Practice lecture of anesthesia equipements

Second stage

Department of anesthesia

By

Hasan dwain al-hillfi

Nada shaker al-sultani

B.M.T of anesthesia and I.C.U

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CENTRAL PIPELINE SYSTEMS

Nonflammable gases, such as O_2, N_2O, Air, CO_2 can be delivered to operating rooms and other patient care areas via central piping system. Central piping systems are installed by contractors or suppliers dealing with medical gas pipelines and are maintained by the bioengineering or the maintenance department of the healthcare institute. The most important aspect of centralized medical gas pipeline systems for any hospital to ensure supply of medical gases/vacuum at each outlet point at desired pressure and flow.

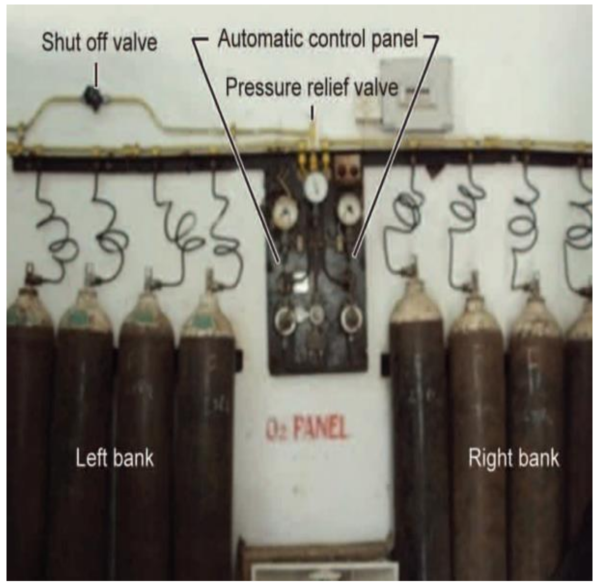
Piped O_2 is provided from a central O_2 source, which may be in the gaseous form, i.e. a cylinder manifold, gas in manifold cylinders or in the liquid form or a vacuum insulated evaporator or an O_2 concentrator. Piped medical air may be supplied from either a cylinder manifold or a compressor with an outlet filter. Nitrous oxide is generally supplied from a cylinder manifold.

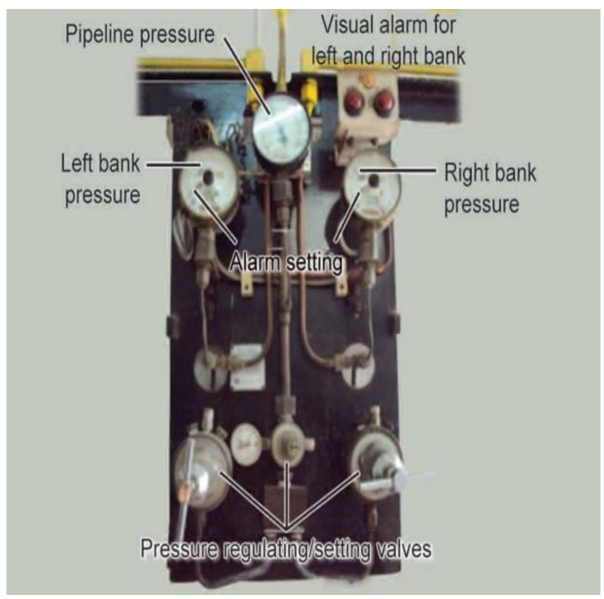
Components of Central Piping System:

- Source equipment: Central manifold containing cylinders, liquid tank or central plant containing generators for piped compressed air and vacuum
- Pipeline distribution system: Piping emerging out from source equipment and extending to locations where the gas may be required
- Terminal units: Wall outlets, ceiling pendants and bed head panels at the user points
- Suction and O_2 therapy products.

Cylinder manifolds

Note1. Cylinder Manifolds are two banks (one right sided bank and one left sided bank) Large cylinders (e.g. size J each with 6800 L capacity) are usually divided into two equal groups, primary and secondary. The number of cylinders depends on the expected demand.





Note2. All cylinders in each group are connected through non-return valves to a common pipe. This in turn is connected to the pipeline through pressure regulators.

Note3. In either group, all the cylinders' valves are opened. This allows them to empty simultaneously. The supply is automatically changed to the secondary group when the primary group is nearly empty. The changeover is achieved through a pressure sensitive device that detects when the cylinders are nearly empty. The changeover activates an electrical signalling system to alert staff to the need to change the cylinders.

Problems in practice and safety features

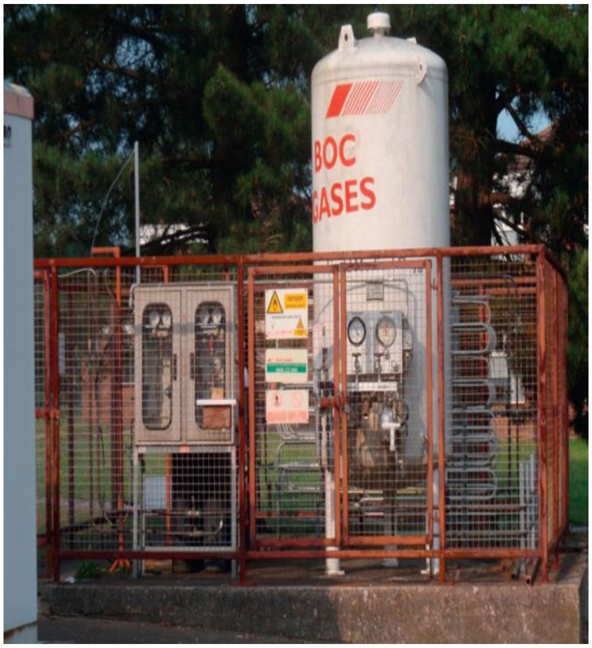
1. The manifold should be housed in a well-ventilated room built of fireproof material away from the main buildings of the hospital.

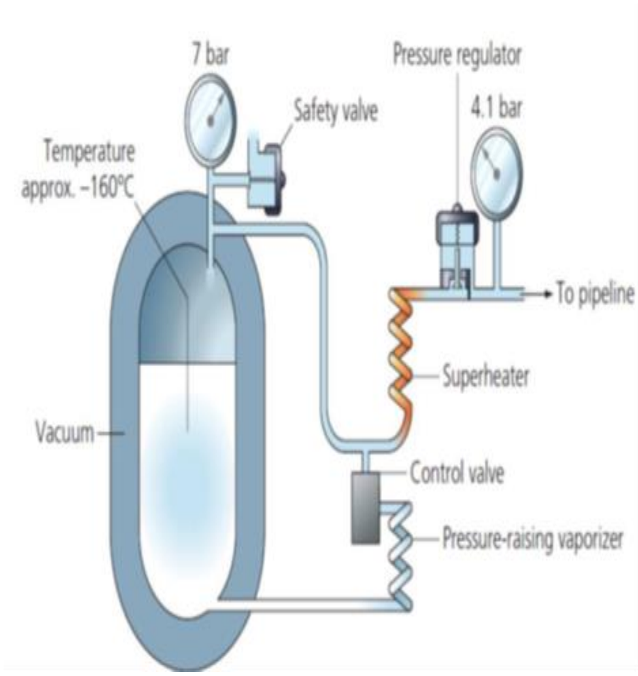
2. The manifold room should not be used as a general cylinder store.

3. All empty cylinders should be removed immediately from the manifold room.

Liquid Oxygen Supply

Liquid O2 containers are installed when large amounts of O2 are required. A vacuum-insulated evaporator (VIE) is the most economical way to store and supply oxygen.





Note1: Liquid oxygen is stored (up to 1500 L) at a temperature of −150° to −170°C (lower than the critical temperature) and at a pressure of 10.5 bars.

Note2: The cold oxygen gas is warmed once outside the vessel in a coil of copper tubing. The increase in temperature causes an increase in pressure.

Note3: At a temperature of 15°C and atmospheric pressure, liquid oxygen can give 842 times its volume as gas.

Note4: The tank is well-insulated, a small amount of heat will be continuously absorbed from the surroundings, causing the liquefied gas to evaporate. This will slowly increase the pressure in the container which will open the safety relief valve venting O2 to atmosphere. Therefore, if a liquid system is left standing unused for a long period of time, a significant amount of O2 will be lost. Using liquid containers is economical only when there is a fairly constant demand. Having the proper size container will minimize O2 loss from venting.

Note4: The maximum oxygen concentration achieved is 95% by volume. Argon is the main remaining constituent.

Note5: The life of the zeolite crystal can be expected to be at least 20 000

hours (which is about 10 years of use). Routine maintenance consists of changing filters at regular intervals.

O2 generator

Centralized vacuum or suction system

components

1. A pump or a power source that is capable of continuously generating a negative

pressure of500- mmHg.

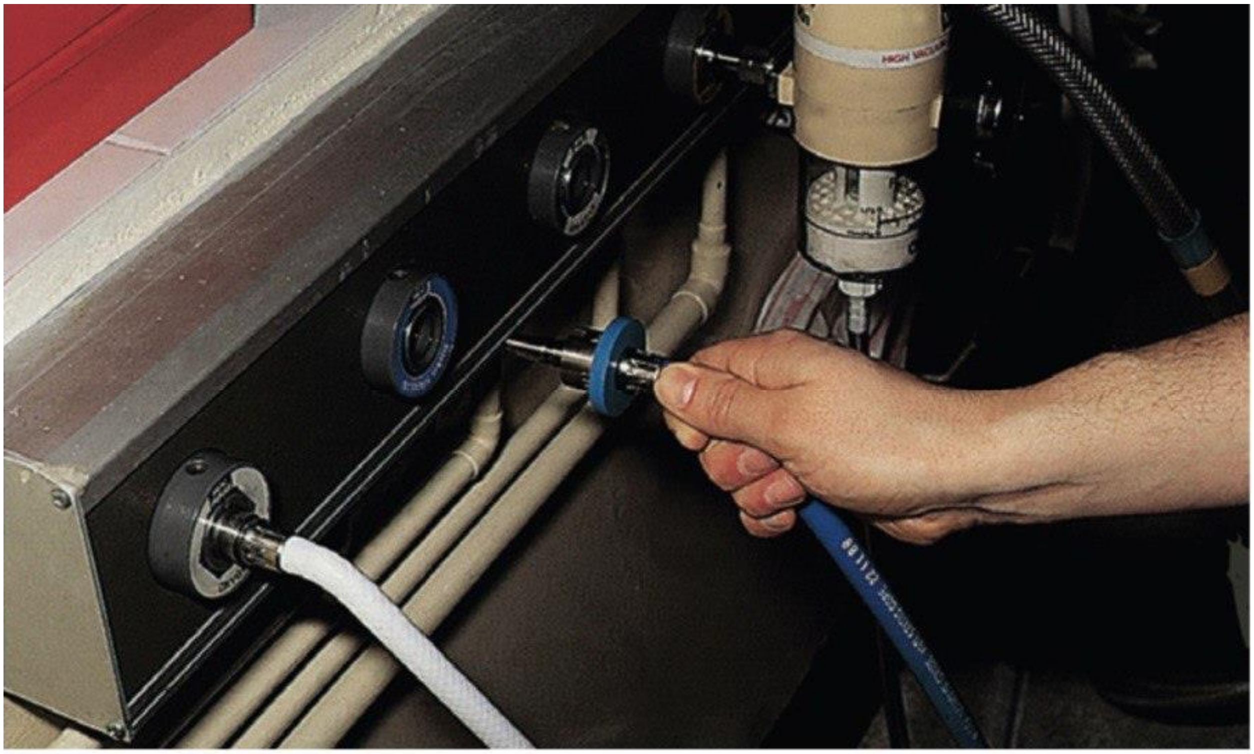
2. A suction controller with a filter.

3. A receiver or a collection vessel.

4. A suction tubing and suctionnozzle (e.g. a Yankaeur sucker) or catheter.

Pipeline

Pipework made of special high-quality copper alloy, which both prevents degradation of the gases it contains and has bacteriostatic properties. The fittings used are made from brass.



The size of the pipes differs according to the demand that they carry. Pipes with a 42 mm diameter are usually used for leaving the manifold. Smaller diameter tubes, such as 15 mm, are used after repeated branching.

Outlets are identified by gas colour coding, gas name and by shape. They accept matching quick connect/ disconnect probes, with an indexing collar specific for each gas (or gas mixture).

Flexible colour-coded hoses connect the outlets to the anaesthetic machine.

Thank you