



**COMPRESSED GASES AND CRYOGENIC LIQUIDS  
STANDARD OPERATING PROCEDURE**

**I. Purpose**

To minimize exposure to fire and explosion hazards associated with the use and storage of compressed gas cylinders, as well as prevent deaths and injuries from compressed gases and cryogenic liquids. This Standard Operating Procedure (SOP) includes information on compressed gas cylinders and cryogenic gases/liquids.

**II. Recommended Safe Practices for Handling/Storage of Compressed Gasses**

**General Safety Requirements**

- a. All containers shall have their contents identified on the label. Color shall not be used to identify container content. Containers not bearing a legibly written, stamped, or stenciled identification shall not be used and shall be returned to the supplier.
- b. The fittings on vessels should not be modified under any circumstances.
- c. All compressed gas cylinders, either in use or in storage (empty or full), shall be secured in an upright position by means of a strap, chain or rack. NOTE: Chains and straps secured to the wall should be attached to studs rather than sheet rock to ensure secure points of attachment and shall be around the upper third of the cylinder.
- d. Suitable hand trucks, equipped with safety chains, shall be utilized when transporting gas cylinders. Cylinders shall never be transported in the horizontal position or dragged. Never use the cylinder valve as a handle to move a cylinder.
- e. Ropes, chains or slings shall not be used to suspend containers unless equipped with appropriate lifting attachments such as lugs. Where attachments have not been provided, suitable cradles or platforms to hold the containers shall be used for lifting.
- f. Protective valve caps must be in place when cylinders are not in use. Do not switch caps since not all suppliers use the same cap threads.
- g. Container valves shall be closed at all times (full or empty) except when the container is in use. Valve outlets shall be pointed away from all personnel when the valve is being opened.
- h. All cylinders, lines, and equipment used with flammable compressed gases shall be grounded. Cylinders used in conjunction with electric welding shall not be grounded or used for grounding.
- i. When in use, all cylinders must be equipped with an appropriate regulating device. All regulators must be marked to identify the gas (or group of compatible gases)

with which the regulator is to be used. Regulator threads must match cylinder valve outlet threads.

- j. Adapters shall never be used to attach a regulator to a cylinder that it is not designed.
- k. When a cylinder is in use, a hand wheel, valve handle, spindle key or special tool to open the cylinder valve shall be attached to the cylinder so that it will be available immediately in the event of an emergency.
- l. Cylinders containing compressed gases shall be used only in well-ventilated areas.
- m. Cylinders containing toxic or flammable gases must be stored in an approved storage area. Storage areas shall be prominently posted with the hazard class or the name of the gases stored.
- n. Containers shall not be stored near elevators, walkway, unprotected platform edges, or in locations where heavy moving objects may strike or fall on them. Stored containers (inside or outside) shall not obstruct exit routes or other areas normally used or intended for the safe exit of personnel.
- o. Cylinders containing oxidizing gases, such as oxygen and nitrous oxide, shall be stored separately from flammable gases or liquids. Separation will be 25 feet or by a fire-rated wall.
- p. Flammable gases shall be stored in well-ventilated areas away from oxidizers, open flames, sparks, and other sources of heat or ignition.
- q. Empty cylinders shall be so identified and stored separately from full or partially full cylinders.
- r. Compressed gas cylinders shall be used only for their intended purposes.
- s. Compressed gases should be handled only by experienced and properly instructed personnel.

### **III. Recommended Safe Practices for Handling/Storage of Cryogenic Liquids**

Cryogenic liquids are gases handled in liquid form at relatively low pressures and extremely low temperatures (usually below -130 deg F (-90 deg C)). Because of their low temperatures, cryogenic liquids are handled in double-wall, vacuum-insulated containers to lessen evaporation and venting of gas. Some cryogenic liquids in small quantities are also handled in open, low pressure, thermos-type containers (dewars) in laboratory work.

- a. When handling cryogenic liquids, wear suitable eye protection, such as a face shield and safety glasses or safety goggles.
- b. Wear hand protection, such as insulated gloves, to prevent contact with cold liquid, cold gas, and cold equipment or piping. Gloves should be loose fitting so that they can be readily removed in the event liquid is splashed into them.
- c. Wear cuff-less trousers over (outside) high-topped shoes to prevent spills from being trapped in shoes or allowed to contact the feet.
- d. Handle and store containers in an upright position.
- e. The containers shall not be dropped, tipped over, or rolled on their sides. Use a four-wheel hand truck designed to move such containers to move cryogenic liquefied gas containers with a capacity greater than 20 gal (76 L).
- f. Store and handle cryogenic liquefied gas containers in well-ventilated areas to prevent hazardous concentration of the gas.

- g. Containers and equipment assigned for a specific cryogenic liquefied gas service shall not be used for the storage or use of another cryogenic liquefied gas.
- h. Provide gas containers with pressure relief devices adequate to relieve excessive pressures within the containers.
- i. Where cryogenic liquefied gas or cold gas may be trapped in piping between valves, equip the piping with a pressure relief device. Only transfer lines designed for cryogenic liquefied gases shall be used. It is recommended that all vents be piped to the exterior of the building.
- j. Store and transfer cryogenic liquids under positive pressure to prevent the infiltration and solidification of moisture, air, or other gases.

#### **IV. Training**

All personnel working with compressed gas cylinders shall be trained in safety and proper procedures.

Training should include the following as a minimum, as applicable:

- a. General safety procedures for use with compressed gas cylinders or medical gases including:
  - i. safety hazards associated with the gases
  - ii. hazards associated with high-pressure cylinders
  - iii. hazards associated with the specific equipment
  - iv. hazards associated with contaminated tools, parts, etc.
- b. Procedures to prevent cross connections of medical gas pipelines. NOTE: Many older outlets are not inherently safe from cross connection due to common threads or fittings used for different gases.
- c. Mechanical skills required for work on equipment.
- d. Procedures to follow prior to any shutdown of a service or during an emergency.
- e. Location, operation, and areas controlled for all valves.

Training should be conducted and documented annually. Training records shall be kept for at least three years. Training materials are available on the [TTU Environmental Health and Safety website](#).

#### **V. Inspection**

Environmental Health and Safety (EHS) shall conduct hazard surveillance of all laboratories annually. During the annual site visit the storage and use of compressed gas cylinders/cryogenic liquids shall be evaluated. Deficiencies shall be noted on the standard inspection form and communicated to the responsible individual. The person responsible for the area that contains cylinder deficiencies shall make corrections and respond to the EHS.

#### **VI. Chemical Inventory**

Compressed gas cylinders shall be included on the chemical inventory for each department that contains these vessels.

## **VII. Associated Standards**

Compressed Gas Association (CGA) Pamphlet, CGA P-1, "Safe Handling of Compressed Gases in Containers"

Compressed Gas Association (CGA) Pamphlet, CGA P-12, "Safe Handling of Cryogenic Liquids"

NFPA Codes 43-A, 43-C, 45, 50-A, 51, 58, 70, and 77

OSHA 29 CFR 1910, Subpart H