

Chapter 14: [Pressure Systems](#)

# Compressed Gas Cylinder and Dewar Storage and Handling Requirements

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URL: <https://www-esh.slac.stanford.edu/eshmanual/references/pressureReqCGCHandling.pdf>

## 1 Purpose

The purpose of these requirements is to ensure the safe handling and use of *compressed gas cylinders (cylinders)* and pressurized cryogenic liquid containers (*dewars*).

They cover storage and handling, labeling, and removal.

They apply to workers and supervisors.

## 2 Requirements

The following are the storage and handling requirements for compressed gas cylinders (cylinders) throughout their lifecycle at SLAC.

**Important** In addition to the following requirements, adhere to the equipment manufacturer's instructions and complete applicable training with an experienced equipment user.

When a cylinder or dewar is connected to a gas system, it becomes a part of the compressed gas system (see [Pressure Systems: Installation, Inspection, Testing, Maintenance, and Repair Requirements](#)).

### 2.1 Storing Cylinders and Dewars

- Store adequately secured containers upright on solid, dry, level footing, preferably outside of occupied buildings and away from traffic lanes.
- Store containers away from sources of intense heat (furnaces, steam lines, radiators).
- Do not stockpile gas, especially flammables, poisons, or corrosives, beyond the amount required for immediate use.
- Ensure that containers stored or used in public areas are protected against tampering and damage. Furthermore, containers stored inside or outside must not obstruct exits routes or other areas that are normally used or intended for the safe exit of people.
- Always store cylinders with protective caps in place.
- For additional information on storage, see [Chemical Lifecycle Management: Chemical Storage Asset Requirements](#).

## 2.2 Securing Cylinders

All compressed gas cylinders in service or storage at the user's location must be secured to prevent them from falling. Gas cylinders with a water volume of less than 5 L (305 cubic inches) may be stored in a horizontal position, as long as they are prevented from rolling, and will be considered adequately secured.

### 2.2.1 Individual Cylinders

- Use appropriate material, such as chain or commercially available straps.
- Use two restraints to secure cylinders that are four or more feet in height. Place one restraint around the cylinder body above the cylinder's center of gravity; place the second restraint around the cylinder body below the cylinder's center of gravity. (A good rule of thumb is to place the restraints at one third and two thirds the length of the cylinder).
- Smaller cylinders can be secured in cages, ventilated cabinets, or stands.

### 2.2.2 Cylinders in Six-unit Stands

- When storing six-unit stands (*six-packs*), individually secure each gas cylinder to the stand using a single restraint.
- Restrain the stand itself in a cage or secure it to a wall or to the ground.

## 2.3 Securing Dewars

- Individually secure each dewar to the wall or structure designed to withstand the loads of such unit using a single restraint, preferably a nylon strap over a chain.

## 2.4 Handling Cylinders

- Ensure that the protective valve cover is in place when a cylinder is not connected to a regulator or manifold.
- Always assume a cylinder is pressurized: handle it carefully and avoid bumping or dropping. Never drop cylinders to the ground from trucks or any raised surface.
- Lifting a standard cylinder, or any cylinder weighing more than 50 pounds, requires two people, for example, a cylinder containing carbon dioxide or sulfur hexafluoride can weight up to 250 pounds.

**Warning** If a container is falling or off balance, move out the way and let it fall.

- Never lift a cylinder by the cylinder cap.
- Do not handle oxygen cylinders with greasy, oily hands or gloves. The reaction between oxygen and hydrocarbons can be violent, even when small quantities are involved.
- Secure cylinders in suitable cradles or skid boxes before raising them with cranes, fork trucks, or hoists. Do not use ropes or chain slings alone for this purpose.
- Never use a gas cylinder as a roller for moving materials or for supporting other items.

- While transporting cylinders inside elevators, use a suitable material-handling device such as a hand truck and hold the cart during the whole transport from one floor to another. The user must use the elevator alone, no other person is allowed in the elevator.

## 2.5 Handling Dewars

Dewars can present a risk to personnel handling them when they are moved. These units are very heavy; for example, a 240-liter container can weigh approximately 260 pounds (120 kilograms) empty and 1,000 pounds (450 kilograms) when filled with argon. If they fall or tip during movement, there is a risk of serious injury or fatality.

In addition to the hazards encountered by a tipping or falling container, the mass of these containers presents potential ergonomic hazards when moving them. Pushing, pulling, and turning these containers incorrectly can lead to musculoskeletal injuries to many body parts, including the back, arms, shoulders, legs, and more. Handlers should ensure that best practices regarding stretching, body positioning, and personal limitations are followed.

When possible, move these containers over surfaces that are smooth and even. Plan the path of movement before moving the container. When leaving a container unattended, ensure that the surface where the container is left will not cause it to roll or move on its own.

**Important** When or where the situation requires, ask for assistance.

Be aware that, when pushing the container, the forward view could be obstructed. Tools, equipment, or other objects should not be placed on the container during movement. Placing objects on the container can affect its center of gravity and, therefore, its tipping point and handling. When moving these containers, the handler should avoid placing themselves between the container and a structure or other object. Also, handlers should be aware of open edges on elevated surfaces.

All requirements for transporting cylinders apply to dewars. In addition, the following requirements apply for transporting dewars inside elevators:

- Use recommended personal protective equipment.
- Inspect the container for frosting or sweating at the bottom of the container, which can indicate a faulty or damaged vacuum jacket.
- Inspect the container for continuous venting. Cryogenic liquid containers that are continuously venting must not be transported in elevators.
- Ensure that any pressure building valves are closed.
- Inspect the pressure of the container by reading the pressure gauge. Ensure that the container's pressure is below the PRD's pressure setting and that the PRD has not recently been activated as indicated by frosting, sweating, or cool to the touch. If there are indications that the PRD has recently been activated, move the container to a well-ventilated area that is safe for the public, personnel, and the environment, then manually vent the pressure down to below the PRD's set pressure.
- Ensure that the container is transported in an upright position, not on its side.
- Use a freight elevator when available.
- No person is allowed to travel with the dewar from one floor to the next one.

- After loading the dewar and cart into the elevator, use the chain and signal to avoid personnel entering the elevator while in transit.
- A second person must be assigned to receive the dewar on the destination floor.

## 2.6 Empty Cylinders and Dewars

### 2.6.1 Handling

- Handle empty cylinders as carefully as full ones.
- Do not completely empty a cylinder; always leave some residual pressure (a minimum of 20 psig) to prevent “suck-back” and contamination.
- Once a cylinder is nearly empty, replace the cap and store it in a compressed gas cylinder storage area, segregated from filled cylinders.
- Label all empty cylinders with tags or write EMPTY or MT along with the date it was emptied using chalk or durable marker. If the cylinder has a yellow tag, be sure to tear off the IN SERVICE section to identify the cylinder for removal.
- Mark any unidentifiable cylinder CONTENTS UNKNOWN.
- Do not refill compressed gas cylinders: only gas suppliers can refill compressed gas cylinders.
- Only SLAC owned dewars can be refilled inhouse.

### 2.6.2 Return to Vendor

Once any SLAC-owned or return-to-vendor cylinder is empty, or once the gas in such a cylinder is of no further use, the cylinder must be returned to the vendor through chemical management services (CMS). Contact the [CMS coordinator](#) to initiate removal.

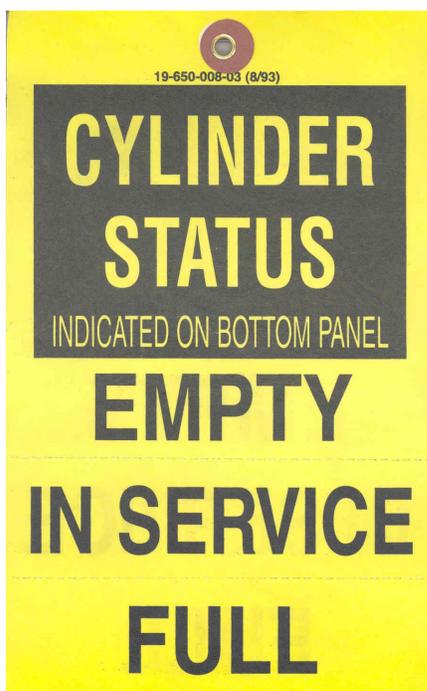
**Note** Cylinders labeled EMPTY with the vendor-supplied yellow tag will be removed automatically.

### 2.6.3 Damaged, Unidentifiable, or Abandoned Cylinders

To dispose of any damaged, unidentifiable, or abandoned cylinders, contact Waste Management (WM).

## 2.7 Tags

Cylinders are delivered with a yellow tag, as shown here. If a tag is missing, contact the [chemical coordinator](#).



**Figure 1** Cylinder Tag

The tag is used to indicate the status of the cylinder by tearing off successive tabs. Make sure the tag identifies the status of the cylinder accurately by ripping off the appropriate tab each time the status changes.

- **FULL**  
The original tag, which includes all status options, indicates that no gas has been discharged. If you discharge any gas, be sure to tear off the FULL tab.
- **IN SERVICE**  
IN SERVICE indicates that gas has been discharged. The cylinder is ready to be returned to the vendor when a small amount of pressure remains. (Do not discharge completely.) Tear off the IN SERVICE portion of the tag when the pressure is low.
- **EMPTY**  
The cylinder is ready for removal by the gas vendor.

### 3 Forms

The following are forms and systems required by these requirements:

- [Chemical Management Services](#). Information on ordering and tracking chemicals, includes links to safety data sheets

## 4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- None

## 5 References

[SLAC Environment, Safety, and Health Manual](#) (SLAC-I-720-0A29Z-001)

- [Chapter 14, “Pressure Systems”](#)
  - [Pressure Systems: Installation, Inspection, Testing, Maintenance, and Repair Requirements](#) (SLAC-I-730-0A21S-053)
  - [Pressure Systems Safety Program](#) (SharePoint)
- [Chapter 40, “Chemical Lifecycle Management”](#)
  - [Chemical Lifecycle Management: Management and Use Requirements](#) (SLAC-I-730-0A09S-038)
  - [Chemical Lifecycle Management: Chemical Storage Asset Requirements](#) (SLAC-I-730-0A09S-018)
- [Chapter 53, “Chemical Safety”](#)
  - [Chemical Safety: Hazard Communication Requirements](#) (SLAC-I-730-0A09S-042)

Other Documents

- Compressed Gas Association (CGA)
  - CGA P-1, “Safe Handling of Compressed Gases in Containers” ([CGA P-1](#))
  - CGA P-12, “Guideline for Safe Handling of Cryogenic and Refrigerated Liquids” ([CGA P-12](#))
  - CGA P-84, “Guideline for the Safe Handling of Liquid Containers on Wheel Bases” ([CGA P-84](#))
  - CGA PS-45, “Transport of Compressed Gas Cylinders and Cryogenic Liquid Containers in Elevators” ([CGA PS-45](#))