

Compressed Gas Cylinder Training

PFW ANNUAL TRAINING

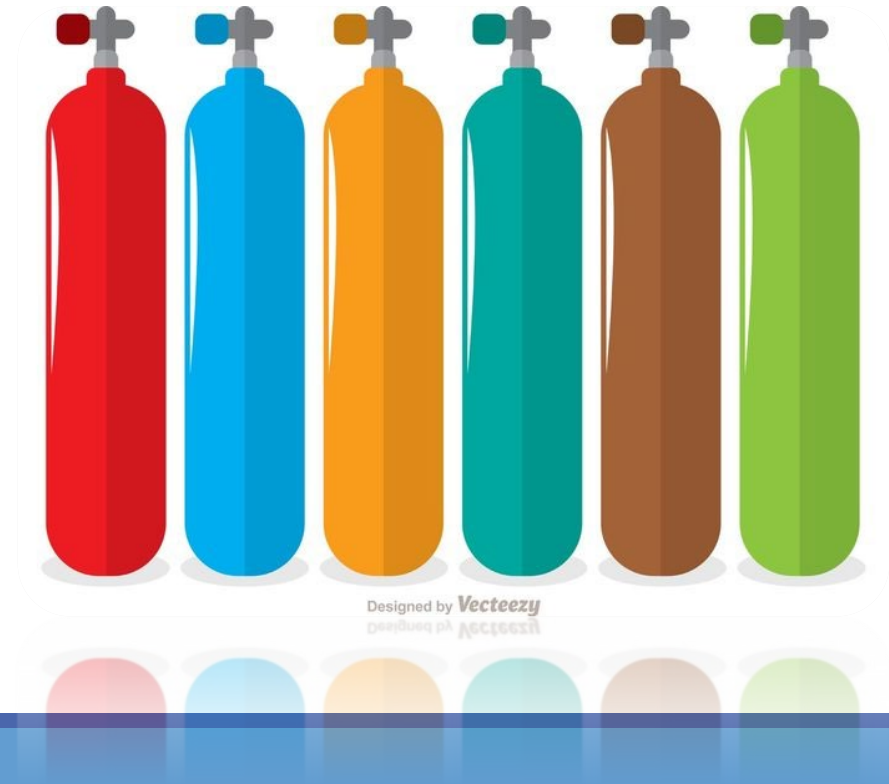
Overview of Training

Description of compressed gas cylinders

How compressed gas cylinders are used

Potential hazards of compressed gas cylinders

Best practices for storage, transport, and use



Description of compressed gas cylinders

Compressed gas cylinders are portable tanks used to store, transport, and dispense gases for use in a broad range of industrial, research, and medical applications.

The purpose of a high pressure gas cylinder is to serve as a reliable source of a specific type of gas for a specialized function.

A large volume of gas is compressed into a relatively small volume of the cylinder... the result is a versatile high pressure cylinder that can be easily delivered where ever its needed .

These cylinders are designed to be easy to handle **BUT can create potential health and safety hazards if not properly handled.**

Description of compressed gas cylinders

Common Industrial High Pressure Cylinder

- Height 5 ft.
- Diameter 9 in.
- Wall Thickness ½ in. steel
- Weight 140 lbs.
- Internal Capacity 1.8 ft^3
- Design Pressure 2,400 psi

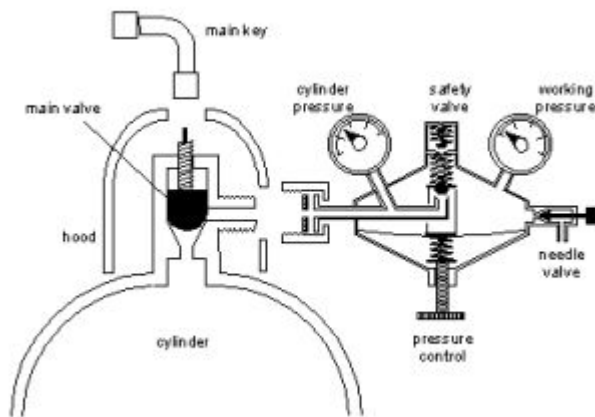
Description of compressed gas cylinders

A main fill and shut off valve is secured into the single opening at the top of the cylinder.

When the cylinder is put into use, a pressure regulator is attached to reduce and control the pressure of gas flowing from the cylinder.

When the cylinder is not in use, the regulator is typically removed and a protective cap can be screwed over the main valve for safe storage.

Some cylinders have a built in protective ring in place of the cap.



Hazards

Under certain conditions, these cylinders can present physical and or chemical hazards to those who transport, handle, or use them.

Physical hazards occur as a result of improper handling of the cylinder

- **Heavy cylinders can crush body parts or inflict lethal injuries** if they fall or unexpectedly release high pressure gas

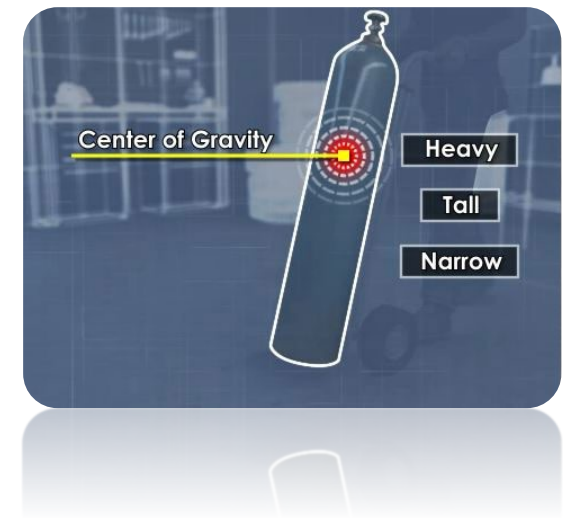
Chemical hazards are posed by exposure to the contents of a cylinder

- Chemical exposure to the small leaks resulting from improper fittings or a large gas release caused by equipment damage, can have immediate and acute effects

Hazards

Because the gas containing cylinders are heavy, tall, and narrow, they tend to have a high center of gravity

- This means they can fall over easily if unsecured during transport or use
- The impact from a fall of a massive 140 lb steel cylinder can crush bones and break equipment
- The force of gas rapidly exiting the tank due to an equipment malfunction poses a danger to eardrums and eyes
- If the main cylinder cap breaks off, the cylinder can become a missile
- If the cylinder body ruptures, the effects on the surroundings are bomb-like



Hazards

When a typical cylinder is filled to its designed pressure of 2,400 psi, it will contain almost 300 ft^3 of atmospheric pressure gas.

- This compression of gas represents a tremendous amount of stored energy
- If the outlet valve is broken off, **the sudden release compressed gas can turn the cylinder into a missile with the energy to shoot through a cinder block wall**

❖ In one reported incident, a damaged cylinder penetrated two sheet metal walls before becoming airborne and exiting through the roof

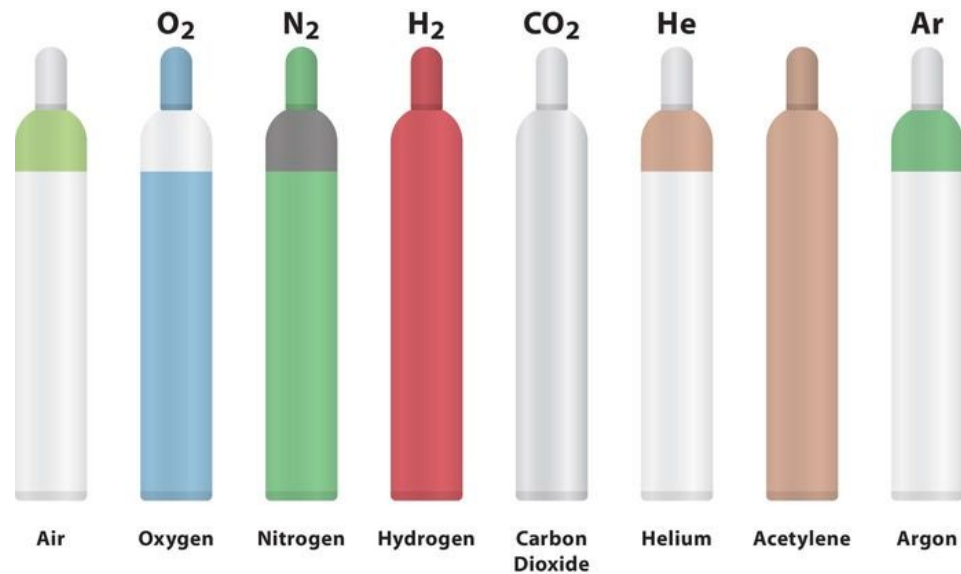
- ❖ The tank reached an altitude of 140 ft before falling back through the buildings roof a second time



Hazards

The potential chemical hazards related to gas cylinders are associated with the nature of their contents.

- Common cylinder contents
 - Inert
 - Flammable
 - Toxic



Inert gases

Inert gases (ex. Nitrogen , Helium) are neither flammable nor toxic.

- However, if a large amount of inert gas is accidentally released into a poorly ventilated room or confined space, the otherwise harmless gas will displace oxygen containing air – **This will result in a danger low oxygen atmosphere which may lead to unconsciousness and even death!**

Flammable gases

If a leaking or broken cylinder contains a flammable gas such as Hydrogen, Methane, or Propane - normal air will also be displaced.

- Even more dangerous, clouds of flammable gases ignite easily and burn explosively
- Leaking hose connections, faulty valves, and ruptured cylinders can release flammable gases that can accumulate in confined spaces
- Electrical outlets, switches, open flames, and other ignition sources can easily ignite these clouds



Oxygen

Oxygen is a common compressed gas which is not directly flammable or toxic – none the less, an excess in oxygen in an enclosed area presents a danger.

- Because oxygen is such a powerful oxidizer, it enhances any combustible materials ability to burn
- Fires in an oxygen enriched atmosphere will start *more easily* and *burn more quickly* and intensely than in normal air
 - For this reason, in a pure oxygen system even grease and oil in fittings and regulators must be avoided in order to prevent their combustion

Toxic gases

High pressure gas cylinders which contain an inherently toxic gas present the greatest danger.

Accidentally exposure to a released toxic gas presents an immediate hazard.

- Gases such as ammonia or chlorine will quickly attack and burn the eyes and sensitive nose and lung tissue

To prevent exposure, extra care should be taken to be sure all toxic gas hose connections and valves are sealed and operating properly.

Toxic gases

Unexpectedly released toxic gases

- Can disperse quickly leaving little time to react
- Even at low concentrations can overcome personnel
- Common gases such as carbon monoxide are both flammable and toxic

Signs of carbon monoxide poisoning



Safe Practices

The inherent risk associated with handling, storing, transporting, and using compressed gas cylinders can be mitigated by following some established best practices.

Storage

- Cylinders which are not in use should never be stored in active work areas
 - A dedicated storage area (appropriate for the types of gases) should be used
- For safe storage, compressed gas cylinders should be
 - Placed in a well ventilated, non-corrosive, dry environment
 - Protected from excessive heat
 - Separated by hazard classification
 - Secured in an upright position with a chain or strap above the midpoint of the cylinder
 - Prepared for storage by securing the protective valve cap in place
 - Clearly labeled, empty cylinders should be clearly marked and stored separately



Safe Practices

Transport

- The risk of an accident is highest when cylinders are being transported and set up
- Safely moving compressed gas cylinders requires specialized equipment and extra caution

Follow these best practices to avoid problems that could occur during transport

- Wear safety shoes, gloves, and other necessary PPE
- Move cylinders with a hand cart specially designed to transport cylinders
- Always keep the protective valve cap in place during transport



Safe Practices

Transport

- The cylinder may be slightly tipped and rolled on its base for only very short distances
- **DO NOT drag a cylinder or roll it on its side!**
- **Never lift a cylinder or move it by the valve or cap**



Safe Practices

Installation

- When installing high pressure gas cylinders, follow these best practices
 - Wear safety glasses, goggles, or a face shield while setting up a cylinder
 - Position the cylinder away from pedestrian and equipment traffic
 - Ensure that any cylinder in use is securely anchored to something solid using a strap or chain
 - Never rely on connection piping to hold a cylinder in place
 - Carefully remove protective valve cap – do not use excessive force or prying tools (this can lead to valve damage)
 - Use only compatible connections, hoses, and equipment in order to prevent mixing of gas types
 - The thread type on the main cylinder and valve should match those of the regulator. A regulator should connect easily to a cylinder valve
 - Never force a regulator connection or put gas to a regulator which is not firmly connected to the cylinder
 - Ensure that the pressure regulator is closed or relieved before attaching it to a tank
 - Easy access to the valve should always be maintained, do not allow piping, clothing, or anything else to obstruct access to the valve in case of the need to quickly shut it off

Safe Practices

Use

- When using high pressure gas cylinders, follow these best practices
 - Be aware of the properties and hazards related to a cylinder's contents, read the content label
 - Never make an assumption of the cylinder's contents based solely on the tank color
 - Open and close valves using hand pressure only, **never use an extender or excessive force**
 - Open main cylinder valves slowly when initially pressurizing the regulator
 - Do not stand in front of the regulator as it pressurizes
 - Only open the main valve enough to achieve sufficient gas flow to allow for a quick shut off in the event of an emergency
 - Once gas is flowing properly, check the fittings and all associated tubing for leaks. Use a soap solution or electronic leak detector. **Never use open flame to look for leaks!**
 - Close the main cylinder valve when the cylinder is not in use



Safe Practices

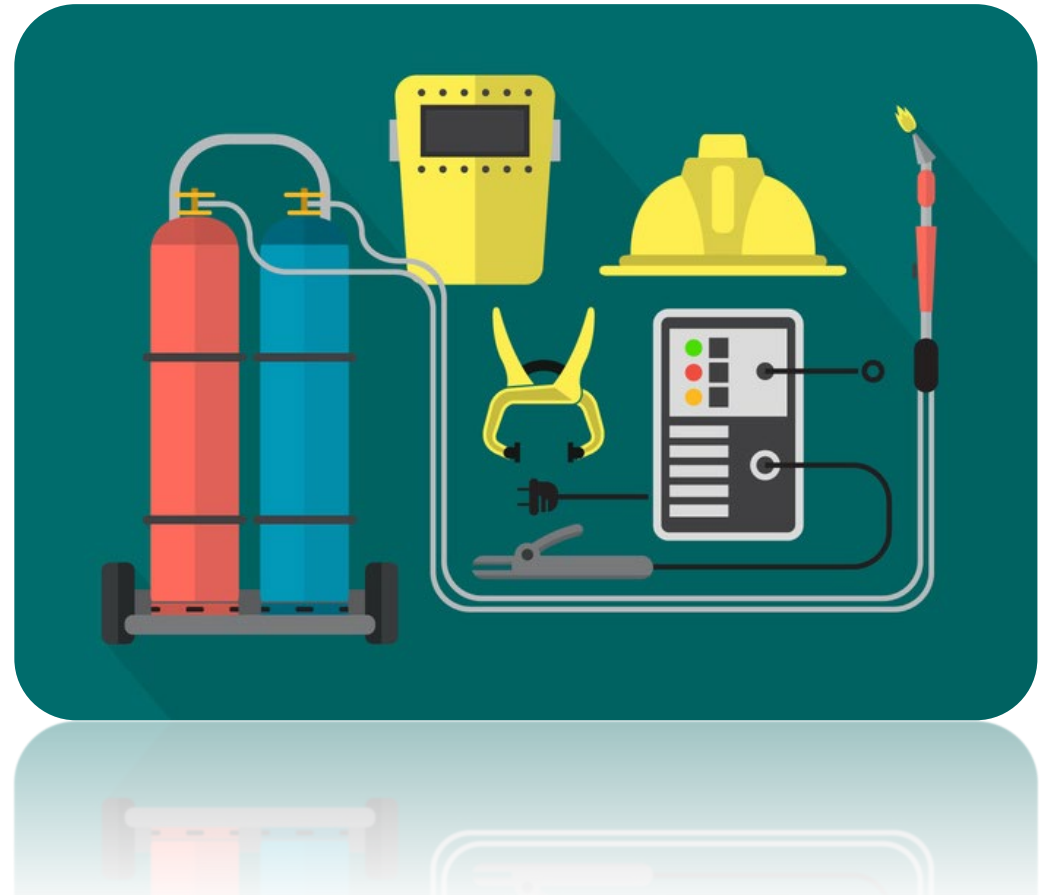
Use

- When a cylinder is empty, clearly mark the side of the tank, remove it from operation, and prepare it for storage
- Leave a slight positive pressure in the tank and close the main valve – this will prevent the tank from becoming contaminated during storage
- Replace the protective valve cover and return it to a storage area
- Keep empty tanks separate from full tanks

Safe Practices

Since gas welding and cutting operations represent a common use of compressed gas cylinders, here are some best practices for the safe use of flammable gases

- Work in a well ventilated area to avoid exposure to harmful chemicals and fumes
- Ensure mobile welding carts are stable and appropriately sized for the cylinders in use
- Keep the gas cylinders secured and upright at all times
- Inspect all equipment and replace worn or damaged hoses, valves, or components
- Secure all connections and test for leaks periodically
- Wear PPE appropriate for the job
- Be sure that both gas lines have a flow check valve at the torch and flashback arrestor at the regulator
- When the job is complete, securely close all valves and purge the lines to release the pressure in the hoses and torch





- ❖ If you have any questions, please contact Environmental Health & Safety (EHS)
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