
	PRINCETON PLASMA PHYSICS LABORATORY ES&H DIRECTIVES		
	ES&HD 5008 SECTION 9, CHAPTER 2 Compressed Gas Cylinder Safety		
Approved:	Date: 2/16/07	Revision 3	Page 1 of 7

CHAPTER 2 COMPRESSED GAS CYLINDER SAFETY

2.1 INTRODUCTION

The use of compressed gas cylinders is a frequent adjunct to the Laboratory's daily operation. These cylinders contain gases that vary in chemical properties from inert and harmless to toxic and explosive. In addition, the high pressures of these gases constitute a serious hazard in the event that the cylinders are exposed to physical damage and/or high temperatures.

2.2 SCOPE

This chapter provides guidelines concerning the safe use of compressed gas cylinders in the Laboratory. Identification, inspections, transport, storage, installation, use, and disposal of gas cylinders are discussed. This chapter does not provide guidance for the protection of personnel against inhalation hazards associated with the accidental dispersion of gases (for details, refer to Section 8, "Industrial Hygiene," Chapter 7).

2.3 DEFINITIONS

Approved Testing Facility - A facility authorized and approved by the US Department of Transportation for requalification, repair, or rebuilding of cylinders. The facility must have a Requalification Identification Number (RIN) assigned by DOT.

Compressed Gas - A gas, other than in solution, that is in a packaging under charged pressure and is entirely gaseous at a temperature of 20 °C (68 °F).

DOT Cylinder - Cylinder meeting U.S. Department of Transportation Regulation 173.34.

Toxic Gas - A gas having a health rating of three or four, as defined by the National Fire Protection Association (NFPA) 704, "Standard System for the Identification of the Fire Hazards of Materials."

Standard Cylinder Status Tag - A tag attached to a compressed gas cylinder that gives the status of the cylinder as follows: full, in use, or empty.

2.4 RESPONSIBILITIES

2.4.1 Department or Division Heads are responsible for ensuring implementation of this section.

2.4.2 Line Supervisors/Users are responsible for direct implementation of this section. Specifically, Line Supervisors shall provide training in the proper use and handling of cylinders.

2.4.3 Industrial Hygiene (IH) is responsible for assisting in the interpretation and implementation of this section.

2.4.4 M&ES is responsible for administering the basic ordering agreement for the supply of industrial and specialty gases, and ensuring that the selected supplier:

H. Cylinders shall not be refilled by anyone other than the owner of the cylinder.

2.6.2 Cylinder Use

A. Moving and Handling

1. Caps shall be kept on at all times except when cylinders are physically connected to a regulator, manifold, or distribution apparatus.
2. Cylinders shall not be lifted by the cap.
3. Cylinders shall not be dropped or permitted to strike against each other or other surfaces violently.
4. Cylinders shall not be lifted with a lifting magnet. Slings, ropes, or chains should not be used unless provisions have been made on the cylinder by the manufacturer for appropriate lifting attachments, such as lugs. A crane may be used only when a safe cradle or platform is provided to hold the cylinders.
5. Cylinders shall be transported by suitable hand trucks, or rolled on the bottom edge. Rolling compressed gas cylinders on the bottom edge is an acceptable practice for short distances only, for example, moving the cylinder from a cart to its final resting place. Cylinder carts shall be the primary means of transporting compressed gas cylinders. Cylinders cannot be rolled when conditions are unsafe, such as when surfaces are icy or wet.
6. Before returning cylinders to the supplier, the valve shall be closed and the protective cap reattached.

B. Storing Cylinders

1. Compressed and liquefied gases in portable cylinders shall be stored in accordance with NFPA 55.
2. Cylinder storage areas shall be posted prominently with the types of gases to be stored.
3. Where gases of different types are stored at the same location, cylinders should be grouped by types of gas, and the groups arranged to take into account the types of gas contained, e.g., flammable gases shall not be stored next to oxidizing gases.
4. When oxygen and a fuel gas such as acetylene are to be stored, they shall be separated by a distance of twenty feet or by a non-combustible barrier at least five-feet high having a fire-resistance rating of one-half hour.
5. Cylinders shall not be stored near highly flammable or combustible substances, shall not be exposed to sparks or flames, and shall not be located where they could become part of an electrical circuit.
6. Charged and empty cylinders shall be stored separately. Old stock should be stored in an accessible area so as to be removed first. Empty cylinders shall have their valves closed.

7. The gas cylinder storage area shall be dry, cool, well ventilated, and fire resistant, where practical.
8. Heated storage areas shall be arranged so that stored cylinders or other containers cannot be spot-heated or heated above 125 °F (51.7 °C).
9. Cylinders should not be stored in the open; but in such cases where required, they shall be protected against extremes of weather. In summer certain gases when stored in the open should be protected from the continuous rays of the sun (refer to the supplier for specific recommendations). If ice or snow accumulates on a cylinder, it should be thawed at room temperature or with water at a temperature not exceeding 51 °C (125 °F).
10. Cylinders shall be protected from any object that will produce a cut or other abrasion in the surface of the metal. Do not store near elevators, stairs or gangways, or in locations where cylinders will be knocked over or damaged by passing or falling objects. Do not store cylinders in unventilated enclosures.
11. Cylinders shall not be exposed to continuous dampness and shall not be stored near salt or other corrosive chemicals or gases. Corrosion may damage the cylinders and may cause the valve-protective caps to stick.
12. Fuel gas storage inside a building shall be kept to no more than 2,000 cubic feet or 300 pounds of liquefied petroleum gas.
13. Cylinders shall not be stored on two or three wheeled carts. Four wheeled carts may be used for storage of cylinders if the cart is in a stable position with all wheels on the ground.

C. Installation

1. Compressed gas cylinders should be handled only by personnel who have attended the PPPL Training course, "Compressed Gas and Cryogenics Safety".
2. The user responsible for the cylinder and for its installation shall check the identity of the gas before use. The cylinder shall be returned to the supplier, unused, if the cylinder content is not identified, if hydrostatic test date is past due, or if the cylinder is in any way damaged.
3. Cylinders shall be secured properly (see paragraph E of this section).
4. Valve-protective caps shall be kept in place until the cylinder is connected to a regulator or manifold.
5. Suitable pressure regulating devices must be used in all cases where gas is admitted to systems designed for pressure less than cylinder pressure. Only regulators approved by the manufacturer for the gas being used and in good condition shall be installed.
6. Before connecting a cylinder to a regulator, the valve should be opened slightly and closed immediately. Stand to the side of the outlet, never in front of it. Never crack a flammable or oxygen cylinder near sparks, flame, or other sources of ignition.

B. Liquid Oxygen, Nitrogen, and Argon

DOT cylinders containing these gases must be transported, stored, and used in an upright position to permit venting of the vapor to maintain safe internal pressure (for details, see Section 9, Chapter 7, "Cryogenic Safety").

C. Oxygen - Oxygen cylinders shall not be stored within 20 feet of flammable gases or highly combustible materials, particularly oil or grease, as oil and grease in the presence of oxygen may ignite violently. Alternatively, oxygen may be separated from flammable and combustible materials by a fire rated wall at least five feet high.

1. Oil, grease, or other combustible material shall not come into contact with valves, regulators, gauges, or any fittings used with oxygen.
2. Such cylinders should never be handled with oily hands or gloves.
3. Oxygen shall never be used as a substitute for compressed air.

2.8 REFERENCES

DOT Regulation 49 CFR 178.

OSHA Regulation 29 CFR 1910.

CGA Pamphlet P-1, "Safe Handling of Compressed Gases."

NFPA 55, "Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Container."

NFPA 704, "Standard System for the Identification of the Fire Hazards of Materials."

DOT Regulation 49 CFR, Parts 171-179.

ANSI Z48.1-1954.