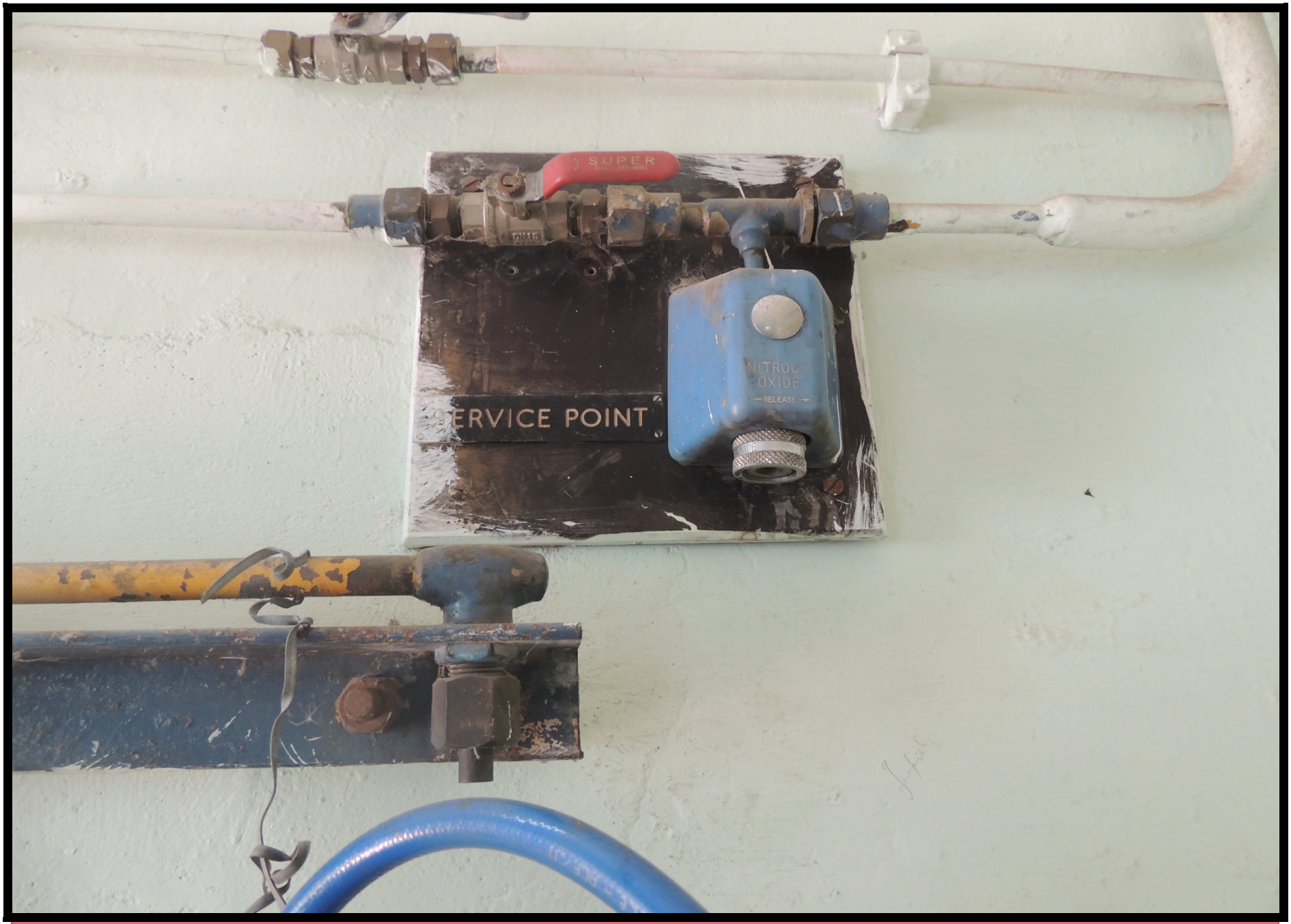
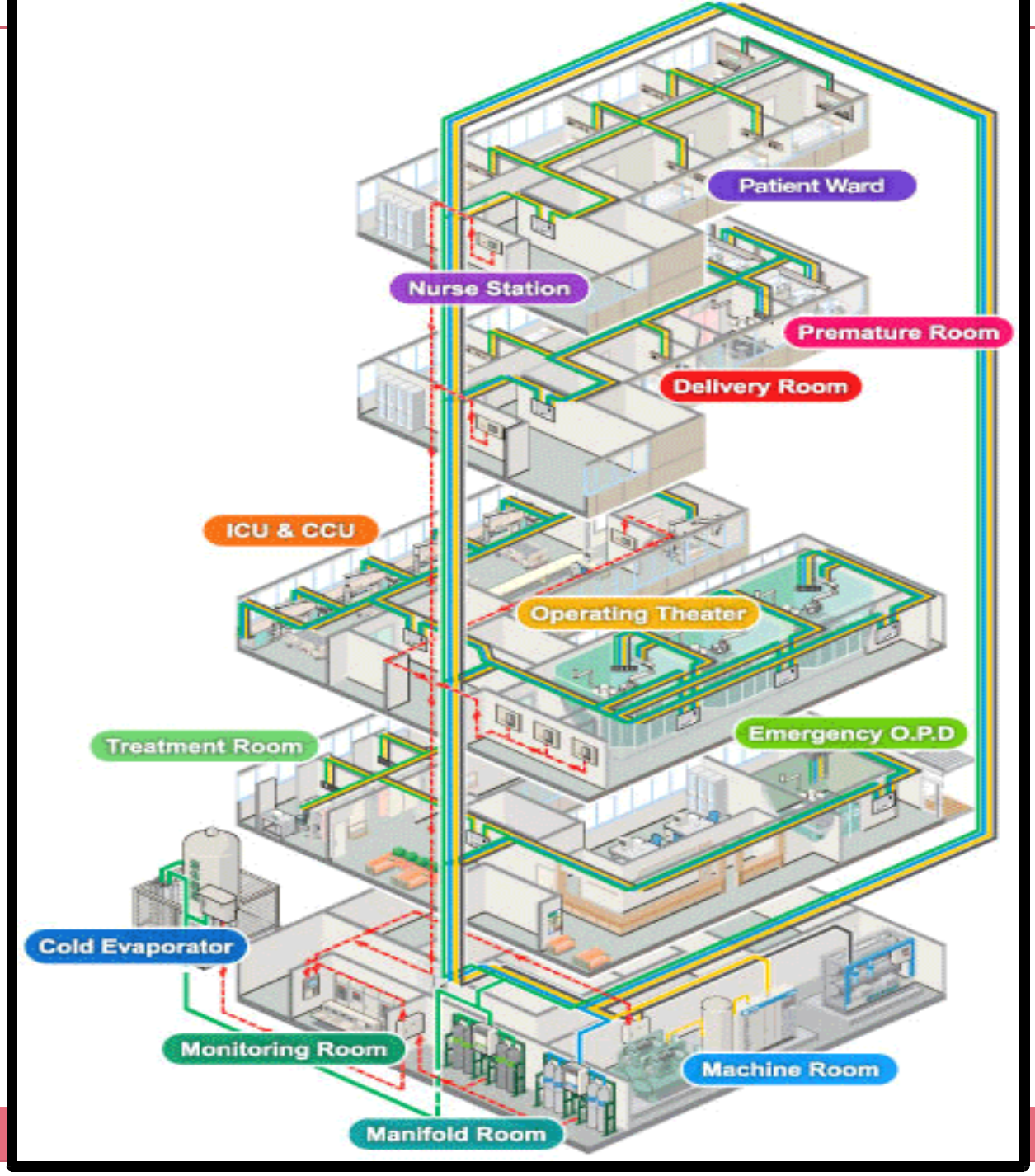
CENTRAL OXYGEN SUPPLY,PIPELINES,CYLINDERS OPERATING PRINCIPLES OF VARIABLE BYE-PASS VAPORIZERS

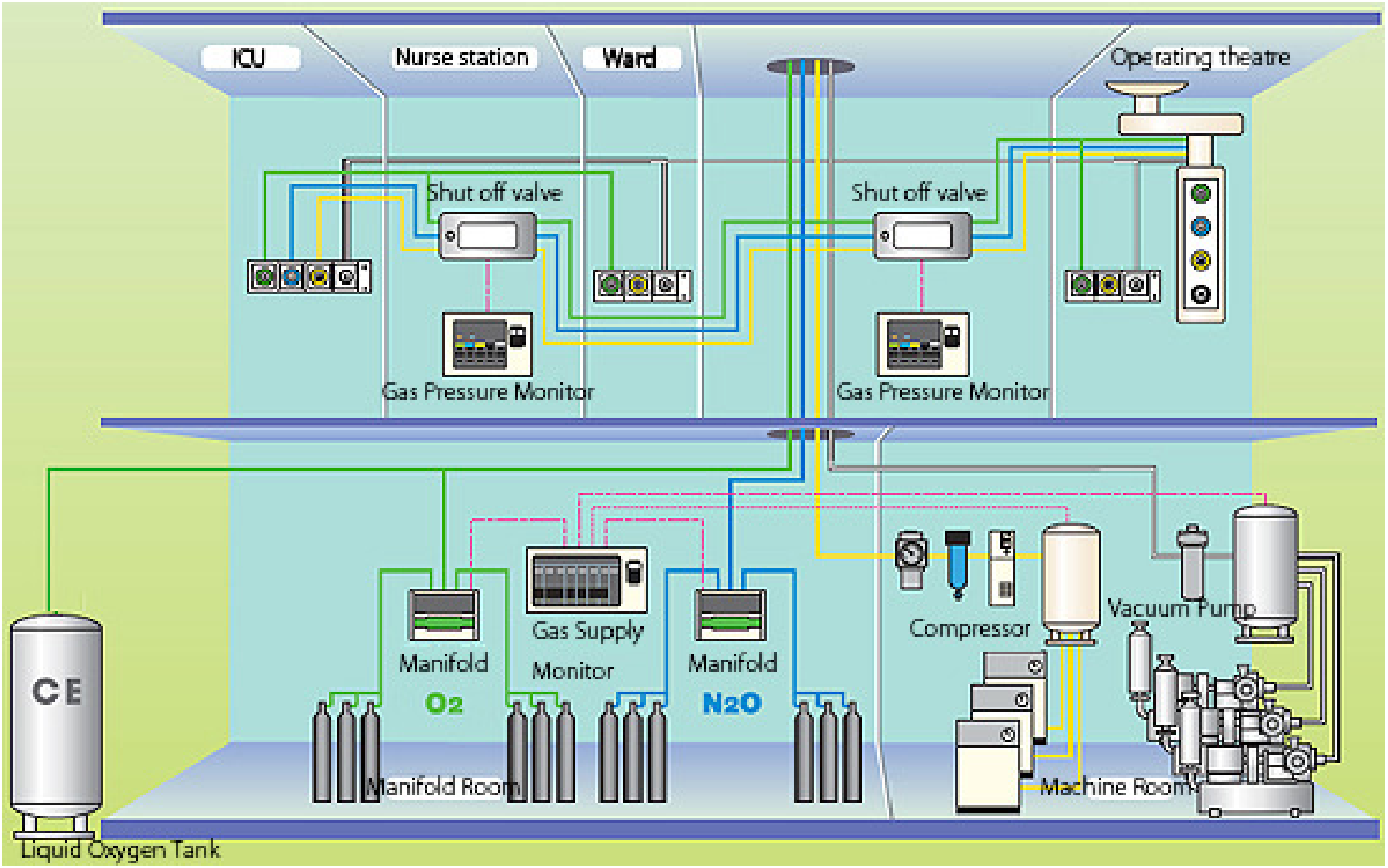
CENTRAL OXYGEN MANIFOLD ROOM

PRESSURE REDUCING VALVES AND CHANGE OVER CONTROL UNIT


OXYGEN


SUPER
ERVICE POINT
NITROUS
OXIDE
RELEASE


Patient Ward
Nurse Station
Premature Room
Delivery Room
ICU & CCU
Operating Theater
Emergency O.P.D
Treatment Room
Cold Evaporator
Monitoring Room
Machine Room
Manifold Room

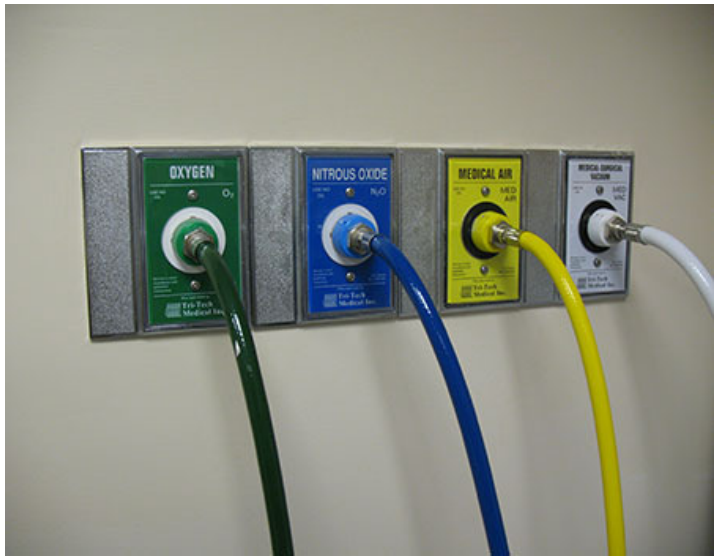

ICU
Nurse station
Ward
Operating theatre
Shut off valve
Shut off valve
Gas Pressure Monitor
Gas Pressure Monitor
Gas Supply
Monitor
Manifold
O2
Manifold
N2O
Compressor
Vacuum Pump
CE
Manifold Room
Machine Room
Liquid Oxygen Tank

Digital Gas Alarm Systems


ON
OFF
gabrielchu.en.alibaba.com

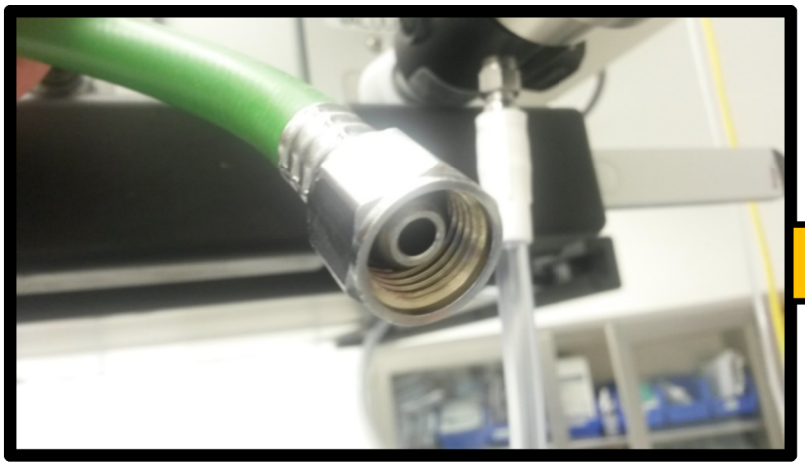
GAS OUTLET SYSTEM IN O.T

QUICK COUPLERS

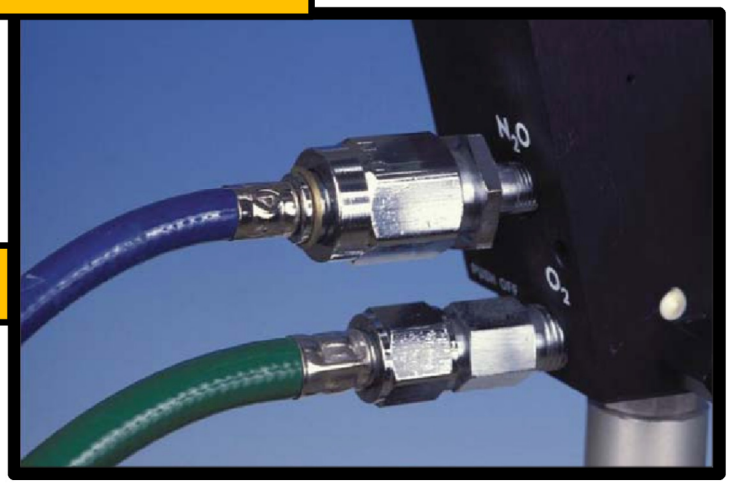


DIAMETER INDEXED SAFETY SYSTEM-DISS

OXYGEN OUT LET-CONNECTORS



DISS

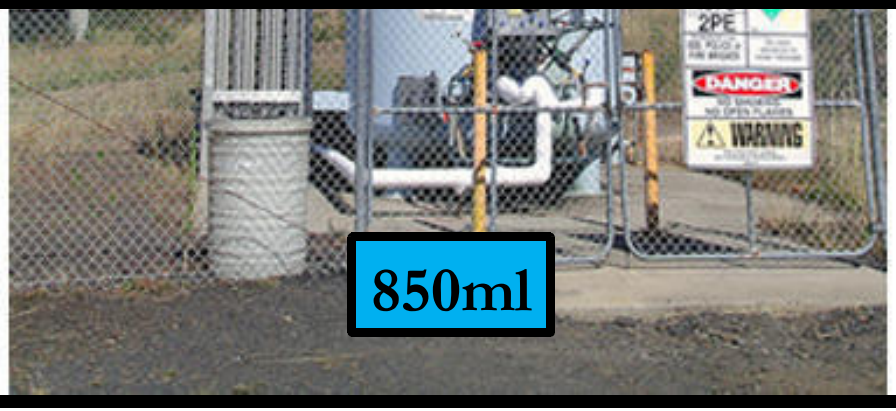


SCHRADER QUICK COUPLERS

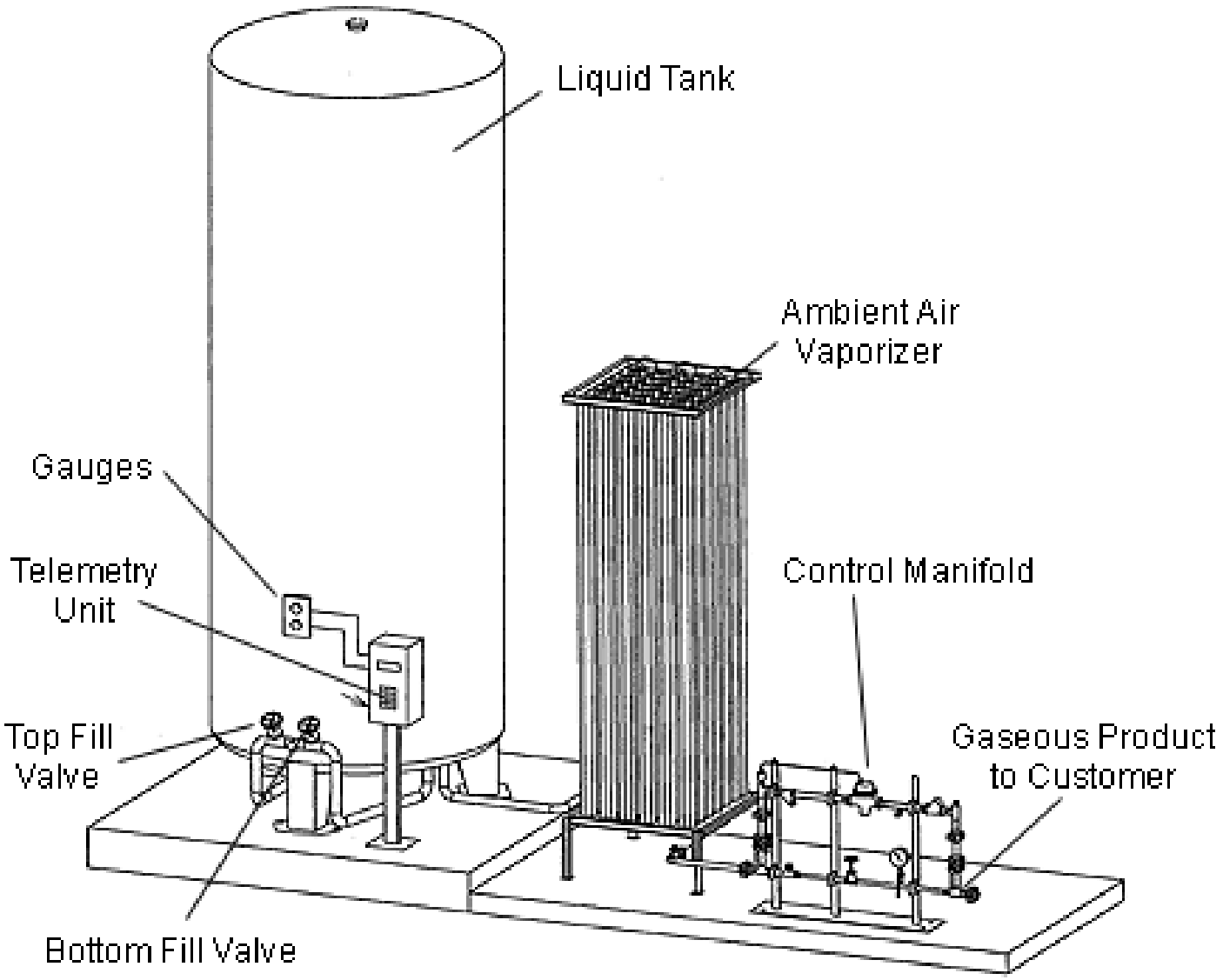
CENTRAL PIPELINE OUTLET AT O.T- PENDANT SYSTEM

LIQUID OXYGEN SUPPLY TANK

How much gaseous O_2 will come out of evaporation of 1ml liquid O_2?



850ml


Liquid Tank
Ambient Air Vaporizer
Gauges
Telemetry Unit
Control Manifold
Top Fill Valve
Gaseous Product to Customer
Bottom Fill Valve


WHY THEY OPENED HERE?
FILLING PROCESS IS GOING ON

ANAESTHETIC GAS CYLINDERS

What is the pressure inside the L.P.G cylinder…?

Any where from 100 lbs to 180 lbs. The regulator reduces it to around 11 lbs for a grill

MATERIAL USED FOR THE CONSTRUCTION OF CYLINDERS

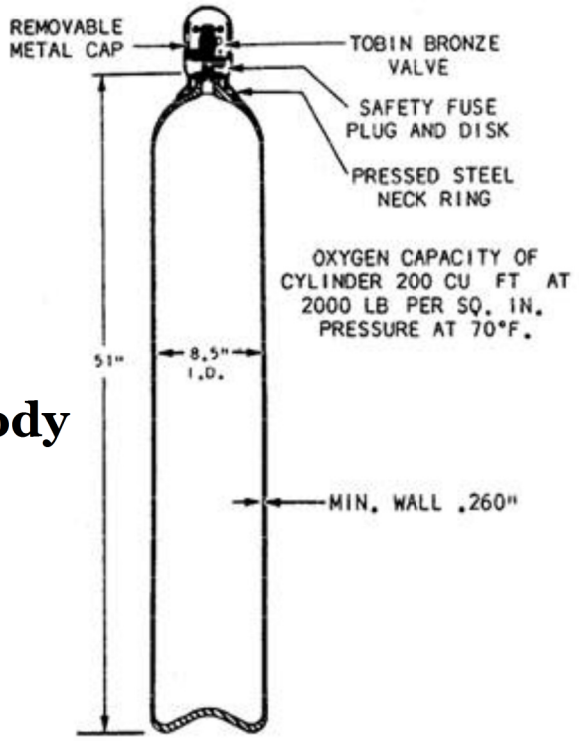
- LOW CARBON STEEL
- HIGH CARBON STEEL
- MANGANESE STEEL -1946
- MOLYBDENUM STEEL
- CHROME MOLYBDENUM STEEL
- ALUMINIUM
- COMPOSITE (Aluminium wrapped in carbon fibre)

COMPONENTS OF THE CYLINDER

BODY

SHOULDER : curved upper part of the body

NECK : Threaded end of the shoulder



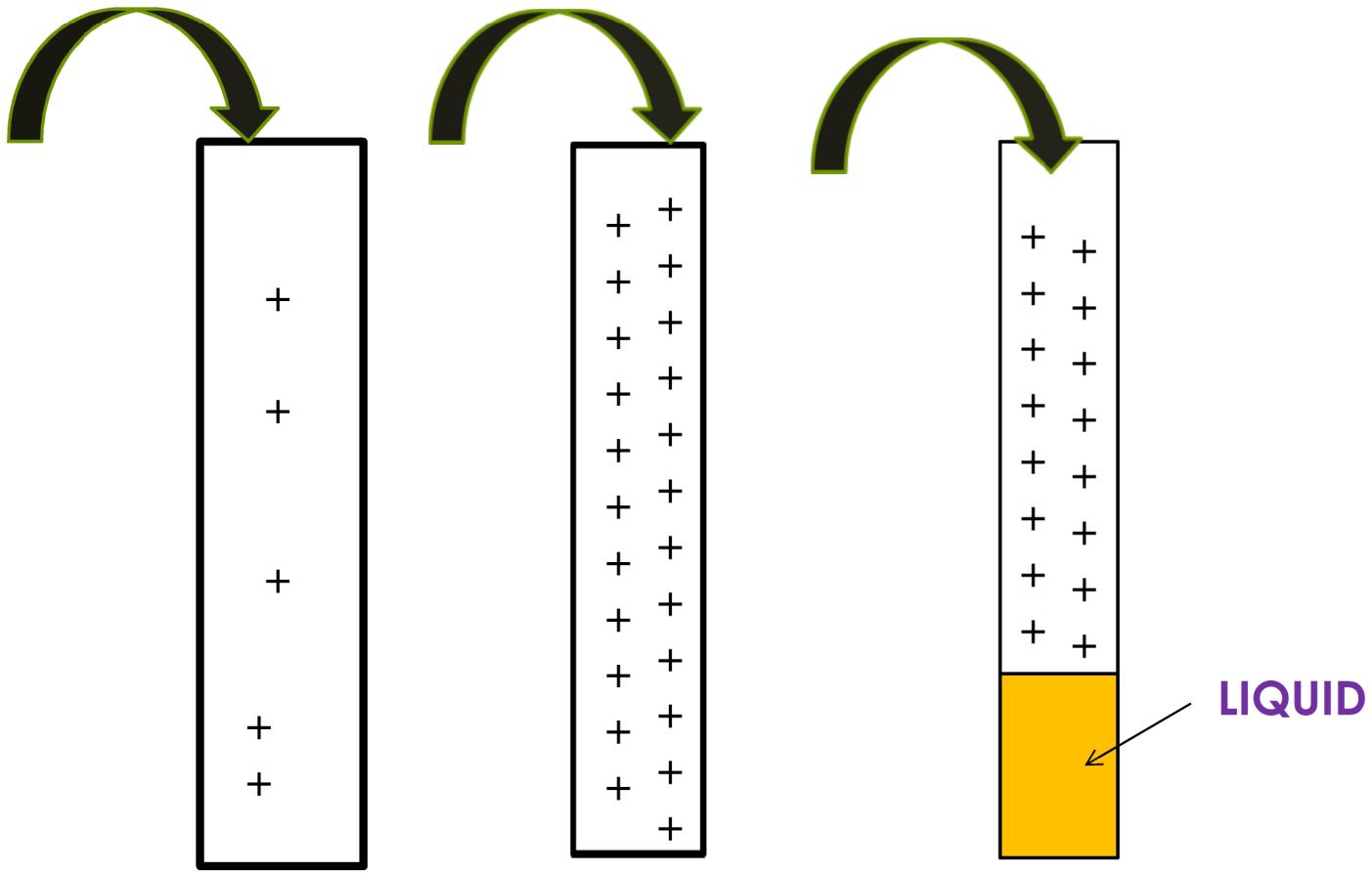
PRESSURE INSIDE THE CYLINDERS

OXYGEN : 1800 -2000 PSI (13700kPa)

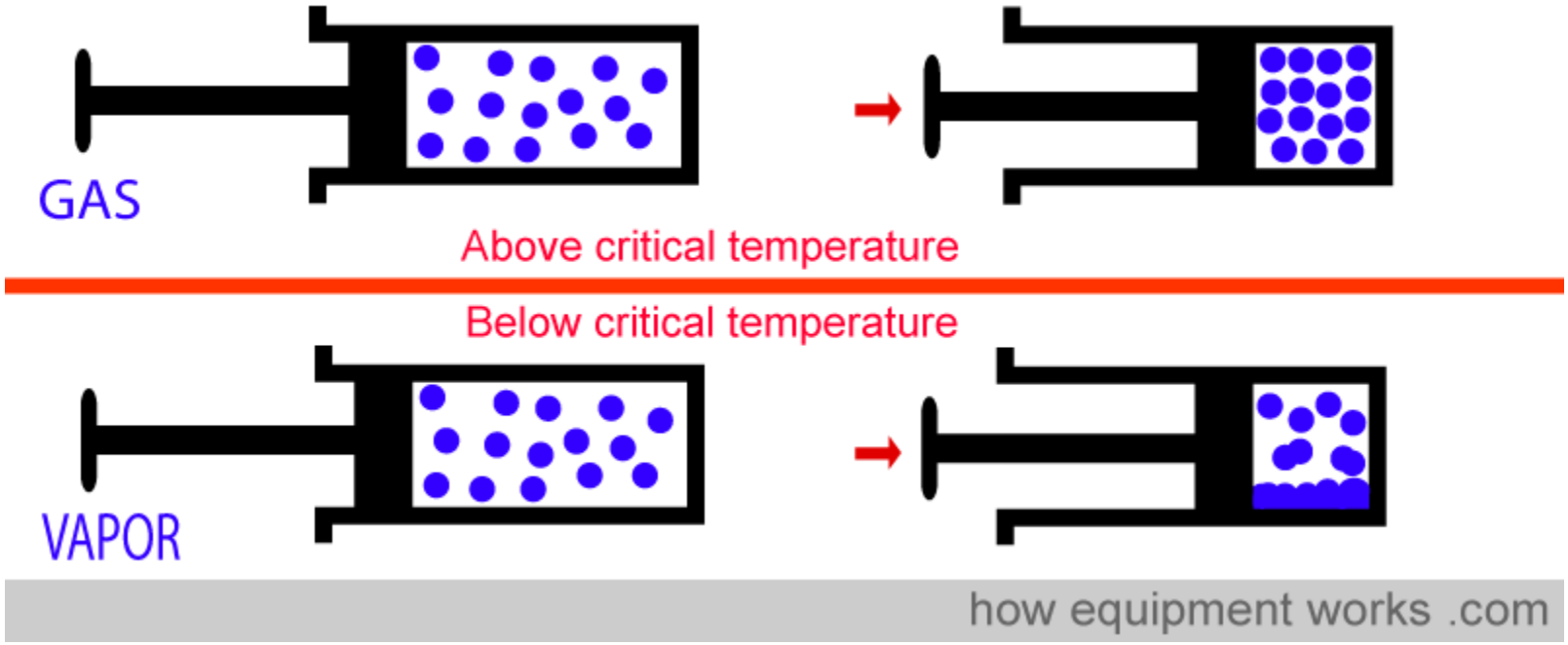
NITROUS OXIDE : 750 PSI (4400kPa)

CARBONDIOXIDE: 850PSI (5000kPa)

ENTONOX : 2000 PSI



FILLING OF THE CYLINDER WITH GAS


GAS
Above critical temperature
Below critical temperature
VAPOR
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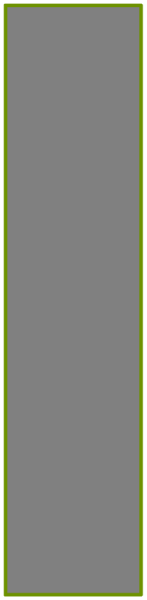
CRITICAL TEMPERATURE OF A GAS

Critical temperature is the temperature above which a Substance can't be liquefied no matter how much pressure Is applied…

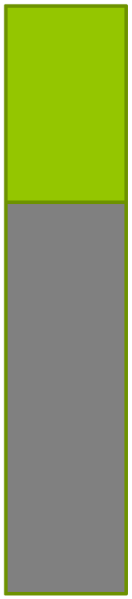
N2O : 36.5 C

OXYGEN : -118 C

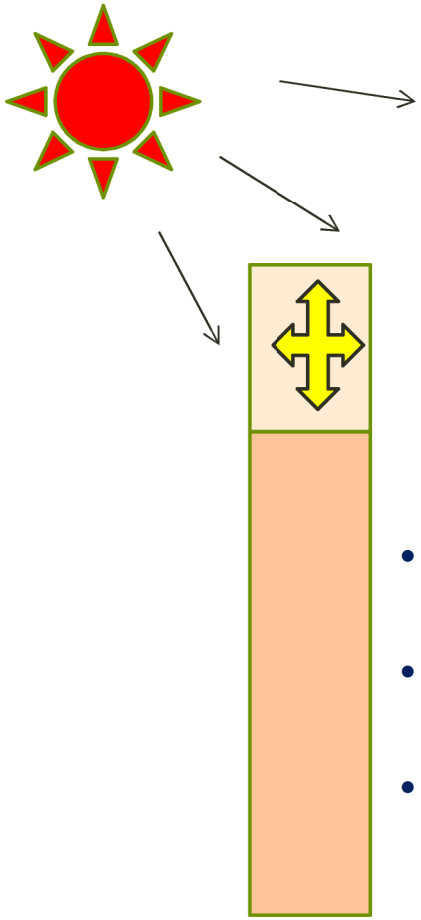
FILLING OF THE CYLINDERS



OXYGEN



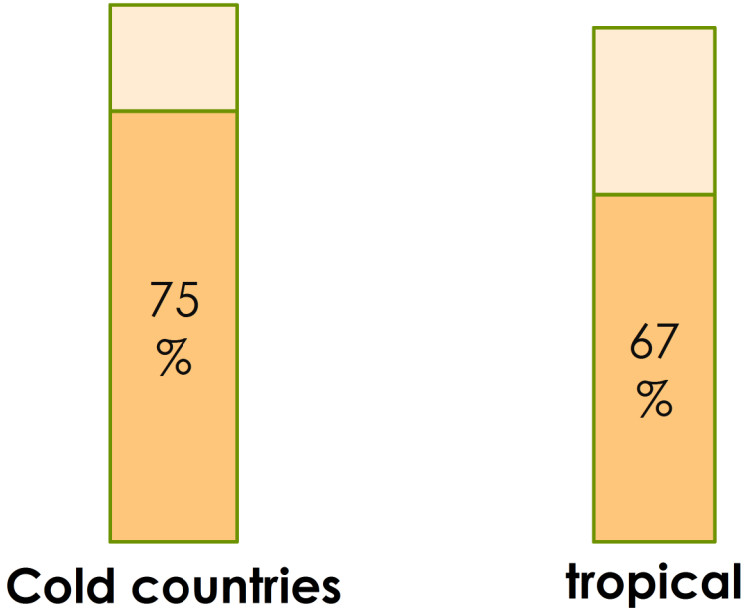
NITROUS OXIDE



- Liquid evaporates in hot conditions
- Pressure above the liquid column increases
- Explosion of the cylinder is a possibility

FILLING RATIO OF THE CYLINDERS

Is the weight of the fluid in the cylinder divided by The weight of water required to fill the cylinder



COLOUR CODING OF CYLINDERS

	Oxygen	Nitrous oxide	Air	Carbon-dioxide	Entonox	Nitrogen	Helium
Physical state in cylinder	Gas	Gas+Liquid (below 98^0 F)	Gas	Gas+Liquid (below 88^0 F)	Gas	Gas	Gas
Color (India)							
Body	Black	Blue	Black	Gray	Blue	Black	Brown
Shoulder	White	Blue	White/Black	Gray	White/Blue	Black	Brown
International							
Color	White	Blue	Black/White	Gray	Blue/White	Black	Brown
Formula	O_2	N_2O	-	CO_2	-	N_2	He
Pin index	2-5	3-5	1-5	1-6	7	1-4	No pin

IDENTIFY THE CYLINDERS

OXYGEN

N_2O

CO_2

ENTONOX

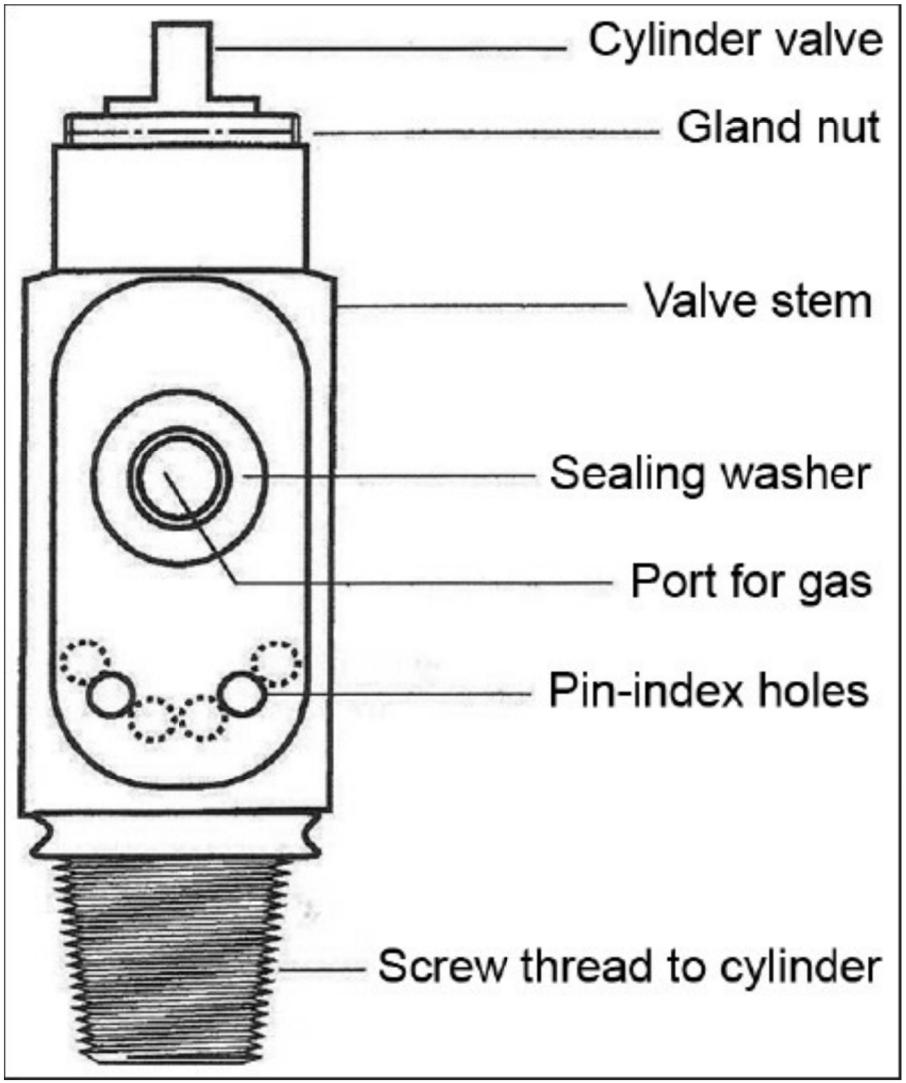
HELIUM

Can you identify the cylinders by looking at the colour coding?

LABELLING OF THE CYLINDER

Name and chemical symbol of gas.
Product specification.
Hazard warning diamond shaped figure denoting hazard class contained gas.
Name and address of cylinder manufacturer.
Cylinder contents in liters.
Tare weight (weight when empty).
Maximum cylinder pressure.
Cylinder size code.
Directions for use.

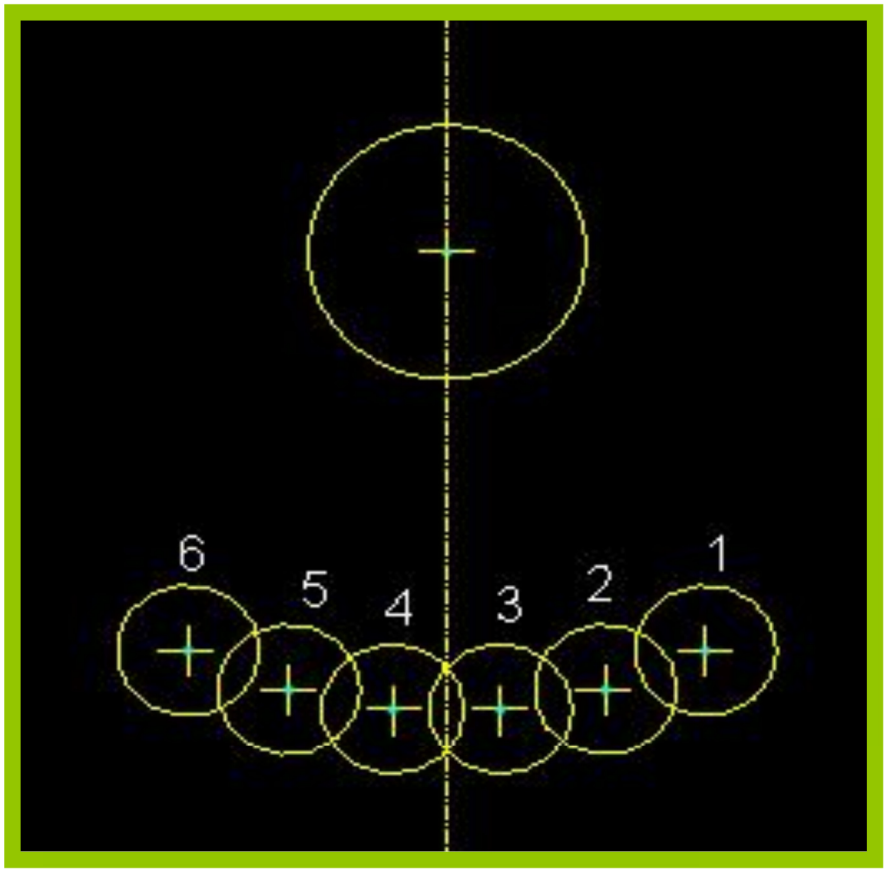
CYLINDER VALVE



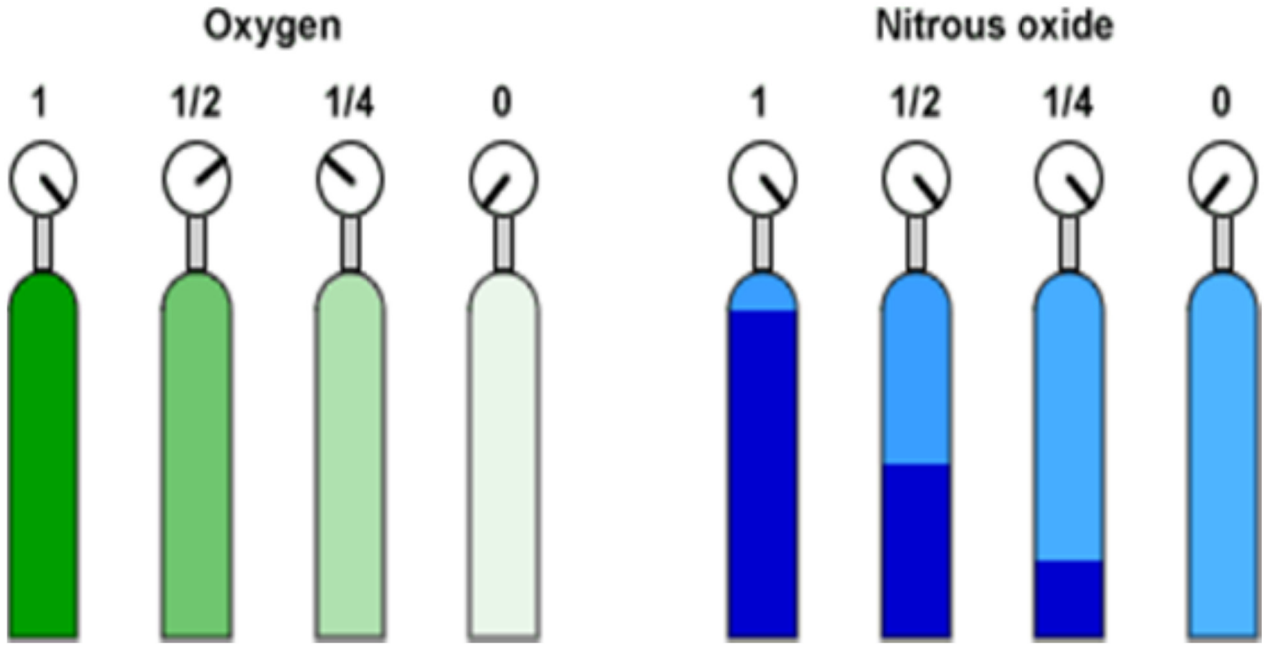
PIN INDEX SYSTEM

unique configuration of holes and pins which match precisely to eliminate connection of the wrong cylinder to equipment, thus prevents delivery of wrong gas to patients

PIN INDEX SAFETY SYSTEM



O_2 : 2 – 5
N_20 : 3 – 5
AIR : 1 – 5
CO_2 : 1 – 6
HELIOX : 2 – 4
ENTONOX : 7
HELIUM : ?



DOES THE PRESSURE GAUGE INDICATE THE TRUE CYLINDER CONTENT?

HOW TO CALCULATE THE QUANTITY INSIDE THE CYLINDER?

N_2O

AVAGADRO'S LAW: One gram molecular weight of any substance will give rise to 22.4 L of gas and will contain 6.024 x 1023 number of molecules

MOL.WEIGHT OF O_2 = 2 X 16 = 32

N_20 = 2 X 14 + 16 = 44

AMOUNT OF N_2O GAS IN A CYLINDER

TARE WEIGHT OF THE CYLINDER = 12.5 K.G

CYLINDER WEIGHT WITH N_2O = 15 K.G

SO.. WEIGHT OF THE N_2O = 2.5 K.G = 2500G

44G OF N_2O = 22.4 L

THEREFORE 2500 G = 22.4/44 x 2500 = 1272 L

TESTING OF CYLINDERS

Hydraulic test: Is a measure of cylinder's elasticity.[8] The cylinder is connected by a thread to testing unit, filled with water and the water level is measured by gauge. The gauge is isolated and cylinder pressurized to 240 atmospheres. The pressure is released and gauge opened. The cylinder should stretch less than 0.02%.

Tensile test
Done in one out of 100 cylinders. The yield point should not be less than 15 tons per square inch.

Flattening test
The cylinder is kept between two compression blocks and pressure is applied from both sides until the distance between blocks remains 6 times the thickness of the wall of cylinder. The walls should not crack.

Impact test
Three of each, longitudinal and transverse stripes are taken from a finished cylinder and struck by mechanical hammer. Mean energy to produce the crack should not be less than 5 and 10 lb/ft for transverse and longitudinal strips, respectively.

Bend test
A ring of 25 mm width is cut from the cylinder and divided into strips. Each strip is bent inward until inner edges are a part, not greater than the diameter of strip.

STORAGE OF CYLINDERS

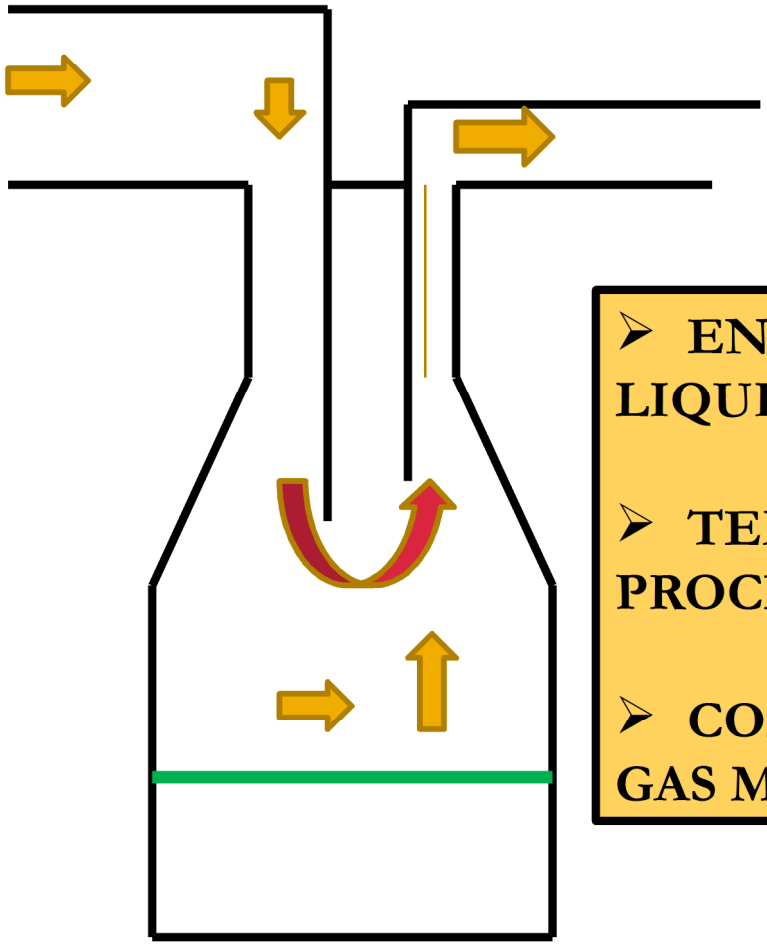
The storage area should be cool, dry, ventilated, clean area constructed of fire resistant material
Have good access for deliveries and a reasonable level floor surface
Should have segregation of "Full" and "Empty cylinders"
Cylinders with an oldest fill date should be used first
Cylinders should not be stored in direct sunlight.
Easily visible sign such as no smoking, no open flames or sparks, no oil or grease etc., should be displayed
Cylinders should not be exposed to dampness, corrosive chemicals, fumes as they may damage cylinders and/or cause valve protection caps stick
The temperature should not go below 10°C where Entonox cylinders are stored
Cylinders should always be kept in place with chain or any other restraining device
The suitable trolley/cart should be used to transport and support the cylinders.

Handling and installation

Before using, the contents of the cylinder must be identified by reading the label and also seeing the color of the cylinder
Full cylinders are fitted with tamper evident seal, usually a shrink wrapped around the valve, should be removed immediately before use
Before connecting to yoke, the cylinder valve be cracked (i.e., Opened only slightly) to blow away any dust or flammable silting on the valve.
The person opening the cylinder should be positioned so that the valve outlet and/or the face of pressure gauge points away from self, patient and machine
Care should be taken to see that sealing washer (Bodok Seal) is present on the yoke and is in good condition to prevent leakage. More than one washer should never be used as it can default PISS
The valve should be opened slowly to release the pressure gradually. Sudden opening can produce a shock wave in the pressure gauge and regulator and can damage parts. Also, if gas passes quickly in the space between the valve and yoke or regulator, it can generate a large amount of heat. As there is almost no time to dissipate, this constitutes an adiabatic process (no heat is lost or gained from surrounding). The heat generated can ignite grease or any dust particle present, causing flash fire or explosion
The cylinders should never stand upright without support
Handling should only be by trained staff.

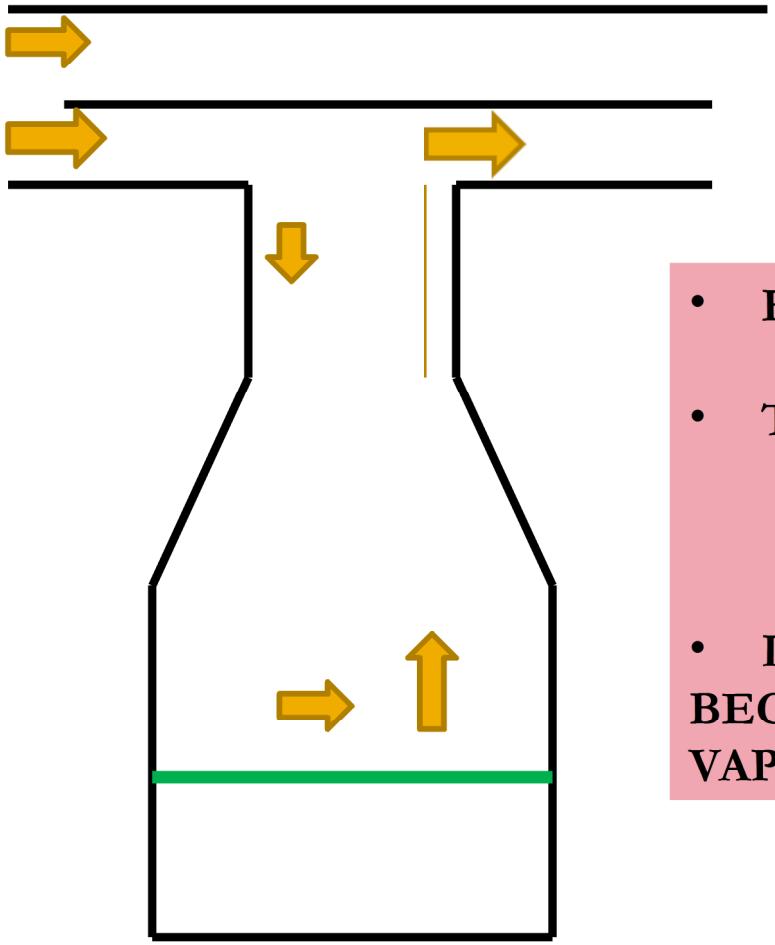
OPERATING PRINCIPLES OF VARIABLE BYE-PASS VAPORIZERS

FLOW OVER VAPORIZER



- ENTIRE GAS FLOWS OVER THE LIQUID ANAESTHETIC
- TEMPERATURE FALLS AS VAPORIZATION PROCEEDS
- COMPLETE SATURATION OF FRESH GAS MAY NOT BE POSSIBLE

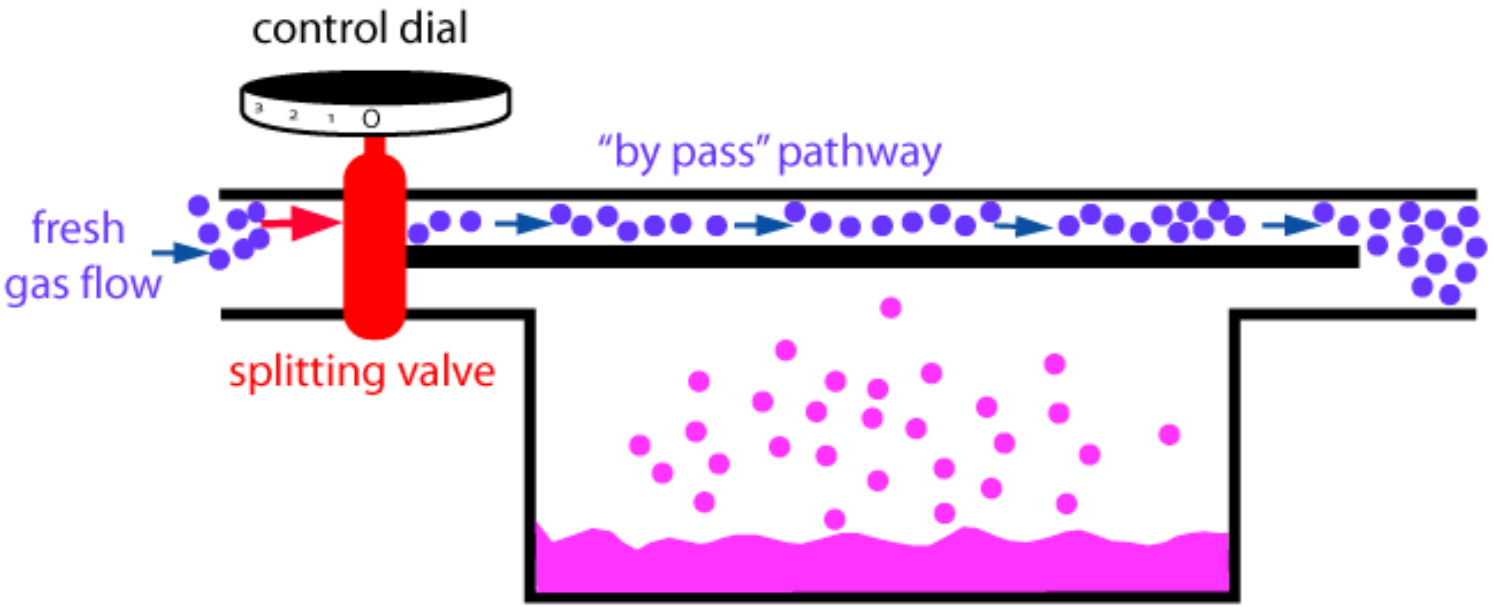
VARIABLE BYE-PASS FLOW OVER VAPORIZER



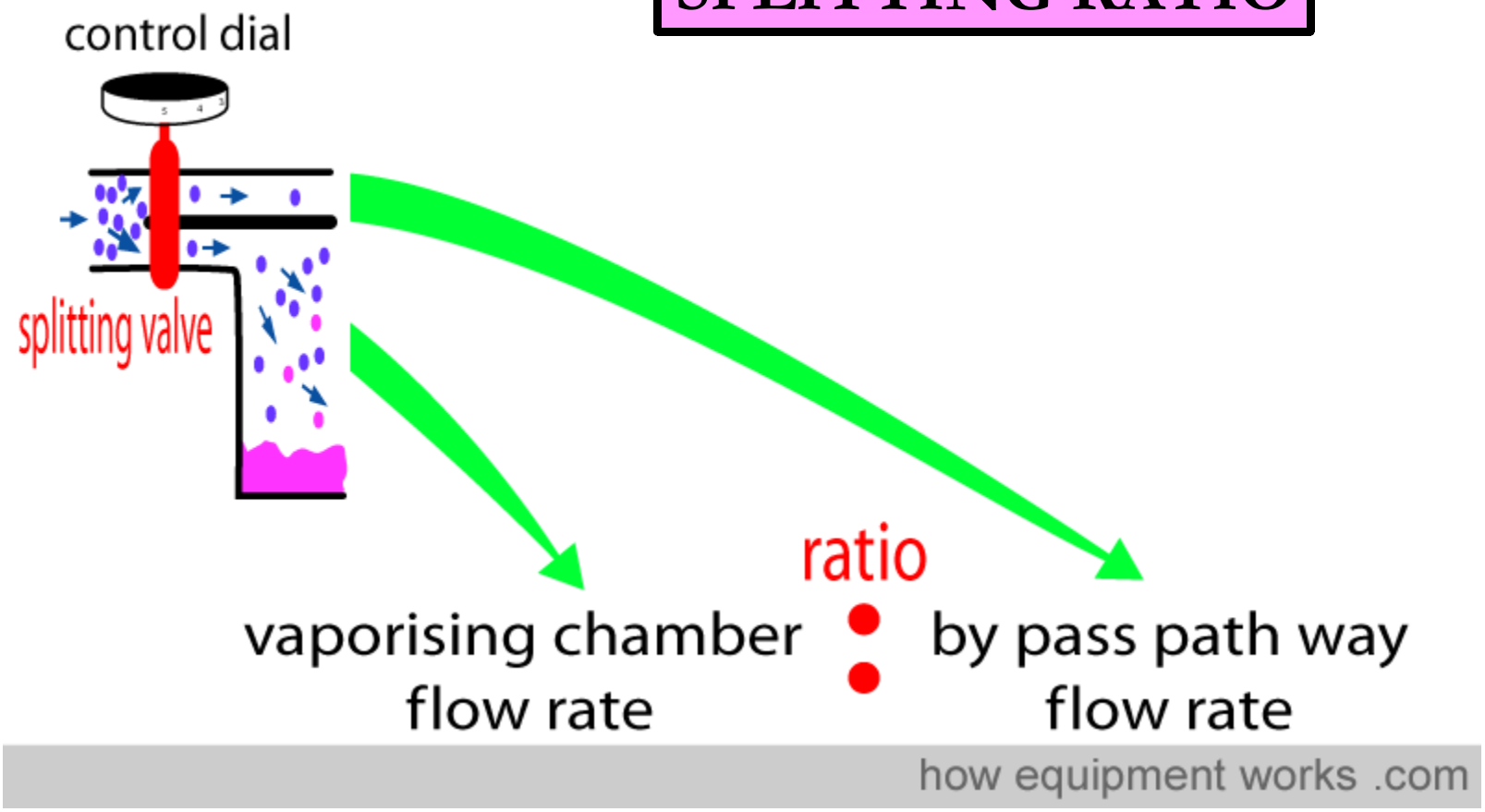
- FRESH GAS IS SPILIT INTO TWO
- TWO PATHWAYS
  VAPORIZING CHAMBER
  BYE-PASS CHAMBER
- IF VAPORIZATION DECREASES

BECAUSE OF TEMP FALL, FLOW INTO VAPORIZING CHAMBER CAN BE INCREASED

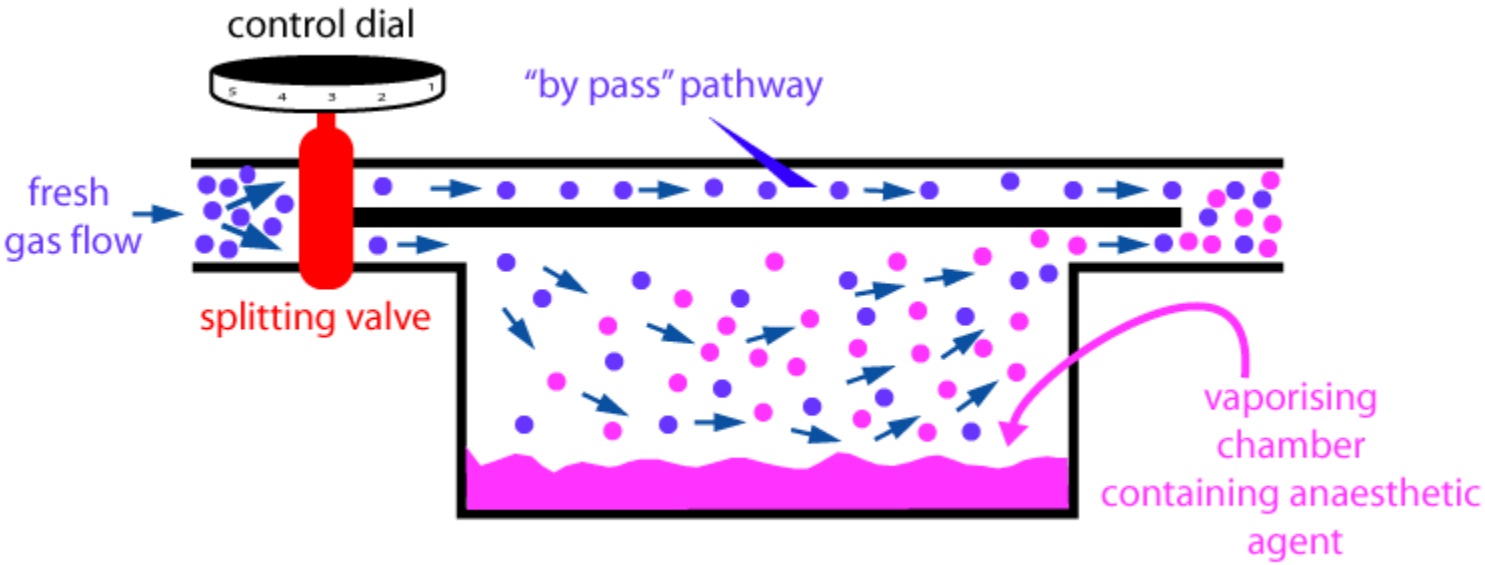
VAPORIZER IN OFF POSITION



SPLITTING RATIO

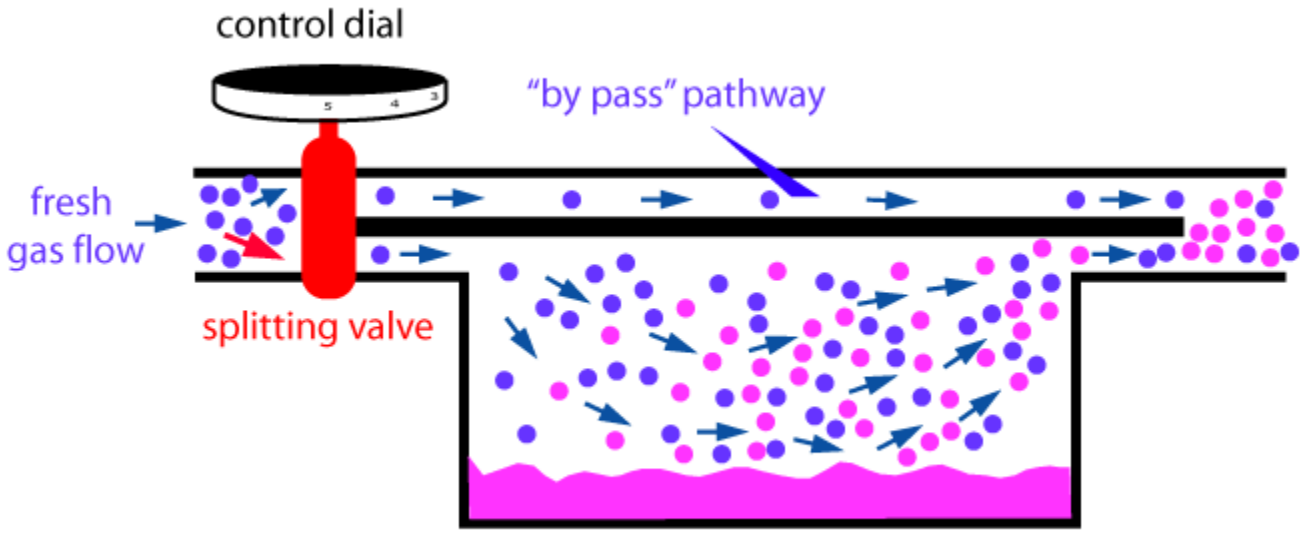


VAPORIZER IS "ON" POSITION



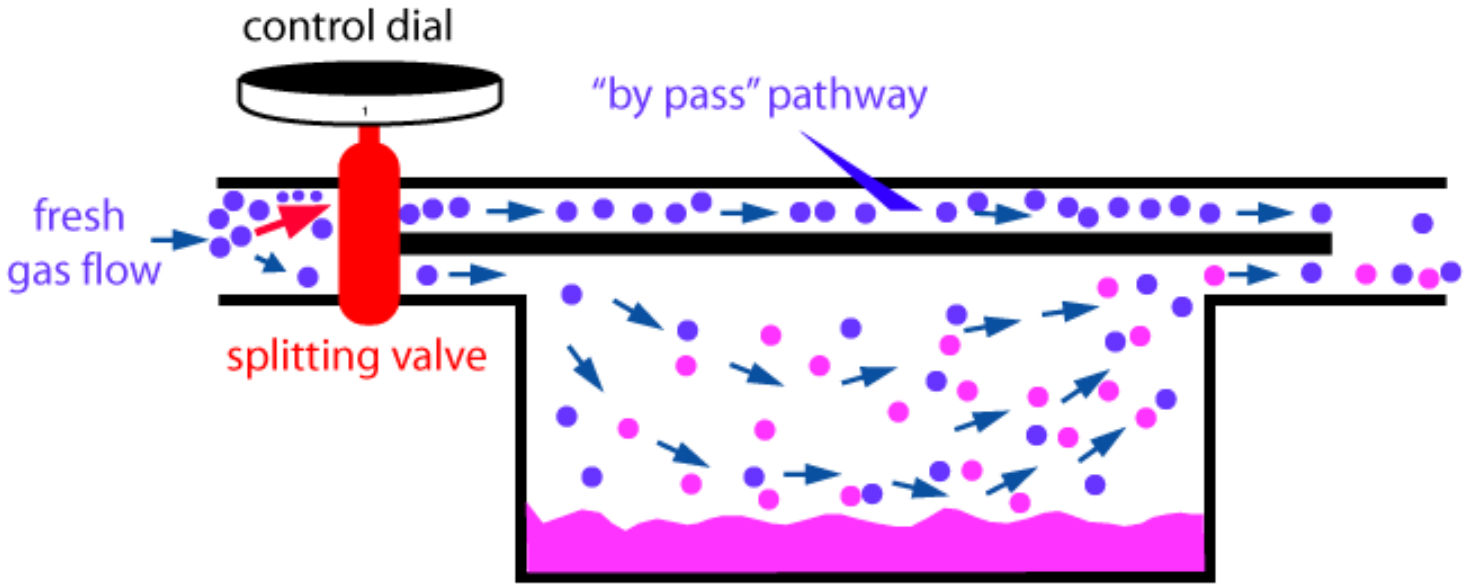
Fresh gas flow is split in to two and part of the fresh gas flows over the inhalational agent and picks up vapour. The output concentration will be decided at the outlet of the vaporizer after two gases get mixed…

DIAL IS OPENED MAXIMALLY..



More amount of fresh gas is made to flow over the inhalational agent.

When the dial setting is reduced…



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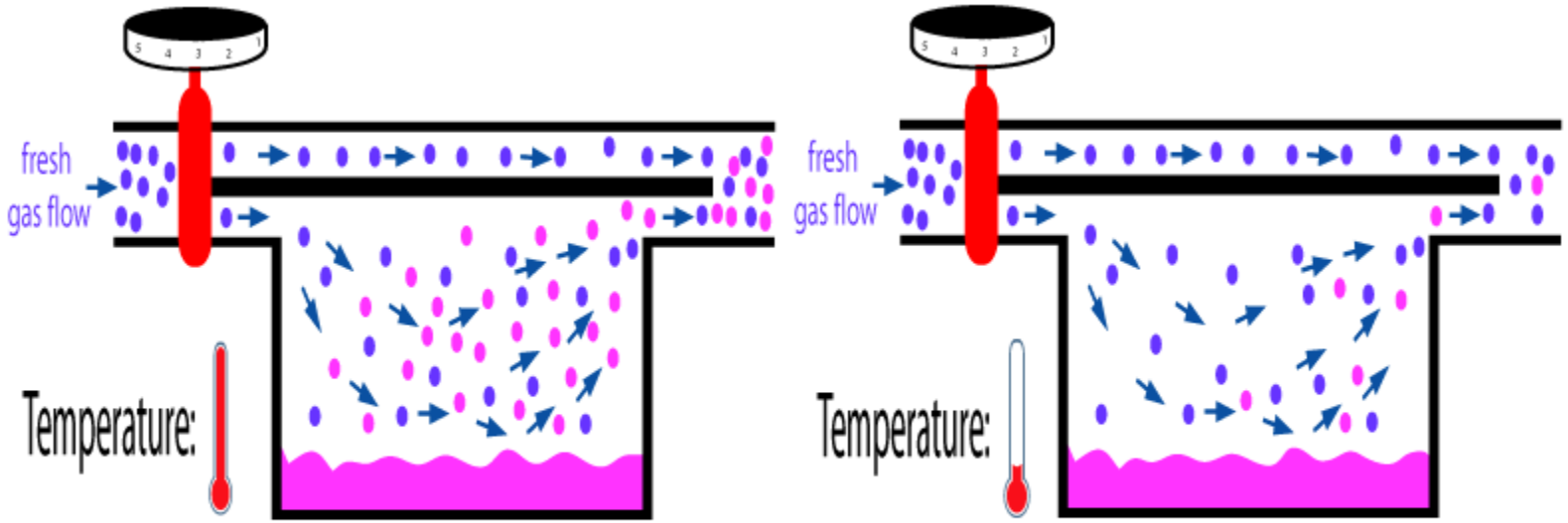
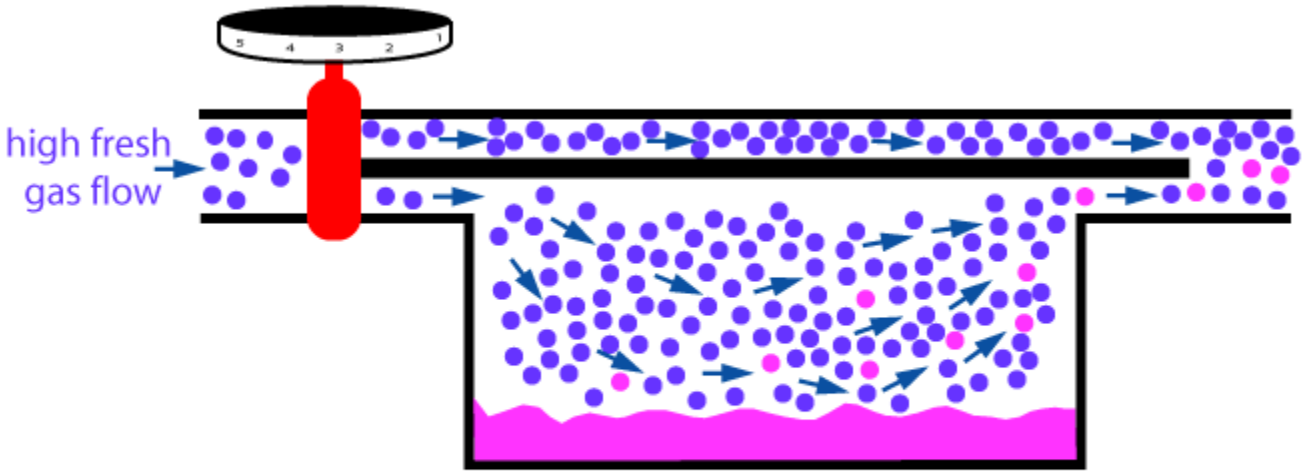
The problem of heat loss…



The volatile liquid needs heat energy for its continuous evaporation.
It takes the heat energy from the container,environment and the remaining liquid.
As the heat energy is taken off from the liquid, it gets cooled and vaporization Decreases.

REASONS FOR THE FALL IN OUTPUT CONCENTRATION



At high flows, there is inadequate vaporisation

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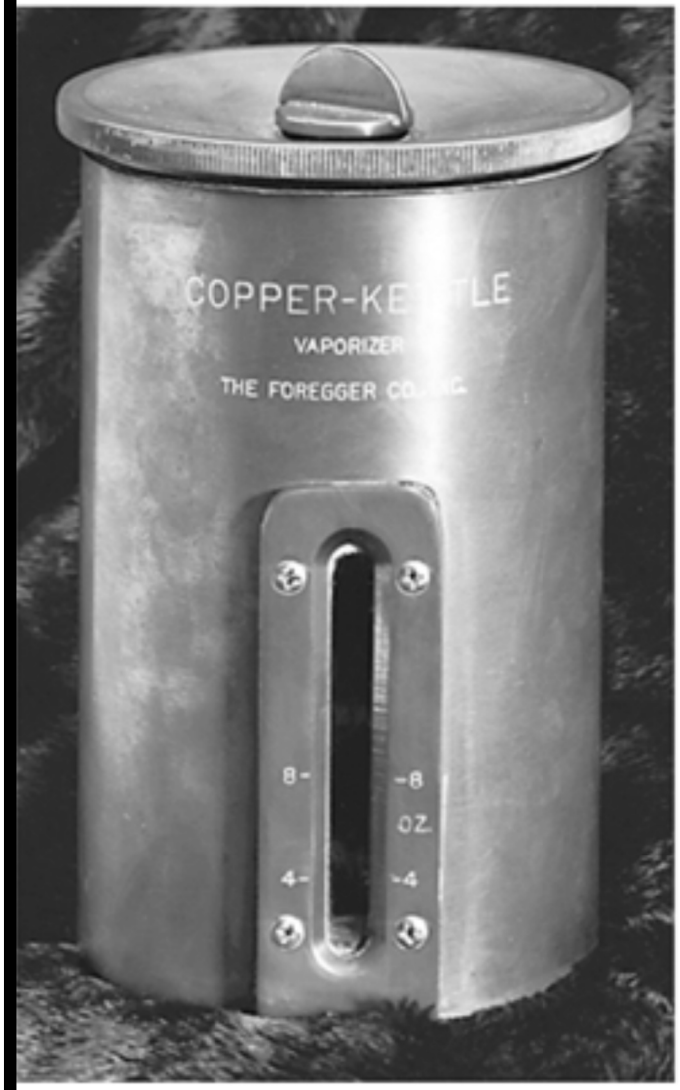
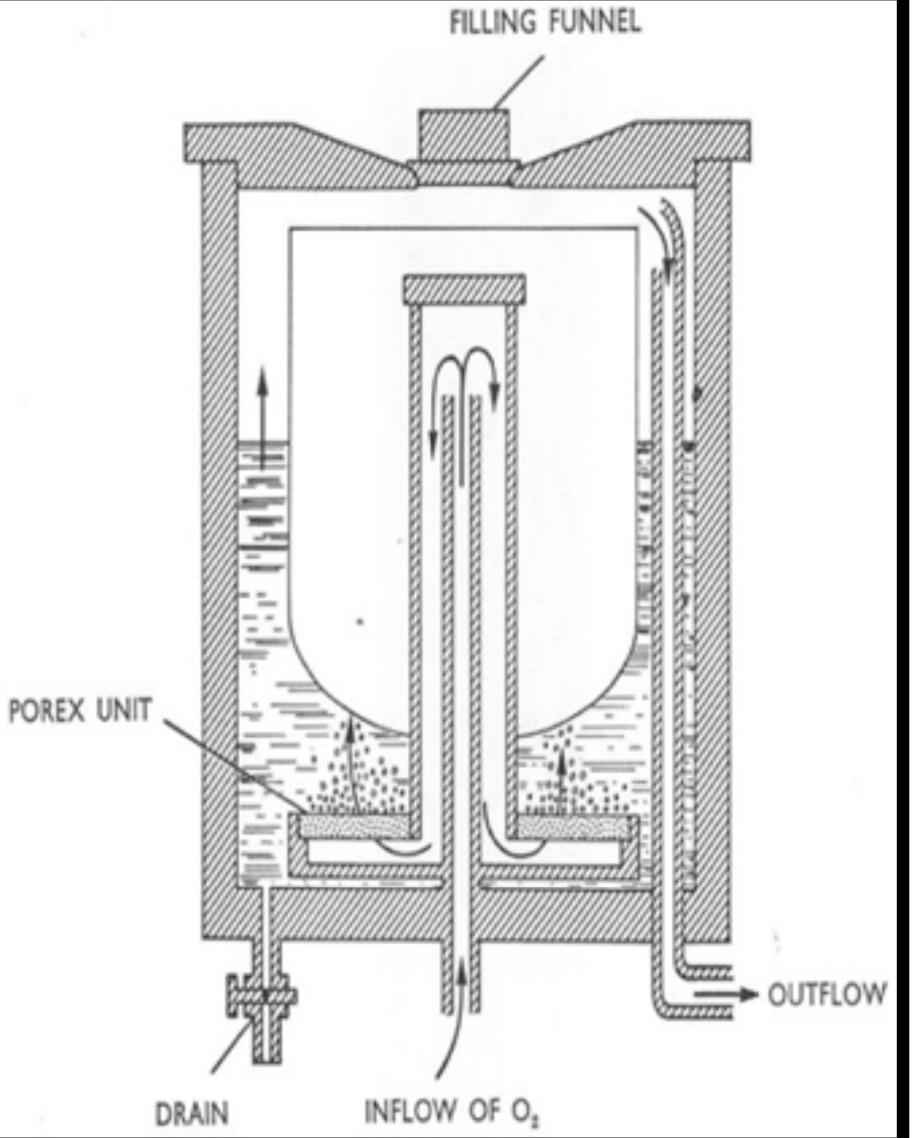
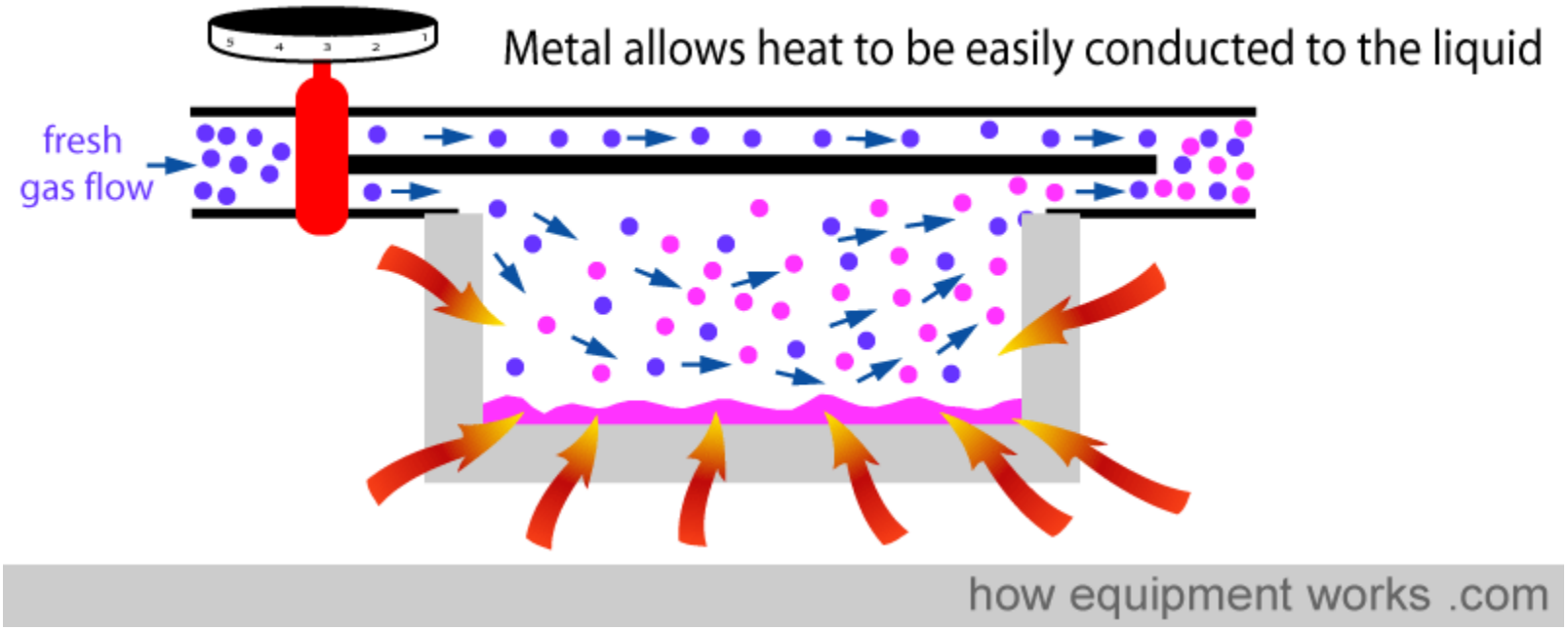
1. INADEQUATE SURFACE AREA OF CONTACT
2. FALLING TEMPERATURE OF THE LIQUID

high fre
gas flo


VAPORIZER
8-
-8
OZ.
4-
-4


FILLING FUNNEL
POREX UNIT
OUTFLOW
DRAIN
INFLOW OF O_2

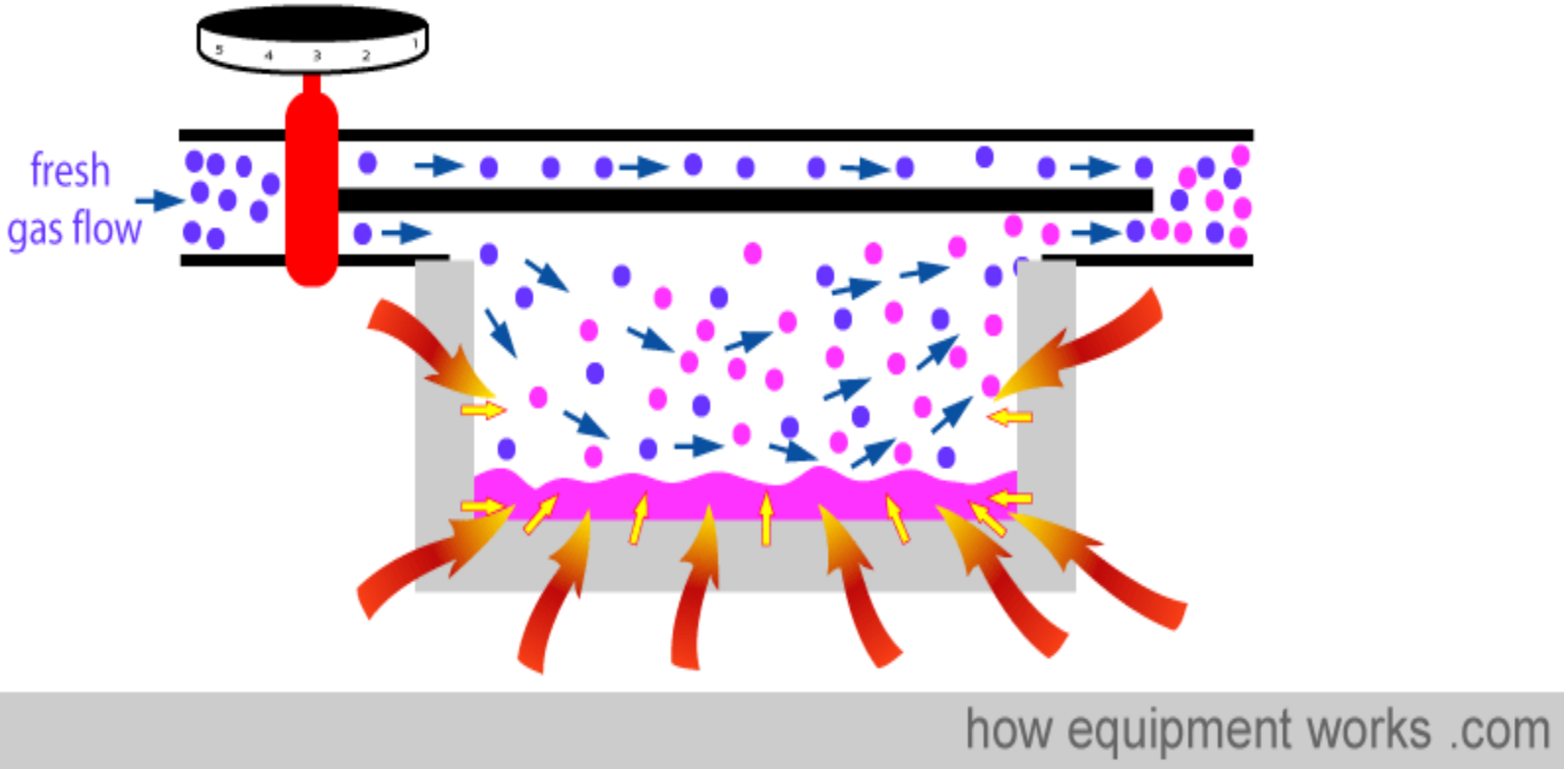
BY SELECTING A MATERIAL FOR THE VAPORIZER CONSTRUCTION…



- **HIGH THERMAL CONDUCTIVITY**
- **HIGH SPECIFIC HEAT CAPACITY**

COPPER

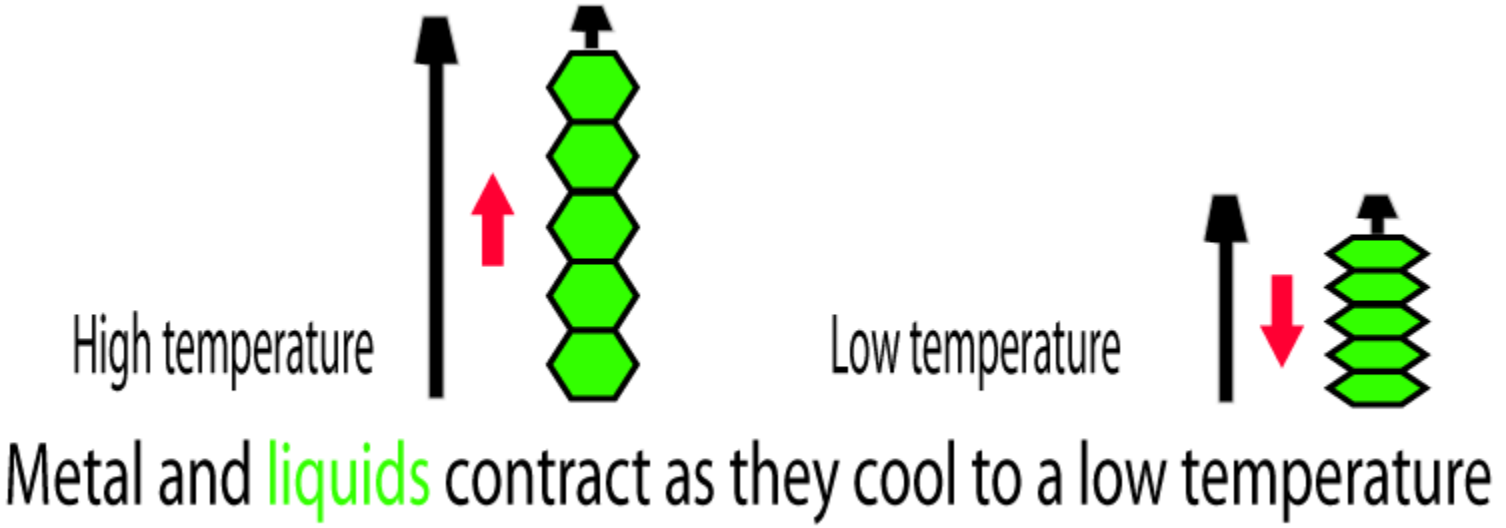
Conduction of heat from the environment
By providing its specific heat..

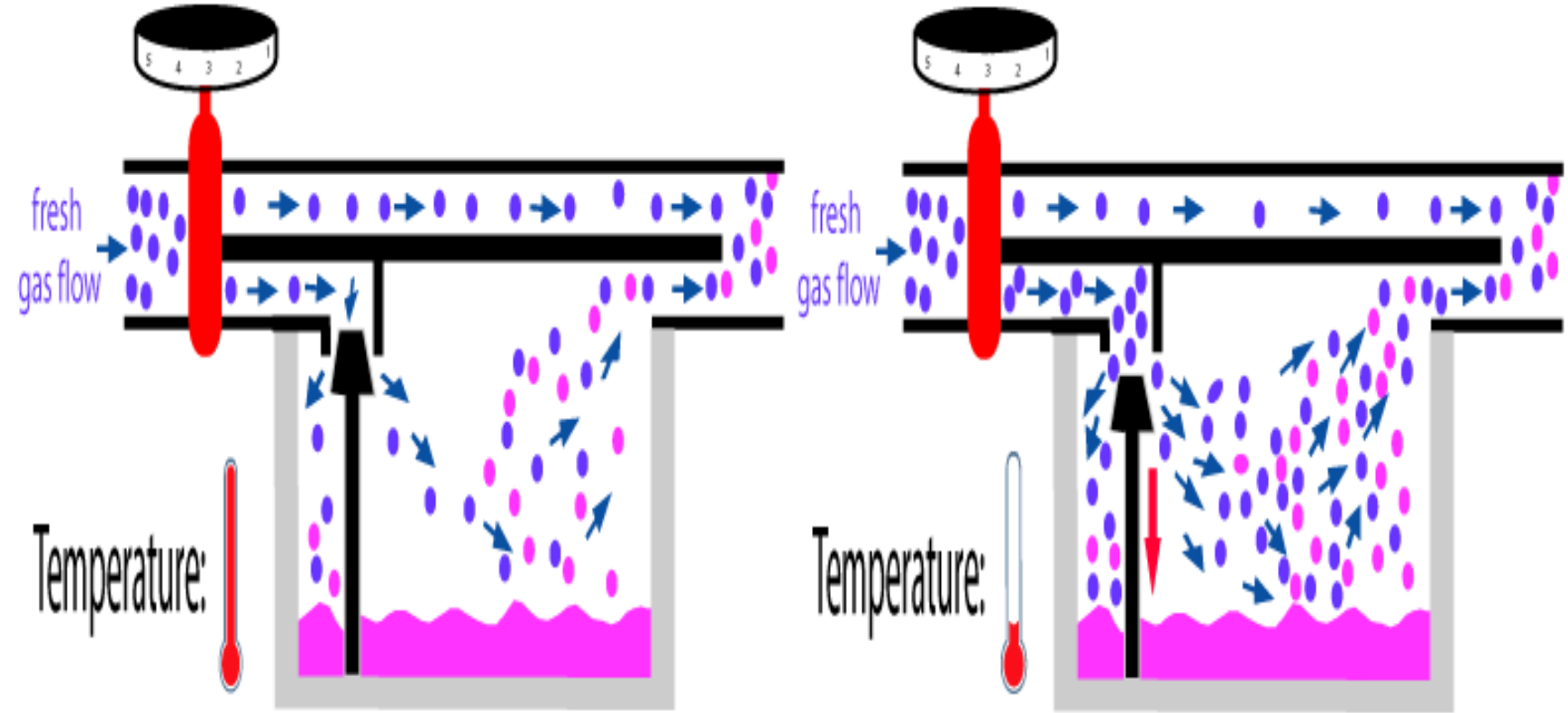


EPSTEIN MCINTOSH OXFORD ETHER VAPORIZER

WHATS SPECIAL IN THIS VAPORIZER?

By allowing more fresh gas to enter in to the vaporizing chamber…





"Metal rod" temperature compensating valve

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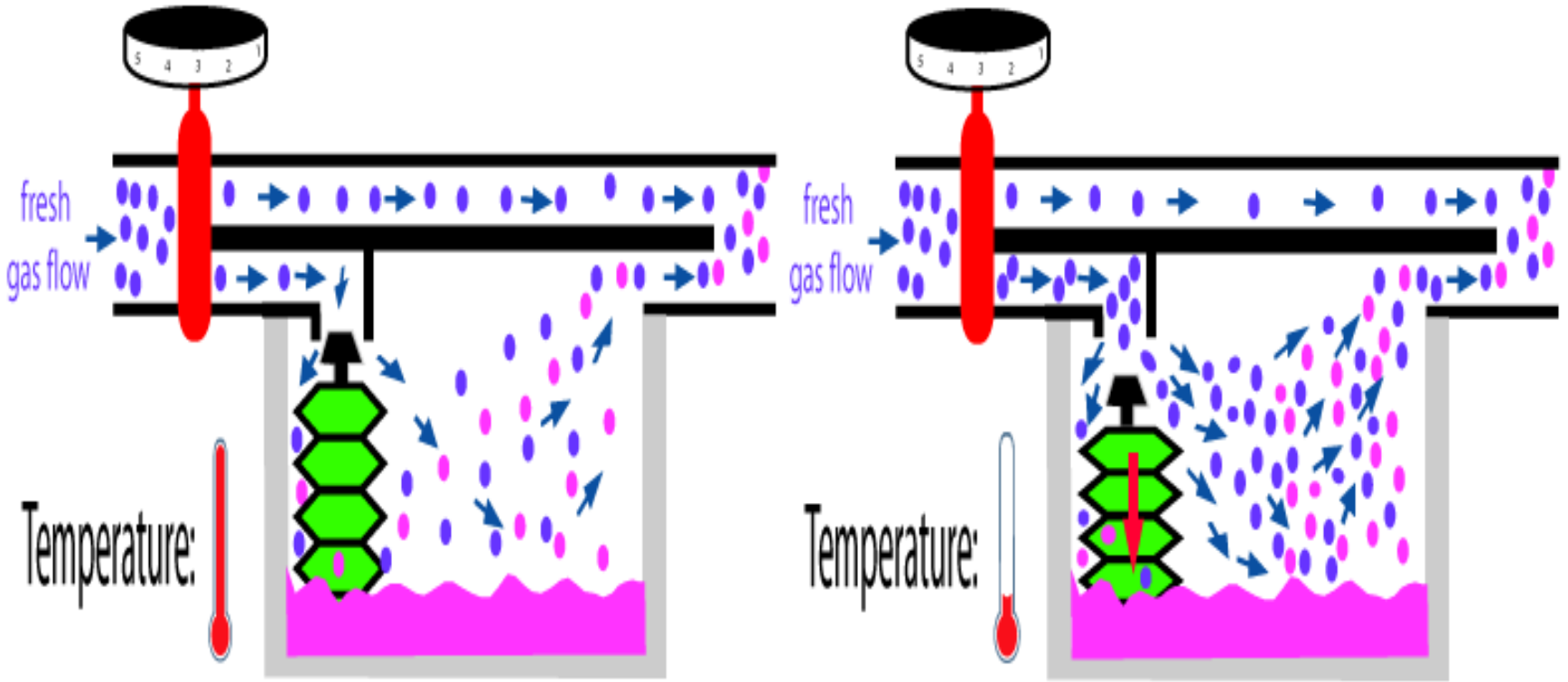

"Liquid Bellows" temperature compensating valve

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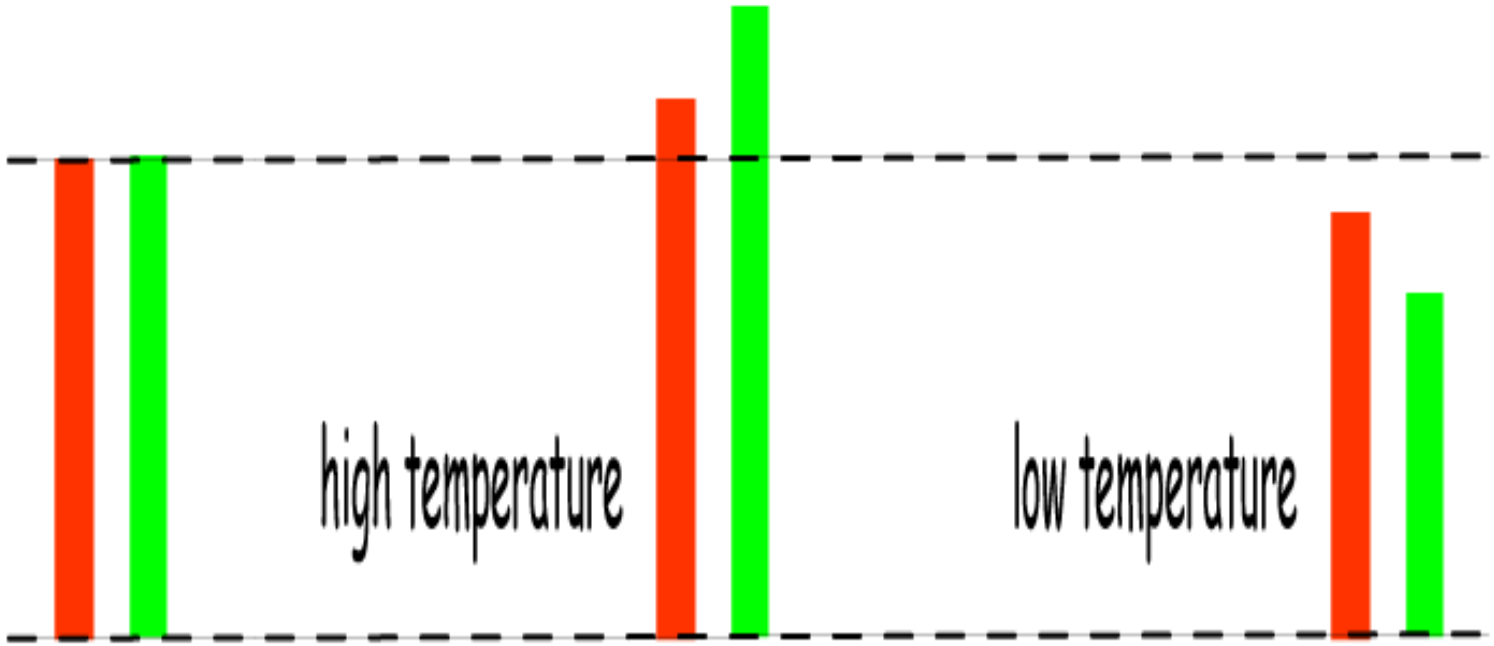
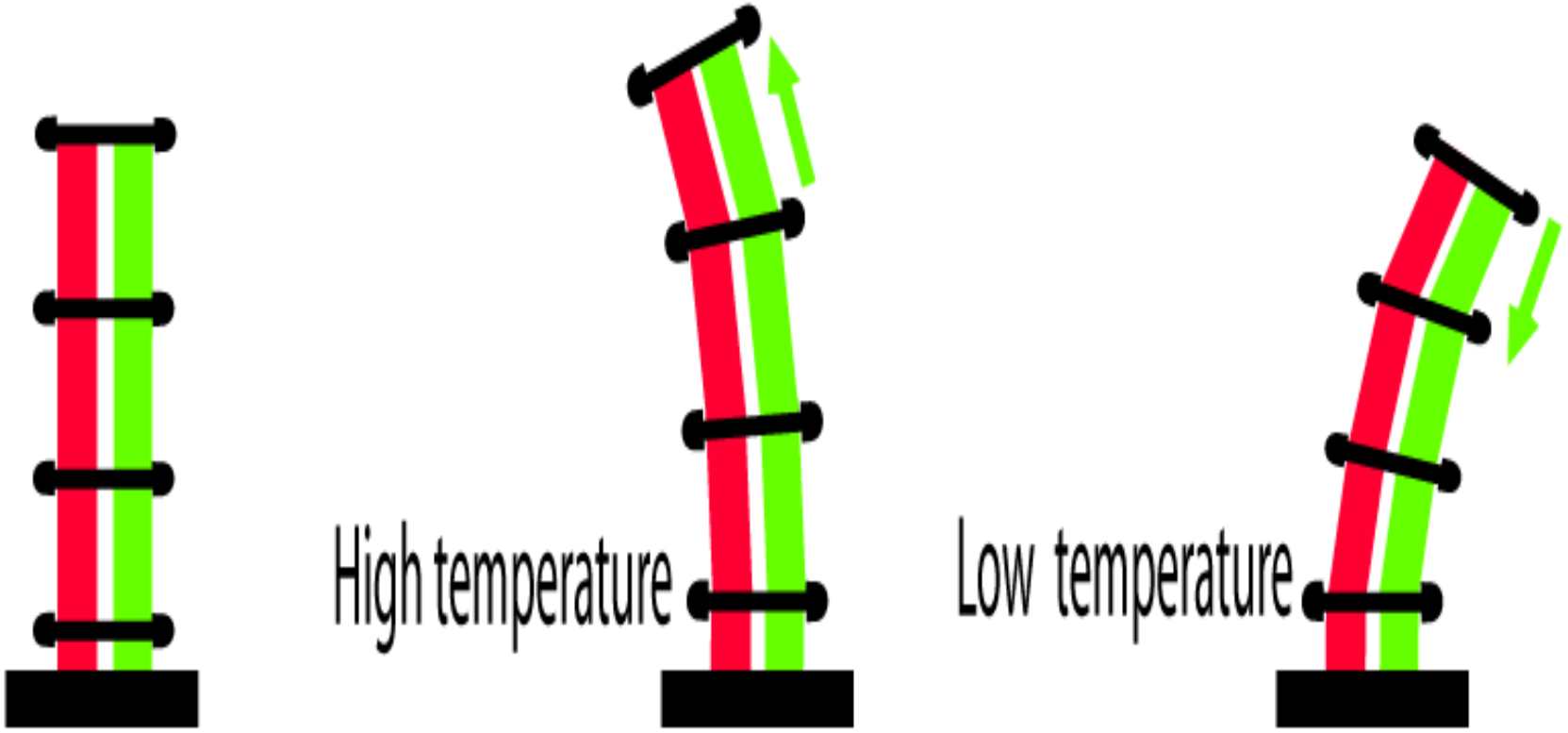


Different thermal expansion



Bi metallic strip

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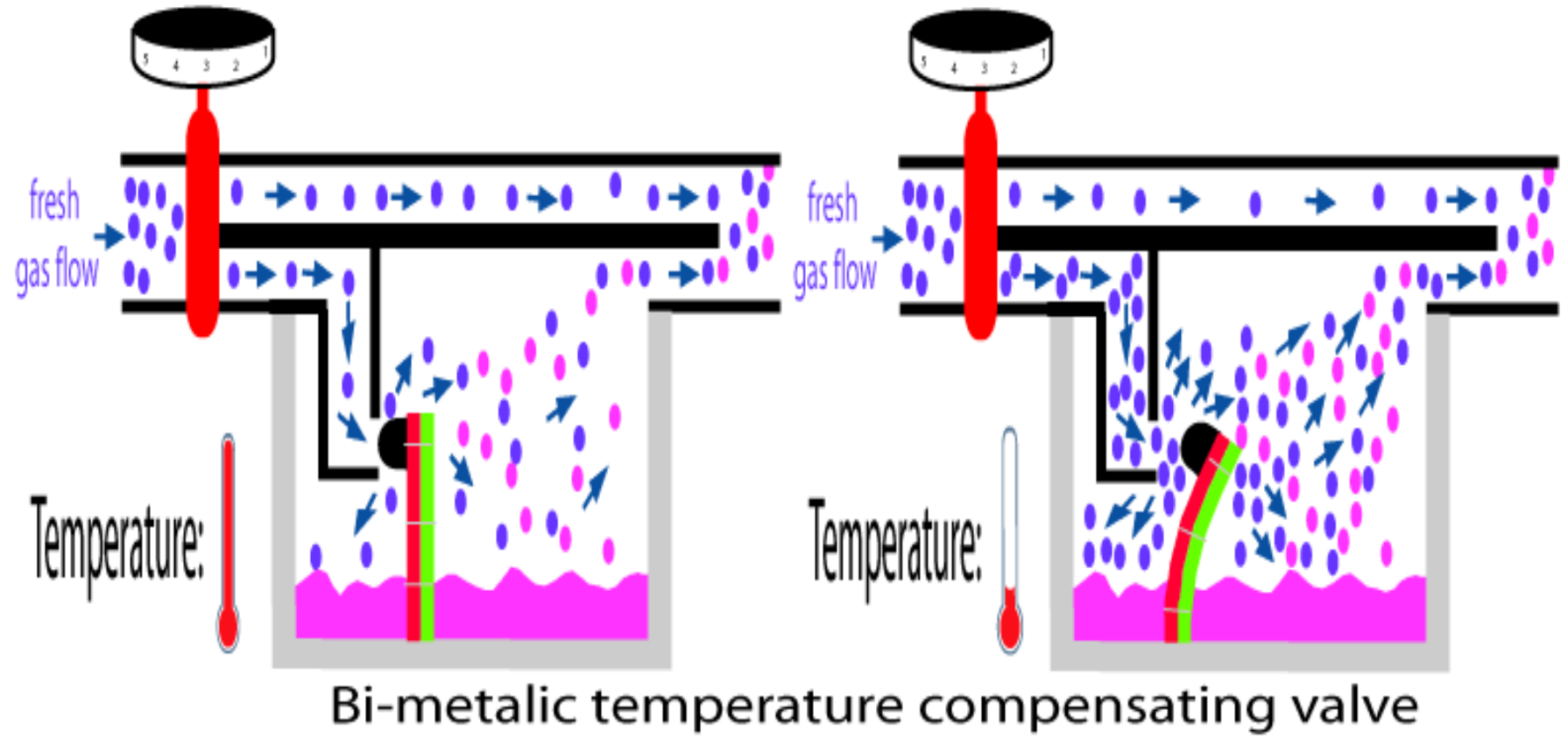

CAN YOU NAME THE METALS IN USE IN THE CONTEMPORARY BIMETALLIC STRIP?

SUMMARY:

- Two banks of Oxygen cylinders have to be kept in the Central manifold room.
- Two stage pressure regulators are employed in the manifold room.
- Liquid oxygen cylinder installation is economical as 1ml of Liquid oxygen gives rise to 850 ml of gaseous oxygen.
- The better understanding of the cylinders in terms of their colour coding, sizes, content, pressure and safety features helps us to improve the patient and personnel safety inside the O.T.
- The vapour output in the variable bye-pass vaporizer may not be constant as the time goes on.
- The temperature fall in the vaporizer may be countered by utilising various mechanisms like bimetallic strip, bellows or wicks.

CONCLUSION:

- Anaesthesiologists play a major role in the installation and maintenance of central manifold room and liquid oxygen plants.

- A thorough knowledge about them is mandatory for a smooth functioning of hospital oxygen supply system.

dr.r.selvakumar. M.D.D.A.DNB
professor of anaesthesiology,
madurai medical college,
Madurai.