

# Standard Operating Procedures for Medical Gas Supply in Health Care Facilities



# Standard Operating Procedures for Medical Gas Supply

## 1.0 OBJECTIVE

1.1 This SOP is to provide guidance to all staff on safe use and operation of the compressed gases cylinder in Hospitals.

## 2.0 SCOPE

2.1 This SOP is applicable to all staff where compressed gas cylinders will be/are used and/or stored.

## 3.0 RESPONSIBILITY

3.1 Principal Investigator (Director/SIC/CMS/MS) shall designate and arrange training for staff who are required to handle and use compressed gases and ensure that compressed gases are handled in accordance with good work practices.

3.2 All staff and students working with compressed gases must be able to handle and use compressed gases, ensure that compressed gases are handled in accordance with good work practices and must obtain necessary training to work safely.

## 4.0. TYPES OF MEDICAL GASES USED IN HOSPITALS

### 4.1. Medical Air

Medical Air refers to a clean supply of compressed air used in hospitals and healthcare facilities to distribute medical gas. It is free of contamination and particles, has no oil or odors, and is dry to prevent water buildup in the facility's pipeline. When a patient is in the operating room, whether it's an emergency or not, a surgeon relies on a medical air compressor to keep the patient comfortable and breathing.

### 4.2. Oxygen

Oxygen is a medical gas required in every healthcare setting, and is used for resuscitation and inhalation therapy. It can be used for medical conditions such as **COPD, cyanosis, shock, severe hemorrhage, carbon monoxide poisoning, trauma, cardiovascular and respiratory arrest, resuscitation, and life support.**

### 4.3. Carbon Dioxide

Carbon Dioxide is used for insufflating medical gas for less invasive surgeries like **laparoscopy, arthroscopy, endoscopy, and cryotherapy**, as well as for respiratory stimulation during and after anesthesia. CO<sub>2</sub> may be piped in large hospitals, but more likely comes from a tank.

### 4.4. Nitrogen (Medical Liquid Nitrogen)

Nitrogen is a medical gas used for cryosurgery removal of some cancers and skin lesions, and also for **the storage of tissues, cells, and blood in cryogenic temperatures** to avoid oxidation of the samples. It can also be used as part of the medical gas mixture for lung function tests. The pharmaceutical industry uses this medical gas in the manufacture of medications. Nitrogen as a gas is used to power tools in places where they do not have instrument air. Most of the time it comes from a manifold of cylinders and is piped at pressure with an alarm system at the source and on the use site.

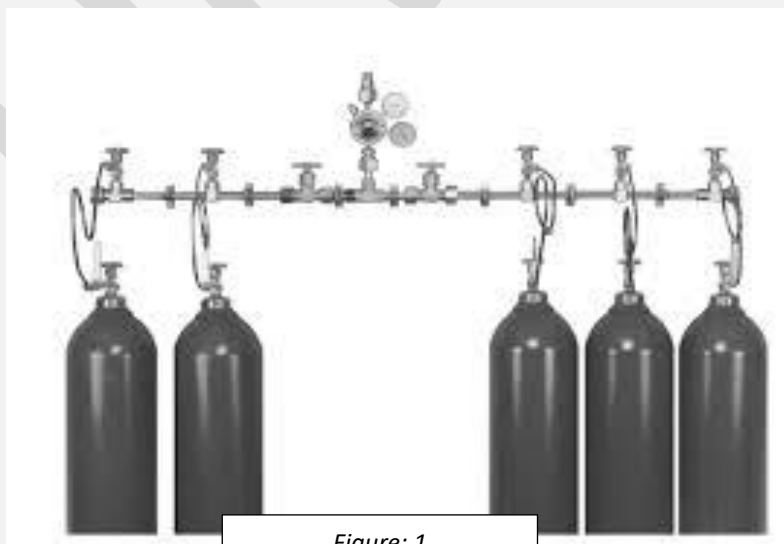
#### 4.5. Nitrous Oxide

Nitrous Oxide is a medical gas **commonly known as "laughing gas"** .This medical gas is used in numerous surgical procedures as both an anesthetic and analgesic.

There are certain times when this medical gas is contraindicated and patients undergoing those types of procedures are provided with a medical gas warning wristband that alerts your facility's staff not to administer it.

#### 5.0 Procedures

- The hospital should always take medical gases supply from an agency with license to do so. At no point of time, industrial oxygen should be used in the hospital.
- To avoid capital cost, the hospital should make arrangements with the gas agency for supplying of their own cylinders, which in any case are being rotated. Empty ones are given back and filled cylinders are received. The agency can be bargained to supply cylinders for total need of the hospital, as they are supplying gas also
- If cylinders are purchased by the hospital, a register with serial numbers of all the cylinders should be maintained. The hospital authorities through manifold technician will ensure that the empty cylinders are not exchanged from other cylinders. But their own cylinders are filled and brought back to the hospital.
- At the time of purchasing a new cylinder, always insist on Explosive Certificate/"Fitness Certificate" from the regulatory authorities.
- These cylinders should be sent for inspection periodically as specified by the gas agency. Inspection certificates should be preserved.
- The gas manifold unit consists of:
  - Control Panel
  - Right and Left bank of cylinders for oxygen and Nitrous Oxide
  - Stand by arrangement (Emergency Supply Manifold)
- Individual oxygen cylinder should not be used without properly fitting with oxygen therapy accessories, e.g. Oxygen regulator, Flow meter and humidifier, as has already been emphasized.



*Figure: 1  
Oxygen Manifold System*

## **6.0 Procedure for Oxygen Cylinder**

- Wards/ Emergency/ OT will send weekly demand in duplicate signed by Medical Officer/ Nurse in-charge of the Department. In framing such demands in- charges will ensure utmost economy.
- The demand will be countersigned by the Administrator. The stores will keep one copy of the indent, and will place order with the gas agency
- Urgent and unexpected demands, duly signed by the specialist (Anaesthetist), will be complied with as and when presented
- Once the demand is received in the stores, it will immediately be entered in the stock register after checking the cylinders as per specifications laid down here:
  - ✓ Oxygen cylinders will be checked by pressure of gas in it. Fix the pressure guage in the cylinder and check the pressure . The pressure specified for oxygen 'B'type full cylinder is 137 bar anything below 125 should be rejected/ returned
  - ✓ Oxygen cylinders of 'C' type for Boyle's apparatus will also be checked in the similar way as for 'B' type cylinders.
  - ✓ Nitrous cylinders will be checked by weight. Ask the agency about the weight of nitrous oxide cylinder, they will be supplying.

## **7.0 Duties of Supervisors are to:**

- Ensure staff in their charge receive appropriate training specific to the compressed gases they are handling and using;
- Ensure that compressed gases are used only for their intended purpose and in accordance with defined procedures and rules;
- Ensure that applicable Safety Data Sheets (SDS), Emergency Response Plan (ERP) or other relevant literature is made readily available to staff
- Provide staff and visitors with appropriate personal protective equipment (PPE);
- Provide appropriate supervision of staff
- Ensure staff, and visitors adhere to applicable occupational health and safety regulations for the use of compressed gases; and
- Investigate reported incidents to determine the cause and to develop appropriate preventative measures to minimize a recurrence.
- Maintain appropriate records pertaining to the handling and use of compressed gases including an up-to-date inventory, training records, and reported incidents;

## **7.1 Duties of Staff are to:**

- Adhere to defined procedures and rules, and applicable occupational health and safety regulations for the use of compressed gases;
- Wear and maintain PPE provided;
- Notify their supervisor of identified hazards related to the use of compressed gases
- Notify their supervisor of any incident related to the use of compressed gases.

## 7.2 Duties of Safety Resources to:

- Provide information and advice in health, safety and environmental protection including on the safe use of compressed gases;
- Develop and administer health, safety and environmental programs;
- Provide health and safety training;
- Provide hazardous waste disposal services;
- Respond to reported incidents and spills of hazardous materials
- Support regulatory compliance.

## 7.3 Duties of Manifold Operator:

- First time in the morning , he will ensure that all the cylinders in the Manifold Room are OK
- He will open the number of cylinders to ensure the correct pressure in the pipelines
- He will be using cylinders from one side of the Manifold cylinders bank (Right sight or Left side)
- The cylinders of the other side should be sent for refilling as soon as all the cylinders of that bank are empty.
- He will check all cylinders for leakage using soap water mixture
- He will maintain a stock of required tools with him in the Manifold room .
- After checking the manifold room, he should take a round of the hospital to see all the outlets by him, and to find out its proper functioning from staff posted there.
- He will repair or arrange to repair any defects in the outlets or in the pipeline including Main Manifold room.
- He will place order for refilling of the cylinders in consultation with the Authorized officer
- He will also take care of the Nitrous cylinders in the operation theatres, if there is no central supply of this gas. He will also ensure supply of Oxygen in other areas without central pipeline
- He will also help OT Technician in the maintenance of the Boyle's machine
- Changing the ward's cylinder is also his duty
- All the major problems are to be brought to the administrators immediately.

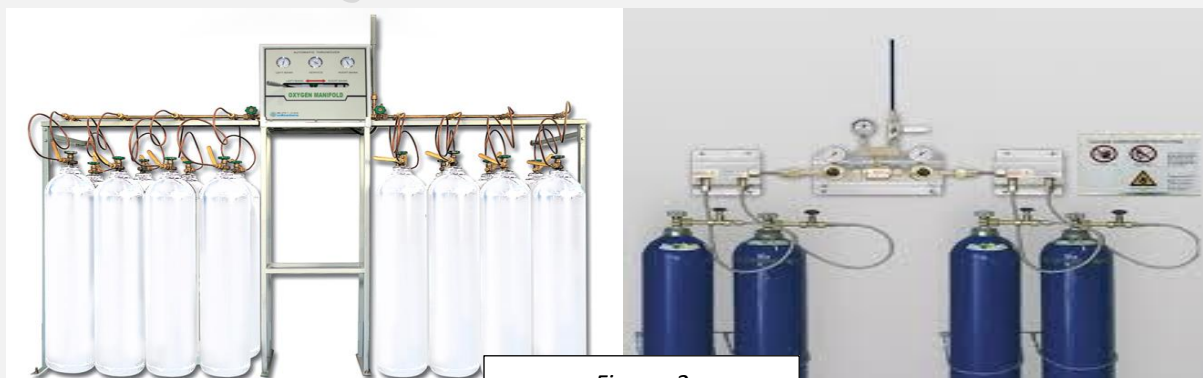


Figure: 2  
Oxygen Manifold System

## 8.0. Hazards Associated with Gas Cylinders

- Impact from the blast of a gas cylinder explosion or rapid release of compressed gas.
- Impact from parts of gas cylinders that fail, or any flying debris.
- Fire resulting from the escape of flammable gases or fluids.
- Impact from falling cylinders.
- Manual handling injuries.

### 8.1 PERSONAL PROTECTIVE EQUIPMENT

Wear proper Personal Protective Equipment (PPE) when performing lab operations/tasks involving compressed gases: long sleeved lab coat, long pants, covered toe shoes, safety glasses and gloves.

## 9.0 . SAFE PRACTICES WHEN WORKING WITH COMPRESSED GASES

### 9.1 . Identification of Contents

- Contents of the gas cylinder should be clearly identified.
- Color coding is not a reliable means of identification. Cylinder colors vary from supplier to supplier.
- Do not deface or remove any markings, tags or stencil marks used for identification of contents attached by the gas vendor.
- Cylinders which do not bear a legibly written, stamped, or stenciled identification of the contents should not be used and the gas vendor should be contacted for removal.
- Read the MSDS and labels for all of the materials you work with.

### 9.2 . Operational Safety Checks

- Cylinders **MUST** always be secured.
- Never open the cylinder valve unless the cylinder is connected to a regulator or to equipment. Regularly check for leaks using soapy water. Leakage will be revealed by either hissing or, in the case of fuel gases, by an odour. **DO NOT TEST FOR LEAKS WITH A NAKED FLAME.**
- Never use force when opening or closing valves. Only use reasonable force. **OPEN** by turning the hand wheel or cylinder valve key anticlockwise. **CLOSE** by turning the hand wheel or cylinder valve key clockwise.
- The storage area should be secure, kept well ventilated and clean at all times. The ground surface should be reasonably level and firm (preferably concrete), that allows for easy trolley access.



*Figure: 3  
Oxygen Manifold System*

### 9.3 . Handling and Use

- Gas cylinders should always be used in a vertical position, unless specifically designed to be used otherwise.
- Gas cylinders should always be securely restrained to prevent them falling over.

- Cylinders must always be secured to a trolley when being transported
- Ensure that the cylinder/gas is the right one for the intended use.
- Segregate and clearly mark full and empty cylinders.
- Wear appropriate personal protective equipment, such as safety shoes and safety spectacles.
- Never roll, drag, or drop cylinders or permit them to strike each other.
- Close all valves when cylinders are not in use.
- When the cylinder is not in use the valve protection cap shall be in place to protect the valve



**CYLINDER VALVE CAP** (Figure – 4)

#### 9.4 . Lifting and Transport

- Use cylinder trolley when handling gas cylinders.
- Fit suitable protective valve caps and covers to cylinders before transporting.
- Transport cylinders with valve caps. Do not lift cylinders by the cap.
- Do not transport with the regulator attached.
- Cylinders must be fastened securely in upright position.



**CYLINDER TROLLEY** (Figure – 5)

## 9.5 . Storage

- Gas cylinders should not be stored for excessive periods of time. Only purchase sufficient quantities of gas to cover short-term needs.
- Properly secure the cylinder at all times: straps, belts, or chains.
- Store gas cylinders in cool, dry, well-ventilated areas, away from incompatible materials and ignition sources.
- Gas cylinders should be stored away from sources of ignition, other flammable materials or oxygen cylinders.
- Store gas cylinders securely when they are not in use and should be properly restrained.

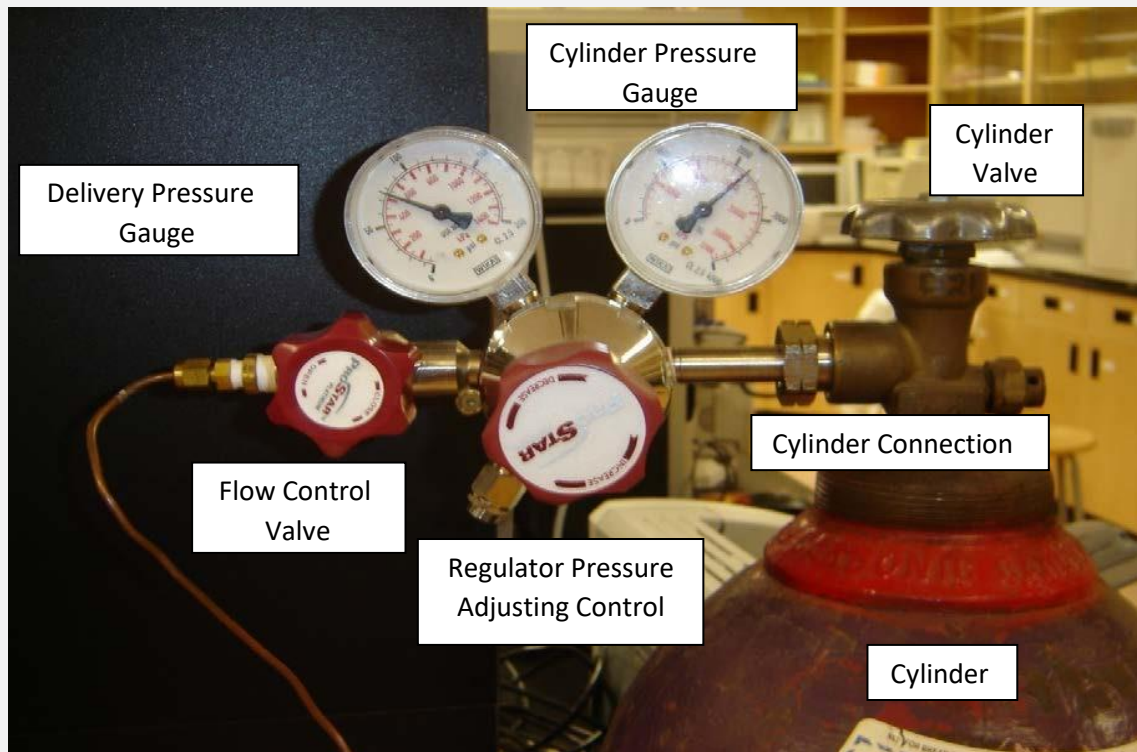


**COMPRESSED GAS CYLINDER STORAGE AREA. (Figure – 6)**

## 10.0 . SAFE USES OF REGULATORS

- A regulator is a device that receives gas at a high pressure and reduces it to a much lower working pressure.
- Regulators are gas specific. Be sure to use the proper regulator for the gas tank in the cylinder.
- Always check the regulator before attaching it to a cylinder. If the connections do not fit together readily, the wrong regulator is being used.
- Before a regulator is removed from a cylinder, close the cylinder valve and release all pressure from the regulator.
- Regulators shall be removed from the cylinder during transport.
- Two stage regulators are commonly used in most labs. The gauge closest to the tank itself is the main gauge. It provides the total pressure reading of the gas in the tank. The primary stage should be kept closed whenever the gas tank is not actually in use. The second stage allows careful control and release of a lower constant pressure of gas. The reading on the second gauge provides an indication of the actual pressure of the gas being released from the tank.





**MAIN COMPONENTS OF A COMPRESSED GAS CYLINDER AND REGULATOR ASSEMBLY (Figure – 7)**

#### **11.0 INCIDENTS OR ACCIDENTS REPORTING**

Accidents resulting in injuries must be reported to the PI and/or laboratory safety lead immediately after first aid is applied.

#### **12.0 Training Requirements**

- Only trained personnel shall use compressed and liquefied gases. Training must include all relevant safety training courses offered by Safety Resources. This includes, but is not limited to:
  - ✓ Safety Orientation for Employees;
  - ✓ Safety Orientation for Supervisors;
  - ✓ Transportation of Dangerous Goods training.
- Staff must also receive site-specific training on the particular activities they will be engaged in including known hazards and how to protect themselves from those hazards.
- Training must also be provided on work procedures, rules and emergency response associated with the work to be performed.
- It is the responsibility of the supervisor to maintain appropriate records pertaining to staff training.