Standard Operating Procedure for High Pressure Gas Cylinder

Dr. Ragauskas group safety meeting
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High pressure Gas Cylinder

Gas cylinder with protection caps

regulator and gauge

Valve
Components of a high pressure Gas Cylinder

1. Cylinder Cap
2. Valve Handwheel
3. Valve Outlet Connection
4. Valve Pack Nut
5. Pressure relief valve
6. Valve Outlet Cap
7. Cylinder Collar
8. DOT/Cylinder type & PSI rating
9. Cylinder serial number
10. Initial hydrostatic test date
11. First 5 year hydrostatic retest
12. “∗” qualifies for 10 year retest
13. Original inspectors insignia
A compressed gas cylinder is like a sleeping giant. It is heavy, smooth, and hard to grip securely. It can be up to 57 inches tall, may weight up to 155 lbs full and be pressurized up to 2,200 psi.

The effects of unintentional release of energy by a compressed gas cylinder can have devastating results. Over 150 pounds of steel, traveling at high speed, can cause severe damage, personal injury and even death.
INTRODUCTION

Compressed gases present a unique hazard. Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases may be:

- Flammable or combustible
- Explosive
- Corrosive
- Poisonous
- Inert
- or a combination of hazards
Hazards of high pressure Gas Cylinders

High pressure gas cylinders present both mechanical and chemical hazards in the workplace.

**Physical Hazards**
- Tip over
- Explosion
- Uncontrolled projectile

**Chemical Hazards**
- Asphyxiation
- Poisoning
- Anesthetic effects
- Tissue Damage
Gas cylinder after explosion
Safe Practices for Handling & Use
Identification of Contents of Compressed Gas Cylinders

- Clearly label all cylinders
- Labels should be durable
- Do not accept cylinders that are not clearly labeled
- Color-coding is not a reliable means of identification
  - Cylinder colors vary from supplier to supplier
- If cylinder contents cannot be identified:
  - Mark as “Contents Unknown”
  - Contact the manufacturer
Do not rely on cylinder **color**
The cylinder should be clearly stenciled or stamped

The identification label should be permanently attached to the cylinder

If in doubt do not use the cylinder!
Always read the label!
Some gases have very specific procedures for safe use. Before handling any compressed gas cylinder, locate the Material Safety Data Sheet, or MSDS, for the gas you are using. This document contains vital information for handling each gas.
Safe Practices for Handling & Use

Cylinder Valves
Safe Practices for Handling & Use

There are a number of different types of cylinder valves affixed to cylinders. Standard cylinder-valve outlet connections developed by the Compressed Gas Association (CGA) are configured differently for each family of gases to minimize the potential of mixing incompatible gases. CGA connections typically utilize a three-digit coded number. This code generally includes:

- Outside diameter of valve threads
- Threads per inch and thread size
- Left-hand thread or right-hand threads
- External or internal threads

Right-handed

Left-handed (notched fitting)
## Safe Practices for Handling & Use

### Common Laboratory Gasses and their CGA Standard Outlet Connections

<table>
<thead>
<tr>
<th>GAS</th>
<th>CGA Valve Outlet &amp; Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylene ($C_2H_2$)</td>
<td>510</td>
</tr>
<tr>
<td>Argon (Ar)</td>
<td>580</td>
</tr>
<tr>
<td>Carbon Monoxide (CO$_2$)</td>
<td>320</td>
</tr>
<tr>
<td>Chlorine (Cl$_2$)</td>
<td>660</td>
</tr>
<tr>
<td>Helium (He)</td>
<td>580</td>
</tr>
<tr>
<td>Hydrogen (H$_2$)</td>
<td>350</td>
</tr>
<tr>
<td>Nitrogen (N$_2$)</td>
<td>580</td>
</tr>
<tr>
<td>Oxygen (O$_2$)</td>
<td>540</td>
</tr>
</tbody>
</table>
Safe Practices for Handling & Use

Pressure Regulators

- Two-Stage
- Low Pressure
- Single-Stage
- High Pressure
Components of a Pressure Regulator

Two-Stage Gas Pressure Regulator

- Cylinder Connection
- Cylinder Pressure Gauge
- Delivery Pressure Gauge
- Flow Control Valve
- Delivery Pressure Adjustment Knob
Regulator Operation

1. Attach the regulator to the cylinder valve outlet.

2. Turn the delivery pressure adjustment knob counterclockwise until it turns freely.

3. Ensure the flow control valve is in the closed position.

4. Slowly open the cylinder valve until the regulator registers the cylinder pressure.

5. Turn the delivery pressure adjustment knob clockwise until the desired delivery pressure is reached.

Be certain that the tubing used to convey the gas from the regulator to its end use is compatible with the gas. 

Example: Copper tubing + acetylene =copper acetylide (explosive)
Safe Practices for Handling & Use

Gas Cylinder Operation
Safe Practices for Handling & Use

Opening cylinders:

1. Place the cylinder in an upright position so the valve is always within reach.
2. Check fume hood or ventilation.
3. Warn co-workers that you are about to open the valve and position the cylinder with the valve pointing away from you.
4. Be sure fittings are clean, dry, and free of oil or grease.
5. Be sure the threads on the regulator correspond with those on the cylinder valve outlet.
6. Use regulators and pressure gauges only with gases for which they are designed.
7. Open the valve slowly and close the valve immediately when finished.
Safe Practices for Handling & Use

Closing cylinders:

1. Close the cylinder valve completely.

2. Bleed the lines if possible.

3. Tighten the flow control valve on the regulator or remove it if the cylinder is empty.

4. Replace the safety cap.
Inspecting & Testing Compressed Gas Cylinders

Regularly inspect cylinders. Take a few extra minutes to inspect the compressed gas cylinder. It could save you and your co-workers serious injury.

Ask these questions:

- Does the cylinder have signs of defects?
- Does it show signs of deep rusting?
- Does it contain the correct gas in the designated usage area?

Return any cylinders with problems (e.g., cap rusted shut, etc.) to the supplier.
Safely Transport Compressed Gas Cylinders

Whether you move cylinders short or long distances, follow these guidelines:

1. Remove the regulator. Never move a cylinder with the regulator still in place.

2. Replace the valve protection cap. Never lift a cylinder by the valve or protective cap.

3. Secure the cylinder to a suitable hand truck or cart in an upright position.

4. Take precautions so cylinders will not fall or strike each other or any other surface. Never roll, drag, or slide the cylinder.
Many accidents occur while moving or transporting cylinders. Handle cylinders gently. They may look strong and solid, but if a cylinder is damaged it can become an uncontrolled projectile damaging anyone or anything in its path.

Safely Transport Compressed Gas Cylinders

Correct cylinder transport by cart
Always use a proper cylinder trolley for moving cylinders........
Even for a short distance.
Never lift a cylinder by its cap, guard or valve.
Storage of high pressure Gas Cylinders

- Properly secure at all times
  - Straps, belts, or chains

- Keep valve caps on unless the cylinder is being used

- Store in a well ventilated area
  - Keep away from electrical circuits

- Segregate Oxygen cylinders (empty or full) from fuel-gas cylinders and combustible materials
  - 20 feet minimum distance
Segregate cylinders by hazardous gases. Incompatible gases must be stored by hazard class in separate areas, even when the cylinder is empty. Separate the incompatible cylinders by:
a distance of at least 20 feet, or a five foot firewall with a fire rating of 1/2 hour.
Examples of Proper Storage
Things to Remember

- Always wear eye protection when working with compressed gases
- Only use regulators that have both high and low pressure gauges
- Never refill a cylinder or use a cylinder for storing any material.
- The greatest hazard to a user of compressed gases is asphyxiation
- Remember, except for oxygen and air, ALL GAS IS AN ASPHYXIANT
Things Not To Do

- Never roll a cylinder to move it.
- Never carry a cylinder by the valve.
- Never leave an open cylinder unattended.
- Never leave a cylinder unsecured.
- Never grease or oil the regulator, valve, or fittings of an oxygen cylinder.
- Never refill a cylinder.
- Never use a flame to locate gas leaks.