



**COMPRESSED GAS
CYLINDER
PROGRAM**

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Compressed gas cylinders are in use all over campus in both academic and administrative areas and present a potentially serious risk to the campus community if they are not handled or stored properly. A recent campus audit indicated that, in a few areas on campus, this appeared to be the case, and overall there was a general lack of knowledge of proper compressed gas cylinder safety procedures. The audit also indicated a need for more accountability of gas cylinders, (i.e., some Departments did not know if they had any cylinders, or if they did, they did not know what was in them, to whom they belonged, and whether or not they were purchased or leased from a supplier).

Wherever possible, compressed gas cylinders should ***not*** be purchased outright but rather leased from a reputable compressed gas supplier. Leasing ensures that the gas cylinder will be properly inspected and maintained in accordance with OSHA and DOT regulations and properly disposed of when the cylinder is no longer needed or becomes unserviceable. If the cylinder is purchased, TU assumes the responsibility for inspection, maintenance and disposal.

Compressed gas cylinders may be classified as EPA regulated hazardous wastes depending on their contents. If this is the case, TU is responsible for their disposal from “cradle to grave”. The proper disposal of unused/old compressed gas cylinders is extremely expensive. For example, lecture bottles (small gas cylinders approximately 12 inches long and 3 inches in diameter) cost approximately \$500.00 each to dispose of. Larger cylinders can cost much more. Gas cylinders are virtually impossible to dispose of through traditional domestic waste channels. And given the problems society has recently experienced with hazardous wastes contaminating public landfills, waste haulers and landfills will refuse to accept gas cylinders regardless of their condition or status. As you can see, it’s definitely to TU’s advantage to lease compressed gas cylinders wherever possible.

Therefore, to assist the campus community in the safe handling and storage of compressed gas cylinders, EHS has prepared this document for all users of compressed gases. It is by no means complete. The enclosed information should be read by everyone who uses or has the potential to use any type of compressed gas cylinder on campus. If you have any specific questions pertaining to gas cylinders, contact the cylinder supplier or Environmental Health & Safety (EHS) at 410-704-2949 or at safety@towson.edu.

Handling

1. Avoid dragging or sliding cylinders, even for short distances. Cylinders should be moved by using a cart or hand truck designed for cylinders. Secure cylinders with straps or chains.
2. Never drop cylinders or permit them to strike each other violently. When cylinders are moved, they should not be subjected to abnormal mechanical shocks that may cause damage to their valves, pressure relief devices or the cylinders themselves.

3. The valve protection cap should be left in place until the cylinder has been secured against a wall, bench, placed into a cylinder stand or on a cylinder cart and is ready to be used. Cylinders should always be secured when in use.
4. Never tamper with pressure relief devices in valves or cylinders.
5. Never permit oil, grease, or other readily combustible substances to come into contact with oxygen cylinders, valves or regulators.
6. Do not remove the product information labels or change the cylinder colors.
7. When returning empty cylinders, close the valve before shipment. Leave some positive pressure in the cylinder. Replace any valve outlet and protective caps originally shipped with the cylinder. Mark and label the cylinder “EMPTY” or “MT”.
8. Compressed gas cylinders should not be refilled except by qualified compressed gas suppliers.
9. Shipment of a compressed gas without the consent of the owner is a violation of Federal Law.
10. The disposal of compressed gases and cylinders is strictly regulated by the Maryland Department of the Environment and the U.S. EPA. The improper disposal of either is a felony and may result in criminal and civil penalties. Contact either the supplier or EHS for proper disposal procedures.
11. Never lift a cylinder by the cap, except with an approved cylinder cart designed for this purpose.

Receiving Cylinders

1. Upon receiving a new cylinder, check for proper labeling of the contents.
2. The contents of the gas should be stamped on the cylinder.
3. Check the cylinders last pressure test date.

Storage

1. Always store compressed gas cylinders in an upright position. Cylinders should be stored separately according to hazard class (flammable gas, poisonous gas, oxygen, etc.) and full and empty cylinders should be segregated.
2. Full cylinders should be stored such that the oldest cylinders are consumed first. Cylinders should never be stored with regulators in place. All cylinders shall be stored with the protective cap in place when not in use. Empty cylinders should be prominently marked either “EMPTY” or “MT” and have their valves closed and their protective caps installed.
3. The area should be dry, cool, well ventilated and preferably fire resistant. Keep cylinders protected from excessive temperatures by storing them out of direct sunlight and away from radiators and other sources of heat. Cylinders may be stored in the open, but should be protected against weather extremes and from damp ground to prevent rusting.
4. In general, cylinders should be secured with a chain, strap or other securing device while in storage. In public areas, cylinders should be protected from tampering. Locked cages are the preferred method.
5. If stored indoors, cylinders should be stored in dry, well-ventilated areas to avoid the accumulation of potentially explosive or toxic vapors. Indoor storage areas shall be designed and constructed in strict compliance with:
 - National Fire Protection Association (NFPA) Standard 55, *Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders*,
 - American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) recommended guidelines,
 - Compressed Gas Association (CGA) Standard P-1 2008, and
 - OSHA Subpart H (specifically 1910.101) regulations.
6. Make sure all cylinders are properly (and legibly) labeled as to contents and have the appropriate DOT approval.
7. Smoking or other open flames should be prohibited in oxygen or flammable gas cylinder storage areas. Keep all stored cylinders at least 50 feet away from all sources of ignition such as sparks, electric arcs, open flames, heaters, etc.

8. Oxidizers, such as oxygen cylinders must be stored in such a manner as to be separated from flammable gases (i.e., propane, acetylene, etc.) or other flammable or combustible materials by at least 20 feet or by a noncombustible masonry wall at least five feet high.
9. Never store cylinders (even temporarily) in high traffic areas, near where vehicles are operated, building entrances, exits, stairwells or other areas used for the safe exit of building occupants.
10. Prominently post all compressed gas storage areas in accordance with current OSHA requirements and with **NO SMOKING** signs.

Use

1. Know and understand the properties, uses and safety precautions of the gas before using the gas and/or associated equipment. Consult the manufacturer's Material Safety Data Sheet (MSDS) for the particular gases being used. MSDS's are available at no cost from gas suppliers. If unavailable from gas suppliers, contact EHS 410-704-2949 or safety@towson.edu.
2. The cylinder decal or label is the only positive way to identify the gas contained in a cylinder. Do not remove or deface the label in anyway. Color-coding of cylinders is an identification method used for the convenience of the gas cylinder supplier only.
3. Do not use cylinders as rollers for moving materials or other equipment.
4. Never attempt to mix gases in a cylinder.
5. Never use oxygen as a substitute for compressed air.
6. No part of a cylinder should be subjected to a temperature above 125⁰F. Prevent sparks or flames from welding and cutting torches or any other source from coming in contact with cylinders. Never allow cylinders to come into contact with electrical circuits or apparatus.
7. Use regulators and pressure relief devices when connecting cylinders to circuits of lower pressure service ratings. Only regulators approved for the specific gas should be used. Open the cylinder before adjusting the pressure on the regulator.
8. Always open an acetylene or oxygen cylinder slowly.
9. Cylinder valves should be closed on cylinders, and all pressure released from equipment connected to a cylinder at the end of a work shift or prior to any extended periods of nonuse.

10. Use check valves or traps to prevent backflow of water or other contaminants if backflow can occur into the cylinder. If backflow occurs, mark the cylinder **“CONTAMINATED”** and notify the supplier immediately.
11. Acetylene cylinders must be equipped with reverse flow check valves and flashback arrestors.
12. If a cylinder protective cap is extremely difficult to remove, do not apply excessive force or pry the cap loose with a bar inserted into the ventilation openings. Attach a label or tag identifying the problem and return the cylinder to the supplier.
13. Wrenches should never be used on valves equipped with a hand wheel. If you experience any problems operating the cylinder valve, discontinue use and immediately contact the supplier. If the valve is faulty, attach a label or tag to the cylinder identifying the problem and return the cylinder to the supplier.
14. Use only oxygen-compatible threading compounds such as TEFLON tape on oxygen cylinder valve threads.
15. Ensure that grease and oil do not come into contact with the oxygen cylinders, especially near the nozzle or the valve in order to protect against fire. Do not handle oxygen cylinders with oily or greasy hands.
16. Check for leaks using soapy water.
17. Keep cylinders in carts specifically designed for them. Always transport cylinders in an upright position, securely fastened in carts designed for them. When transporting, remove regulators and ensure cylinder valves are closed and protective caps are installed.

Emergency Procedures

1. Leaking cylinders should be immediately moved to an isolated area out of doors and away from buildings, personnel and potential ignition sources. (If the cylinder is small and you have access to an operable chemical fume hood, you may place the cylinder in the fume hood.) The valve should then be opened slowly allowing the gas to escape. The cylinder should then be tagged **“DEFECTIVE”** and returned to the supplier.
2. In the event of a fire involving compressed gases, immediately activate the building fire alarm and evacuate the building via the nearest emergency exit. If you can do so safely, as you evacuate close doors behind you to contain the fire, smoke or gas

vapors. From a safe location, dial 911 and request emergency assistance. When the fire department arrives, identify yourself and be prepared to provide any information they may require.

3. In the event of a personal injury caused by compressed gases, immediately request medical assistance through 911.

Disposal of Compressed Gas Cylinders

1. When compressed gas cylinders are no longer needed, they should be promptly disposed of rather than allowed to accumulate and potentially deteriorate.
2. Leased gas cylinders should be returned to the gas supplier for disposal.
3. TU owned (or of questionable/unknown ownership) gas cylinders should be identified and disposed of immediately by contacting the TU Department of Environmental Health & Safety (EHS) at 410-704-2949 or at safety@towson.edu.

Appendix A.

Compressed Gas Safety Checklist

(A) General Use

- _____ Are containers/cylinders labeled properly? (3.1.3)
- _____ Pressure Relief Device present and free from damage? (3.2.4)
- _____ Container free of corrosion and other recognized damage? (3.2.10- 3.2.11)
- _____ Valve protection caps in place and at least hand tight? (3.3.2)
- _____ Containers are not used as rollers, supports, or other unintended purposes? (3.3.3)
- _____ Are empty cylinders marked as such and valves closed? (3.3.4)
- _____ Cylinders are not placed where they may become part of an electrical circuit?
(3.3.5)
- _____ Cylinders are not exposed to temperatures greater than 125 F? (3.3.6)
- _____ Are cylinders leaking? (3.3.8)
 - _____ Tighten Valve
 - _____ Close Valve
 - _____ Tag Unserviceable
 - _____ Toxic? Provide proper respirator protection
 - _____ Keep away from flames
 - _____ Take outdoors or place in exhaust system
 - _____ Place warning tag on cylinder
 - _____ Notify supplier
- _____ Valve Caps are not used to lift cylinders. (3.4.3.1)
- _____ Ropes Slings, or chains are not used to suspend cylinders without appropriate lifting attachments?
- _____ Storage (3.5)
 - _____ Grouped by types and labeled with name of gas
 - _____ Full and empty containers separate and stored upright
 - _____ Storage rooms dry and well ventilated
 - _____ Not stored near salts, corrosive chemicals or fumes, dampness
 - _____ Protected from damage by other material
 - _____ Stored away from walkways, gangplanks, aisles, doors, exits, etc.
 - _____ Outside storage chemicals protected from bottom corrosion

_____ Employees trained on handling and use of cylinders? (3.6.1)

_____ Containers are secured to prevent them from being knocked over? (3.6.4)

_____ Compressed gasses are not used to dust off clothing? (3.6.11)

Additional Precautions for Specific Gases

Flammable Gases (4.1)

_____ Adequate fire extinguishers near storage areas

_____ No Smoking signs posted near storage

Oxygen (4.2)

_____ Containers, valves, regulators, hose, and other apparatus free from oil and grease

_____ Stored 20 feet from combustibles or separated by a wall at least 5 foot high and made of non combustible material with at least a 30 minute fire rating

_____ Ambient air oxygen content not greater than 23 percent except hyperbaric chambers

Acid and Alkaline Gases (4.3)

_____ Proper Personal Protective Equipment- Goggles, faceshields, gloves, aprons, long sleeve shirts, trousers. No open shoes or sneakers.

_____ Proper Respiratory protection available

_____ Eyewash stations and showers

Some Common Acid and Alkaline Gases

Ammonia	Sulfur Dioxide	Ethyl amine
Boron	Trifluoride	Methyl amine
Hydrogen Chloride	Chlorine	Trimethyl amine
Hydrogen Bromide	Hydrogen Sulfide	Nitrosyl Chloride
Fluorine	Dimethyl amine	

Highly Toxic Gases (4.4)

_____ Proper respiratory protection available

_____ Store outside or in separate, noncombustible building, without other occupancy

_____ Used in forced ventilation

_____ Employees trained on proper use and handling

Some Common Highly Toxic Gases

Carbonyl Fluoride	Chlorine	Phosphine
Fluorine	Germane	Hydrogen Cyanide
Hydrogen Selenide	Nitric Oxide	Nickel Carbonyl (liquid)
Nitrogen Dioxide	Ozone	Phosgene

Appendix B.

Compressed Gas Safety Checklist

(B) Welding and Cutting

- _____ Mixtures of fuel and air or oxygen guarded against? (3.1.1)
- _____ Acetylene used <15 psi <30 psi absolute pressure? (3.1.2)
- _____ Only approved apparatus used? (3.1.3)
- _____ Employees trained on handling and use? (3.1.4)
- _____ Cylinders labeled properly? (3.2.2)
- _____ Storage (3.2)
 - _____ Kept away from heat and flame
 - _____ Empty cylinders valves closed
 - _____ Valve protection caps in place and hand tight
 - _____ Greater than 20 feet from combustibles
 - _____ Ventilation
 - _____ Protected from damage
- _____ Oxygen cylinders, valves, regulators, hose and apparatus free of oil and grease?
(3.2.4)
- _____ Cylinder valves open and closed by hand? (3.2.5)
- _____ When parallel lengths of oxygen and acetylene hose are taped together , not more than 4 inches out of 12 inches shall be covered with tape (3.5.5)
- _____ Proper pressure reducing regulators used for gas and pressures for which they are intended? (3.5.6)
- _____ Acetylene cylinders equipped with reverse flow check valve and flashback arrestor.