

3.9. Compressed Gases – Procedures for Safe Handling and Storage

In general, a compressed gas is any material contained under pressure that is dissolved or liquefied by compression or refrigeration. Compressed gas cylinders must be handled as high-energy sources and therefore as potential explosives and projectiles. Prudent safety practices must be followed when handling compressed gases because they expose workers to both chemical and physical hazards.

This section provides general standard operating procedures for use of compressed gases in laboratories. For further information refer to the [IU Compressed Gas Cylinder Safety Program](#).

3.9.1. Handling

- Safety glasses with side shields (or safety goggles) and other appropriate personal protective equipment must be worn when working with compressed gases.
- Cylinders must be marked with a label that clearly identifies the contents.
- All cylinders must be checked for damage prior to use. Do not repair damaged cylinders or valves. Damaged or defective cylinders, valves, etc., must be taken out of use immediately and returned to the manufacturer/distributor for repair.
- All gas cylinders (full or empty) must be rigidly secured above the mid-line of the cylinder. Only two cylinders per restraint are allowed in the laboratory and only soldered link chains or belts with buckles are acceptable. Cylinder stands are also acceptable but not preferred.
- Handcarts shall be used when moving gas cylinders. Cylinders must be chained to the carts.
- All cylinders must be fitted with safety valve covers before they are moved.
- Only three-wheeled or four-wheeled carts should be used to move cylinders.
- A pressure-regulating device shall be used at all times to control the flow of gas from the cylinder.
- The main cylinder valve shall be the only means by which gas flow is to be shut off. The correct position for the main valve is all the way on or all the way off.
- Cylinder valves must never be lubricated, modified, forced, or tampered. Regulator fittings must not be sealed with Teflon tape, grease or pipe sealant. Never grease any oxygen fittings (use PTFE Teflon tape only).
- After connecting a cylinder, check for leaks at connections. Periodically check for leaks while the cylinder is in use.
- Regulators and valves must be tightened firmly with the proper size wrench. Do not use adjustable wrenches or pliers because they may damage the nuts.
- Cylinders must not be placed near heat or where they can become part of an electrical circuit.
- Cylinders must not be exposed to temperatures above 50o C (122o F). Some rupture devices on cylinders will release at about 65o C (149o F). Some small cylinders, such as lecture bottles, are not fitted with rupture devices and may explode if exposed to high temperatures.
- Rapid release of a compressed gas must be avoided because it will cause an unsecured gas hose to whip dangerously and also may build up enough static charge to ignite a flammable gas.
- Appropriate regulators must be used on each gas cylinder. Threads and the configuration of valve outlets are different for each family of gases to avoid improper use. Use the Compressed Gas Association (CGA) numbered fittings appropriate for the gas in use. Consult manufacturer's catalogs for the appropriate equipment. Adaptors and homemade modifications are prohibited.
- Cylinders must never be bled completely empty. Leave a slight pressure to keep contaminants out.
- Gases shall not be transferred from one compressed gas cylinder to another.

3.9.2. Storage

- When not in use, cylinders must be stored with their main valve closed and the valve safety cap in place.
- Cylinders with less than 1.3 gallons water volume may be stored on their side. All cylinders must be secured. Dissolved gases such as acetylene (which is dissolved in acetone) must be stored upright (see Special Precautions). The pressure relief device on cylinders of gases that are liquid under pressure (such as some flammable gases) must be in contact with the gas phase.
- Cylinders awaiting use and empty cylinders must be stored according to their hazard classes.
- Cylinders must not be located where objects may strike or fall on them.
- Cylinders must not be stored in damp areas or near salt, corrosive chemicals, chemical vapors, heat, or direct sunlight. Cylinders stored outside must be protected from the weather.
- Corrosive gas cylinders must be returned for disposal every two years.

3.9.3. Special Precautions

3.9.3.1. Flammable Gases

- No more than two cylinders can be manifolded together; however several instruments or outlets are permitted for a single cylinder.
- Valves on flammable gas cylinders must be shut off when the laboratory is unattended and no experimental process is in progress.
- Flammable gas cylinders must be grounded. (Do not ground to an electrical outlet.)
- Flames involving a highly flammable gas must not be extinguished until the source of the gas has been safely shut off; otherwise it can reignite causing an explosion.

3.9.3.2. Acetylene Gas Cylinders

- Acetylene cylinders must always be stored upright. They contain acetone, which can discharge instead of or along with acetylene. Do not use an acetylene cylinder that has been stored or handled in a non-upright position until it has remained in an upright position for at least 30 minutes.
- The outlet line of an acetylene cylinder must be protected by a flame arrestor.
- Compatible tubing must be used to transport gaseous acetylene. Some tubing like copper forms explosive acetylides.

3.9.3.3. Lecture Bottles

- All lecture bottles must be marked with a label that clearly identifies the contents.
- Lecture bottles must be stored according to their hazard classes.
- Lecture bottles which contain toxic gases must be stored in a ventilated cabinet.
- Lecture bottles must be secured in storage and when in use, secured to a fixed frame or structure.
- Lecture bottles must not be stored near corrosives, heat, direct sunlight, or in damp areas.
- To avoid costly disposal fees, lecture bottles should only be purchased from suppliers that will accept returned bottles (full or empty). Contact the supplier before purchasing lecture bottles to ensure that they have a return policy.
- Lecture bottles should be dated upon initial use. It is advised that bottles be sent back to the supplier after one year to avoid accumulation of old bottles.