

COMPRESSED GAS

Compressed gases are used widely across campus in research laboratories and support areas. As they present both physical and health hazards, special use, handling, storage, and transport procedures are necessary to ensure the safety of all who work with and around compressed gases.

Compressed gases are defined as:

- A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or
- A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg. C) regardless of the pressure at 70 deg. F (21.1 deg. C); or
- A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 deg. C) as determined by ASTM D-323-72.

Potential Hazards

High Pressure

All compressed gas cylinders present physical hazards due to their high pressure. A sudden or uncontrolled release can cause physical damage to people and surroundings.

Asphyxiation

Inert gases may displace oxygen in a space, creating an oxygen-deficient atmosphere, which could result in asphyxiation.

Chemical Hazards

Gases which are toxic or corrosive pose health hazards to those who may be exposed during use or a release.

Physical Hazards

Flammable, pyrophoric or reactive gases pose physical hazards such as fire or explosion under the right conditions.

Precautions and Controls

General

- Wear appropriate personal protective equipment (safety glasses or a faceshield, suitable gloves, closed toe shoes, lab coat, etc.) and attire when handling and swapping cylinders. If the gas is also corrosive or reactive, additional protective clothing and chemically-resistant gloves may be necessary.
- Transport cylinders using a gas cart. Prior to transporting, the regulator should be removed and the valve covered with the protective cap. Strap the cylinders securely to the cart.
- Keep compressed gas cylinders upright and secure at all times, using chains, straps, stand, or cart. Secure each cylinder individually, if possible. Bench clamps must be installed according to the manufacturer's instructions.
- Remove regulators and cover the valve with the cap when a cylinder is not in use.
- Leak check lines and fittings before use and after performing maintenance or making modifications which could affect the integrity of the system. Always use a leak check solution that is approved for oxygen whenever leak checking oxygen or nitrous oxide cylinders.
- Inspect cylinders prior to installation for damage and corrosion. Remove and tagout compromised cylinders.
- Identify all gas cylinders as Full, In Service, or Empty.

- Label all gas lines leading from a remote compressed gas supply, identifying the gas, the direction of flow, and the laboratory served.
- Ensure gases are stored/used in areas with adequate ventilation.
- Store and use toxic and corrosive gases in exhausted gas cabinets or enclosures. Flammable gases may also be required to be used/stored in exhausted gas cabinets or enclosures.
- Segregate cylinders by hazard classes.
- Segregate flammable gas cylinders from oxygen cylinders and other oxidizing gases. This can be accomplished by keeping a 20-foot separation between them, or by separating the gases by using rated gas cabinets or other fire rated structures.
- Keep all cylinders away from sparks, flames or radiant heat.
- Maintain an access path to storage areas.
- Return refillable cylinders to the original supplier when empty or no longer needed. Submit an online chemical waste pickup request to have pressurized/partial cylinders disposed of, if needed.

Handling and Use

- Ensure the cylinder is equipped with the appropriate regulator. The regulator must match the kind of gas and pressures involved, following the Compressed Gas Association's guidelines.
- Inspect regulators prior to use and periodically field test them following the guidance in this [Regular Maintenance](#) guide.
- Never use adaptors to make a regulator fit a cylinder.
- Do not use Teflon tape on regulators. Teflon tape should only be used on pipe threads.
- Keep oil, grease, and other hydrocarbon materials away from all elements of oxygen systems.
- Inspect all fittings and seals whenever changing cylinders and replace consumable seals as recommended by the supplier.
- Identify the cylinder relief valve and ensure it is not damaged or blocked.
- Place the cylinder so that the valve handle is readily accessible at all times.
- Avoid over-tightening the fittings, as most are constructed from brass or similar soft alloys. Hand-tighten first, before applying force with a wrench, tightening only enough to secure a leak-proof seal.
- Turn cylinder valve slowly to the fully open position. Acetylene valves, however, should only be turned approximately 1/4 to 1/3 of a turn.
- Verify regulator pressure is at the desired setting prior to use and periodically during use. Limit Acetylene operating pressure below 15 psi.
- Open valves slowly, standing with the cylinder between yourself and the regulator (valve outlet facing away from you). Do not use excessive force.
- Close cylinders when not in use and do not leave pressure on the regulator.
- Release all pressure on the regulator before removing it.
- Use tubing/piping that is compatible with the gas and pressure. Avoid reusable hose clamps. Use all stainless steel tubing and fittings for Helium and Hydrogen systems.

Manifold Systems

- Ensure the manifold system, and all associated equipment, is designed for the intended use (e.g., pressure, flows, etc).
- Identify atmospheric monitoring equipment location, alarm notification features and ensure proper operation when required.
- Document proper procedures for use of the system and train all users.
- Prevent cross-contamination by equipping lines with check valves, where applicable.
- Inspect system components regularly, making sure that pigtailed are not kinked, twisted or bent.

- Close cylinder valve and confirm there is no pressure in the line before disconnecting a cylinder from the system.

Emergencies

Compressed Gas Leak

If a cylinder leak cannot be stopped by tightening the valve gland or packing nut, follow the appropriate guidelines below:

- **Inert gas:** Place the cylinder in a well-ventilated location and contact the vendor for removal.
- **Toxic or Corrosive gas:**
 - Attend to injured or contaminated persons and remove them from exposure.
 - Alert people in the laboratory to evacuate.
 - Close doors to affected area.
 - Call the 24-hour Yale Hazardous Materials Emergency Response number (203-785-3555) to report the incident and request assistance.
 - Have a person with knowledge of the incident and laboratory available to answer questions from responding emergency personnel.
- **Flammable gas:**
 - Turn off sources of ignition if safe to do so.
 - Alert people in the laboratory to evacuate.
 - Close doors to affected area.
 - Call the 24 hour Yale Hazardous Materials Emergency Response number (203-785-3555) to report the incident and request assistance.
 - Have a person with knowledge of the incident and laboratory available to answer questions from responding emergency personnel.

Additional Information

- [EHS Safety Videos](#)