

Compressed Gases--Generic Procedure for Safe Handling and Storage¹

(see <http://safety.dri.edu/Programs/Compressed.pdf> for additional details)

In general, a compressed gas is any material contained under pressure that is dissolved or liquefied by compression or refrigeration. Compressed gas cylinders should be handled as high energy sources and therefore as potential explosives and projectiles. Prudent safety practices should be followed when handling compressed gases since they expose workers to both chemical and physical hazards. For more detailed information, refer to the [DRI Use, Handling and Storage of Compressed Gases and Cryogenic Liquids](#) procedure.

Handling

- Safety glasses with side shields (or safety goggles) and other appropriate PPE must be worn when working with compressed gases.
- Cylinders must be marked with a label that easily visible and 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 to a substantial structure at 2/3 height. Double chaining is preferred and only link chains or belts with buckles are acceptable. Cylinder stands are also acceptable but not preferred.
- Gas cylinder hand carts shall be used when moving gas cylinders. Only three-wheeled or four-wheeled carts should be used to move cylinders. Cylinders must be chained to the carts.
- Plan the route of transport. The best practice is to avoid using an elevator. If an elevator cannot be avoided, send the cylinder to the required floor in an empty elevator, with a warning sign posted. A co-worker should be waiting on the other level to receive the cylinder.
- All cylinders must be fitted with safety valve covers before they are moved.
- A pressure-regulating device shall be used at all times to control the flow of gas from the cylinder. The appropriate regulator for the gas must be used. (Threads and the configuration of valve outlets are different for each family of gases to avoid improper use. Adaptors and homemade modifications to regulators are prohibited.)
- 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 should never be lubricated, modified, forced, or tampered.
- Regulators and valves should be tightened firmly with the proper size wrench. Do not use adjustable wrenches or pliers because they may damage the nuts.
- After connecting a cylinder, check for leaks at connections. Periodically check for leaks while the cylinder is in use.
- 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 122° F (50° C). Some rupture devices on cylinders will release at about 149° F (65° C). Some small

¹Additional topics, such as appropriate PPE, spill procedures, disposal, etc., must be added in order to use this document as a stand alone training tool to satisfy lab specific training requirements.

Compressed Gases--Generic Procedure for Safe Handling and Storage¹

(see <http://safety.dri.edu/Programs/Compressed.pdf> for additional details)

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 shall 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.
- Cylinders must never be bled completely empty. Leave a slight pressure to keep contaminants out.

Storage

- When not in use, cylinders shall be stored with their main valve closed and the valve safety cap in place.
- Segregate and clearly mark full and empty cylinders.
- Toxic gases (NFPA health hazard rating of 3 or 4) should be stored and used in a ventilated hood or gas cabinet. An area monitor with alarm should be used if a ventilated enclosure is not used, and when the toxic gas has poor warning properties (such as carbon monoxide). Contact EH&S for specific guidance
- Cylinders must be stored upright and not on their side. All cylinders must be secured.
- Cylinders awaiting use must be stored according to their hazard classes.
- Cylinders should 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 should be protected from the weather.

Maximum Number of Gas Cylinders:

The maximum amount of compressed gas or liquefied gas cylinders per control area (generally an area enclosed by exterior and/or corridor walls) are:

Flammable Gas	2000 ft ³
Oxidizing Gas (including oxygen)	3000 ft ³
Corrosive Gas	1620 ft ³
Toxic Gas	1620 ft ³
Highly Toxic Gas*	20 ft ³

*Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures.

Note¹: Above limits are based on the International Fire Code with additional allowance given for DRI buildings being equipped with sprinklers. For areas without sprinklers, the maximum is 50% of the amounts listed above.

Note²: Contact EH&S if there is a need to have more than 500 ft³ of any of the above groups in individual labs. This is to ensure that storage limits within a control area are not exceeded.

¹Additional topics, such as appropriate PPE, spill procedures, disposal, etc., must be added in order to use this document as a stand alone training tool to satisfy lab specific training requirements.

Special Precautions

Flammable Gases:

- Low melt point piping must not be used with flammable gases.
- Manifolds systems shall be designed and constructed by competent personnel who are thoroughly familiar with the requirements for piping of flammable gases. Manifolds shall comply with the standards of a recognized safety authority (i.e., Underwriters Laboratories, Compressed Gas Association). Consultation with the gas supplier before installation of manifolds is recommended.
- Valves on flammable gas cylinders must be shut off when the laboratory is unattended and no experimental process is in progress.
- 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.
- Heat generated by flames associated with the use of flammable gases in laboratories must be vented.

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.
- A flame arrestor must protect the outlet line of an acetylene cylinder.
- Compatible tubing must be used to transport gaseous acetylene. Some tubing like copper forms explosive acetylides.

Lecture Bottles:

- All lecture bottles must be marked with a label that clearly identifies the contents.
- Lecture bottles shall be stored according to their hazard classes.
- Lecture bottles that contain toxic gases shall be stored in a ventilated cabinet.
- Lecture bottles must be stored in a secure place to eliminate them from rolling or falling.
- Lecture bottles shall not be stored near corrosives, heat, direct sunlight, or in damp areas.
- To avoid costly disposal fees, lecture bottles must only be purchased from suppliers that will accept returned bottles (full or empty). Contact the supplier before purchasing to ensure that they have a return policy.
- Lecture bottles must 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.

¹Additional topics, such as appropriate PPE, spill procedures, disposal, etc., must be added in order to use this document as a stand alone training tool to satisfy lab specific training requirements.