

COMPRESSED GAS CYLINDERS HANDLING, STORAGE & USE

NYC DEP GENERAL GUIDANCE

REVISION 1; EFFECTIVE AUGUST 20, 2009

1 Background

Compressed gases are unique in that they represent both a physical and a potential chemical hazard (depending on the particular gas). Gases contained in cylinders may be from any of the hazard classes (flammable, reactive, corrosive, or toxic). Because of the physical state (gaseous) of compressed gases, ambient concentrations in the facility can increase instantaneously if leaks develop at the regulator or piping systems, creating the potential for a toxic chemical exposure or a fire/explosion hazard. Often there is little or no indication that leaks have occurred or are occurring. The large amount of potential energy resulting from compression of the gas makes a compressed gas cylinder a potential rocket or fragmentation bomb if the tank or valve is broken.

OSHA regulation 29CFR 1910.101(a) requires employers to determine whether compressed gas cylinders under their control are in a safe condition to the extent that the cylinders' mechanical integrity can be determined by visual inspection. This general guidance and the attached checklist were developed in accordance with Compressed Gas Association (CGA) Pamphlets C-6-2001, C-8-1997 and P-1 2000 and are provided as a tool to assist DEP facilities/operations in meeting these requirements.

This guideline is not applicable to construction, for which OSHA has separate construction standard requirements (29 CFR 1926.350). The checklist does not pertain to small cylinders (30 lbs. water capacity or less) such as "lecture" size and small calibration gas bottles (hereafter referred to as "small cylinders"). The nominal exterior dimensions of small cylinders can be as much as 7"dia x 30"h or 9"dia x 17"h. Guidelines for these types of small quantity cylinders are provided in Section 10 and are based on CGA SB-27-2006. Liquefied gas cylinders (e.g., LPG or propane) are not addressed by this guidance; follow OSHA 29 CFR 1910.110 and applicable local regulations.

2 Definitions

Compressed gas [29CFR1910.1200(c)] -

- A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or
- A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); or
- A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72.

Containers (compressed gas) [CGA Pamphlet P-1, §1.3.6] - Vessels of various shapes, sizes, and materials of construction such as cylinders, portable tanks, or stationary tanks, and designs meeting the specifications of either the ASME (American Society of Mechanical Engineers), TC (Transport Canada), or the DOT (U.S. Department of Transportation).

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3 Acceptance Criteria for Receiving Gas Cylinders from the Vendor

Make certain that:

- Each cylinder is marked legibly with the contents, hazard warnings (physical/health hazards and target organ effects), name/address of supplier and, in New York City, the CAS number to identify its contents;
- The valve protection cap is securely in place;
- The hydrostatic test date stamped on the cylinder is current (generally required every 5 years or less for reusable cylinders);
- The cylinder is not leaking (hissing or bubbles which form when soap solution is applied to valve indicate a leak);
- The cylinder is not corroded, dented and bulging; and
- There is adequate space at the facility to safely secure, store and use.

A cylinder that does not meet the labeling acceptance criteria may be accepted if the appropriate labels are affixed. Other cylinders that do not meet the acceptance criteria should be rejected and not accepted for delivery, when feasible. If immediate rejection is not possible, mark the cylinder and arrange for its return to the vendor as soon as possible. If the tank is leaking, follow the emergency procedures detailed below in the emergency procedure section.

Figure 1 below shows the general arrangement of a gas cylinder.

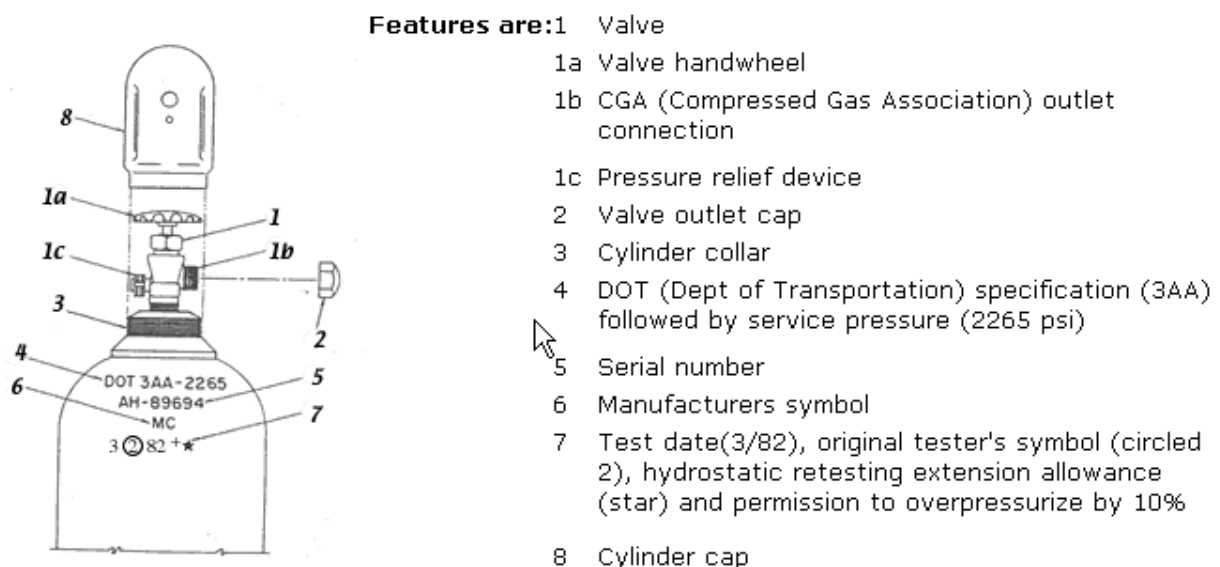


Figure 1 - Features Common to Gas Cylinders

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4 Proper Handling/Storage

Refer to DEP's procedure on FDNY Permits and Certificates of Fitness for a complete discussion of requirements for facilities in New York City.

- Upon receipt of cylinder affix a tag indicating its condition: full / in use / empty (unless there is a vendor tag or another system to separate full and empty containers).
- Cylinders are to be handled carefully. Rough handling can damage the cylinder, valve, or safety devices and cause leakage.
- Cylinders may only be transported when firmly secured to a handcart in upright position with the protective cap in place. Cylinders must never be rolled.
- Cylinders must be stored in well-ventilated areas with their protective caps (i.e., bonnets) in place. The protective caps on the cylinders should be hand-tight. Do not store cylinders near heat or high traffic areas. Keep cylinders separated at least 20 feet from flammable liquids and highly combustible materials, and do not store cylinders in a location subject to arcing electrical equipment, open flame, or other sources of ignition. Keep flammables separated from oxidizers by at least 20 feet in storage areas or by a noncombustible material barrier at least 5 ft high with a fire resistance rating of ½ hour or more.
- Storage of large quantities of cylinders (e.g., greater than 2,500 scf of flammable gases) must be in a separate gas cylinder storage area in accordance with relevant codes and standards (e.g., NFPA 55).
- Cylinders shall always be stored in an up-right position and secured with chain or straps to a sturdy immovable structure. In no case may the cylinder be secured to plumbing or electrical conduits.
- Safety devices shall not be tampered with.
- Limited amounts (e.g. a one day supply ready for connection) of flammable gases may be stored in the area of use when the gas is used for part of an ongoing operation only. Under no circumstances may the flammable gases be used or stored below grade level.
- The flammable gases must be stored separately from chemicals, acids and oxidizing agents. A capacity (water container capacity) of 9.24 cubic feet of flammables may be stored in up to 500 square feet of facility area.
- Flammable gas containers should not be stored in a location where they would be subject to arcing electrical equipment, open flame, or other sources of ignition.
- Verify that the construction of separate storage rooms and storage locations in shared occupancies meet all local codes (e.g., typically ≥ 1 hr. fire resistance for separate storage rooms).
- Do not expose cylinders in storage or use to temperatures above 125°F (52°C) and keep cylinders away from radiators or other sources of heat.

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- Containers shall not be placed where they might become part of an electrical circuit. When compressed gas containers are used in conjunction with electric welding, they shall not be grounded or used for grounding
- Toxic gases with an NFPA health hazard rating of 3 or 4 must have special provisions for storage and use (refer to NFPA 55, Section 3).

5 Cylinder Use

- A leak test must be performed every time a cylinder is put into use. This test is performed using a solution of soap and water. The formation of bubbles indicates a leak. Connections must be re-inspected and tightened as necessary. Perform the test until no bubbles are formed. Visual inspection of the cylinders, including attention to the pressure gauge, should be conducted regularly during use. An unexpected drop in pressure (a faster than anticipated usage) should be investigated by leak testing all connections. Defective cylinders will be taken out of service, removed from the area, and returned to the vendor as soon as possible.
- Connections - Threads on cylinder-valve outlet connections have been standardized by type by the Compressed Gas Association to prevent accidental mixing of incompatible gases from an interchange of connections. Most valve outlet connections are designed with metal-to-metal seals; use washers only if indicated. Do not use Teflon® tape on the valve threads to prevent leaking; the tape may become powdered and get caught on the regulator poppet causing full pressure downstream. Never lubricate, modify, force, or tamper with cylinder valves. Do not put oil or grease on the high-pressure side of a cylinder containing oxygen, chlorine, or another oxidizing agent. An autoignition or explosion may result.
- Cylinders must be used with proper regulator and tubing. Incompatible combinations can result in the formation of shock sensitive compounds; for example, acetylene must not be used with copper tubing. Never open a cylinder valve without the proper regulator installed.
- To prevent contamination of the inside of the cylinder, a small amount of gas must be left in the cylinder and the cylinder valves must be closed.
- Tear off the 'Full' portion of the indicator tag when cylinder is put into service. Tear off the 'In use' portion when cylinder is empty.
- Only cylinders that are in use shall be kept in the work area. All others, including empties, shall be stored in the designated compressed-gas cylinder storage area for the particular facility.
- The cylinders shall be returned to the designated storage area when there is no "reasonable anticipation" that gas will be used in the near future (i.e., a spare welding cart used for incidental field repair that has ended).

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- A single acetylene cylinder and a single oxygen-fuel cylinder may be left on a welding cart when it is anticipated that gas will not be drawn from the cylinder within 24 hours, if the following additional conditions are met:
 - a. Both cylinders have valves closed.
 - b. Protection caps are on or cylinders are connected to a properly functioning regulator.
 - c. The cart holds no more than one oxygen cylinder and one acetylene cylinder in the upright position.
 - d. The cylinders are securely held to the cart (e.g., by straps, chains or other device).
 - e. The cart is on a firm, level surface.
 - f. The location has no reasonably foreseeable risk of being struck by vehicles, equipment, or materials (such as in a pathway for vehicles).
- If oxygen-fuel gas cylinders are stored with regulators attached (i.e. weld shops, machine shops, garages etc.), periodic inspection of the regulator assembly should be performed. Additionally, when work involving the oxygen-fuel cylinders is complete, ensure the system is secured by closing the cylinder valves and not the regulator valves. If the oxygen-fuel cylinders will not be used for an extended period of time (i.e. several weeks), the regulators should be removed, cylinder caps installed, and the cylinders placed in their designated compressed gas storage area.
- If oxygen-fuel gas cylinders are to be moved with their regulators attached, ensure all of these conditions are met.
 - a. The cart containing the cylinders is specifically designed for the oxygen and acetylene cylinders.
 - b. The cylinders are secured in an erect or nearly erect position.
 - c. Protection of the cylinders and regulators is provided during transport.
- Wear safety goggles, gloves, long sleeved shirt/coat and closed toe shoes when handling compressed gases that are irritants, corrosive or toxic.
- Cylinders must never be dragged across the floor. Serious accidents have occurred when a cylinder with a regulator in place was improperly moved.

6 Special Guidelines for Handling Acetylene

The following special guidelines apply to cylinders of acetylene:

- Acetylene cylinders are partially filled with acetone and should always be kept upright. If a cylinder has been handled in a non-upright position, do not use it until it has sat upright for at least 30 minutes.
- When connecting an acetylene cylinder, be sure to use a flash arrestor at the outlet of the cylinder and the correct kind of tubing to transfer the gas. Some tubing materials, such as copper and lead solder, form explosive acetylides.

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- Never exceed the pressure limit indicated by the warning red line of an acetylene pressure gauge.
- Shut the cylinder valve following use. The wrench for opening the cylinder valve should always be kept on the valve spindle while in use.

7 New York City Certificates of Fitness Requirements

Certificates of fitness are required in New York City for Laboratory Supervision and handling of compressed gases. Refer to DEP's procedure on FDNY Permits and Certificates of Fitness for a complete discussion of when certificates are required. Gases that require certificates for use in laboratories in New York City include:

- Flammable Non-Liquefied Gases - individual cylinder exceeding 2.5 ft³ or total storage exceeding 10 ft³ (e.g., Carbon Monoxide, Ethylene Oxide (over 12%), Hydrogen, Methane).
- Liquefied Petroleum Gas (LPG) - individual container water capacity $\geq 1\frac{1}{2}$ ft³ or total container capacity ≥ 8 ft³.
- Non-Flammable Gases - individual cylinder exceeding 2.5 ft³ or total storage exceeding 20 ft³. Examples: Argon, Oxygen, Nitrous Oxide, Chlorine, Carbon Dioxide, Helium, Anhydrous Ammonia, Nitrogen, Ethylene Oxide (12% or less).
- Non-Flammable Liquefied Gas - individual cylinder exceeding 1.5 ft³ (~12 gallons) or total storage exceeding 12 ft³ (~90 gallons). Examples: Liquid Oxygen, Liquid Nitrous Oxide, Liquid Argon, Liquid Helium, Liquid Nitrogen, Liquid Carbon Dioxide.

Note: Cubic foot (ft³) capacities are in water capacity of container, not gas capacity.

8 Frequency of Inspection

The frequency with which this checklist should be used is not defined by OSHA regulations. OSHA requires in 1910.101(a) that "*Each employer shall determine that compressed gas cylinders under his control are in a safe condition to the extent that this can be determined by visual inspection.*" It is recommended that this inspection be performed monthly along with other routine facility safety inspections or no less frequently than quarterly.

9 Emergency Procedures

For leaks in cylinders containing **any gases (except air)**, the procedures should include the following:

- Personnel shall be promptly evacuated from the immediate area in danger and kept upwind at a sufficient distance to avoid any inhalation or contact with the potential asphyxiating or hazardous gases until safe re-entry can be ensured.
- In the event of an emergency involving such a cylinder, activate the emergency action plan and contact local emergency response (e.g. 911).

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10 Guidelines for Small Cylinders (e.g., Calibration Gas and “Lecture Bottles”)

Use the smallest returnable cylinder instead of lecture bottles (i.e., small 2” x 13” compressed gas cylinders), if possible, to avoid the cost and difficulty of lecture bottle disposal. The following guidelines apply to all small cylinders, including small calibration gas cylinders and lecture bottles:

- Before using toxic gas cylinders, consult with EHS staff for requirements.
- Cylinders must be clearly marked with a label identifying the contents.
- Transport small cylinders by hand one at a time or in a gas cylinder carrier with protective and dust caps in place.
- Secure cylinders at all times or store in suitable protective containers (e.g., padded mobile instrument case). Do not store on high shelves without restraints or where objects may fall on them.
- Store in a cool, dry place away from other flammable or combustible materials. Do not store in direct sunlight in extremely hot conditions.
- Keep valves and cylinders free of oil, grease or combustibles to prevent possible explosion (e.g., with oxygen or nitrous oxide).
- Do not lift cylinder using valve or regulator as a handle.
- Do not drop cylinders or permit them to violently strike each other.
- Do not try to repair or open damaged cylinders or valves.
- Dropped cylinders that are dented or on which the valve has been impacted shall be removed from service, marked that they were dropped and returned to the supplier.
- Do not use excessive force connecting cylinder to valve or end use.
- Small cylinder valves are easily damaged by over-tightening. Follow supplier instructions for opening and closing the valve leak-tight (e.g., either hand-tighten fittings or use short wrenches recommended by supplier).
- Check for leaks at all threaded connections before use.
- Close valves leak-tight on cylinders when they are not in use. Tightly cap cylinders before they are moved.

While CGA SB-27-2006 and these guidelines do not call for formal inspection, those responsible for small cylinders should follow the above safeguards at all times and should return or properly dispose of expired or unneeded small gas cylinders.

Compressed Gas Cylinder - Visual Inspection Checklist¹

Instructions: Answer each question by placing a ✓ mark in the column under Yes; No; or NA for Not Applicable. If the answer to any question is No, then provide corrective actions at the bottom of the page in the space provided.

Facility/ Workgroup:			
Date:		Completed by:	

Criteria	Yes	No	NA	Comments
Storage Areas				
Are cylinders stored in upright positions and secured by chains or other means to prevent them from being knocked over?				
Are cylinders stored away from highly flammable substances such as oil, gasoline, or waste?				
Are cylinders stored in a way that prevents them from becoming part of an electrical circuit?				
Are flammable gas cylinders stored ≥ 20 ft away from flammable liquids, and highly combustible materials and not stored in a location subject to arcing electrical equipment, open flame, or other sources of ignition?				
Are flammable gas cylinders separated from oxidizers by ≥ 20 feet in storage areas or by a noncombustible material barrier ≥ 5 ft high with a fire resistance rating $\geq \frac{1}{2}$ hour?				
Are storage rooms for cylinders dry, cool, and well ventilated?				
Are cylinders stored away from incompatibles, excessive heat, continuous dampness, salt or other corrosive chemicals, and any areas that may subject them to damage?				
Is the storage area permanently posted with the proper hazard class and/or names of the gases stored in the cylinders and "NO SMOKING" signs, where appropriate?				
Are all compressed gas cylinders stored so they do not interfere with exit paths?				
Are charged or full cylinders labeled and stored away from empty cylinders?				
Cylinders				
Do all cylinders have contents and precautionary labeling clearly marked on their exteriors?				
Are all compressed gas cylinder valve covers in place when cylinders are not in use?				
Unless all of the following conditions are met, are regulators for oxygen-fuel cylinders removed when it is not anticipated that gas will be drawn from the cylinder within 24 hours? <ul style="list-style-type: none"> • No more than a single acetylene cylinder and a single oxygen cylinder on a cylinder cart specifically designed to hold/carry oxygen and acetylene cylinders in the upright position. • Cylinders must be securely held to the cart by straps, chains or other securing device. • The cart is on a firm, level surface. • The cart is not in an area where there is a reasonably foreseeable risk of being struck by vehicles, equipment, or materials (e.g., in a pathway for vehicles). • Both cylinders have valves closed and either have protection caps on or are connected to a properly functioning regulator. 				
Are all compressed gas cylinders free from corrosion, pitting, cuts, gouges, digs, bulges, neck defects and general distortion?				
Do all compressed gas cylinders have safety pressure relief valves/devices?				
Are safety relief devices in the valve or on the cylinder free from any indication of tampering?				
Are the cylinder, valve, and safety relief devices free from any indication of repair or alteration? Note: All alterations and repairs to the cylinder and valve must be made by the compressed gas vendor. Modification of safety relief devices beyond the tank or regulator should only be made by a competent person appointed by management.				
Are cylinders free from any indication of painting done without authorization by the owner?				
Is the bottom of the cylinder protected from the ground to prevent rusting?				
Are all cylinders containing oxygen, chlorine, or other oxidizing agents free from oil, grease, or other foreign matter on the valve, neck ring, and cylinder exterior?				
Operations				
Are cylinder valves closed at all times, except when the valve is in use?				
Are the cylinder valves free from any indication that wrenches or other tools have been or are being used for opening and closing the valves?				
Are all compressed gas cylinder connections such as pressure regulators, manifolds, hoses, gauges, and relief valves checked for integrity and tightness?				

Corrective action(s):

¹ This checklist covers the handling, storage, and use of compressed gases in cylinders or portable tanks under the OSHA General Industry standard (29 CFR 1910.101). The OSHA standard adopts by reference the Compressed Gas Association's (CGA) Pamphlets C-6-1986, C-8-1962, and P-1-2000.