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| <p><b>Carnegie Mellon University</b><br/>Environmental Health &amp; Safety<br/>FIRE   LAB   WORK </p> | <p><b>Environmental Health and Safety</b><br/><b>Compressed Gas Cylinders - Guideline</b></p> |
| <p><b>Date of Issuance:</b> 1/10/18</p>  | <p><b>Revision Date:</b> 10/23/2023</p>   |
| <p><b>Revision Number:</b> 3</p>   | <p><b>Prepared by:</b> EHS</p>  |

## 1. Purpose

Carnegie Mellon University has developed this guideline to cover general procedures for the safe handling and storage of all compressed gas cylinders and provide recommended safe practices for the handling, storage and transport of cylinders.

## 2. Scope

This guideline applies to all Carnegie Mellon faculty and staff that use, handle, store or transport compressed gas cylinders.

## 3. Definitions

A compressed gas is defined as:

- a. Any mixture of gases in a container with a pressure exceeding 40 pounds per square inch (psi). at 70F;
- b. Any mixture of gases in a container with a pressure exceeding 104 psi. at 130F;
- c. Any flammable liquid with an absolute vapor pressure exceeding 40 psi. at 100 F (per ASTM D-323-72).

## 4. Roles and Responsibilities

- a. Carnegie Mellon University Environmental Health and Safety is responsible for:
  - i. Developing the written Compressed Gas Cylinder Safety Program and revising the Program as necessary;
  - ii. Developing a training program on the safe handling, use, storage, and transportation of compressed gas cylinders; and
  - iii. Conducting routine inspections to ensure the proper storage and use methods are used.
- b. Departments will be responsible for:
  - i. Understanding and complying with the requirements of this program;
  - ii. Ensuring the proper handling, use, storage, and transportation of compressed gas cylinders according to this Program;
  - iii. Training employees on the safe use, handling, storage, and transportation of compressed gas cylinders; and
  - iv. Contacting CMU EHS if assistance is needed.

- c. Employees will be responsible for:
  - i. Completing [Compressed Gas and Toxic Gas Procedures Training](#) as necessary;
  - ii. Complying with the procedures outlined in this Program; and
  - iii. Informing their supervisor of any problems, defective equipment, or lack of proper storage space for compressed gas cylinders used by them.

## 5. Guidelines

- a. Container Requirements for Compressed Gases
  - i. Compressed gas cylinders or containers delivered to or shipped from the University must be marked, labeled, stored, and handled in accordance with all applicable rules and regulations, including DOT, OSHA, and NFPA standards.
  - ii. The contents of each cylinder and container must be clearly identified (by tag or stamp) on the cylinder.
  - iii. University faculty, staff and students must not remove or alter any identification on a compressed gas cylinder.
  - iv. Do not purchase a larger cylinder size than necessary. Only gases in returnable containers should be selected for purchase/rental.
- b. Storage of Compressed Gas Cylinders
  - i. Storage areas for compressed gas cylinders must be designed to accommodate the gases used and provide adequate spacing and/or segregation, in accordance with applicable building codes and regulations. Compressed gas cylinder storage areas must be segregated from exit corridors and egress paths.
  - ii. Storage areas should be designated by hazard class and marked clearly with appropriate warning signs that restrict access.
  - iii. Consideration must be given to separate storage of full and empty containers. Incompatible gases must be segregated by at least 20 feet or a ½ hour rated wall or barrier.
  - iv. The cylinder storage area should be dry and well-ventilated, and be of fire-resistant construction when necessitated by the gas in storage.
  - v. Compressed gas cylinders must not be stored near sources of heat and ignition, or near corrosive chemicals or fumes.
  - vi. Compressed gas cylinders must not be stored near unprotected platform edges, or in any location where heavy moving objects may strike or fall on them.
  - vii. Compressed gas cylinders (whether empty or full) must be secured in an upright position using an approved chain, strap, or floor device to prevent falling.
  - viii. Approved chains or straps should be secured around the top 1/3 of the cylinders. Securing devices should never be around the neck, regulator, or bottom 1/3 of the cylinder.
  - ix. Compressed gas cylinders must be fitted with a protective valve cap or guard while in storage.
  - x. If use of small non-refillable cylinders is unavoidable (lecture bottles), they should be secured in a device, cage or box designed for cylinders 18" or smaller.
  - xi. Toxic gases (such as carbon monoxide and hydrogen sulfide) should only be handled with CMU EH&S approval.

- c. Safe Handling of Compressed Gas Cylinders
  - i. Persons handling compressed gas cylinders must:
    - 1. Be familiar with the hazards of the compressed gas.
    - 2. Always use a cylinder cart or other transport device to move cylinders in secured fashion. Never drag a cylinder by valves or caps, or roll a cylinder in the horizontal position. Compressed gas cylinders should be transported with the cylinder cap securely fastened.
    - 3. Never use a compressed gas cylinder as a support or door stop.
    - 4. Keep caps on cylinders unless connected to dispensing equipment systems.
    - 5. Never expose cylinders to temperature extremes, direct flame, or heat.
  - ii. Empty compressed gas cylinders must be:
    - 1. Closed
    - 2. Secured at all times
    - 3. Labeled to indicate "Empty"
  - iii. Compressed gas piping, regulators, and flow control equipment must be:
    - 1. Compatible with the chemical and physical properties of gas.
    - 2. Capable of withstanding gas supply pressures.
    - 3. Installed and operated by trained and qualified persons' familiar with the specific hazards of the gases in use.
    - 4. Grounded to minimize sparks due to static discharge when using flammable gas.
    - 5. Provided with a means for safely purging the system and devices to prevent backflow of gases or liquids into the gas storage cylinders when using hygroscopic corrosive gases, such as anhydrous hydrogen chloride.
    - 6. Leak tested upon installation and monthly thereafter around valve gland, regulator connections, and fittings.
- d. Emergency Procedures for Compressed Gas Cylinders
  - i. Personnel should be aware of common emergency situations involving compressed gases and their associated hazards, such as:
    - 1. An unsecured cylinder may tip and become damaged in a manner that the release of internal pressure can cause the cylinder to become a dangerous high-speed projectile.
    - 2. A fire threatening the cylinder can cause a rupture or explosion.
    - 3. A flammable gas leak can cause a buildup of explosive gases.
    - 4. A leak can cause high concentrations of gas that exceed safe breathing levels or an inert gas leak can cause an oxygen-deficient atmosphere that is a threat to life safety.
    - 5. An unplanned chemical reaction may cause a cylinder rupture or explosion of apparatus.
  - ii. Fire emergencies involving compressed gas cylinders should be handled with extreme caution:
    - 1. Do not take unnecessary risks to save equipment-- evacuate the area.

2. Only when safe to do so, release pressure in affected pipelines and shut off equipment prior to evacuation.
  3. If safe to do so, shut off gas supply to ignited flammable gas leaks or allow fire to burn out while controlling the ignition of surrounding materials.
  4. Never attempt to extinguish a flammable gas leak without stopping the flow of gas.
  5. Any compressed gas cylinder involved in a fire *must* be taken out of service and returned to the supplier.
- iii. Some common leak points and their potential repairs:
1. Valve outlet /regulator connection: dirt in connection, damaged connector or washer.
  2. Valve stem spindle: tighten adjustable gland nut ¼ turn with valve stem loosened or tighten lock nut if present on gland fitting.
  3. Cylinder valve to cylinder joint: If it cannot be repaired in the field, remove from service. Label and return to CMU Mellon Stores, 412-268-3212 or to supplier.
  4. Valve closure: tighten valve or if defective, set aside, label and return to CMU Mellon Stores, 412-268-3212 or to supplier.
  5. Leaking gas control equipment/pipelines: isolate gas supply, release pressure, and purge equipment of hazardous gas before attempting repair.
- e. Disposal of Compressed Gas Cylinders
- i. Contact to CMU Mellon Stores, 412-268-3212 or supplier to return empty, damaged, excess, or unknown cylinders.
  - ii. If the cylinder is non-returnable, [contact EHS](#) for cylinder disposal via the chemical waste disposal program.

## 6. Revisions

| Date       | Documented Changes                     | Initials |
|------------|--|----------|
| 1/28/2020  | Updated format                         | MAS      |
| 8/2020     | Updated format and accessibility check | MAS      |
| 10/23/2023 | Reviewed = no update necessary         | AJL      |

For additional questions or concerns please [contact EHS](#).