

## Compressed Gas Safety

Compressed gases expose users to both chemical and physical hazards. Gases contained within compressed gas cylinders can be toxic, flammable, oxidizing, corrosive, inert, or some combination thereof. Because the chemical is in gaseous form and pressurized, it can quickly contaminate a large area in the event of a leak in the cylinder, the regulator, or in the tubing coming off of the cylinder, therefore, familiarity with the chemical hazards of the gas is necessary. In addition to the chemical hazards, the amount of energy resulting from the compression of the gas makes a compressed gas cylinder a potential rocket. Appropriate care in the handling and storage of compressed gas cylinders is essential. This safety bulletin contains the basic measures necessary to use compressed gas cylinders safely. Additional information pertaining to each specific gas can be found in the cylinder labeling and in the Material Safety Data Sheet.

### A. General Requirements

1. Contents of the gas cylinder should be clearly identified. Color coding is NOT a reliable means of identification. Do not deface or remove any markings, tags or stencil marks used for identification of contents attached by the vendor. Cylinders which do not bear a legibly written, stamped, or stenciled identification of the contents should not be used: they should be segregated and returned to the vendor as soon as possible.
2. Caps used for valve protection should be kept on the cylinder except when the cylinder is in use. A cylinder's cap should be screwed all the way down on the cylinders neck and should fit securely. The cap is for valve protection only.
3. LEAKING CYLINDERS
  - If a cylinder containing poison gas is leaking, immediately leave the room, close the door(s), pull the nearest fire alarm, evacuate the area and call 9-911 from a safe place to report the emergency. Be sure to meet the Fire Department at the main entrance to the building to explain the situation. The supplier should be contacted for disposal of the cylinder once the emergency situation is stabilized.
  - If a cylinder containing flammable or oxidizing gas is leaking, follow the same steps as above, but turn off all sources of ignition in the room prior to leaving, if the shut offs are accessible. Never attempt to extinguish a fire involving flammable gas without shutting off the gas supply; explosive atmospheres could be created.
  - If the leaking cylinder contains inert gases, place the cylinder in a well-ventilated location, preferably an outdoor cylinder storage area, and contact the vendor for removal.
4. If a cylinder or valve is noticeably corroded, the vendor should be contacted and their instructions followed. Any other damage that might impair the integrity of the cylinder should be called to the attention of the vendor before the cylinder is returned.
5. Do not order lecture bottles unless it is absolutely necessary. In many instances, gases are cheaper to purchase in standard sized cylinders, since demurrage is the only cost, and return of the cylinder is free. Disposal costs for lecture bottles can range from \$0 (non-hazardous only) to over \$1,000
6. All gas lines leading from a gas cylinder should be labeled clearly to identify the gas carried.
7. The practice of transferring compressed gases from one commercial cylinder to another is NOT permitted.

## **B. Moving and Transporting Cylinders**

1. Always use a suitable hand truck or similar device; the cylinder must be firmly secured for transporting and unloading. DO NOT roll or drag a cylinder to move it or allow cylinders to strike each other or any other surface violently.
2. Protective valve caps must be secured when moving cylinders. DO NOT lift or move the cylinder by the cap.
3. Ropes or slings should not be used to suspend cylinders unless the vendor has made provisions for such lifting and attachment points are provided on the cylinder.

## **C. Storing Cylinders**

1. All cylinder storage areas must be prominently marked with the hazard class or the name of the gasses to be stored, e.g. Flammable Gas Storage Area, and "No Smoking" signs posted where necessary.
2. Always secure gas cylinders upright (with valve end up) to a wall, cylinder hand truck, cylinder rack or post, unless the cylinder is specifically designed to be stored otherwise.
3. Where gases of different types are stored at the same location, cylinders (empty or full) should be grouped by the type of gas, e.g., flammable, oxidizer or corrosive. Inert gases can be stored with any other type of gas.
4. Full cylinders should be stored separately from empty cylinders. Cylinders should be used by the "first in, first out" guideline.
5. Cylinders should be stored in a well-ventilated area away from sparks, flames or any source of heat or ignition. Cylinders may be stored outside on a slab, however, where extreme temperatures prevail; cylinders should be stored so that they are protected from the direct rays of the sun. Do not expose cylinders to temperatures above 125 degrees F.
6. Cylinders should not be exposed to continuous dampness, stored near salt or other corrosive chemicals or fumes. Corrosion may damage cylinders and cause their valve protection caps to stick. Cylinders containing corrosive chemicals should be periodically checked to ensure that the valve has not corroded.
7. Avoid prolonged storage of cylinders in corridors.
8. Never store cylinders in elevator lobbies, stair towers or any other location which could obstruct the safe exit pathway of the building occupants.

## **D. General Use Precautions**

1. Do not use compressed gas cylinders for any purpose other than the transportation and supply of gas.
2. Never tamper with or attempt to repair or alter cylinders, valves or any safety relief devices. Return cylinders to the vendor for all repairs.
3. Do not attempt to remove a stuck cap by using a lever in the cap ports. The lever may accidentally open the valve when the cap turns.
4. Do not place cylinders where they might become part of an electric circuit or allow them to come into contact with an electrically energized system.
5. Use "Snoop", soapy water or leak detection equipment to ascertain that there are no leaks in the gas transport system.
6. Use pressure regulators which are equipped with pressure relief devices.

## **E. Utilizing Compressed Gases**

1. Before using the gas, read all label information and the data sheets associated with the use of that particular gas.
2. Before attaching cylinders to a connection, be sure that the threads on the cylinder and the connection mate, and are of a type intended for gas service.

3. The threads and mating surfaces of the regulator and hose connections should be cleaned before the regulator is attached. Wipe the outlet with a clean, dry, lint-free cloth. Particulate can clog the regulator filter (if so equipped) or cause the regulator to malfunction.
4. Always use the proper regulator for the gas in the cylinder. Always check the regulator before attaching it to a cylinder. If the connections do not fit together readily, the wrong regulator is being used.
5. Attach the regulator securely with the secondary valve closed and preferably with the regulator flow backed off (counterclockwise) before opening the cylinder valve wide.
6. Do not permit oil or grease to come in contact with cylinders or their valves, especially cylinders containing oxidizing gases (See Section H. Special precautions for using oxidizing gases.)
7. Always use a cylinder wrench or other tightly fitting wrench to tighten the regulator nut and tube connections. Use "backup" wrenches to minimize stress on tubing and fittings where appropriate.
8. Teflon tape should never be used on cylinder connections or tube-fitting connections. Use Teflon tape only on pipe threads where the seal is made at the threads. All other connections have metal to metal face seals or gasket seals.
9. Open cylinder valves SLOWLY. Point the valve opening away from yourself and other persons. Never use a wrench or hammer to open or close a hand wheel type cylinder valve. If the valve is frozen and cannot be operated by hand, return the cylinder to the vendor.
10. Before a regulator is removed from a cylinder, close the cylinder valve and release all pressure from the regulator.
11. Never completely empty a rented gas cylinder, rather discontinue use of the cylinder when it has at least 25 psi remaining. Mark the cylinder so that others know that it is nearly empty, e.g., write MT on a piece of tape and stick it on the cylinder. Close the valve and secure the cylinder valve protective cap and outlet cap or plug, if used.

**F. Special precautions for using flammable gases**

In addition to the above guidelines, the following measures should be taken when handling flammable gases.

1. Cylinders containing flammable gases (empty or full) should be separated from cylinders containing oxidizing gases by a minimum distance of 20 feet or by a barrier at least 5 feet high which has a fire-resistance rating of at least one-half hour, e.g., a concrete block wall.
2. Do not store flammable or oxidizing gases near highly flammable solvents, combustible materials or near unprotected electrical connections, gas flames or any other source of ignition.
3. It is preferable to store flammable gases in a ventilated, fire resistant enclosure, e.g., an approved gas cabinet. If this is not possible, flammable gas cylinders should be stored in a well-ventilated space.
4. The quantity of flammable gases in a laboratory should be kept to a minimum. A maximum of three full-size cylinders of flammable gas are permitted in one laboratory.
5. It is preferable to use flow restrictors or surge protectors on flammable gas cylinders so that there cannot be a sudden large flow of gas if a rupture or other unexpected release happens in the system.

**G. Special precautions for using poison gases**

In addition to the general guidelines, the following measures should be taken when handling poison gases:

1. Poison gases must be stored in a ventilated enclosure, e.g., an approved gas cabinet or a fume hood.
2. Gas detection systems may be required in laboratories utilizing poison gases. Contact the Safety Coordinator or ORS for information.
3. The quantity of poison gas in a laboratory should be kept to a minimum.
4. Flow restrictors are required on most poison gas cylinders.
5. Ensure that pressure-relief devices vent directly to a laboratory exhaust system.

#### **H. Special precautions for using oxygen and oxidizing gases**

In addition to the general guidelines, the following measures should be taken when handling oxidizing gases:

1. Do not permit oil or grease to come in contact with cylinders or their valves, especially cylinders containing oxidizing gases. Regulators and tubing used with oxidizing gases must be specially cleaned to remove oil and other reducing agents. Explosions may occur when pressurized oxidizers, e.g. oxygen, come into contact with grease or oil.
2. Cylinders containing oxygen or oxidizing gases, e.g., chlorine, (empty or full) should be separated from cylinders containing flammable gases by a minimum distance of 20 feet or by a barrier at least 5 feet high having a fire-resistance rating of at least one-half hour, e.g., a concrete block wall.
3. Do not store oxidizing gases near flammable solvents, combustible materials or near unprotected electrical connections, gas flames or other sources of ignition.