







Compressed Gas Safety

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 will be discussed below, different gases may have several hazardous chemical properties.

Types of Compressed Gases	<p>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</p>
	<p>Liquefied - can become liquids at normal temperatures inside cylinders under pressure. Examples: Anhydrous Ammonia, Propane, Butane, Propylene, Carbon Dioxide</p>
	<p>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</p>
	<p>Cryogenics - 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</p>




Hazards of Gases		Flammables – gases that ignite on contact with heat source.
		Oxidizers – gases that react with oxygen and oxidizing gases to produce heat or an explosive reaction.
	 PYROPHORICS	Pyrophorics – gases that spontaneously ignite on contact with air.
		Asphyxiants – gases that displace oxygen in air (less than 19.5% of oxygen) causing suffocation.
		Toxics – poisonous gases. *Must notify Campus Fire Marshall or EH&S prior to purchase of toxic/poison gases.
	 CORROSIVE	Corrosives – gases that cause skin or eye burns or irritation on contact or exposure.

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

Dry Ice

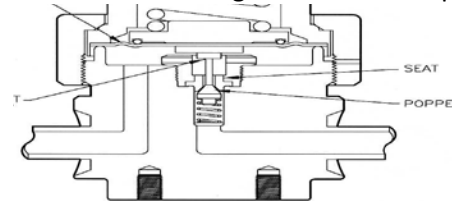
- Sublimates directly to CO₂
- Can displace oxygen
- Use in well ventilated areas
- Wear PPE and avoid skin contact



Personal Protective Equipment		<p>Eye and face protection</p> <ul style="list-style-type: none"> • Safety Glasses or Goggles • Face Shield
		<p>Non-absorbent, loose fitting gloves</p> <ul style="list-style-type: none"> • Leather Gloves • Cryogenic Gloves
		<p>Proper clothing</p> <ul style="list-style-type: none"> • Long Sleeve Lab Coat/Apron • Long Cuff-less Pants
		<p>Closed-toed shoes</p> <ul style="list-style-type: none"> • Safety Shoes

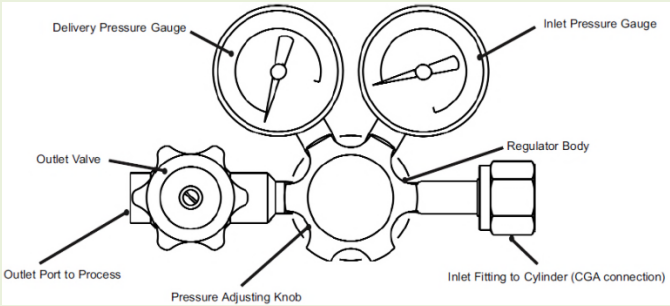
Regulator Failures:

- Pressure creep on the delivery pressure gauge indicates foreign materials, corrosion build up, or contamination lodged between the poppet and seat.



- Pressure gauge not reading zero indicates the bourdon tube has been damaged and the gauge must be replaced.
- Gas leaking through the bonnet assembly indicates a diaphragm failure typically caused by failure to ensure regulator is shut off prior to installing on a new cylinder.

Compressed Gas Self-Inspection Checklist Tool:

Pre-use	<ul style="list-style-type: none"> ✓ Dock on proper personal protective equipment such as safety goggles, gloves, lab coats, long pants, and steel-toe or closed-toe shoes. ✓ Make sure cylinder labels are in places and legible. ✓ Make sure that the cylinder has been periodically tested by the manufacturer or vendor. ✓ Read the Safety Data Sheets (SDS) to become familiar with the hazards of the contents of the cylinder. ✓ Make sure that there is no visible damage on the cylinder such as dents, corrosions, or burns. ✓ Also make sure that there are 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.
Storage	<ul style="list-style-type: none"> ✓ Cylinder caps are in place when not in use. ✓ Cylinders are stored upright in racks or double chained. ✓ Cylinders are securely chained/strapped on the bottom and top third of its height. ✓ Cylinders are not blocking or obstructing any exits or pathways. ✓ Cylinders are stored away from excessive heat, continuous dampness, corrosive chemicals instead store in dry, cool, well-ventilated areas. ✓ Separately store <ul style="list-style-type: none"> ▪ Incompatible gases such as flammable gases away from oxidizing gases; ▪ Oxygen and fuel gases (minimum of 20ft distance or separated by fire-resistant partition); ▪ Full and empty cylinders; ▪ Compressed gases and flammable substances such as gasoline, oil, or wastes. ✓ Empty cylinders are labeled or tagged. Cylinder is considered empty at 25psi; never empty all the way. ✓ Place toxic and corrosive gas cylinders in approved cabinets.
Transport	<ul style="list-style-type: none"> ✓ Ensure regulator is detached. ✓ Valves are tightened, closed, and covered with cap. ✓ Use proper material handling equipment such as hand carts with chain links to secure cylinders when transporting even at short distances. ✓ Keep the cylinder close to upright position not horizontal.
Regulator	<ul style="list-style-type: none"> ✓ Use an approved regulator wrench when opening and closing valves. ✓ Install on regulator with compatible pressure rating and gauge range and only install with correct CGA fitting. ✓ Make sure that there is no debris, grease, or contaminant in the cylinder outlet connection. ✓ Inspect for damage to the regulator CGA connection. ✓ If regulator is designed to have a washer, replace CGA connector with new washers when changing cylinders. ✓ Regulator is tightly connected without any use of a plumbers tape. <div style="text-align: center; margin: 10px 0;">  </div> <ul style="list-style-type: none"> ✓ Once regulator is installed, close the outlet valve before slowly turning the cylinder valve to a turn and a half. ✓ Apply leak-detection liquid (such as Snoop) to find leaks. ✓ Turn the pressure adjusting knob until it reach the desired pressure.
Leaks	<ul style="list-style-type: none"> ✓ 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. ✓ If the gas is flammable or toxic, place an appropriate sign at the cylinder warning of these hazards. ✓ Notify the gas supplier and follow their instructions as to the return of the cylinder. ✓ Emergency evacuation and response procedures must be put in place and practice, if leak becomes uncontrollable and there is risk of hazardous material release.