TAKE 5 Compressed Gas Cylinders

A 5-Minute Safety Training Aid

HS94-046F (12-21)

Thousands of products are available that contain gases and mixtures of gases stored under pressure in cylinders. Most of these gases are classified as "compressed gases" according to the Occupational Safety and Health Administration (OSHA) standards.

The pressure of gas in a cylinder is usually measured in pounds per square inch (psi). Compressed gases have an absolute pressure above 40 psi at 70°F (20°C) or above 104 psi at 130°F (54.5°C).[1] The average compressed gas cylinder is four feet tall and weighs between 75 and 80 pounds with contents pressured up to 2,200 psi.[2] While not particularly heavy, serious injuries such as the following can occur when cylinders are moved incorrectly or fall on an employee:

- abrasions;
- contusions;
- fractures and broken bones;
- asphyxiation;
- musculoskeletal disorders;
- spinal cord injuries;
- poisoning; and
- death.

In addition, handling compressed gases is more hazardous than handling liquid and solid materials because of the:[3]

- high pressure;
- how easily and widely the gas can spread (ease of diffusion);
- how easily flammable gases can burn or explode (low ignition points);
- low boiling points; and
- inability to see or smell some of the hazardous gases.

Types of Compressed Gases

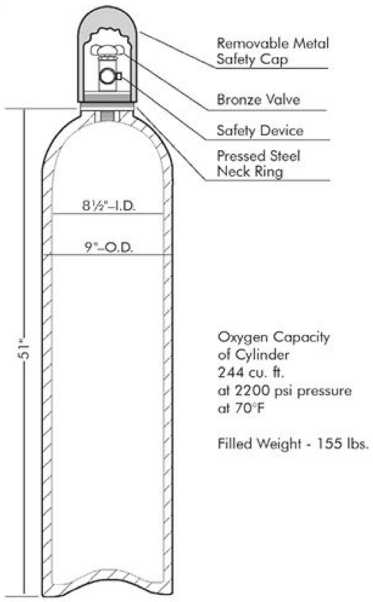
There are three major types of compressed gases: liquified gases, non-liquified gases, and dissolved gases.[4]

Liquified gases are liquid at normal temperatures when they are inside cylinders under pressure. Common liquified gases include ammonia, chloride, propane, and nitrous oxide.

Non-liquified gases are also known as compressed, pressurized, or permanent gases. Oxygen, nitrogen, helium, and argon are all examples of non-liquefied gases.

Dissolved gases are very unstable chemically. Acetylene is the only common dissolved gas.

Types of Cylinders



Compressed gas cylinders come in different shapes and designs, which are mostly based on the pressure of the gas they contain. In general, they are grouped as high-pressure cylinders, low-pressure cylinders, and cryogenic containers.[5]

High-pressure cylinders are typically tall and narrow, thick-walled, heavy when empty, generally made of steel or aluminum, and can withstand up to 10,000 psi. Common examples are nitrogen, helium, hydrogen, oxygen, and carbon dioxide cylinders.

Low-pressure cylinders are typically fatter and lighter than high-pressure cylinders. They have thin-walled, welded seams, and can withstand up to 500 psi. Common examples are liquefied petroleum gases (LPG) such as propane and refrigerant gases.

Cryogenic containers operate at a pressure of 20 – 500 psi. They have relief valves to help vent pressure as the temperature increases. Cryogenic containers are used to store natural gases such as oxygen, argon, nitrogen, helium, and other materials at the correct temperature and pressure for transportation.[6]

Compressed Gas Hazards

The use, storage, and handling of compressed gas cylinders present two types of hazards: chemical and physical.[7]

Chemical hazards result because compressed gases can be:

- **toxic**, creating poison atmospheres;
- **flammable**, resulting in fire and exploding cylinders;
- **oxidizing**, reacting rapidly and violently with combustible materials;
- **corrosive**, causing chemical burns and destroying skin tissue; or
- **inert**, capable of quickly displacing oxygen in a large area causing suffocation.

Physical hazards of compressed gas include:

- **sudden, uncontrolled release of cylinder contents** -- damaged cylinders can rocket or spin out of control causing severe injury and damage (often caused by knocking over an uncapped cylinder and breaking the cylinder valve) and
- **frostbite** – gases escaping from a cylinder may be very cold, which can lead to serious, permanent skin damage.

The Deadly Nature of Compressed Gas Cylinders

An industrial explosion involving a single damaged oxygen cylinder killed three people and injured an eyewitness standing 25 feet away. The blast was heard nearly a mile away. After a prolonged search, the upper part of the cylinder was found at another factory more than a half-mile from the blast scene. Pieces of the exploded cylinder turned into shrapnel, blowing off arms, legs, and decapitating one of the victims. A wall and the roof, both 25 feet away, were damaged, causing the roof frame to collapse. Human remains were found scattered among structural debris in a 25-foot radius from the blast.[8]

Safe Use, Handling, and Storage

To use, handle, and store cylinders, it is important to know and follow these safety steps:

- read the cylinder label to identify the contents (the color of the cylinder is not always an identifying factor);
- read the Safety Data Sheet (SDS) and know the safety and first-aid requirements;
- identify the hazards associated with the contents and take the precautions listed on the label and the SDS;
- report unlabeled cylinders to a supervisor so the supplier can be contacted to either provide the correct information or pick up the cylinder;
- never expose a cylinder to spark-producing electrical tools, cigarettes, or open flames;
- secure cylinders at all times with chain, plastic coated wire cable, or commercial cylinder straps;
- never attempt to make repairs to cylinders or valves;
- do not use cylinders as rollers;
- do not drop cylinders or allow them to bump violently against each other;
- do not permit cylinders to become part of an electrical circuit;
- never accept cylinders if they have an expired hydrostatic pressure test date;
- do not use grease or oil on oxygen cylinders;
- do not use greasy or oily gloves on oxygen cylinders;

Safe Use, Handling, and Storage

- do not use cylinders that are dented, cracked, or have other visible damage;
- always move cylinders with a suitable hand truck;
- always store cylinders in an upright, secured position, and in an adequately ventilated area;
- secure cylinder caps in a straight, hand-tightened manner, whether the cylinder is full or empty;
- never store a cylinder near an open flame or potential ignition or heat sources;
- never store a cylinder in an area exposed to weather extremes;
- never store cylinders where heavy objects may fall on them; and
- never store oxygen cylinders within 20 feet of fuel gas cylinders or highly combustible materials.

Empty Cylinder Safety

Empty cylinders should be:

- labeled as empty;
- stored with the valve closed and cylinder cap secured;
- stored separately from full cylinders; and
- returned with all original accessories.

For more information on the safe handling of compressed gas cylinders, review OSHA 29 CFR 1910.101 Compressed Gases (General Requirements). For regulatory citations and standards on specific gases, review:

- 1910.102 – Acetylene
- 1910.103 – Hydrogen
- 1910.104 – Oxygen
- 1910.105 – Nitrous oxide

References

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