

## SAFETY BRIEF: COMPRESSED GAS CYLINDERS

**Riddle:** What can fly through the air for a half mile or more, smash its way through brick walls, yet release its power through an opening no bigger than the diameter of a pencil?

**Answer:** A compressed gas cylinder!

Compressed gas cylinders contain gases at varying pressures. These gases may be inert, toxic, flammable, oxidizing, corrosive, or a cylinder could contain a combination of gases. The combined hazards of pressurized gases and the characteristics of the gases themselves creates a high potential for a severe incident. Compressed gas cylinders should be treated with care in use, handling, and storage.

There are three major groups of compressed gases stored in cylinders:

- **Liquefied** – examples include anhydrous ammonia, chlorine, propane, and carbon dioxide. These gases become liquids at normal temperatures when they are inside cylinders under pressure. Gas fills the space above the liquid in the cylinder. As gas is removed from the cylinder, enough liquid evaporates to replace it, keeping the pressure in the cylinder constant.
- **Non-liquefied** – such as oxygen, nitrogen, helium, and argon. These gases do not become liquid when they are compressed at normal temperatures, even at very high pressures.
- **Dissolved gases** – acetylene is the only common dissolved gas. Acetylene is chemically very unstable and can explode at atmospheric pressure. Nevertheless, acetylene is routinely stored and used safely in cylinders at high pressures.

Compressed gas cylinders must be stored properly, handled correctly, and used with the correct tools and equipment. The properties of the gases they contain must be fully understood in order to protect life and property. For example, a half-empty cylinder of propane, a liquefied gas, handles differently than a half-empty cylinder of oxygen or acetylene. Think of a half-empty bucket of water sloshing back and forth as you carry it and you get the idea. The hazards you face when storing, handling, and using compressed gas cylinders include:

- **Physical damage** – cylinders have internal pressure up to 250 pounds per square inch gauge; any damage which causes a weakness or a crack in the cylinder can cause the cylinder to rupture and explode.
- **Valve hazard** – a broken valve can cause a cylinder to rapidly release all its gas (a possible health and/or flammability concern) and possibly spin uncontrollably. Cylinders with non-standard valve inlet openings, such as those used for propane or butane and fire protection system cylinders, could take off and become airborne.
- **Tipping & falling** – the most common major hazard is having a cylinder tip over or fall on you or a nearby worker. A 100 lb. propane cylinder, for example, weighs 77 pounds when empty and 170 pounds when full. A similarly sized acetylene cylinder weighs more than 175 pounds empty!
- **Valve leakage** – proper ventilation and storage can minimize risks from valve leakage.

Employees that work with or around any compressed gas cylinders should read the identifying label on the cylinder and review the Safety Data Sheet (SDS) for safety information. Some cylinders are filled with inert gases, but many gases are flammable, explosive, toxic or a combination. Because these gases are stored under high pressure, they must be stored, transported, and used properly to prevent the uncontrolled release of pressure.



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### TRANSPORTING CYLINDERS

*Most accidents or injuries involving compressed gas cylinders happen when moving or handling the cylinders.* As mentioned previously, compressed gas cylinders can be very heavy and difficult to move. Workers frequently cite the weight and bulkiness of objects being lifted as major contributing factors to their injuries. When moving or transporting cylinders, employees should be aware of potential injuries including strains and sprains from improper lifting or from carrying loads that are too large or too heavy, and fractures and bruises caused by being struck by falling or improperly secured cylinders. Since numerous injuries can result from improperly handling and storing materials, it is important to be aware of accidents that may occur from unsafe or improperly handled equipment and improper work practices, and to recognize the methods for eliminating, or at least minimizing, the occurrence of those accidents.

- Use the right equipment, correct procedures, and sufficient number of persons to lift and move cylinders to avoid personal injury and cylinder damage.
- Wear protective footwear, safety glasses, and heavy gloves.
- Securely install the valve protection devices, such as caps or guards.
- Secure cylinders upright to a proper hand truck or cylinder cart designed for the purpose.
- Prevent damage; avoid dropping or banging cylinders.
- DO NOT lift by the protective cap/guard.

### STORING CYLINDERS

- Store cylinders upright and secure them with a chain, strap, or cable to a stationary building support or to a proper cylinder cart to prevent them from tipping or falling.
- Completely close the valves, and keep valve caps or guards securely in place.
- Store cylinders in a dry, well-ventilated area at least 20 feet from combustible materials. DO NOT store in lockers where leakage can result in a dangerous buildup of gases.
- Mark the storage area with proper precautionary signs, such as FLAMMABLE, OXIDIZER, or TOXIC.
- Place in a location where they will not be subject to mechanical or physical damage, heat, or electrical circuits.
- Store empty cylinders separate from full ones.
- Keep oxygen cylinders at least 20 feet away from fuel-gas cylinders such as acetylene, or separate them with a non-combustible barrier, such as a masonry wall, at least 5 feet high with a fire-resistance rating of at least one-half hour.

### HOW TO USE CYLINDERS

- Keep cylinders secured upright and away from heat, sparks, fire, physical damage, or electrical circuits to avoid damage or rupture.
- Use in a well-ventilated area to avoid gas accumulation.
- Do not bring a cylinder into a confined space to avoid possible suffocation from the accumulation of flammable, toxic or reactive gases.
- Read, understand and follow all cylinder markings and labels to avoid misuse. Do not use any cylinder that is not clearly marked as to its contents.
- Before connecting a regulator, stand to one side and momentarily open the valve and then close it immediately. This procedure will clear the valve of dust or dirt that could enter the regulator.
- Open valves slowly by hand to avoid gauge damage. If a specific tool is required to open the valve, leave it in position so that the flow of gas can be stopped quickly in an emergency.



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- Lift and move cylinders properly, with valve closed and valve protection cap in place.
- Close the gas cylinder valves when not in use, such as during breaks or at the end of a shift, to avoid leaks.
- Avoid getting any oil or grease on the cylinders or regulators/gauges to prevent fire or explosion.

### CYLINDER MAINTENANCE

- Protect the markings on cylinders that identify the contents, and mark the full/empty status on cylinders.
- Don't use the recessed top of the cylinder as a storage area for tools or materials.
- If cylinders are leaking, isolate them outdoors and away from sparks or heat. Contact your gas supplier to send qualified personnel to take care of the problem—don't try any repairs yourself. Tag leaking cylinders.
- Never mix gases in a cylinder or try to refill a cylinder—always contact your gas supplier.

### Standards in General Industry

OSHA's General Industry standards, 29 CFR 1910, that apply to compressed gas cylinders can be found primarily in Subpart H – Hazardous Materials and Subpart Q – Welding, Cutting and Brazing. The standards that apply to storage and handling include:

**1910.101(a)** 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. Visual and other inspections shall be conducted as prescribed in the Hazardous Materials Regulations of the Department of Transportation (49 CFR parts 171-179 and 14 CFR part 103). Where those regulations are not applicable, visual and other inspections shall be conducted in accordance with Compressed Gas Association Pamphlets C-6-1968 and C-8-1962, which is incorporated by reference as specified in Sec. 1910.6.

**1910.253(b)(2)(ii)** Inside buildings, cylinders shall be stored in a well protected, well ventilated, dry location at least 20 feet from highly combustible materials such as oil or excelsior. Cylinders shall be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage spaces shall be located where cylinders will not be knocked over or damaged by passing or flying objects, or subject to tampering by unauthorized persons. Cylinders shall not be kept in unventilated enclosures such as lockers or cupboards.

**1910.253(b)(2)(iii)** Empty cylinders shall have their valves closed.

**1910.253(b)(2)(iv)** Valve protection caps, where cylinders are designed to accept a cap, shall always be in place, and hand-tight, except where cylinders are in use or connected for use.

**1910.253(b)(4)(i)** Oxygen cylinders shall not be stored near highly combustible material (especially oil and grease); near reserve stocks of carbide, acetylene, or other fuel gas cylinders; near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.

**1910.253(b)(4)(iii)** Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials (especially oil and grease) a minimum of 20 feet or by a noncombustible barrier at least (5)feet high having a fire-resistance rating of one-half hour.

Remember, compressed gas cylinders pack a double threat of hazards. You must be aware of both the chemical hazards and the physical hazards associated with compressed gas cylinders so that you can safely use, transport, and store compressed gases.

*Monthly question: Can oxygen and acetylene cylinders be stored together? Explain your answer.*

