UC RIVERSIDE | Environmental Health & Safety

Compressed Gas Safety

REFERENCE GUIDE

Compressed gas cylinders encompass a wide class of hazards-both physical and chemical. Due to high pressure inside the cylinders, they can be propelled with force that can cause extreme injury. Even with the pressure contained, the sheer weight of the cylinder can be dangerous to the body and as it will be discussed below, different gases may have several hazardous chemical properties.

Types of Compressed Gases

Non-liquefied	- also called compressed gases or permanent gases. They do not become liquid when they are compressed at normal temperatures, even at very high pressures. Examples: Oxygen, Nitrogen, Helium, Argon
Liquefied	- can become liquids at normal temperatures inside cylinders under pressure. Examples: Anhydrous Ammonia, Propane, Butane, Propylene, Carbon Dioxide
Dissolved	- chemically very unstable and can explode even at atmospheric pressure. The cylinders are usually packed with inert, porous filler saturated with acetone or other suitable solvent. Examples: Acetylene
Cryogens	- are liquefied gases that are kept in their liquid state at very low temperatures. These gases must be cooled below room temperature before an increase in pressure can liquefy them, and therefore have two properties in common: they are extremely cold, and small amounts of liquid can expand into very large volumes of gas. Examples: Liquid Oxygen, Liquid Nitrogen

Hazards of Gases

	**Flammables** – gases that ignite on contact with heat source. **Must notify EH&S prior to purchase of hydrogen.*		**Asphyxiants** – gases that displaces oxygen in the air (less than 19.5% of oxygen) causing suffocation.
	**Oxidizers** – gases that react with oxygen and oxidizing gases to produce heat or an explosive reaction.		**Toxics** – poisonous gases. **Must notify EH&S prior to Purchase for all.*
	**Pyrophorics** – gases that spontaneously ignite on contact with air. **Must notify EH&S prior to purchase for all.*		**Corrosives** – gases that cause skin or eye burns or irritation on contact or exposure.

Dry Ice

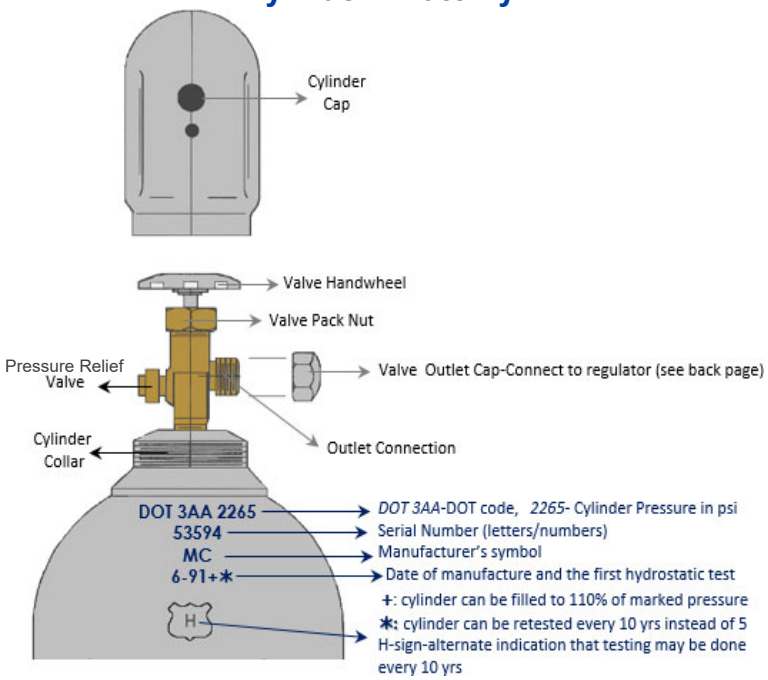
- Sublimates directly to CO_2
- Can displace oxygen
- Use in well ventilated areas
- Wear PPE and avoid skin contact

*Many gasses carry multiple hazards. Know all applicable gas hazards beyond the cylinder labeling.

Personal Protective Equipment

	**Eye and face protection** • Safety Glasses or Goggles • Face Shield
	**Non-absorbent, loose fitting gloves** • Leather Gloves • Cryogenic Gloves
	**Proper clothing** • Long Sleeve Lab Coat/Apron • Long Cuff-less Pants
	**Closed-toed shoes** • Steel-toe Shoes

Cylinder Anatomy



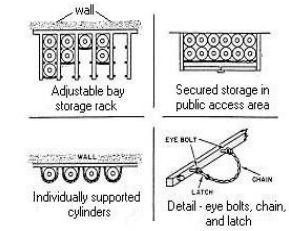
Compressed Gas Self-Inspection Checklist Tool:

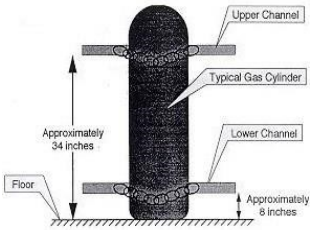
Pre-use

- ☐ Put on required personal protective equipment such as safety goggles, gloves, lab coats, long pants, and steel-toe or closed-toe shoes.
- ☐ Cylinder labels are in place and legible.
- ☐ The cylinder has been periodically tested by the manufacturer or vendor (within last 5 years).
- ☐ Read the Safety Data Sheets (SDS) to become familiar with the hazards of the contents of the cylinder.
- ☐ No visible damage on the cylinder such as dents, corrosions, or burns.
- ☐ No tear on any tubing or hoses or damage to the regulators.
- ☐ Know the location of your emergency eyewash and showers, fire extinguishers and evacuation routes.

Storag

- ☐ Cylinder caps are in place when not in use.
- ☐ Cylinders are stored upright in racks or double chained.
- ☐ Each individual cylinder is secured with two non-combustible restraints. The preferred location for restraints are on the bottom and top third of the cylinder.
- ☐ Cylinders are not blocking or obstructing any exits or pathways.
- ☐ Cylinders are stored in dry, cool, well-ventilated areas. Keep away from excessive heat, continuous dampness, corrosive chemicals.
- ☐ Separately store incompatible gases such as,
  - Oxygen and fuel gases (minimum of 20ft distance or separated by fire-resistant partition);
  - Corrosive gases and flammable substances such as gasoline or oil
  - Full and empty cylinders.
- ☐ Empty cylinders are labeled or tagged. The cylinder is considered empty at 25psi; never empty all the way to zero.
- ☐ Place toxic and corrosive gas cylinders in approved cabinets.



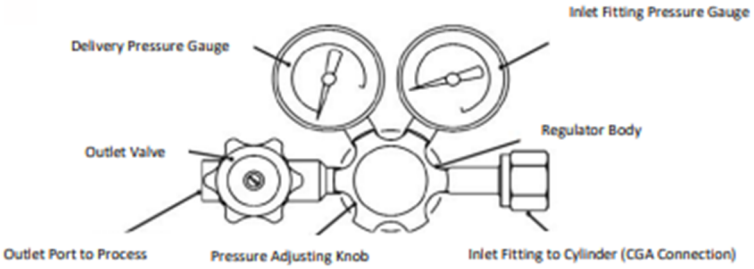


Transport

- ☐ Ensure the regulator has been removed.
- ☐ Valves are tightly closed and covered with cap.
- ☐ Use proper material handling equipment such as hand carts with chains to secure cylinders when transporting even at short distances.
- ☐ Keep the cylinder as close to a full upright position. Do not transport horizontally.

Regulator Installation

- ☐ Use an approved regulator wrench when opening and closing valves. Use non-sparking tools with flammables.
- ☐ Install regulator with compatible pressure rating and gauge range and only install with correct CGA fitting.



- ☐ Ensure there is no debris, grease, or contaminants in the cylinder outlet connection.
- ☐ Inspect for damage to the regulator CGA connection.
- ☐ If the CGA connector of the regulator is designed to have a washer, replace with new washers when changing cylinders.
- ☐ The regulator is tightly connected. Do not use plumbers' Teflon tape.
- ☐ Once the regulator is installed, close the outlet valve tightly before slowly turning on the valve one and a half turns.
- ☐ Apply leak-detection liquid (such as Snoop) to find leaks.
- ☐ With face to the side of the gauges, slowly turn the pressure adjusting knob until it reaches the desired pressure.

In case of a cylinder leak:

- If leak becomes uncontrollable and there is risk of hazardous material release, call 911 and stay with on the call until the first responders arrive at the scene.
- Never conduct your own repair of any cylinder leaks. If handling of a leaking cylinder could be done in a safe manner, move the cylinder in a well-ventilated and isolated area away from any combustibles, ignition sources, and other flammable materials.
- Have the supplier or vendor contact information to provide to the first responders.
- Emergency evacuation and response procedures must be part of lab safety training included in the SOPs.