

TerranearPMC Safety Share

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Week of September 3, 2019 – Compressed Gas Cylinders

One of the most common hazards we find – whether at outdoor work sites or within a facility – are compressed gases. Compressed gases are gases that are stored under pressure in cylinders. And to go a step further, a gas is defined as a substance or matter in a state in which it will expand freely to fill the whole of a container, having no fixed shape (unlike a solid) and no fixed volume (unlike a liquid). A gas may consist of atoms of one element (e.g., H₂, Ar) or of compounds (e.g., HCl, CO₂) or mixtures (e.g., air, natural gas). The three major types of compressed gasses are liquefied gasses, non-liquefied gasses and dissolved gasses. The pressure of the gas in a cylinder is usually recorded as pounds per square inch gauge (psig) or kilopascals.

Liquefied gasses are liquid at normal temperatures when they are inside cylinders under pressure. Common liquefied gasses include ammonia, chloride, propane and nitrous oxide. Non-liquefied gasses are also known as compressed, pressurized or permanent gasses. Oxygen, nitrogen, helium and argon are all examples of non-liquefied gasses. Acetylene is the only common dissolved gas and is very unstable chemically.

Since its inception, OSHA has been recording workplace accidents that stem from compressed gases. Cases are on record that document amputated fingers as well as crushed toes due to poor handling practices as well as cylinders exploding, resulting in severe injuries and even fatalities. When a cylinder is filled to its typical design pressure of 2400 psig, it will contain almost 300 cubic feet of pressurized gas – about 160 times the internal volume of the cylinder. Should the valve break off – a common occurrence when the valve cap is not secured and the cylinder drops - the sudden release of pressurized gas can turn into a missile with enough energy to penetrate a cinder block wall.

Hundreds of different materials are packaged in compressed gas cylinders and include atmospheric gases, fuel gases, refrigerants, calibration and quenching gases. The hazards associated with these gases include oxygen displacement, explosion/fire hazards, toxic/poisonous effects, corrosive hazards and the physical hazards of a ruptured cylinder.

The Occupational Safety and Health Administration (OSHA) references general requirements for compressed gases in title 29 of the Code of Federal Regulations (CFR) 1910.101. This regulation states that employers must visually inspect compressed gas cylinders to ensure that they are in a "safe condition." Visual cylinder inspections should focus on leaks, bulging, defective valves, evidence of physical abuse, fire or heat damage, pitting, rusting or corrosion. If cylinders do not pass a visual inspection they need to be repaired and re-qualified per Department of Transportation (DOT) regulations.

The OSHA regulation, 29 CFR 1910.101(b), references the Compressed Gas Association (CGA) – the premier trade organization in the United States that addresses safety for compressed gases to ensure compressed gases are properly housed, stored and transported. The specific CGA standard that addresses proper storage and handling of compressed gases is Pamphlet P-1; Standard for Handling of Compressed Gases in Containers.

Gas cylinders should always be properly secured to prevent tipping, falling or rolling. They can be secured with straps or chains connected to a wall bracket or other fixed surface, or by use of a cylinder stand.

Gas cylinders should be stored in a cool, dry, well-ventilated, fire-resistant locations that meet all applicable federal, state and local regulations.

When a gas cylinder is empty or not being used, ensure that the valve is closed, the regulator removed, and the valve protector cap is secured in place.



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Gas cylinders should be transported using hand trucks designed for that purpose and the cylinders should be secured so that they do not tip, fall or roll.

Appropriate lifting devices, such as cradles or nets, are required when a crane, hoist or derrick is used to transport gas cylinders. Do not use magnets or slings to lift gas cylinders. DO NOT use the valve protection cap for lifting a gas cylinder.

It is necessary to take precautions so that gas cylinders are not dropped or allowed to strike each other or other objects. Dropping or striking may damage the gas cylinder valve, which could turn the gas cylinder into a dangerous torpedo with the potential to destroy property and/or seriously injure people.

Industrial gas cylinders are color coded to provide identification "at a glance". For instance, fuel-gas cylinders are yellow (such as hydrogen and acetylene), and oxygen cylinders are green. In addition to color coding, the exact identification of the material contained in the compressed-gas cylinder must be indicated by a written title that appears in two locations-diametrically opposite and parallel to the longitudinal axis of the cylinder.

Regulators, cylinders and cylinder valves must be inspected regularly to ensure safe operation. Meanwhile gases that may react with each other must be stored separately. And NEVER attempt to repair a cylinder or valve.

Below are other important "do's and don'ts" to ensure compressed gas cylinders are handled safely:

- Firmly attach cylinders to a bench top, wall, or holding cage. Use chains or sturdy straps
- Shut the cylinder valve when gas is not in use
- Open cylinder valves slowly. Never fully open cylinder valves.
- Don't store acetylene cylinders on their side
- Maintain 20 feet between flammable gas cylinders and oxygen cylinders
- Never bleed a cylinder below 25 psi.
- Close all valves and replace caps before moving
- Store empty and full cylinders in separate areas
- Use safety glasses or face shield when handling or connecting gas cylinders
- Never roll or drag cylinders
- Use wheeled carts to move larger cylinders
- Move only one cylinder at a time

As a first step to understanding the hazards of compressed gases – which include proper controls to use, handle and store compressed gases, Safety Data Sheets (SDS) should be read and maintained on site.

OSHA regulations for specific gas requirements are found in the following regulations:

- 29 CFR 1910.102 – Acetylene
- 29 CFR 1910.103 – Hydrogen
- 29 CFR 1910.104 – Oxygen
- 29 CFR 1910.105 – Nitrous Oxide
- 29 CFR 1910.110 – Storage and Handling of Liquefied Petroleum Gases (LPG)
- 29 CFR 1910.111 – Storage and Handling of Anhydrous Ammonia

Worry is the interest paid by those who borrow trouble - George Washington

