control, barriers or pull backs shall be provided or used.

(5) One or more safety emergency stop devices shall be provided on all multispot welding machines with a minimum of 1 stop device at each operator position.

(6) A large welding press shall be equipped with one or more safety pins, latches or blocks capable of sustaining the full static load. The blocks, pins and latches shall be electrically interlocked with the power source so that when the blocks are removed from their storage area on the machine and inserted under the ram or platen, the machine becomes inoperative.

(7) The welding transformer secondary shall be grounded by one of the following:

(a) Permanently grounding 1 side of the welding secondary circuit.

(b) Connecting a grounding reactor across the secondary winding with a reactor tap to ground.

(c) As an alternate, on nonportable machines, arranging for an isolation contactor to open 1 side of the line, while the welding or electronic contactor shall open the other side.

#### **R 408.11283. Portable welding guns.**

**Rule 1283.** (1) Unless the design makes it unnecessary, a portable welding gun shall be counterbalanced including the cables.

(2) All suspended portable welding gun equipment, except the gun assembly, shall be equipped with a safety chain or cable capable of supporting the total shock load in event of failure of any component of the supporting system.

(3) When a trolley is used to support a portable welding machine with a clevis for attachment to a safety chain, the clevis shall be wrought or forged steel and capable of supporting the shock load in event of failure of the trolley.

(4) The movable holder shall have such clearance where it enters the welding gun frame that a shear action cannot take place if the operator's fingers are placed on the operating movable holder or guarding shall be provided.

(5) The secondary and case of a portable welding transformer shall be grounded by a center tapped secondary or by a center tapped grounding reactor connected across the secondary.

#### **R 408.11284. Flash welding.**

**Rule 1284.** (1) A flash welding machine shall be equipped with a hood to control flying flash.

(2) For the protection of an operator of nearby equipment, fire-resistant curtains or suitable shields shall be set up around the machine and in such a manner that the operator's movements are not hampered.

## **ACETYLENE GENERATORS**

### **R 408.11291. Acetylene generators, marking, and pressure limits.**

**Rule 1291.** (1) An acetylene generator shall be of approved construction and permanently marked with the following information:

(a) Manufacturer's name and address.

(b) Name or model number of the generator.

(c) Capacity in cubic feet per hour.

(d) Weight and size of carbide of a single charge.

(2) The carbide used shall be not more than that marked on the acetylene generator and the rated capacity shall not be exceeded. Unless the generator is especially rated higher, a carbide feed generator shall not be rated at more than 1 cubic foot per hour per single charge.

(3) A relief valve for a generating chamber shall be set to open at a pressure of not more than 15 psig. (103 kPa gage). A relief valve for a hydraulic back pressure valve shall be set to open at a pressure of not more than 20 psig. (137.4 kPa gage).

(4) A nonautomatic generator used for generating acetylene shall be set to operate at a pressure of not more than 1 psig, (.687 kPa gage) and all water overflows shall be visible.

(5) An acetylene generator shall be so located that there will be unobstructed space around it to operate the machine without interference to or from other machines or employees and to permit adjustment and charging.

### **R 408.11292. Stationary acetylene generators.**

**Rule 1292.** (1) An acetylene generator shall be installed level and in a manner not to place a strain on the generator or its connections. A generator shall be electrically grounded.

(2) A generator shall be located where water will not freeze. Heating shall be by steam, hot water, or other indirect means. Open flames, fire, or other sources of ignition shall not be permitted inside a generator house, room, or in any enclosure communicating with them. Sodium chloride or other corrosive chemicals shall not be used for protection against freezing.

(3) A water supply line to an acetylene generator with a noncontinuous connection shall terminate not less than 2 inches (5.08 centimeters) above the fill opening so that the water can be observed as it enters the generator. A supply line with a continuous connection shall be used only when the generator is provided an open overflow or an automatic water shutoff which will prevent overfilling the generator.

(4) An acetylene generator shall discharge only through an open connection into a vented outdoor receptacle or residue pit.

(5) Each generator shall be provided with a vent pipe of galvanized iron or steel. The pipe shall be secured to the building without a trap and shall be installed so that condensation will drain back to the generator. The pipe shall carry to outside the building and shall terminate in a hood or bend not less than 12 feet from the ground and 3 feet (.91 meters) from combustible construction, away from a window or other opening in a building and any source of ignition, and shall be constructed so that rain, snow, insects, or birds cannot obstruct the opening. The vent pipes from several generators shall not be interconnected, but shall lead outside separately.

**R 408.11293. Gas holders.**

**Rule 1293.** (1) A gas holder shall be constructed on the gasometer principle, the bell being suitably guided. The gas bell shall move without a tendency to bind and shall have a clearance of not less than 2 inches (5.08 cm) from the shell.

(2) The compressor or booster cutoff of a gas holder shall be located 12 inches above the landing point of the gas bell to prevent collapse of the bell.

(3) A gas holder shall be located in a heated and ventilated room as prescribed in R 408.11292 (2) and the Michigan Occupational Safety and Health Administration (MIOSHA) standards. When heat is not supplied, the gas holder seals shall be protected from freezing.

(4) A means shall be provided to stop the generator feeding mechanism before the gas holder reaches the upper limit of its travel. A gas holder connected to only 1 generator shall have a capacity of not less than 1/3 of the hourly rating of the generator.

(5) Protective devices shall be installed in each supply line when acetylene is used from a gas holder without an increase in pressure at some points but with increased pressure by a compressor or booster pump at other points. A low pressure protective device shall be installed between the gas holder and the shop piping, and a medium pressure protective device shall be installed between the compressor or booster pump and the shop piping (see FIGURE 2). Approved protective equipment is used to prevent all of the following:

(a) Backflow of oxygen into a fuel gas supply system.

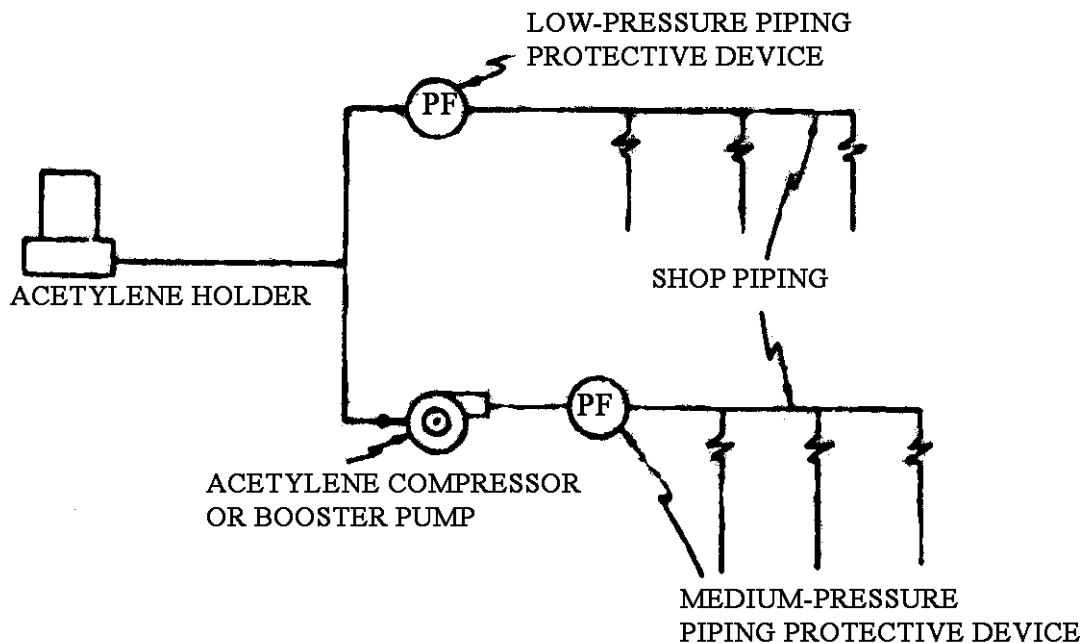
(b) Passage of a flashback into a fuel gas supply system.

(c) Excessive back pressure of oxygen in the fuel gas supply system. The 3 functions may be combined in 1 device or may be provided by separate devices.

(6) A compressor or booster pump shall be located in a ventilated area away from sources of ignition.

(7) A compressor or booster pump shall be provided with a pressure relief valve which will relieve at not more than 15 psig (103.5 kPa gage) as prescribed in R 408.11292(5). The discharge outlets of a compressor or booster pump shall be provided protective equipment as prescribed in R 408.11252.

**FIGURE 2**



**R 408.11294. Stationary acetylene generators; outside houses and inside rooms.**

**Rule 1294.** (1) An opening in an outside acetylene generator house shall not be located within 5 feet (1.6

meters) of an opening in another building. The walls, floor, and roof shall be of noncombustible construction with a 1-hour, fire-resistance rating.

(2) Where part of a generator house is used for storage or manifolding of oxygen cylinders, the space to be occupied shall be separated from the generator or carbide storage section by construction partition walls continuous from floor to ceiling, gastight, constructed as prescribed in subrule (1) of this rule, securely anchored and with not less than 1 exterior wall. Separation walls shall be without openings.

Exit doors shall be located so as to be accessible in an emergency.

(3) Explosion venting for generator houses and rooms shall be provided in the exterior wall or roof. The venting area shall be equal to not less than 1 square foot (.092 square meters) per 50 cubic feet (1.42 cubic meters) of room volume and may consist of 1 or any combination of the following:

(a) Walls of light, noncombustible material, preferably single-thickness, single-strength glass.

(b) Lightly fastened hatch covers.

(c) Lightly fastened swinging doors on exterior walls which swing outward.

(d) Lightly fastened walls or roof designed to relieve at a pressure of not more than 25 pounds (11.35 kilograms) per square foot.

(4) The installation of an acetylene generator within a building shall be restricted to a 1-story building or roof or top floor of a multistory building. A generator installed inside a building shall be enclosed in a separate room and constructed as prescribed in subrule (2) of this rule.

(5) A generator room or house shall be equipped with vents located at ceiling and floor levels.

(6) Illumination during daylight hours shall be by natural light. Where artificial lighting is necessary, it shall be from explosion-proof fixtures and controls. Wiring shall run through rigid conduit with threaded connectors. Telephone and other electrically powered apparatus either shall be designed for an explosive atmosphere or located outside the generator room or house.

#### **R 408.11295. Portable acetylene generators.**

**Rule 1295.** (1) A portable acetylene generator shall not be used less than 10 feet (3.2 m) of combustible material other than the floor. Ceiling height shall not be less than 10 feet (3.2 m).

(2) A portable generator shall be located in a room with a total volume of not less than 35 times the total gas generating capacity per charge of all generators in the room. The gas generating capacity in cubic feet per charge is figured by multiplying the pounds of carbide per charge by 4 1/2.

(3) A portable acetylene generator shall:

(a) Be protected from freezing. Salt or other corrosive chemicals shall not be used.

(b) Be cleaned, recharged and the air mixture blown off outside the building.

(c) Not be moved by a crane or derrick when charged. When transported and operated on a vehicle, it shall be secured to the vehicle. The generator shall not be operated, charged or cleaned while vehicle motor is running.

(d) Not be stored in a room in which an open flame is used unless the generator contains no carbide and has been purged of acetylene. The storage room shall be ventilated.

(e) Be protected from any source of spark or flames.

(4) A portable generator shall be of a type approved for portable use.

#### **R 408.11296. Maintenance and operation.**

**Rule 1296.** (1) An unauthorized employee shall not enter an acetylene generator room or house.

(2) Operating instructions shall be posted near the acetylene generator for ready reference.

(3) A batch type acetylene generator shall be flushed with water and the water supply replenished after a charge of carbide is exhausted, before additional carbide is added.

(4) The water carbide residue mixture shall be piped into a settling pit not a sewer pipe. Only the clear water from the settling pit may be discharged into a sewer pipe.

(5) Carbide added to an acetylene generator shall refill the space provided without ramming the charge. Steel or other ferrous tools shall not be used.

(6) The water chamber of an acetylene generator shall be maintained at the indicated level except when draining during a recharging operation.

(7) Prior to making a repair involving a source of ignition such as welding, soldering or other hot work, the carbide charge and feed mechanism shall be removed. All acetylene shall be expelled by completely flooding the generator with water and disconnecting the generator from the piping system. Water shall be maintained in the generator until repairs are completed. Hot repairs shall not be made in a room or house with other acetylene generators unless all generators and piping have been purged.

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

## CARBIDE STORAGE

### **R 408.11297. Carbide storage; general.**

**Rule 1297.** Carbide shall be contained in metal packages capable of containing the material without rupture. The package shall be made watertight and airtight without using a solder that would melt during a fire. The package shall have a screw top or equivalent.

### **R 408.11298. Carbide storage indoors.**

**Rule 1298.** (1) Inside storage areas for carbide shall not be protected by a sprinkler system.

(2) Carbide stored indoors shall not exceed 600 pounds (272.2 kilograms). The area shall be dry, waterproof, and ventilated. Carbide storage with cylinders of fuel gas shall not exceed 600 pounds (272.2 kilograms).

(3) Packages of carbide, except for 1 of each size, shall be kept sealed. A seal shall not be broken when there is more than 1 pound (.454 kilograms) of any other unsealed package of the same size of carbide in the room.

(4) Carbide in excess of 600 pounds (272.2 kilograms), but not more than 5,000 pounds (2267.96 kilograms), shall be stored as follows:

(a) In an inside acetylene generator room or outside generator house.

(b) In a separate room of a 1-story building, which may contain other occupancies, that is without a cellar or basement beneath the carbide storage area. This room shall be constructed as prescribed in R 408.11294 and shall not be used for any other purpose.

(c) In a 1-story building which is without a cellar or basement and which is used for no other purpose. If the building is of noncombustible construction, it may adjoin another 1-story building, but the buildings shall be separated by an unpierced firewall. If the building is separated by less than 10 feet (3.2 meters) from another building, there shall be no openings in the mutually exposed sides within 10 feet (3.2 meters). If the carbide storage building is of combustible construction, it shall be not less than 20 feet (6.4 meters) from any other 1- or 2-story building and not less than 30 feet (9.6 meters) from any other building more than 2 stories.

### **R 408.11299. Carbide storage outside.**

**Rule 1299.** (1) Only unopened metal containers of carbide shall be stored outside.

(2) The container of carbide stored outside shall be inspected monthly for water and air tightness and rusting.

(3) The bottom tier of each row of carbide containers shall be placed on wooden planking or equivalent so that the container will not make contact with the ground or ground water.

(4) Containers of carbide shall be used on a first in, first out basis.



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