



# SOP: GAS CYLINDERS

## INTRODUCTION

Compressed gases can be hazardous because each cylinder contains large amounts of energy and may also have high flammability and toxicity potential.

High pressure cylinder – 200 Bar filling pressure

Low Pressure cylinder – 35 Bar filling pressure

<b>GAS NAME</b>	<b>CYLINDER APPEARANCE</b> <b>This will vary between different Gas Providers!!!</b>
<b>Acetylene</b>	Maroon
<b>Air technical</b>	Greyish cylinder (totally)
<b>Carbon dioxide technical dry</b>	Grass Green cylinder
<b>Carbon Monoxide</b>	Black cylinder with grey
<b>Argon</b>	Turquoise/Blue or Blue + White Top
<b>Helium</b>	Orange + Brown Top
<b>Hydrogen</b>	Red + White Top
<b>Nitrogen gas technical</b>	Orange + Black & Grey Top
<b>Oxygen Technical</b>	Black (totally)
<b>H<sub>2</sub>/N<sub>2</sub> mix</b>	Pink + Red Top
<b>CO<sub>2</sub>/H<sub>2</sub> mix</b>	Pink + Red Top
<b>Ammonia</b>	Grey + Yellow & Red Top

- Mixture cylinders shall be painted and stencilled with contents.
- Flammable gas component in mixtures will have a red shoulder.
- Toxic gas component in mixtures will have a yellow shoulder.
- Flammable and toxic component in mixture will have red shoulder with yellow band.



## GAS CHARACTERISTICS & HEALTH EFFECTS

### Argon

Argon is colorless, odorless, and nontoxic as a solid, liquid, and gas. Argon is chemically inert under most conditions and forms no confirmed stable compounds at room temperature.

Although argon is a noble gas, it has been found to have the capability of forming some compounds. It can act as a simple asphyxiant by diluting the concentration of oxygen in the air below the levels to support life.

### Acetylene & LPGas

Acetylene and Handigas, being highly flammable gases, are ignited instantly by a spark or a piece of hot metal. In confined spaces, a small amount of either gas will create an extremely dangerous explosive atmosphere.

### Ammonia

**Ammonia** or **azane** is a compound of nitrogen and hydrogen with the formula  $\text{NH}_3$ . It is a colourless gas with a characteristic pungent smell. Exposure to very high concentrations of gaseous ammonia can result in lung damage and death.

### Carbon Dioxide

No smell, but can cause the nose to sting. Toxic. Will cause asphyxiation and death. Much heavier than air. Will collect in ducts, drains and low lying areas. Can cause cold burns on skin.

### Hydrogen

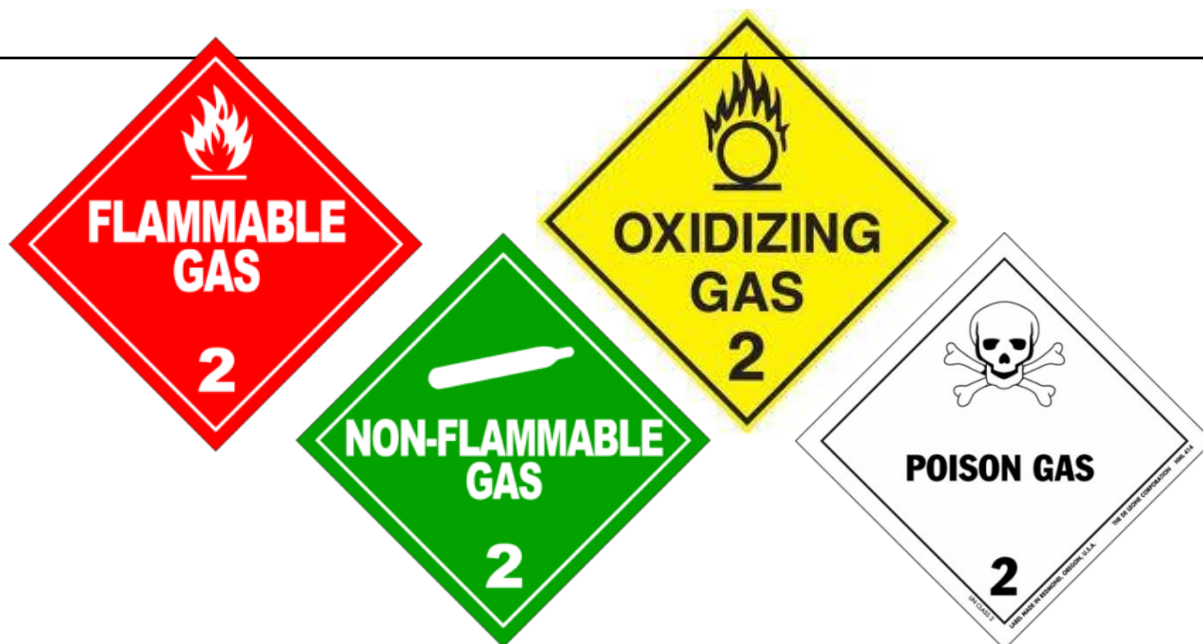
Hydrogen gas (dihydrogen or molecular hydrogen) is highly flammable and will burn in air at a very wide range of concentrations between 4% and 75% by volume. Hydrogen poses a number of hazards to human safety, from potential detonations and fires when mixed with air to being an asphyxiant in its pure, oxygen-free form. In addition, liquid hydrogen is a cryogen and presents dangers (such as frostbite) associated with very cold liquids. Hydrogen dissolves in many metals, and, in addition to leaking out, may have adverse effects on them, such as hydrogen embrittlement, leading to cracks and explosions. Hydrogen gas leaking into external air may spontaneously ignite. Moreover, hydrogen fire, while being extremely hot, is almost invisible, and thus can lead to accidental burns.

### Nitrogen

No smell, not flammable. Non-toxic but It can cause rapid suffocation when concentrations are sufficient to reduce oxygen levels below 19.5%. At high concentrations almost instant unconsciousness may occur followed by death. The prime danger is that there are no warning signs before unconsciousness occur.

### Oxygen

No smell. Generally considered non-toxic at atmospheric pressure. Will not burn, but supports and accelerates combustion. Clothes and other materials not normally considered flammable will burn fiercely in the presence of oxygen and can be set alight by a single spark or even hot cigarette ash.





## GAS STORAGE

1. There are two gas cylinder storage areas on level 4 P8 side: 1) the inside inert gas & 2) outside flammable gas stores. There is a gas cylinder layout in the gas cylinder store.
2. Each group has its own dedicated storage area assigned to it – the area will contain a label at the top.



3. Ensure that you ONLY take a full cylinder from your group – there should be a marked label or a chalked marker on each gas cylinder indicating the group and if it is FULL.
4. It is best to store all cylinders upright and secured with a chain to prevent them from falling in the store and lab.
5. Do not store cylinders in exits or emergency evacuation exit routes, especially in labs.
6. Brace/chain cylinders with non-combustible material to a sturdy structure (e.g. the wall, bench) with one chain, strap, clamp at ideally 2/3 the height at the top of the cylinder and with a second chain, strap etc. at 1/3 the height of the gas cylinder from the bottom.
7. Within the flammable gas storage area, oxygen should be stored at least 5 metres from fuel gas cylinders e.g. LP Gas and other flammables such as hydrogen.
8. Full cylinders are stored separately from empty ones.
9. Label empty cylinders “EMPTY” or “MT” and date it; treat the empty cylinder in the same manner that you would if it were full.
10. Cylinders from different research groups and areas must be segregated from each other. Individual gases – where possible should be kept in separate bays.
11. Ensure security control by e.g. locking gas cylinder storage area.
12. Ensure there is a fire extinguisher (usually powder) close by.



## SAFE USE OF GAS

**FETCHING & REPLACING GAS CYLINDERS IN GAS CYLINDER STORE SHOULD PREFERABLY TAKE PLACE IN THE AFTERNOONS WHEN SWEETNESS IS MORE AVAILABLE TO GIVE ACCESS.**

### EMPTIES

**STEP 1:** Wear the correct SDS prescribed PPE before fetching gas cylinder: Goggles, Gloves, Labcoat etc.

**STEP 2:** Only use a gas cylinder trolley/cart (upon which gas cylinder is secured) to transport gas cylinders to & from store.



**STEP 3:** Ask Sweetness Dyule-Nozewu to give access to the gas cylinder store.

**STEP 4:** When it is an EMPTY cylinder ensure it is placed in the EMPTY cylinder section.

**STEP 5:** Ensure that the gas cylinder indicates it is EMPTY, by writing with chalk on the cylinder EMPTY, MT.



**STEP 6:** First loosen chain where an open gas cylinder space/slot is – slowly roll cylinder vertically from trolley into this space.

**STEP 7:** Once cylinder is in the empty slot ensure that the chain is hooked back onto the bolt and the chain is tight and secure enough that it will prevent cylinders from toppling over.

**STEP 8:** Close door/gate to store when leaving.



## FULL

**STEP 1:** Wear the correct SDS prescribed PPE before fetching gas cylinder: Goggles, Gloves, Labcoat etc.

**STEP 2:** Only use a gas cylinder trolley/cart (upon which gas cylinder is secured) to transport gas cylinders to & from store.



**STEP 3:** Ask Sweetness Dyule-Nozewu to give access to the gas cylinder store.

**STEP 4:** Only take gas cylinder from your dedicated group's cylinders. All cylinders are labelled with tags to identify which lab they belong to or will be marked with your groups name written in chalk on the cylinder.

**STEP 5:** Unbolt chain and slowly roll gas cylinder vertically until it is on trolley.

**STEP 6:** Replace chain into bolt.

**STEP 7:** Secure gas cylinder on trolley. Cylinders must never be left free-standing.

**STEP 8:** Close door/gate to store when leaving.

## OPENING REGULATORS

1. After the regulator has been attached to the cylinder valve outlet, turn the delivery pressure-adjusting screw counter-clockwise until it turns freely.
2. Ensure all fittings are secure.
3. Stand to one side and open the cylinder valve slowly until the tank gauge on the regulator registers the cylinder pressure.
4. Stiff valves must be treated cautiously – it should easily open by hand – **DO NOT** force with a wrench or hammer open.
5. Never open valve until backstop and leave it there, rather turn valve at least a half a turn back to avoid seizure in the open position.
6. Use adjustment valves downstream of the main pressure valve.
7. With the flow-control valve at the regulator outlet closed, turn the delivery pressure-adjusting screw clockwise until the required delivery pressure is reached.
8. Control of flow can be regulated by means of a valve supplied in the regulator outlet or by a supplementary valve put in a pipeline downstream from the regulator.
- 9. The regulator itself should not be used as a flow control by adjusting the pressure to obtain different flow rates.**
10. When finished turn valve shut.
11. When shutting valve turn it clockwise - just enough to stop the gas completely.
12. Never wrench/force a valve shut.





## OPENING/CLOSING OF VALVES

- ✓ **ALWAYS** open from cylinder to equipment
- ✓ **ALWAYS** close from equipment to cylinder
- ✓ **CLOSE SYSTEM WHEN NOT IN USE**

When regulator builds pressure after valve has been closed or if needle does not lay on nil anymore - **DEFINITE SIGN OF LEAKAGE**

## HEALTH & SAFETY ISSUES

1. If a cylinder needs to be changed, first close all valves and remove the regulator, before moving cylinder.
2. **DO NOT** use insulation tape - You may use plumbers tape.
3. Use the correct tubing/hoses.
4. **NEVER** use old or second-hand clips as hose connections.
5. **NEVER** use wire to secure tubing.
6. Check & feel tubing & connections regularly. Replace tubing when brittle, hard or broken.
7. **NEVER** use regulator itself as a flow control - by adjusting the pressure to obtain different flow rates.
8. Ensure gas cylinder is securely fastened on trolley before moving it around.
9. Cylinders must be secured in an upright position (clamped or chained) in the lab or in gas cylinder stores.
10. Cylinders may **NOT** stand "double row". Each cylinder must be chained & bolted separately.
11. Ensure all cylinders are tightly chained with chain placed properly into bolt.



12. Ensure gas cylinders indicates the group name and if it is **FULL or EMPTY**.
13. **Keep cylinders and valves clean. If grid, oil or dirty water gets into the cylinder valve sockets, leakage may occur. Purge gas slowly from cylinder, before assembling regulator and fittings, for a second or two, just to blow clean and wipe oil and water off.**
14. If you suspect that the valve has a broken or damaged spindle, do not use it.
15. Use equipment that can take the gas pressure.
16. Be careful try not to have a cylinder fall as it can explode or if the control valve is knocked off, the tremendous pressure escaping will turn it into a rocket with disastrous results.
17. Report any suspicion of a leaking cylinders immediately.
18. Check the pressure gauges and reducers regularly.



## HEALTH & SAFETY ISSUES

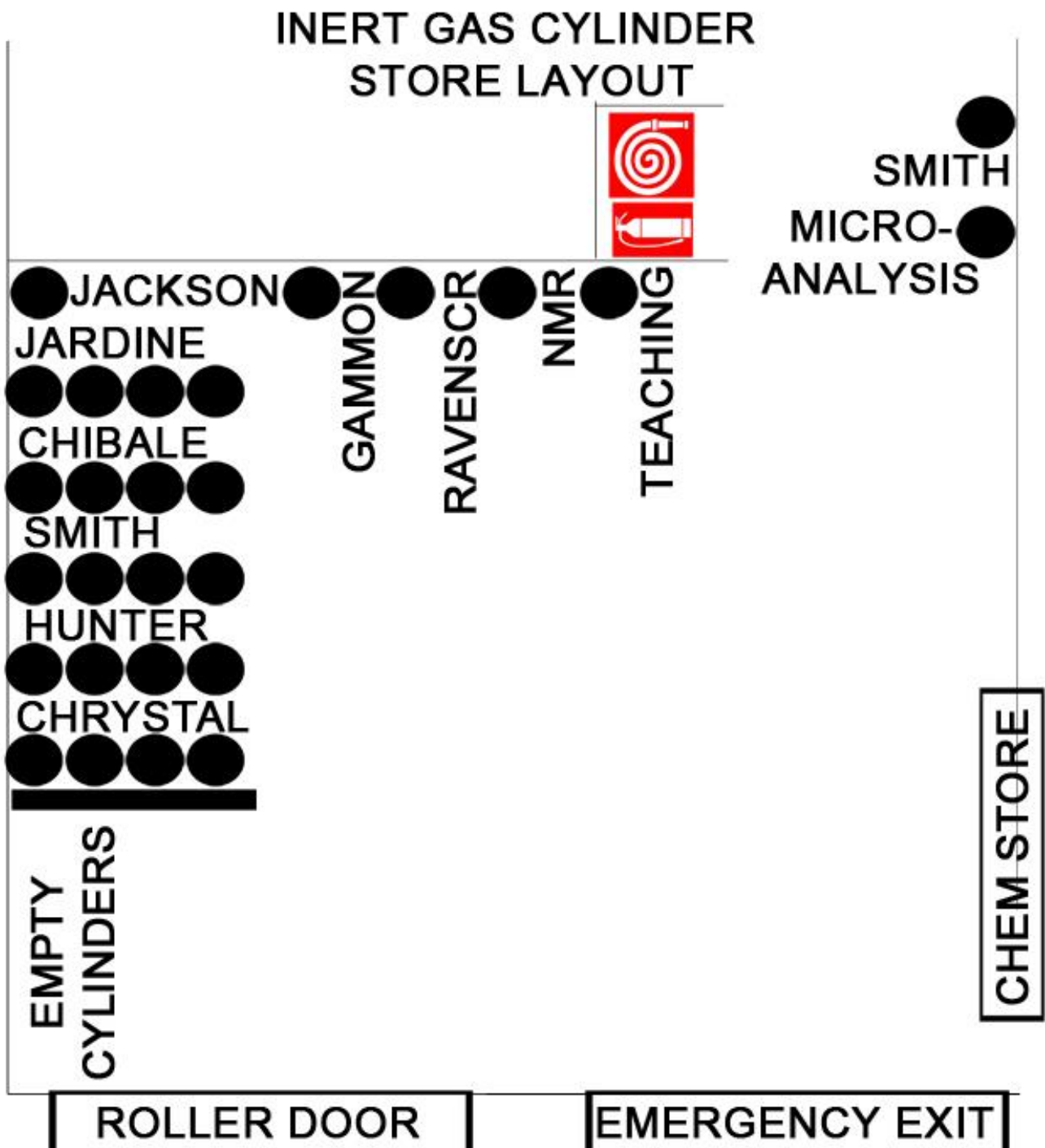
19. Inspect tubing regularly for perishing & hardening. Replace immediately when found.
20. **NEVER** leave a system set up with gas valves open if not in use.
21. The leakage of gases usually causes oxygen deficiency.
22. Work in a well-ventilated area or ample ventilation via an extraction system.
23. **DO NOT** leave trailing hoses or cables on the floor creating tripping hazards.
24. Do not smoke or ignite flammable materials when transporting or handling cylinders.
25. Inspect cylinders and tubing regularly to check for leakages or to look for cracks, dents, rust or any other damage that may compromise cylinder safety.
26. Check for leaks around the valve and handle using a soap solution, “snoop” liquid, or an electronic leak detector.
27. **NEVER** attempt to repair a cylinder or regulator.
28. **NEVER** use a cylinder without a valve.
29. **ALWAYS** use the regulator fit for that gas & pressure.
30. **NEVER** disguise damage to cylinders.
31. Always use a regulator to regulate the gas flow pressure – make sure it’s suited for that specific gas.
32. Check thread first before assembling it to cylinder.
33. **DO NOT** use oil or packing on regulators.
34. **NEVER** try to ease any regulator threads with oil.
35. Use the correct tubing/hoses made for gases or that specific gas.

## OTHER ISSUES

1. When **ORDERING** gas – ensure the number of gas cylinders to be collected is also noted on the order form.



# BASIC SCHEMATIC INERT GAS CYLINDER STORE LAYOUT







# BASIC SCHEMATIC FLAMMABLE GAS CYLINDER STORE LAYOUT

## FLAMMABLE & TOXIC GAS GROUPS

