

GAS CYLINDER SAFETY

Certain specific properties of compressed gases make them highly useful in various research activities. These gases, however, can be dangerous if not handled in an appropriate manner. Many of the odorless and colorless gases are highly toxic and flammable and this calls for utmost care while handling them.

TYPES OF GASES

- **Flammable gas**

Flammable gas burns or explodes if it is mixed with air, oxygen or other oxidant, in the presence of a source of ignition.

- **Inert gas**

Inert gas is resistant to chemical action under normal temperature and pressure conditions.



- **Oxidizing gas**

Oxidizing gas supports combustion.

- **Pyrophoric gas**

Pyrophoric gas spontaneously ignites upon exposure to air.

- **Corrosive gas**

Corrosive gas can burn and destroy body tissues on contact. Corrosive gases can also attack and corrode metals.

- **Poisonous (Toxic) gas**

Poisonous (Toxic) gas is harmful to humans when it exceeds the maximum allowable concentration in air.

HAZARDS IN GAS CYLINDER USAGE

- Oxygen deficient atmosphere resulting in asphyxiation.
- Formation of flammable gas air mixtures in case of leakage of flammable gas.
- Oxygen enriched atmosphere in case of leakage of oxygen gas.
- Injury caused by fall of gas cylinders during handling.
- Exposure to high concentrations of toxic or corrosive gases in case of leakage.
- Gas cylinders can explode when exposed to high temperatures, e.g., in case of fire.
- If the valve breaks, the sudden release of compressed gas can turn it into a lethal projectile.
- Gas cylinders should be capped when they are not connected to the system.

Oxygen deficiency:

Leakage of any gas (except oxygen) inside a confined/enclosed space can cause displacement of oxygen resulting in an oxygen deficient atmosphere. Entry into a workspace with oxygen level below 19.5% is unsafe and not permitted.

Oxygen levels and effects:

Above 21%	Oxygen enriched atmosphere
20.95%	Normal atmospheric level
19.5%	Minimum required level
19.5 -12%	Increased breathing rates, accelerated heartbeat, and impaired thinking.
0-12%	Faulty judgment, intermittent respiration, and exhaustion
6-10%	Nausea and unconsciousness
Less than 6%	Cessation of breathing followed by cardiac arrest

Oxygen enrichment:

- An atmosphere having more than 21% of oxygen is considered as an oxygen enriched atmosphere and is not safe for entry/working.
- A leakage of oxygen gas in an enclosed space can result in an oxygen enriched atmosphere.
- An excess of oxygen in the air can be a fire hazard, as oxygen is a supporter of combustion and it causes materials to burn violently.

Flammable vapour air mixtures:

- A leakage of a flammable gas would form a flammable vapour air mixture.
- If the vapour air mixture is within the flammable range, it can explode in the presence of an ignition source.

Flammability limits:

- Vapour air mixtures will only ignite within a well-specified range of composition.
- The lower flammable limit (LFL) is the leanest mixture that can ignite, i.e., the mixture with the smallest fraction of combustible gas.
- The upper flammable limit (UFL) is the richest fraction of combustible gas mixture that can ignite.

Toxicity:

Toxicity is the ability of a substance to produce an unwanted physiological effect when the substance has reached a sufficient concentration at a certain site in the body.

Toxicity-Threshold Limit Value(TLV):

The concentration of an airborne substance to which an average person can be repeatedly exposed without adverse effects.

PURCHASING/ RECEIVING GAS CYLINDERS

- Purchase smallest quantities wherever and whenever possible.
- When receiving gas cylinders:
Ensure that they are properly labeled.
Do not accept cylinders without label of the content.

- Visually inspect for damage.
- Ensure that the gas cylinders are received with valve caps.

STORAGE OF GAS CYLINDERS

- Gas cylinders must be stored in a separate storage area outside the building.
- The storage area must be protected from weather.
- Flammable gas cylinders must be separated from oxygen cylinders by a distance of 6m or by a wall of 30 minutes fire resistance.
- Empty cylinders must be marked /tagged and stored separately.

STORAGE OF GAS CYLINDERS INSIDE LABS

- Only gas cylinders for immediate use must be stored inside the laboratory.
- Materials must not be stored in front or on top of gas cylinders.
- All cylinders in the laboratories must be clearly labeled.
- Gas cylinders must not be stored near exits and passages.
- Gas cylinders must be stored away from heat sources.
- Place the valve cap on the cylinder whenever the regulator is removed.
- Cylinders must always be kept chained or supported in a manner to prevent fall.

TRANSPORTATION OF GAS CYLINDERS INSIDE LABS

Before moving gas cylinder

- Valve must be closed.
- Regulator must be removed.
- Cylinder must be capped.
- Secure the cylinder in a cylinder cart (with chain).

SAFE USE OF GAS CYLINDERS

- Refer the Material Safety Data Sheet (MSDS) for the gas before usage, to know about the hazards and precautions to be taken.

- Do not tamper with the cylinder valves.
- Always use the correct regulator for the cylinder.
- Inspect the regulator for damage before use.
- Never use damaged regulators, piping, etc.
- After the regulator is attached, the cylinder valve must be opened just enough to indicate pressure on the regulator gauge and all connections must be checked with a compatible solution for leaks.
- Do not stand in front of the regulator gauge or the valve outlet side, while opening the valve.
- Use safety glasses while working with gas cylinders.
- Before a regulator is removed from a cylinder, the cylinder valve must be closed and the regulator relieved of gas pressure.
- Ensure proper ventilation in the area where gas cylinders are stored.
- Spindle key must always be placed at an easily accessible location, for closing the valve in case of emergency.
- A cylinder must never be emptied to a pressure lower than 25 psi as the residual contents may become contaminated if the valve is left open.
- Close cylinder valve whenever:
work is finished
cylinder is empty
- Store toxic/pyrophoric gases in gas cabinets.
- Gas detectors must be installed for detecting gas leaks.
- The cylinder valve and other fittings used with gas cylinders must be compatible with the type of gas used. Incompatible materials can cause gas leak.
- Greasy and oily materials must never be used on oxygen cylinders or fittings as it can cause explosion.
- Regulators for oxygen service must never be used with flammable gases. Cross contamination of internal parts may result in rapid oxidation and fire.
- If a gas leak occurs from the cylinder inside the gas cabinet it must not be removed from the cabinet.

EMERGENCY MEASURES

- No attempt must be made to repair a leak from the base of the valve.
- Personal protective equipment must be used while dealing with toxic/corrosive gas leaks.

- The building must be evacuated immediately if a gas (flammable/pyrophoric/toxic/corrosive) leak becomes uncontrollable.
- Emergency measures must be undertaken only by trained personnel.
- The gas supplier must be intimated immediately.
- Self Contained Breathing Apparatus(SCBA) must be used while dealing with toxic/corrosive gas leaks or if an oxygen deficient atmosphere exists.
- Contact Emergency team in case of any support required.