



Policy Title:	Compressed Gas Cylinders
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Policy Management Area(s):	Environmental Health and Safety

## SUMMARY:

This program contains requirements for practices designed and implemented to protect students and employees from the hazards of compressed gases as defined by OSHA in 29 CFR 1910, the National Fire Protection Association (NFPA) and the Compressed Gas Association (CGA).

## POLICY:

### I. COMPRESSED GAS CYLINDERS

#### A. Scope

This program is applicable to all employees in their day-to-day operations, including contractors, vendors, students and visitors. Compressed gas cylinders present an accident hazard of high magnitude because of the very large amounts of energy stored therein. It is essential that all users who store, handle or use such items be thoroughly familiar with procedures and safety requirements relating to their use.

Users of compressed gas should become familiar with the properties and inherent hazards of the products they use. Valuable information pertaining to each specific gas is contained within its product labeling and Safety Data Sheet (SDS). Please read this information and inform your co-workers of the importance of understanding and applying the precautions established within the available safety literature.

#### B. Definitions

1. Absolute pressure-expressed as “pounds per square inch” (psig) and is the measurement of the force gas exerts on its surroundings.
2. Compressed gas - Any gas or mixture of gases in a container having a pressure exceeding 40 psia at 70°F (21.1°C), or regardless of the pressure at 70°F (21.1°C), having a pressure exceeding 104 psia at 130°F (54.4°C), or any liquid having an

- absolute vapor pressure exceeding 40 psia at 100°F (37.8°C).
3. Corrosive gas - A gas that when in contact with living tissue causes destruction of the tissue by chemical action. This term shall not refer to action on inanimate surfaces.
  4. Cryogenic liquids - A cryogenic liquid is a liquid that has a boiling point colder than minus 150°F (minus 65.5°C) at 14.7 psia.
  5. Cylinder - Generally a compressed gas container having a maximum water capacity of 1,000 lbs. (453.6 kg.). This is approximately the equivalent of 120 gallons (454.2L).
  6. Flammable gas - A gas is considered flammable when either a mixture of 13 percent or less (by volume) with air forms a flammable mixture or the flammable range with air is greater than 12 percent regardless of the lower limit.
  7. Gas pressure - The force exerted by a gas on its surroundings, and is commonly designated in pounds per square inch (psi). The term psia refers to absolute pressure.
  8. Gauge pressure - Absolute pressure minus local atmospheric pressure equals gauge pressure. Gauge pressure is commonly designated by “pounds per square inch gauge” using the abbreviation psig.
  9. Handling - Moving, connecting or disconnecting a compressed or liquefied gas container under normal conditions of use.
  10. Highly toxic gas - A compressed gas that has a median lethal concentration (LC50) in air of 200 parts per million or less by volume of gas or vapor when administered by continuous inhalation for an hour.
  11. Inert gas - A term used to describe a variety of gases which are chemically inactive.
  12. Liquid cylinder - A pressurized double-walled and insulated container used to hold either cryogenic liquefied gas or refrigerated liquefied gas.
  13. Manifold - A gas distribution system which transfers product through multiple outlets/inlets to compressed gas containers.
  14. Safety Data Sheet (SDS) - Written or printed material concerning a hazardous material prepared in accordance with the OSHA provisions of 29 CFR 1910.1200.
  15. Pressure regulator - A pressure and/or temperature activated device used to prevent the pressure from rising above a predetermined maximum, thereby preventing rupture of a normally charged cylinder when subjected to a standard fire test.
  16. Toxic gas - A compressed gas that has a median lethal concentration (LC 50) of more than 200 and less than 2,000 parts per million by volume of gas or vapor when administered by continuous inhalation for an hour.
  17. Valve protection cap - A rigid removable cover provided for container valve protection during handling, transportation and storage.

### C. Responsibilities

1. Supervisors: Supervisors are responsible for ensuring that only trained staff handle or use compressed gas cylinders. The supervisor shall instruct employees and users as to the contents of this policy and make frequent checks to ensure understanding and compliance. Supervisors shall immediately intervene in all instances involving

unsafe acts or work practices. Supervisors must verify that compatible materials (valves, hoses, pipes, etc.) are used with compatible gases.

2. Users: Containers are generally provided by the gas manufacturer as a convenient device for storing and delivering a gaseous product to the user. The user is responsible for the safe use of the container and its contents and for returning the container to the gas manufacturer or distributor in the same safe condition as it was received. It is the responsibility of every employee or user to ensure that they abide by the rules and regulations set forth in this policy. The user shall further ensure that the equipment is in proper working condition and report any discrepancies to the supervisor.

#### D. Care and Use

1. Before use all cylinders shall be inspected for damage (i.e., dents, gouges, evidence of leakage or cracks). If any damage is found, the cylinder shall be tagged "out of service" and returned to the manufacturer or distributor. Compressed gas cylinders must be hydrostatically tested every five years by the gas manufacturer or distributor. Check the cylinder upon arrival for the test date and do not accept a cylinder if the most recent test date is more than five years old.
2. The user must know the contents of the cylinder. Do not use a cylinder if you cannot quickly determine its contents. Do not rely on color coding of the cylinder to determine contents since manufacturers use different color codes and there is no standardized system of color coding.
3. Know the chemical and physical properties of the contents. Knowledge of the properties of cylinder contents is essential; be aware of the flammability, corrosiveness or oxidation potential as well as the physiological properties (i.e., toxic, anesthetic or irritating).
4. Handle all cylinders carefully. Careless handling may damage cylinders and valves. Install valve and dust covers when cylinders are not in use. Use cylinders for no purpose other than for containing compressed gases; handle them with the same care whether they are full or empty.
5. Secure all cylinders, whether in use or in storage, full or empty, by using a chain, strap or other approved fastening device.
6. Move cylinders safely. Move cylinders from one location to another by using a gas cylinder hand-truck. Secure the cylinder to the hand-truck while moving it. It is easy to lose control of a cylinder while sliding or rolling it.
7. Keep all cylinders in a vertical orientation at all times. Some gases/cylinders will pose problems if put in a horizontal position. If all cylinders are treated the same way these hazards can be avoided.
8. Do not tamper with cylinder valves or any part of a valve, such as a safety nut or stem-packing nut. If you are unfamiliar with the valves, please seek competent assistance.
9. Use cylinders with appropriate equipment. Do not force connections or use unauthorized adapters. Never use a cylinder without a regulator.
10. Always close the cylinder valve when the cylinder is not in use or when it is empty. Replace dust covers and dust caps.

11. Oxygen cylinders will support the rapid combustion of most materials. Flammable materials contaminated by oxygen, especially materials such as oil, paint or grease, become extremely dangerous. Oxygen is intended for use in welding and is not intended for breathing and must not be substituted for air. Under no circumstances use oxygen as a substitute for compressed air or for any other unauthorized purpose, an explosion may result.
12. Never oil or grease a regulator. If oil or grease is found on an oxygen cylinder or regulator, it must be taken out of service immediately and the cylinder returned to the supplier.
13. Before attempting to place regulators or other fittings on a cylinder, be sure that the threads on the cylinder match those on the fittings. The type of thread, number of threads per inch and the hand of the thread must match to ensure a satisfactory seal. If the fittings are hard to turn, do not force them; instead, check the threads. Check for leaks using soapy water or other leak detector solution on the threaded connections.
14. Open cylinder valves slowly so the gas will not be released suddenly into the regulators. If the valve is hard to open, keep the valve outlet pointed away from your body while you apply greater force. Operate valves only by hand, do not use wrenches or other methods.
15. Before removing a regulator from a cylinder, close the control valves and allow the gas to escape from the regulator. Welders shall not leave an area with regulators or lines pressurized.
16. On oxygen cylinders, do not use a regulator that has been previously used for oil-pumped gases or any combustible gases. The gauges on oxygen regulators must be marked "USE NO OIL."
17. Acetylene is a colorless, flammable gas with a distinctive garlic-like odor. A mixture of this gas with oxygen or air in a confined area will explode when brought in contact with a flame or other source of ignition. A pressure-reducing regulator must be used when drawing acetylene from a cylinder. Never adjust the regulator to obtain a delivery pressure greater than 15 psig.
18. Under certain conditions, acetylene readily forms explosive compounds with copper, silver and mercury. Contact should be avoided between acetylene and these metals, their salts, compounds and high-concentration alloys.
19. Only cylinders that are in use should be located in the lab or work area. Other cylinders should be stored in a designated storage area.

#### E. STORAGE

1. All cylinders, whether in use or in storage, empty or full, shall be secured up-right by a chain, strap or other effective fastening device preventing the cylinder from falling over.
2. Gases may represent a hazard because they are capable of being:
  - a. Flammable
  - b. Asphyxiant (displaces oxygen in air)
  - c. Oxidizer

- d. Corrosive
- e. Toxic
- f. Highly Toxic
- g. Extremely Cold (Cryogenic)
- h. Under High Pressure

Some gases may be a combination of several of the above listed hazards.

3. Do not store cylinders in locations where extreme temperatures may exist, or near radiators or other sources of heat because high temperatures greatly increase the gas pressures in the cylinders. Many cylinders have fusible safety plugs that may release the contents when high temperatures or pressures exist in the cylinder. Do not store them where there is danger of accidental damage or in areas where they will be subjected to corrosive chemicals or similar damaging materials. Do not store cylinders of flammable gases near electrical wires, batteries or other conductors or sources of electricity. Empty cylinders must be plainly marked "EMPTY" and stored separately from full containers. When gas cylinders are stored indoors, ventilate the area to the atmosphere to prevent the accumulation of flammable or asphyxiating gases. Cylinders shall not be kept in unventilated enclosures.
4. Cryogenic cylinders must be fitted with stainless steel plumbing only.
5. Cylinders when stored (either inside or outside) shall not obstruct exit routes or other areas.
6. All cylinders in storage shall have their valves closed. Valve protection cap shall always be in place and hand tight except when cylinders are in use.
7. Oxygen cylinders shall not be stored within 20 feet of highly combustible material (i.e. oil and grease), within 20 feet of stored stocks of acetylene, other fuel gas cylinders or near any other substance likely to cause or accelerate fire. The only exception to this rule is when oxygen and acetylene are on a frequently used welding cart with regulator and hoses attached. If the cart is not used several times a week, the regulators must be removed and the cylinders must be properly stored.