

Handling, storage, and use of compressed gas cylinders and refrigerant drums

Follow these five (5) general safety recommendations:

1. Know and understand the properties, uses, and safety precautions before using any gas or gas mixture. Consult safety Data Sheet (SDS)
2. Determine the appropriate storage location and structure. We suggest co-locating your donation refrigerants in a facility that is already storing refrigerants, so that your club can benefit from the existing infrastructure, reducing cost without sacrificing safety. Some suggestions or considerations
 - a. The Location
 - i. Members that are part of an HVAC/R Organization are likely already storing refrigerant
 - ii. Friend of the club has a refrigerant storage room
 - b. Storage - be aware of the ASHRAE on-site limits related to quantities
 - i. A large box called a "Gaylord" can provide a great space - place it on a pallet. These can be found at the local transfer facility or a large plastics plant
 - ii. A cage or secure box.
 - c. Handling - Use appropriate equipment when handling portable cylinders. They have a high center of gravity, and extreme care must be taken during their movement. Portable cylinders may fall over when being moved if they are stopped suddenly by an object or crack in the floor.
3. Be aware of potential hazards and develop plans to cover possible emergencies. Always store cylinders upright and in a dry place out of the elements.
4. Provide personal protective equipment (PPE) and the required training for its use. Require personnel to wear the proper PPE for each task. Locate other safety equipment such as fire extinguishers, eye wash stations, and showers at appropriate locations. Thoroughly inform everyone about the hazards of the gases they are using and how to respond to an emergency.
5. Follow all national, state, and local regulations pertaining to the storage, use, and disposal of compressed gases and cryogenic liquids. This document highlights the recommendations set forth in ISO Standard 11625, "Gas Cylinders— Safe Handling." In the United States, this document is published by the Compressed Gas Association as Pamphlet P-1, "Safe Handling of Compressed Gases in Containers," and has been incorporated into the regulations, making the contents of the document requirements in the United States, not recommendations.

Handling

Compressed gas cylinders should be handled only by those familiar with the hazards and who are trained in the proper handling techniques. Cylinders containing compressed gases are heavy and awkward to move. Improper handling of compressed gas cylinders can result in sprains, strains, falls, bruises, or broken bones. Other hazards such as fire, explosion, chemical burns, poisoning, and cold burns could occur if gases accidentally escape from the cylinder due to mishandling. Take the following precautions to prevent injuries caused by the improper handling of compressed gas cylinders.

NEVER

- Drag or slide cylinders, even for short distances.
- Drop cylinders or permit them to strike each other violently.
- Subject cylinders to mechanical shocks that may cause damage to their valves.
- Use cylinders as rollers for moving material or other equipment.
- Tamper with pressure-relief devices.
- Permit oil, grease, or other readily combustible substances to come in contact with cylinders, valves, or other equipment in oxidizer service.
- Remove any product labels or shipping hazard labels.
- Refill compressed gas cylinders. This is to be done only by qualified producers of compressed gases.
- Lift a cylinder by its cap using a sling or a magnet.
- Attempt to catch a falling cylinder.

ALWAYS

- Move cylinders using a suitable hand truck or cart. (refer to figure 1)
- Leave the valve protection cap and valve seal outlet in place until the cylinder has been secured in place, these will be needed or transport
- Secure cylinders when in storage, transit, or use.
- When returning cylinders to the supplier, properly close the cylinder valve, replace and secure any valve outlet seals, and properly install the cylinder cap.
- Use a cylinder cage or cradle to lift a cylinder.

PPE & Safety

- Use the proper PPE for cylinder handling. Wear safety glasses with sideshields, leather gloves, safety shoes, and other appropriate equipment.
- Use extreme care and restrict the movement of portable cylinders to localize movement on clean, smooth, level stationary surfaces.
- Use two people for localized manual movement of a portable cylinder if it exceeds 50 LBS of weight . Stay out of the cylinders travel path. Also, be aware of escape routes should the cylinder or drum get out of control or start falling. If a smooth, level surface is not available over which to move the portable cylinder , use a forklift, crane, or other appropriate moving equipment.

Figure 1: Typical Cylinder Hand Trucks



Storage

Take the following precautions to prevent injuries caused by asphyxiation, fire, explosion, high pressure, and improper handling of compressed gas cylinders.

NEVER

- Allow storage temperature to exceed 125°F (52°C).
- Permit smoking or open flames in oxidizer or flammable gas storage areas.
- Expose cylinders to corrosive materials such as ice melting compounds.

- Use cylinder color as a primary means to identify the contents of a cylinder.
- Heat a cylinder to increase its pressure or withdrawal rate unless using an approved method.
- Discharge the contents from any gas cylinder.
- Force cylinder valve connections that do not fit.
- Use a mechanical adapter to connect to the cylinder valve.

ALWAYS

- Store cylinders in accordance with ISO Standard 11625 or CGA Pamphlet P-1.
- Store cylinders upright with valve outlet seals and valve protection caps in place.
- Secure cylinders when in storage, transit, or use.
- Store cylinders in areas designated for that purpose.
- Segregate full and empty cylinders.
- Store cylinders in a dry, cool, well-ventilated, secure area protected from the weather and away from combustible materials.
- Ensure that there is adequate separation from combustibles as specified by national regulations.
- Monitor the atmosphere in areas where gases may vent and collect.
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- Store only the amount of compressed gas allowed by ASHRAE standard
- Store cylinders away from heavily traveled areas and emergency exits.
- Provide adequate access for cylinder handling.
- Visually inspect stored cylinders on a routine basis, or at least weekly, for any indication of leakage or problems.
- Restrict access to cylinder storage areas.
- Protect cylinders from wet or damp ground.

Special Handling Consideration and notes:

- Secure cylinders when in storage, transit or when labelling
- Never accept any cylinder that has a leak or residue around the valve
- Placards must be affixed at all times
- Cylinders must be labeled and tagged once they are in your possession - do not accept an
- Cylinder without proper labeling
- Use caution when placing the cylinder in the box or cage
- Use check valves to prevent reverse flow into the cylinder.
- All cylinders must be properly labeled with the following information
 1. Name of Chemical in the container
 2. Weight (gross weight is fine)
 3. Date received
- Never open or tamper with cylinder valves or caps.
- Prevent sparks and flames from contacting cylinders
- Always have access to SDS sheets for any material that you are managing

How to Identify Cylinders

Both disposable and reusable cylinders are painted (or otherwise marked) in a color code system. This code was voluntarily established by refrigerant manufacturers to identify their products. Common refrigerant colors and identification are set out in Figure below

Color Code System.

R-11	orange
R-12	white
R-12/114	light gray
R-13	light blue
R-13b1	pinkish-red
R-22	light green
R-23	light blue-gray
R-113	dark purple
R-114	navy blue
R-123	light blue-gray
R-124	dot green
R-134a	light blue (sky)
R-401a	pinkish-red
R-401b	yellow-brown
R-402a	light brown
R-402b	green-brown
R-403b	light gray
R-404a	orange
R-407c	brown
R-408a	medium purple
R-409a	medium brown
R-410a	rose
R-414b	medium blue
R-416a	yellow-green
R-417a	green
R-500	yellow
R-502	light purple
R-503	blue-green
R-507	aqua blue
R-508b	dark blue
R-717	silver
NH3	silver

A4.6.1.2. The shade of color may vary from one manufacturer to another. Verify contents by means other than color. Every refrigerant cylinder is silk-screened with product, safety, and warning information. Manufacturer technical bulletins and MSDSs are available upon request. Even though cylinders are designed and manufactured to withstand the saturated pressure of R-502 (the base refrigerant), it is not recommended that any cylinder be repainted with a different color and used with another refrigerant. Refer to Air-Conditioning, Heating and Refrigerating Institute (AHRI) Guideline N, 2008 *Guideline for Assignment of Refrigerant Container Colors*.

Labels and Markings (DOT Requirements). Specific container labeling and marking requirements apply for all DOT-regulated hazardous materials. DOT hazardous materials designations should not be confused with EPA hazardous materials. They are solely concerned with material transportation issues, not environmental issues. For instance, DOT regulates material as hazardous if it is capable of causing injury or property damage due to an accidental release or failure of its packaging during shipment on public roads, railways, and airways. There are nine classes of DOT hazards. Only Class 2, Division 2.2 (non-flammable gases), is pertinent to common refrigerants. This rating is attributable to the pressurized nature of the refrigerant in its container. The applicable AC/R refrigerants are R-12, R-22, R-134a, R-401a, R-401b, R-402a, R-402b, R-404a, R-410a, R-407a, R-407c, R-408a, R-409a, R-423a, R-437a, R-417a, R-422a, R-438a, R-500, R-502, and R-507 shipped in cylinders and ton tanks. They require marking and labeling. R-11, R-113, R-114, and R-123 are not DOT-regulated hazardous materials; therefore, DOT labeling and marking requirements do not apply.

Labeling. Each cylinder shall display a DOT diamond (square-on-point) "Nonflammable Gas" label. The 4-inch by 4-inch (102-millimeter by 102-millimeter) green diamond-shaped label may be printed on a tag and securely attached to the cylinder's valve protection cap before shipment. Ton tanks require two DOT nonflammable gas labels, one on each end.

Marking. Each container shall be marked with a proper DOT shipping name and appropriate United Nations (UN) four-digit chemical or hazard class identification number. Markings must be stamped plainly and permanently in any of the following locations on the cylinder:

On shoulders and top heads when they are not less than 0.087 inch (2.2 millimeters) thick.

On a metal plate attached to the top of the cylinder or permanent part thereof; sufficient space must be left on the plate to provide for stamping at least six retest dates; the plate must be at least 0.0625 inch (1.6 millimeters) thick and must be attached by welding or brazing. The brazing rod will melt at a temperature of 593 °C (1100 °F). Welding or brazing must be along all edges of the plate.

On the neck, valve boss, valve protection sleeve, or similar part attached to the top of the cylinder.

Precautionary Labels. Each container shall display a precautionary label prepared in accordance with American National Standards Institute (ANSI) Z400.1/Z129.1-2010, Hazardous Workplace Chemicals - Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation, and Compressed Gas Association (CGA) C-7, Guide to the Preparation of Precautional Labeling and Marking of Compressed Gas Containers. This label will include:

Product identity;

Antidotes;

Signal word;

Notes to physicians;

Statement of hazards

Instructions in case of contact or exposure;

Precautionary measures;

Instructions in case of fire, spill, or leak

Instructions for container handling and storage.