PHYS 200

Ch. 3

Gas Safety

Chapter 3

Chapter Three

Gas Safety

- ***Compressed Gas***
- ***Use of Compressed Gas Cylinder***
- ***Compressed Gas Cylinder Leaks***
- ***Piping for Compressed Air***
- ***Hoses and Connections***

Compressed Gas

Compressed Gas

Compressed gas cylinders can be extremely hazardous when misused or abused. Compressed gas cylinders can present a variety of hazards due to their pressure and/or content.

Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases used maybe:

- Flammable or combustible
- Corrosive
- Explosive
- Poisonous
- Inert
- Acidic
- Reactive
- or a combination of hazards

Compressed Gas

Without proper use and care compressed gas cylinders can explode killing workers and destroying equipment. Cylinders can also become flying projectiles when cylinder valves are damaged or broken off. Regulators can become bullets that tear through workers if safety precautions are not taken.

Regulations Applicable to Compressed Gas Containers

A. Compressed gases. *Compressed Gas Association Pamphlet P-1-1965*, covers in-plant handling, storage, and use of all compressed gas cylinders, portable tanks, or motor vehicle cargo.

B. Inspection of compressed gas cylinders. Each employer must determine that compressed gas cylinders under his/her control are in a safe working condition to the extent that can be determined by a visual inspection. Visual and other inspections must be conducted as prescribed in the *Hazardous Materials Regulations of the Department of Transportation (49 CFR parts 171-179 and 14 CFR part 103).*

Compressed Gas

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*.

C. Safety relief devices for compressed gas containers. Compressed gas cylinders, portable tanks, and cargo tanks shall have pressure relief devices installed and maintained in accordance *with Compressed Gas Association Pamphlets (CGA) S-1.1-1963 and 1965 addenda and S-1.2-1963*.

D. Welding and cutting. The storage, handling, and use of compressed gas containers for welding and cutting shall comply with the *American National Standards Institute ANSI Z-49.1* and *29 CFR 1910.252*.

E. National Fire Prevention Association. NFPA 55, Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders.

Compressed Gas

Checklist A is intended to assist you in identifying possible safety and health hazards concerning compressed gas cylinders for general use. Following each check is the reference number to the *CGA Pamphlet P-1 1974* (see appendix A).

Checklist B is intended to assist you in identifying possible safety and health hazards concerning installation and operations of oxygen and fuel/gas systems for welding and cutting. Following each check is the reference number for *ANSI-49.1 1969* (see appendix B).

A. Identification "ALWAYS READ THE LABEL"

- The contents of any compressed gas cylinder must be clearly identified. Gas identification should be stenciled or stamped on the cylinder or a label. Commercially available three-part tag systems may be used for identification and inventory.

- No compressed gas cylinder should be accepted for use that does not legibly identify its contents by name. If the labeling on a cylinder becomes unclear the cylinder should be marked "contents unknown" and returned to the supplier.

Compressed Gas

- Do not rely on the color of the cylinder for identification. Color-coding is not reliable because cylinder colors may vary with supplier. Also, never rely on labels on caps because they are interchangeable.

- All gas lines leading from a compressed gas supply should be clearly labeled to identify the gas and the area served. The labels should be coded to distinguish hazardous gases such as flammable, toxic, or corrosive substances. Signs should be posted in areas where flammable compressed gases are stored or used, identifying the substance and appropriate precautions.

Use of Compressed Gas Cylinder

Handling and Use

1. **Before cylinders are first used the following precautions should be taken:**

- Make sure the cylinder is equipped with the correct regulator.
- Inspect the regulator and cylinder valves for grease, oil, dirt, and solvent. Never use grease or oil to lubricate regulators or cylinder valves because they can cause an explosion.
- The cylinder should be placed so that the valve handle at the top is easily accessible.
- When using toxic or irritating gas, the valve should only be opened while the cylinder is in a working fume hood.
- Refer to MSDS for the gas being used for information regarding use and toxicity.

Use of Compressed Gas Cylinder

- Fire extinguishing equipment should be readily available when combustible materials can be exposed to welding or cutting operations using compressed cylinder gases.

Cylinder Storage

- Gas cylinders must be secured at all times to prevent tipping.

- Use appropriate material, such as chain, plastic coated wire cable, commercial straps, etc., to secure cylinders.
- Gas cylinders can not be stored in public hallways or other unprotected areas.

Use of Compressed Gas Cylinder

- Cylinders must be segregated in hazard classes while in storage. Oxidizers (oxygen) must be separated from flammable gases, and empty cylinders must be isolated from filled cylinders.

- The proper storage for oxygen cylinders requires that a minimum of 20 feet is maintained between flammable gas cylinders and oxygen cylinders or the storage area be separated, at a minimum, by a firewall five (5) feet high with a fire rating of 30 minutes.

- Store out of direct sunlight and away from sources of heat and ignition; temperatures must not exceed 125 F.

- Acetylene cylinders must never be stored on their sides.

Use of Compressed Gas Cylinder

- Always place valve protectors on gas cylinders when the cylinders are not connected for use.
- Cylinders must be protected from damage. Do not store cylinders near elevators or gangways, or in locations where heavy-moving objects may strike or fall on them.
- Cylinders must be stored where they are protected from the ground to prevent rusting.
- Cylinders should be protected against tampering by unauthorized individuals.
- Storage areas must be well-ventilated, cool, dry, and free from corrosive materials.

Use of Compressed Gas Cylinder

Example 1:

A broken valve on a fully charged cylinder of a compressed gas can produce a rocket or shrapnel that can do a great deal of damage, the precaution required to avoid that:

Solution:

(C)

(A) Store in a well ventilated area
(B) Treat all cylinders as if they were full
(C) Secure all cylinders to a bench or a wall with a chain before removing the cylinder cap

Use of Compressed Gas Cylinder

Example 2:

Compressed gas cylinders should be stored in a

Solution:

(C)

(A) Direct sunlight and well ventilated room
(B) Direct sunlight in a closely tight room
(C) Away from sunlight and any sources of heat in a well ventilated room

Use of Compressed Gas Cylinder

Example 3:

When a compressed gas cylinder is empty:

Solution:

(A)

(A) Inform the supplier to refill it
(B) Refill it by connecting it to another compressed gas cylinder
(C) None of the above is safe

Use of Compressed Gas Cylinder

Example 4:

When storing compressed gas cylinders, make sure that

Solution:

(C)

(A) Incompatible gases are not stored together
(B) All cylinders are tightened together to a fixed bench or to a wall
(C) All of the above
(D) None of the above is required for safety of compressed gases

Use of Compressed Gas Cylinder

Example 5:

In spite of being non-toxic, compressed gas stored in a poorly ventilated room is still dangerous. The source of danger is that

Solution:

(B)

(A) Non-toxic gases are explosive.
(B) They may interact with oxygen in air and reduce its level below that required for life.
(C) They are corrosive.
(D) They may interact with Nitrogen to form toxic gases.

Use of Compressed Gas Cylinder

Example 6:

Never use grease or oil on the regulator or valve,

Solution:

(B)

(A) The valve or rubber tube may get loosened easily under gas pressure

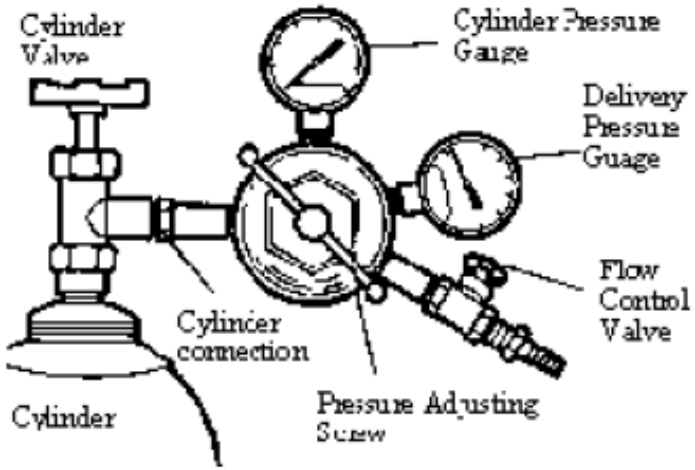
(B) Oil or grease may interact with the gas

(C) Oil or grease are flammable materials

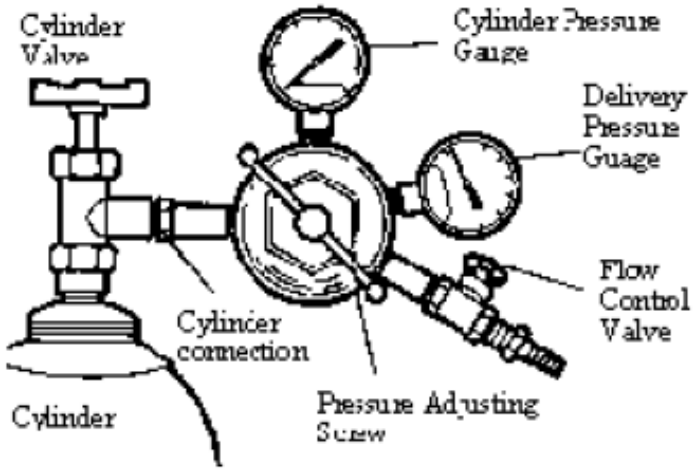
Use of Compressed Gas Cylinder

Moving Cylinders

- Never drag, slide or roll a cylinder; use a cylinder cart or basket.
- Always have the protective cap covering the valve when transporting the cylinder.
- Never transport the cylinder with the regulator in place.
- Make sure the cylinder is secured to the cart before moving it.



Use of Compressed Gas Cylinder



- Do not drop cylinders or strike them against each other or against other surfaces violently.

- Do not use the valve cover to lift cylinders; they could be damaged and become unattached. If the cylinder is dropped on a hard surface it can cause an explosion.

Use of Compressed Gas Cylinder

Example 7:

when transferring compressed gas cylinder

Solution:

(D)

(A) never allow it to fall or bang against other cylinder
(B) secure it to a cart designed for that purpose
(C) ensure that the regulator is removed and the valve cap is in place
(D) all of the above

Use of Compressed Gas Cylinder

Use and Operation

- Only properly trained personal should handle compressed gas cylinders.
- Back off the pressure adjusting screw of the regulator to release spring force before opening the cylinder valve.
- Open the valve slowly and only with the proper regulator in place. Stand with the cylinder between yourself and the regulator (cylinder valve outlet facing away) when opening the cylinder valve.
- Acetylene or other flammable gas cylinder valves should not be opened more than ½ turns of the spindle, and preferably no more than ¾ of a turn. This reduces the risk of explosion and allows for the cylinder valve to be closed quickly to cut off the gas flow.

Use of Compressed Gas Cylinder

- Never heat a cylinder to raise the pressure of the gas (this can defeat the safety mechanisms built in by the supplier).
- Keep the cylinder clear of all electrical circuits, flame, and sparks.
- Never leave the valve open when equipment is not in use, even when empty; air and moisture may diffuse through an open valve, causing contamination and corrosion within the cylinder.
- Do not refill a cylinder, mixing of residual gases in a confined area may cause a dangerous reaction.

Use of Compressed Gas Cylinder

- Never use copper fittings or tubing on acetylene tanks – an explosion may result.
- Never use compressed gas to dust off clothing, this could cause injury to the eyes or body and create a fire hazard. Clothing can become saturated and burst into flames if touched off by an ignition source such as a spark or cigarette.
- Never leave pressure in a regulator when it is not in use.
- Valve protection caps should remain in place until ready to withdraw gas, or connect to a manifold.
- Cylinder discharge lines should be equipped with approved check valves to prevent inadvertent contamination of cylinders connected to a closed system.

Use of Compressed Gas Cylinder

- Do not force connections that do not fit.
- Close the cylinder valve and release all pressure before removing the regulator from the cylinder.
- Do not smoke when oxygen or fuel gases are present. Smoking can cause a fire or explosion.
- Do not use acetylene at operating pressures above 15 psig.
- Purge fuel and oxygen hoses individually before lighting up a torch tip.
- Follow the equipment manufacturer's operating instructions at all times.

Use of Compressed Gas Cylinder

- If an outlet valve becomes clogged with ice, thaw it with warm water (if the gas is not water reactive), applied only to the valve.
- Use the cylinder valve for turning gas off, not the regulator.
- Workers should wear safety glasses and face shields when handling and using compressed gases, especially when connecting and disconnecting regulators and lines.

Use of Compressed Gas Cylinder

OXYGEN IS NOT COMPRESSED AIR, IT IS OXYGEN

Never use oxygen as a substitute as a "compressed air" to run pneumatic tools, in oil heating burners, to start internal combustion engines, to blow out pipelines, or to create pressure for ventilation.

Oxygen cylinder valves should be opened all of the way during use.

Compressed Gas Cylinder Leaks

Cylinder Leaks

- If the cylinder contains a **flammable, inert, or oxidizing gas**, remove it to an isolated area, away from possible ignition sources. Allow it to remain isolated until the gas has discharged, making certain that appropriate warnings have been posted.
- If the gas is a **corrosive**, remove cylinder to an isolated, well-ventilated area. The stream of leaking gas should be directed into an appropriate neutralizing material.
- For **toxic** material, the cylinder should be removed to an isolated, well-ventilated area, but only if this is possible while maintaining personal safety. It may be necessary to evacuate the facility.
- If the leak is at the junction of the cylinder valve and cylinder, do not try to repair it. Contact the supplier and ask for response instructions.
- Never use a flame to detect a gas leak. Use soapy water.

Compressed Gas Cylinder Leaks

6. **After the cylinder is no longer needed, the following steps should be taken:**

Do not completely empty the cylinder; always leave some residual pressure.

If the cylinder is empty, replace the cap and remove it to the empty cylinder storage area.

Label all empty cylinders with tags so that everyone will know their status. Empty cylinders can be marked with "MT and date" with chalk.

Handle empty cylinders as carefully as full ones; residual pressure can be dangerous.

Never refill a cylinder. This requires specialized equipment and techniques.

Never mix gases in a cylinder. The next person who draws from it may unknowingly cause an explosion.

Compressed Gas Cylinder Leaks

Example 8:

Despite some are non-toxic, any compressed gas cylinders must be stored in a well ventilated area, this is because leaked gases:

Solution:

(A)

(A) may interact with oxygen in the room and reduce its level below that required for life

(B) may explode

(C) may cause pressure decrease

Piping for Compressed Air

Piping for compressed air

- Polyvinyl chloride (PVC) plastic pipes can not be used for transporting compressed gases aboveground unless they are completely enclosed in a conduit or casing of sufficient strength to provide protection from external damage and deterioration. The heat generated from compressed air can weaken the PVC pipe and create an explosion hazard. When PVC piping explodes, plastic shrapnel pieces can be thrown in all direction and injure workers or damage equipment.
- Copper piping shall not be used for acetylene.
- Do not use cast iron pipe for chlorine.
- Distribution lines and their outlets need to be clearly labeled.
- Inspect piping systems on a regular basis.
- Pay attention to fittings as well as possible cracks that may have developed.

Hoses and Connections

Hoses and Connections

- Examine hoses regularly for leaks, set up an inspection schedule.
- Do not use unnecessarily long hoses.
- Keep hoses free from kinks and away from high traffic areas.
- Repair leaks promptly and properly.
- Store hoses in a cool place, and protect them from hot objects, and sparks.
- Do not use a single hose having more than one gas passage.

Effects of Elec. Cur. on Human Body

Example 9:

Chose True or False for the following sentences:

- Store and use the cylinders in a well-ventilated area.

(True)

- Use any regulator with any particular gas cylinders.

(False)

- Before removing the cap, secure the cylinder to a fixed bench or to a wall by a chain.

(True)

- A precaution of compressed gas accidents is to treat all cylinders as if they were full.

(True)

Effects of Elec. Cur. on Human Body

- Leakage of non-toxic gases in a closely tight room is not dangerous.

(False)

- Compressed gases are non-toxic, extinguishable or toxic but anyway they still dangerous.

(True)

- It is allowed to wear or use silvered watches or jewelry in a compressed gas room.

(False)

- To avoid gas hazards you should secure all cylinders to a bench or a wall with a strap or chain before removing the cylinder cap.

(True)

Effects of Elec. Cur. on Human Body

- Oxygen is a toxic gas.

(False)

- When a compressed gas cylinder is empty, you can connect it directly to another full cylinder to fill it with gas.

(False)

- Avoid dragging, rolling, or sliding gas cylinders even for short distance.

(True)