

# COMPRESSED GAS CYLINDER SAFETY



Many industrial and laboratory operations require the use of compressed gases for a variety of different operations.

Compressed gases present a unique hazard. Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases may be:

- Flammable or combustible
- Explosive
- Corrosive
- Poisonous
- Inert
- or a combination of hazards

If the gas is flammable, flash points lower than room temperature compounded by high rates of diffusion present a danger of fire or explosion. Additional hazards of reactivity and toxicity of the gas, as well as asphyxiation, can be caused by high concentrations of even "harmless" gases such as nitrogen. Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb.

**Careful procedures are necessary for handling the various compressed gases, the cylinders containing the compressed gases, regulators or valves used to control gas flow, and the piping used to confine gases during flow.**

## Identification

**The contents of any compressed gas cylinder must be clearly identified.** Such identification should be stenciled or stamped on the cylinder or a label. Commercially available three-part tag systems may also be used for identification and inventory.

No compressed gas cylinder should be accepted for use that does not legibly identify its contents by name. If the labeling on a cylinder becomes unclear or an attached tag is defaced to the point the contents cannot be identified, the cylinder should be marked "contents unknown" and returned directly to the manufacturer.



**Always read the label!!**

**Never rely on the color of the cylinder for identification.** Color coding is not reliable because cylinder colors may vary with the supplier. Additionally, labels on caps have little value because caps are interchangeable.

All **gas lines** leading from a compressed gas supply should be clearly labeled to identify the gas, the laboratory or area served, and the relevant emergency telephone numbers.



The labels should be color coded to distinguish hazardous gases (such as flammable, toxic, or corrosive substances) (e.g., a yellow background and black letters).

Signs should be conspicuously posted in areas where flammable compressed gases are stored, identifying the substances and appropriate precautions (e.g., HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES).

## Handling & Use



**Gas cylinders must be secured at all times to prevent tipping.**

Cylinders may be attached to a bench top, individually to the wall, placed in a holding cage, or have a non-tip base attached. Chains or sturdy straps may be used to secure them.

**If a leaking cylinder is discovered, move it to a safe place (if it is safe to do so) and inform the Environmental Health & Safety Department.** You should also call the vendor as soon as possible.

**Under no circumstances should any attempt be made to repair a cylinder or valve.**

Standard cylinder-valve outlet connections have been devised by the Compressed Gas Association (CGA) to prevent mixing of incompatible gases. The outlet threads used vary in diameter; some are internal, some are external; some are right-handed, some are left-handed. In general, right-handed threads are used for non-fuel and water-pumped gases, while left-handed threads are used for fuel and oil-pump gases.

To minimize undesirable connections, only CGA standard combinations of valves and fittings should be used in compressed gas installations; the assembly of miscellaneous parts should be avoided. The threads on cylinder valves, regulators and other fittings should be examined to ensure they correspond and are undamaged.

Cylinders should be placed with the valve accessible at all times. The main cylinder valve should be closed as soon as it is no longer necessary that it be open (i.e., it should never be left open when the equipment is unattended or not operating). This is necessary not only for safety when the cylinder is under pressure, but also to prevent the corrosion and contamination resulting from diffusion of air and moisture into the cylinder after it has been emptied.

Cylinders are equipped with either a hand wheel or stem valve. For cylinders equipped with a stem valve, the valve spindle key should remain on the stem while the cylinder is in service. Only wrenches or tools provided by the cylinder supplier should be used to open or close a valve. At no time should pliers be used to open a cylinder valve. Some valves may require washers; this should be checked before the regulator is fitted.

Cylinder valves should be opened slowly. Oxygen cylinder valves should be opened all the way. Open up the oxygen cylinder valve stem just a crack. Once the needle on the high pressure gauge has stopped, open up the valve all the way. This back-seats the valve. Oxygen cylinders must have the valve opened up all the way because of the high pressure in the cylinder. There is a back-seating valve on the oxygen cylinder. This prevents the high-pressure gas from leaking out through the threaded stem.

When opening the valve on a cylinder containing an irritating or toxic gas, the user should position the cylinder with the valve pointing away from them and warn those working nearby.



Cylinders containing flammable gases such as hydrogen or acetylene **must not** be stored in close proximity to open flames, areas where electrical sparks are generated, or where other sources of ignition may be present.

**Cylinders containing acetylene shall never be stored on their side.**

An open flame shall never be used to detect leaks of flammable gases. Hydrogen flame is invisible, so "feel" for heat. One common practice is to use a natural bristle broom to "sweep" the air in front of you. All cylinders containing flammable gases should be stored in a well-ventilated area.

Oxygen cylinders, full or empty, shall not be stored in the same vicinity as flammable gases. The proper storage for oxygen cylinders requires that a minimum of 20 feet be maintained between flammable gas cylinders and oxygen cylinders or the storage areas be separated, at a minimum, by a fire wall five feet high with a fire rating of 0.5 hours. Greasy and oily materials shall never be stored around oxygen; nor should oil or grease be applied to fittings.

**Regulators are gas specific and not necessarily interchangeable!**

**Always make sure that the regulator and valve fittings are compatible.**



If there is any question as to the suitability of a regulator for a particular gas, check with your vendor for advice. After the regulator is attached, the cylinder valve should be opened just enough to indicate pressure on the regulator gauge (no more than one full turn) and all the connections checked with a soap solution for leaks. **Never use oil or grease on the regulator of a cylinder valve.**

**The following rules should always be followed in regards to piping:**

- Copper piping shall not be used for acetylene.
- Plastic piping shall not be used for any portion of a high-pressure system.
- Do not use cast iron pipe for chlorine.
- Do not conceal distribution lines where a high concentration of a leaking hazardous gas can build up and cause an accident.
- Distribution lines and their outlets should be clearly labeled as to the type of gas contained.
- Piping systems should be inspected for leaks on a regular basis.
- Special attention should be given to fittings as well as possible cracks that may have developed.

A cylinder should never be emptied to a pressure lower than 172 kPa (25 psi/in<sup>2</sup>) (the residual contents may become contaminated if the valve is left open). When work involving a compressed gas is completed, the cylinder must be turned off, and if possible, the lines bled.



When the cylinder needs to be removed or is empty, all valves shall be closed, the system bled, and the regulator removed. The valve cap shall be replaced, the cylinder **clearly marked as "empty,"** and returned to a storage area for pickup by the supplier.

Empty and full cylinders should be stored in separate areas.

Where the possibility of **flow reversal** exists, the cylinder discharge lines should be equipped with approved check valves to prevent inadvertent contamination of cylinders connected to a closed system. "Sucking back" is particularly troublesome where gases are used as reactants in a closed system. A cylinder in such a system should be shut off and removed from the system when the pressure remaining in the cylinder is at least 172 kPa (25 psi/in<sup>2</sup>). If there is a possibility that the container has been contaminated, it should be so labeled and returned to the supplier.

**Liquid bulk cylinders** may be used in laboratories where a high volume of gas is needed. These cylinders usually have a number of valves on the top of the cylinder. All valves should be clearly marked as to their function. These cylinders will also vent their contents when a preset internal pressure is reached, therefore, they should be stored or placed in service where there is adequate ventilation.

**Always use safety glasses (preferably with a face shield) when handling and using compressed gases, especially when connecting and disconnecting compressed gas regulators and lines.**



All compressed gas cylinders, including lecture-size cylinders, must be returned to the supplier when empty or no longer in use.

## **Transportation of Cylinders**

The cylinders that contain compressed gases are primarily shipping containers and should not be subjected to rough handling or abuse. Such misuse can seriously weaken the cylinder and render it unfit for further use or transform it into a rocket having sufficient thrust to drive it through masonry walls.

1. To protect the valve during transportation, the cover cap should be screwed on hand tight and remain on until the cylinder is in place and ready for use.
2. Cylinders should never be rolled or dragged.
3. When moving large cylinders, they should be strapped to a properly designed wheeled cart to ensure stability.
4. Only one cylinder should be handled (moved) at a time.