
Compressed Gas Cylinder Safety Manual

Document Number:
EHS-DOC500.02

Table of Contents

Contents

Policy Statement	5
Purpose	5
Responsibilities	5
1. Training	6
Instructions for Access:.....	6
2. Personal Protective Measures	7
3. Storage of Compressed Gas Cylinders	8
3.1 New Cylinders.....	8
3.2 Proper Storage of Gas Cylinders.....	8
4. General Requirements	9
4.1 Handling and Use of Compressed Gas Cylinders	9
A. Safe Use of Valves and regulators	9
B. Safe Handling	9
C. Safe use of gas cylinders	10
4.2 Requirements for Transporting Cylinders.....	10
4.3 System Construction	11
4.4 System Maintenance	11
4.5 Labeling	12
4.6 Other Requirements	12
5. Specific Hazard Classes	13
5.1 Flammable Gases	13
5.2 Poison Gases	13
5.3 Corrosive Gases.....	13
5.5 Fuel, High Pressure and Oxidizing Gases.....	15
6. Disposal	16
7. Leaks and Emergencies	17
7.1 Pre-Planning.....	17
7.2 Minor Leak	17

7.3 Major Leaks 18

7.4 Accidents Involving Personnel Injury 18

7.5 Fire and Fire-Related Emergencies 18

7.6 Reporting of Incidents (excludes minor leaks)..... 18

Appendix I 19

Appendix II 21

Policy Statement

Purpose

The objective of this policy is to ensure the safe and proper handling, storage, and use of compressed gas cylinders throughout the university. All FIU's employees who handle compressed gases must understand the health and safety hazards of the compressed gas cylinders and comply with all university's safety requirements and local, state, and federal laws.

Additional information is available by contacting Environmental Health & Safety: [Compressed Gas Cylinders Program](#).

Responsibilities

- A. **Supervisor's Responsibility:** It is the responsibility of supervisory personnel where gas cylinders are used to assure that all personnel under their supervision adhere to the procedures set forth in the Compressed Gas Cylinder Safety Manual, including successfully completing all training requirements set forth therein.
- B. **End User's Responsibility:** It is the responsibility of any staff, faculty, student or guest of the University, involved in the use, handling or storage of compressed gas cylinders to abide by the procedures set forth in the Florida International University (FIU) Compressed Gas Cylinder Safety Manual herein incorporated.
- C. **Department of Environmental Health & Safety (EHS):** It is the responsibility of EHS to update the contents of the Manual and to regularly monitor, through a program of self-audit and periodic inspection, the compliance of all compressed gas cylinder users to these procedures. EHS retains the authority to pursue appropriate actions as may be warranted to correct any violations, up to and including suspension of gas deliveries.
- D. **Authority:** The information, procedures and requirements contained in this manual are derived from nationally accepted standards set forth by the Occupational Safety and Health Administration (OSHA) Compressed Gas Standards 29 CFR 1910.101, the National Fire Protection Association (NFPA) 55: Compressed Gases and Cryogenic Fluids Code, and the Compressed Gas Association (CGA) guidelines.

1. Training

Required training is available at [FIU Develop](#).

Instructions for Access:

- A.** Log into the site and in the search tab, type “**Compressed Gas Safety Awareness**” to begin the course.
- B.** Enroll into the course using your FIU account.
- C.** Once the course has been completed, a certificate will be generated. **Print a copy for your supervisor as well as yourself. Every supervisor must maintain a file with employee-submitted certificates. All compressed gas cylinder users must retake this course every year.**

Familiarization with this manual and completion of the course provides the foundation for the safe and proper handling, storage, and use of compressed gas cylinders.

In addition, review of health and safety information associated with the specific gases used in a particular location should be integrated into the overall safety training for that area. Consult the gas’s Safety Data Sheet (SDS) before commencing use.

2. Personal Protective Measures

All personnel involved in the use or handling of compressed gas cylinders must wear the proper personal protective equipment (PPE), which includes, but are not limited to the following:

- **Eye protection** – required any time compressed gases are used or handled to protect against eye injury. Usually full goggles instead of standard safety glasses.
- **Hand and body protection** – required to protect against any hazard exposure depending of the type of gas handled.
- **Respiratory protection** – may be required depending on the type of gas used.
- **Foot Protection** – required to prevent injuries from cylinders slipping or falling.

Inspection: General Requirements

- Compressed gas cylinders shall be visually inspected to ensure that they are in safe condition. Visual cylinder inspections shall be performed to ensure cylinders are free of leaks, rusting or corrosion, defective valves, and evidence of physical abuse.
- Inspections of cylinders shall be conducted in accordance with the following standards:
 - Gas Association Pamphlets C-6-1968 and C-8-1962
 - 49 CFR 171-179 – Department of Transportation Hazardous Materials Regulations.

3. Storage of Compressed Gas Cylinders

3.1 New Cylinders

When a gas cylinder is received, it shall be visually inspected for the following:

- A.** A stamped hydrostatic test date within the last five years.
- B.** A stenciled or labeled identification of its contents.
- C.** Cylinder is in an acceptable condition. (e.g. excessive rust, no damage from hits or falls)
- D.** Presence of a valve protection cap.

3.2 Proper Storage of Gas Cylinders

- A.** Full and Empty cylinders are to be stored separately.
- B.** Compressed gas cylinder storage areas must be in a fire resistant enclosure located away from emergency exits and must be kept well drained, well ventilated, and cool and protected from the weather.
- C.** Regardless of size, all cylinders shall be stored in an upright position provided with supports (straps, chains or other similar devices) capable of preventing the cylinders from falling over.
- D.** Under no condition shall the temperature of gas cylinders exceed 50°C (125°F). When type E gas cylinders are being stored, the storage temperature must not exceed 34°C (93°F) since the relief valves of cylinders are set to release above 35°C (95°F).
- E.** Corrosive gases shall not be stored for more than six (6) months. Usually after this period, there is a deterioration of the gas purity that increases the possibility of cylinder valve malfunction.
- F.** Oxygen, hydrogen or nitrous oxide shall not be stored in the same area with flammable gases unless separated by at least 20 feet or by a one-hour rated fire resistant partition. Cylinders stored in an area outside a building must be a minimum distance of 20 feet from flammable gases or combustible material.
- G.** All storage rooms that contain in excess of 2000 cubic feet of oxygen, hydrogen or nitrous oxide shall be vented to the outside.
- H.** Always have the protective cap covering the valve when the gas cylinder is not connected for use.

4. General Requirements

4.1 Handling and Use of Compressed Gas Cylinders

A. Safe Use of Valves and regulators

1. Tampering with safety relief devices in cylinder valves is not permitted.
2. No university personnel are to attempt to repair or alter cylinders, valves, or other safety relief devices.
3. All cylinder valves are to be kept closed at all times, except when the cylinder is in use.
4. The vendor needs to be notified if any condition has occurred which may have permitted any foreign substance to enter a cylinder or valve.
5. Approved pressure regulating devices must be used in all cases when gas pressure in a system is to be lower than cylinder pressure.
6. All cylinder valves shall be opened slowly to prevent ice formation. Appropriate tools shall be used to tighten or loosen tank valves. If the valve will not readily open, return the cylinder to the vendor.
7. Before a regulator is removed from a cylinder, the cylinder valve shall be closed and all pressure released from the regulator and system.
8. Be sure the regulator pressure control valve is relieved (or closed) before attaching it to the cylinder.
9. Remove all pressure from regulators that are not currently used.
10. Use pressure relief valves in downstream lines to prevent high-pressure buildup in the event that a regulator valve does not seat properly and a tank valve is left on.
11. Vent fume hood or ventilated gas cabinet relief valves when using flammable or toxic gases.
12. Pressurize regulators slowly and ensure that valve outlets and regulators are pointed away from all personnel when cylinder valves are opened.
13. Leave the wrench in place on the cylinder valve, when needed, to open the main valve. Use adequately sized wrenches (12 inches long) to minimize ergonomic stress when turning tight tank valves. Cylinders with “stuck” valves needs to be returned to suppliers to have valves repaired.
14. Fully open valves during cylinder use. A fully open valve improves the internal seal and helps prevent packing leaks.
15. Use a cylinder cap hook to loosen tight cylinder caps. Never apply excessive force to pry off caps. Return a cylinder to the supplier to remove “stuck” caps.

B. Safe Handling

1. All cylinders shall be labeled to identify the content.

2. Only trained personnel shall handle cylinders.
3. Whenever removable caps are provided for valve protection, they shall be kept in place when the cylinder is not in use.
4. Cylinders shall never be lifted by the cap or valve.
5. Cylinders shall never be dropped or permitted to come into violent contact with each other.
6. A cylinder hand truck shall be readily available to avoid dragging, rolling, or sliding cylinders.
7. Cylinders shall never be painted by the user.
8. Never leave cylinders in areas where they will be exposed to damage from falling objects, corrosion, or public tampering.
9. Cylinders shall not be subjected to artificially create low temperatures without the approval of the vendor due to possible decreased ductility of the steel at low temperatures.
10. All empty cylinders shall be handled with the same care as full cylinders.

C. Safe use of gas cylinders

1. Florida International University shall only use cylinders that meet Department of Transportation (DOT) regulations for the transportation and storage of compressed gases.
2. Never apply excessive force when trying to open valves.
3. Open flame can never be permitted to be exposed to any part of a compressed gas cylinder. Flames shall be kept at least 20 feet from any compressed gas cylinder.
4. No cylinder is to be placed where it might become part of a live electrical circuit.
5. No cylinder is to be used if the contents are not known or identified.
6. At no time shall connections between cylinder and auxiliary equipment be forced. If the threads do not match, return the cylinder to the vendor. Teflon tapes can never be used on cylinder or regulator connections.
7. Regulators, gauges, hoses, and other appliances used with a particular gas or group of gases must not be used on cylinders containing gases having different chemical properties unless the vendor grants permission in writing.

Compressed gas shall not be used to remove foreign matter from clothing or any part of the human body.

4.2 Requirements for Transporting Cylinders

- A. You must wear closed-toed shoes.
- B. Magnets, slings, ropes, or chains shall not be used to transport any cylinder. A suitable truck or cylinder cart shall be used for transport.

- C. Make sure that the valve cap is secured before transporting the cylinder.
- D. Once the cylinder is placed on a proper cylinder hand truck, make sure it is properly secured by a strap rack, heavy gauge chain or clamp to prevent them from falling.

4.3 System Construction

The following information applies to the use of manifolds, piping, valves and/or regulators:

- A. Where compressed gas cylinders are connected to a manifold, the manifold and its related equipment (such as regulators), must be of proper design for the product(s) they are to contain at the appropriate temperatures, pressures, and flows.
- B. Use only approved valves, regulators, manifolds, piping, and other associated equipment in any system that requires compressed gas.
- C. Be sure pressure gauges on regulators are correct for the pressure of the gas cylinder used.
- D. Gas threads, configurations, and valve outlets are different for each class of gases to prevent mixing of incompatible gases. Lecture bottles are an exception. Lecture bottles use universal threads and valves, some of which are interchangeable. Label all associated equipment with the gas name to prevent unintentional mixing of incompatible materials.
- E. Compressed Gas Association Pamphlet V-1: "Standard for Compressed Gas Cylinder Valves," lists the appropriate valve for each gas. Manufacturers and distributors shall also be able to identify the valves and associated equipment required for each gas.

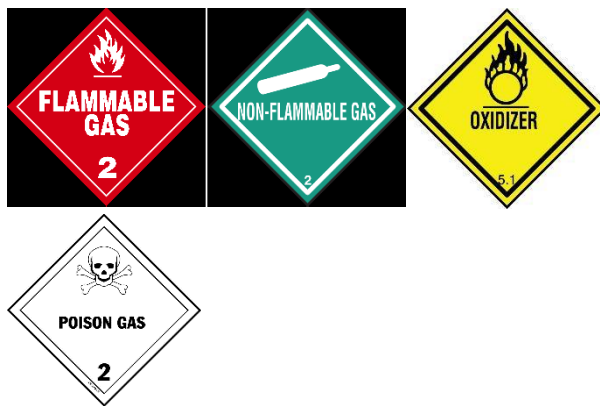
4.4 System Maintenance

The following information applies to the use of system piping, regulators, manifolds, and other apparatuses:

1. Keep piping, regulators, and other apparatuses gas tight to prevent gas leaks.
2. The cylinder user shall make certain that all appliance connections are tight to prevent leakage. All connections shall be tested with a soapy water solution. The system shall be slowly and partially pressurized and leak-tested before fully pressurizing the system.
3. Release pressure from systems before connections are tightened or loosened and before any repairs.
4. Fluorescent light can be used to check for grease or oil in regulators and valves
5. Valve and Regulator Maintenance:
 - a) Know the valve and regulator histories before use.
 - b) Valves and regulators shall undergo periodic maintenance and repair as necessary.
 - c) Perform a visual inspection before each use to detect any damage, cracks, corrosion, or other defects.
 - d) Valves that pass visual inspection are still subject to failure. It is critical that toxic or poisonous gases are used in ventilated enclosures and have local exhaust ventilation in place for downstream pressure relief valves.
 - e) Long-term maintenance or replacement periods vary with the types of gases used, the length of use, and conditions of use. Consult the cylinder, regulator, or gas supplier for recommended valve and regulator maintenance schedules.
 - f) Valves and regulators shall only be repaired by qualified individuals. Consult valve and regulator manufacturers, gas supply companies, or valve and regulator specialty shops for any repair needs.

4.5 Labeling

- A. No one shall deface or remove any markings, labels, decals, tags or stencil marks which been applied/attached for the identification of a cylinder. The cost of determining the contents of an unknown cylinder shall be the responsibility of the department that possesses it.
- B. All cylinders must bear an identification tag stating the name of the gas or mixture and illustrating one of three conditions: full, in service, or empty. (see picture on the left) **For more information on acquiring these tags, please visit EH&S [Compressed Gas Cylinders](https://ehs.fiu.edu) site or e-mail ehs@fiu.edu .**
- C. It is illegal to change the stamped marks on any compressed gas cylinder.
- D. Mixed gases must be clearly labeled with the contents of the cylinder.
- E. Know the contents of each cylinder that you are using. Preferred labeling includes the identity of the material, statement of hazard, and the associated signal word.
- F. Unmarked or illegibly marked cylinders shall be returned to the supplier.
- G. Never rely on cylinder color to identify content.



4.6 Other Requirements

- A. All compressed gases shall be used only for their intended purpose.
- B. Only the gas supplier is allowed to mix gases in a cylinder.
- C. Smoking is not permitted within 20 feet of any compressed gas cylinder.
- D. Leaking, defective, fire burned, or corroded containers must not be shipped without the prior approval of the supplier.

5. Specific Hazard Classes

5.1 Flammable Gases

- A.** No cylinders are to be stored near highly flammable solvents, combustible waste material, unprotected electrical connections, gas flames, or other sources of ignition. Common examples of flammable gases include acetylene, hydrogen, methane, propane, carbon monoxide, and isobutene.
- B.** At no time shall a flame be used to detect a leak. A soapy water solution or approved commercial leak detection solution shall be used.
- C.** Inside buildings, stored oxygen shall be separated from flammable gas cylinders by a minimum of 20 feet, or separated by a fire resistant partition with a height no less than that of the cylinders.
- D.** Post “No Open Flames” signage on access doors to areas that use or store flammable gases.



5.2 Poison Gases

- A.** Before using a poison gas, all label information and Safety Data Sheets (SDS's) associated with the use of the particular poison gas shall be read. Users shall be familiar with the hazards and health effects of the gas that they are using, and procedures to be followed in the event of an emergency.
- B.** Poison gases shall only be used in force-ventilated areas, preferably in hoods with forced ventilation, or outdoor.
- C.** Poison gas cylinders shall be of a size that will ensure the complete usage of the cylinder within a reasonable period.

5.3 Corrosive Gases

- A.** Cylinders containing corrosive gases shall not be stored for more than 6 months.
- B.** Remove regulators after use and flush with dry air or nitrogen.
- C.** Metals become brittle when used in corrosive gas service; check equipment and lines frequently for leak.
- D.** Use a diaphragm gauge with corrosive gases that would destroy a steel or bronze gauge. Check with the gas supplier for recommended equipment.

5.4 Cryogenic Liquids and Gases

Cryogenic liquids and their boil-off gases rapidly freeze human tissue and cause embrittlement of many common materials. All cryogenic liquids produce large volumes of gas when they vaporize and may create oxygen-deficient conditions. Common examples of common cryogenic liquids include liquid oxygen, nitrogen, hydrogen, neon, and helium.

- A.** Use appropriate personal protective equipment, including insulated gloves, lab coat, and eye protection (goggles and face shield) during any transfer of cryogenic liquid.
- B.** In the event of skin contact with a cryogenic liquid, do not rub skin; place the affected part of the body in a warm water bath (not to exceed 40°C [105°F]). If a burn is significant, seek medical attention.
- C.** Use only equipment, valves, and containers designed for the intended product, service pressure, and temperature.
- D.** Inspect containers for loss of insulating vacuum. If the outside jacket on a container is cold or has frost, some vacuum has been lost. Empty the contents into another cryogenic container and remove the damaged unit from service. The manufacturer or an authorized company shall make repairs.
- E.** Transfer operations involving open cryogenic containers must be conducted slowly to minimize boiling and splashing of the cryogenic fluid.
- F.** Ice or other foreign matter shall not be allowed to accumulate beneath the vaporizer or the tank. Excessive ice buildup could result in the discharge of excessively cold gas or structural damage to the cryogenic container or surroundings.
- D.** All cryogenic systems, including piping, must be equipped with pressure relief devices to prevent excessive pressure build-up. Pressure reliefs must be directed to a safe location. Do not tamper with pressure relief valves or the settings for the valves.
- E.** Hot air, steam, or hot water shall be used to thaw frozen equipment. Exception: Do not use water to thaw liquid helium equipment.

5.5 Fuel, High Pressure and Oxidizing Gases

Fuel gases often use a combination of flammable and oxidizing gases. Use of fuel gases must comply with the following:

- A.** OSHA 29 CFR1910.253 – Oxygen-Fuel Gas Welding and Cutting
- B.** OSHA 29 CFR1910.102 – Acetylene
- C.** OSHA 29 CFR1910.103 – Hydrogen
- D.** Compressed Gas Association (CGA) Pamphlet G-1: “Acetylene”
- E.** CGA Pamphlet SB-8: “Use of Oxy-fuel Gas Welding and Cutting Apparatus” NFPA 51: “Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting and Allied Processes.”

High Pressure gases can be rated up to 3,000 pounds per square inch (psi). Typical uses for high-pressure gases include:

- A.** Inert welding gas mixtures
- B.** Cryogenics
- C.** Non-toxic gas distribution
- D.** Medical gas distribution
- E.** Emergency oxygen services

Oxidizing gases are non-flammable. Oxidizing gases include:

- Oxygen
- Chlorine
- Fluorine
- Nitrous Oxide

Do not use oil in any apparatus where oxygen will be used.

6. Disposal

- A.** Proper identification of the contents of all cylinders is required and is the responsibility of the cylinder owner.
- B.** Refillable cylinders shall be returned to the vendor. Return cylinders with at least 30 pounds of pressure to reduce the risk of foreign materials entering the empty vessel.
- C.** If a refillable cylinder is encountered that does not have a manufacturer label, contact the vendor.
- D.** Disposal fees of an unknown cylinder are a departmental expense.

7. Leaks and Emergencies

7.1 Pre-Planning

Despite adherence to cylinder safety practices, accidents involving gases may occur. The amount of damage sustained by personnel and property from these accidents is greatly influenced by the quality of the emergency plan. Users of compressed gas cylinders must be familiar with necessary safety precautions. Standard Operating Procedures (SOP) for using compressed gases must include a discussion of possible accident scenarios, appropriate employee responses, and shall take into account the following factors:

- A.** The nature of the operation (e.g., experimental design, equipment used, and the types of injury that can possibly occur).
- B.** The potential location of a release or spill (e.g., outdoor versus indoor, in a laboratory, corridor or storage area, on a table, in a hood, or on the floor).
- C.** The quantities of material that might be released and the type of containment (i.e. compressed gas tank size, manifold systems, etc.).
- D.** The chemical and physical properties of the compressed gas (e.g., its physical state, vapor pressure, and air and water reactivity).
- E.** The hazardous properties of the compressed gas (e.g., its toxicity, corrosiveness, and flammability).
- F.** The availability and locations of emergency supplies and equipment.
- G.** An emergency plan of action that identifies building evacuation routes, emergency telephone numbers, chemical containment procedures, fire extinguisher usage, etc.

7.2 Minor Leak

Occasionally, a gas cylinder or one of its component parts may develop a leak. Most of these leaks occur at the top of the cylinder, in areas such as the valve threads, pressure safety device, valve stem, or the valve outlet. Here are some guidelines to dealing with minor leaks:

- A.** For non-toxic gases, verify suspected leaks using a gas detector or soapy water solutions (a flame shall not be used for detection). If the leak cannot be stopped by tightening a valve gland or packing nut, notify the vendor. Do not try to fix a leak on a toxic or highly toxic gas cylinder; instead initiate emergency action procedure.
- B.** For flammable (non-toxic), inert or oxidizing gases (non-toxic), move the cylinder to an isolated, well-ventilated area (within or next to a fume hood), away from combustible materials. Post signs that describe the hazard.
- C.** For corrosive and toxic gas leaks, immediately contact the vendor for leak remediation or cylinder removal. Leave the laboratory until the vendor corrects the leak or removes the cylinder from the lab. Do not remove a leaking toxic gas cylinder from a ventilated cabinet.

7.3 Major Leaks

In the event of a large gas release or if an accident takes place, the following emergency procedures shall be done:

- A. Evacuate the area, securing entrances and providing assistance to others on the way out.
- B. Activate building and area fire alarms (or chemical safety alarms if applicable).
- C. Call FIU Police (305-348-5911) immediately and report the incident as exact a location as possible.
- D. Provide emergency response officials with the details of the problem upon their arrival.

7.4 Accidents Involving Personnel Injury

- A. For medical emergencies, call FIU Police (305-348-5911) and provide an exact location and condition of injured individual if known.
- B. Assist injured personnel and administer immediate first aid, which may include:
 - 1) Use of emergency showers (in case of burning clothing or chemical exposure).
 - 2) Removing contaminated clothing.
 - 3) Irrigating the eyes at an eyewash station.
 - 4) Administering cardiopulmonary resuscitation (CPR).
- C. Notify personnel in adjacent areas of any potential hazards.
- D. Move injured personnel only if necessary to prevent further exposure or harm.

7.5 Fire and Fire-Related Emergencies

Small, isolated fires within the laboratory may be extinguished using the appropriate fire extinguisher if the lab personnel are confident that they can safely extinguish the fire.

For large or rapidly spreading fires, the following procedures shall be executed:

- A. Activate building and area alarms.
- B. Evacuate the building, shutting doors, and providing assistance to other on the way out.
- C. Call FIU Police (305-348-5911). If using a FIU phone, to report the fire, dial:
 - 7911** – From Modesto A. Maidique Campus and Engineering Center Campus.
 - 6911** – From Biscayne Bay Campus.
- D. Provide the emergency call taker with the exact location of the incident and the details of the problem. Remain at least 150 feet from the building and upon arrival of fire or police personnel, provide details of the problem, any actions taken and/or unaccounted for personnel.

7.6 Reporting of Incidents (excludes minor leaks)

Notify EHS at **305-348-2621** or e-mail ehs@fiu.edu and provide the following:

- 1) Date of the incident
- 2) Location of the incident
- 3) The type(s) of gas (or gases) that were involved
- 4) Brief description of the incident

Appendix I

Gas Classification Table

Gas Name	Symbol	Toxic	Corrosive	Oxidizer	Pyrophoric	Flammable	Cryogenic	Inert
Acetylene	C ₂ H ₆					X		
Ammonia	NH ₃		X			X		
Argon	Ar							X
Arsine	AsH ₃	X				X		
Boron Trichloride	BCl ₃		X					
Boron Trifluoride	BF ₃		X					
Carbon Dioxide	CO ₂							X
Carbon Monoxide	CO	X				X		
Carbon Tetrafluoride	CF ₄							X
Chlorine	Cl ₂	X	X	X				
Chloroform	CHCl ₃	X						
Diborane	B ₂ H ₆	X			X	X		
Dichlorosilane	H ₂ SiCl ₂	X	X			X		
Difluoromethane	CH ₂ F ₂					X	X	
Disilane	Si ₂ H ₆				X	X		
Decacarbonylirhenium	Re ₂ (CO) ₁₀	X						
Dodecacarbonyltriruthenium	Ru ₃ (CO) ₁₂	X						
Ethylene	C ₂ H ₄					X	X	
Fluorine	F ₂	X	X					
Forming Gas (Hydrogen/Nitrogen Mixture)	H ₂ N ₂							X
Germane	GeH ₄	X			X	X		
Helium	He							X
Hexafluoro-1,3-butadiene	C ₄ F ₆	X				X		
Hydrogen	H ₂					X		
Hydrogen Bromide	HBr	X	X					
Hydrogen Chloride	HCl		X					
Hydrogen Fluoride	HF		X					
Hydrogen Sulfide	H ₂ S	X				X		
Liquid Nitrogen	LN ₂						X	X
Liquid Oxygen	LO ₂			X			X	
Methane	CH ₄					X		
Methyl Chloride	CH ₃ Cl					X		

Gas Name	Symbol	Toxic	Corrosive	Oxidizer	Pyrophoric	Flammable	Cryogenic	Inert
Methylene Fluoride	CH ₂ F ₂					X		
Methyl Fluoride	CH ₃ F					X		
Methylsilane	CH ₃ SiH ₃				X	X		
Neon	Ne							X
Nitrogen	N ₂							X
Nitrogen Trifluoride	NF ₃		X	X				
Nitrous Oxide	N ₂ O			X				X
Octafluorocyclobutane	C ₄ F ₈	X						
Octafluorocyclopentene	C ₅ F ₈	X						
Octane	C ₈ H ₁₆					X		
Oxygen	O ₂			X				X
Ozone	O ₃	X	X	X				
PDE-100	CF ₄ & O ₂							X
Phosphine	PH ₃	X			X	X		
Propane	C ₃ H ₈					X		
Refrigerant 11 (Trichlorodifluoromethane)	CCl ₃ F							X
Refrigerant 12 (Dichlorodifluoromethane)	CCl ₂ F ₂							X
Refrigerant 14 (Tetrafluoromethane)	CF ₄							X
Refrigerant 22 (Chlorodifluoromethane)	CHClF ₂							X
Refrigerant 23 (Trifluoromethane)	CHF ₃							X
Refrigerant 113 (Trichlorotrifluoromethane)	CCl ₂ F-CClF ₂							X
Refrigerant 115 (Chloropentafluoroethane)	C ₂ ClF ₅							X
Refrigerant 116 (Hexafluoroethane)	C ₂ F ₆							X
Silane	SiH ₄				X	X		
Silicon Tetrafluoride	SiF ₄		X					
Silicon Tetrachloride	SiCl ₄		X					
Sulfur Hexafluoride	SF ₆							X
Tetramethylcyclotetrasiloxane	C ₄ H ₁₆ O ₄ Si ₄					X		
Trimethylsilane	C ₃ H ₁₀ Si					X		
Tungsten Hexafluoride	WF ₆	X	X					
Xenon	Xe							X

Appendix II

Gas Cylinder Safety Self-Check List

Gas Cylinder Safety Self-Check List	Yes	No	Comments
Cylinders are clearly labeled and affixed with full/in-service/empty tags.			
Empty cylinders are marked as “EMPTY” and treated in the same manner of full cylinders.			
Cylinders are securely attached to a wall or other fixed structure using straps or chains and in an upright position			
Is the storage area permanently posted with the names of the gases stored in the cylinders?			
Oxygen cylinders are separated from fuel-gas cylinders and other flammable/combustible materials (especially oil or grease) a minimum distance of 20 feet, or are separated from them by a noncombustible barrier at least 5 feet high and having a fire-resistance rating of at least one-half hour.			
Are cylinders stored away from electrical connections, sources of ignition, combustible waste material?			
Are Cylinders stored away from doors and emergency exits?			
Are cylinder valves closed at all times, except when the valve is in use?			
Gas cylinders that are not currently in use are capped and properly secured?			
Are all compressed gas cylinders regularly inspected for corrosion, pitting, cuts, gouges, digs, bulges, neck defects and general distortion?			
Are all compressed gas cylinder connections (pressure regulators, manifolds, hoses, gauges, and relief valves) checked for integrity and tightness?			
Are all compressed gas cylinders regularly subjected to leak detection using an approved leak detecting liquid?			
Have all compressed gas cylinders the contents and precautionary labeling clearly marked on the exteriors?			
Do only experienced and properly trained people handle compressed gases?			
Proper personal protective equipment (PPE) is readily available and being used when handling compressed gas cylinders.			
Are Emergency gas shut-off valves accessible and clearly labeled?			