

◇The anesthesia station has 3 categories of alarms : high, medium, and low priority

◇You can use the ventilator control panel to set

- 1) I:E
- 2) Tidal volume
- 3) Respiratory rate

◇Gas supply:

PMGV {piped medical gasses and vacuum system} had 5 sections

- 1- Bulk store
- 2- Distribution Pipelines
- 3- Terminal outlets 4- flexible hoses
- 5- connection between the flexible hoses and the anesthesia machine

◇Oxygen

●Oxygen is supplied to the PMGV from a bank of several oxygen cylinders attached to a manifold.

●Oxygen cylinder manifolds are 2 groups of J sized cylinders (large) and these 2 groups alternate in supplying Oxygen.

●In each group all the valves are open and empty simultaneously and there are no return valves to prevent backflow to the cylinders.

●The supply changes from the first group to the 2nd group when the 1st group is almost empty and this change activates an electrical signaling system so staff can change the empty cylinders.

◇ Pipeline supply source

●Delivers O₂/N₂O/Air to outlets in the OR

●Outlet connections are gas specific

DISS (Diameter Index Safety System) provides NON-interchangeable connections for medical gas lines to minimize the risk of misconnection.

●N₂O and entonox (50% O₂ + 50% N₂O) are supplied from banks of cylinders connected to manifolds (like O₂)

●medical compressed air is supplied from a bank of cylinders to the PMGV system

● Piped medical vacuum: provided by large vacuum pumps and silencers

◇Terminal Outlets:

- Yellow: Vacuum = at least 53kPa
- White/black: Compressed air = 4Bar
- White/Black: Air = 7Bar
- Blue: N₂O= 4Bar
- White: Oxygen =4Bar
- Scavengings

◇Cylinders:

- Made from molybdenum steel
- A/B/C/D are very small
- E= spare cylinder on the anesthesia machine
- J= biggest "largest" cylinder
- use the pin index system

*** N₂O and CO₂ cylinders contain liquid and vapour and are filled to a known ratio

الالوان مهمة لل cylinders والفرق بين US و UK (اجا عليهم سنوات)

◇Flow tube / flow meter

- A flow tube is called a Thorpe tube inside it is a mobile indicator of the amount of gas (a bobbin)
- New anesthesia machines have electronic flow sensors that measure the flow of each individual gas and display it in a numerical or graphical format or a combination of both.

●Problems with flow meters:

- 1) Non vertical tube: change in the shape of the bobbin leads to variation in flow and it may touch sides of the tube causing friction and inaccurate readings
- 2) static electricity: may cause an inaccuracy by as much as 35% and especially at low flows.
- 3) Dirt on the bobbin: sticking or alteration in size of the bobbin = inaccurate reading
- 4) Back pressure= depresses the bobbin leading to lower than actual reading
لما الهوا يرجع من الجهاز لورا فيضغط عليه لتحت
- 5) Leakage: defect in the top sealing

●O₂ flowmeter is placed downstream

It is harmful to place it upstream because if it got broken the leak will pass to the atmosphere and won't be noticed leading to hypoxia of the patient

From downstream to upstream:

O₂ > Air > N₂O

- Modern machines have a mechanical linkage between N₂O and Oxygen so that the N₂O flow meter decreases if O₂ flowmeter is adjusted to less than 25-35%

◇O₂ flush: delivers pure O₂ from the anesthesia outlet which leads to dilution of the anesthesia mixture with excess O₂. It may cause barotrauma

◇Vaporizers

- Have high temperature conductance to maintain a constant temperature inside the chamber despite the change in the temperature of the surrounding environment

- Desflurane needs a special vaporizer (needs high pressure and temperature)

- 2 types: Draw over and plenum

Draw over : cheap & difficult to control

Plenum : expensive & easy to control

◇ Mapelson systems

- Mapelson A (Magill)

Most commonly used

For spontaneous breathing

Spill valve is close to the mask so it's a heavy system

- Mapelson A (Lack)

Not as efficient as Magill, but the APL valve is on the proximal end far away from the mask

حاول يعدل عمشكلة ال A الاصلية وبعد ال valve بس صار ال system كله inefficient

- Mapelson B&C = not used anymore

- Mapelson D (Bain) = insufficient during spontaneous breathing but is the most efficient during mechanical ventilation

*Mapelson A,B,C D are used in adults

- Mapelson E (Ayers T piece)

Virtually no resistance to expiration

Provides no visual evidence of the presence or adequacy of ventilation

- Mapelson F (Jackson Rees)

Is a modification of mapelson E

Provides visual evidence of presence and adequacy of ventilation

Provides a degree of CPAP and PEEP

*Mapelson E+F = for pediatrics

◇Circle system

- Components:

- 1) Fresh gas inlet
- 2) Inspiratory unidirectional valve and Inspiratory breathing tube
- 3) Y connector
- 4) Expiratory unidirectional valve and expiratory breathing tube
- 5) APL valve
- 6) Reservoir bag
- 7) CO2 absorbent

- Disadvantages of a circle system

The major disadvantage is the volume.

If the system is initially filled with air, the low flow rates of anesthetic gas are diluted substantially and the needed concentration of the inhalational agents cannot be achieved.

- It is necessary to provide an initial total FGF of 3-4L/min. The flow rate may be reduced later.

- In a breathing circuit fresh gas is mixed with the anesthetic to dilute the anesthetic and to prevent the patient from rebreathing exhaled anesthetic.

**Remember: dilution of fresh gas continues at low flow rates and rapid changes in the depth of anesthesia CANNOT be achieved

◇ CO2 absorbers

- Perfect CO2 absorber

- Doesn't react with common anesthetics
- Not toxic
- Low resistance to gas flow
- Low cost
- Ease of handling
- Highly efficient in absorbing CO2

- CO2 absorbents

- Soda lime and calcium hydroxide lime
- Remove CO2 from the breathing circuit
- Soda lime can absorb a maximum of 26L of CO2 per 100g of absorbent + it reacts with sevoflurane to form compound A
- Calcium hydroxylime absorbs 10.2L of CO2 per 100g of absorbent (less than soda lime) but doesn't form compound A with sevoflurane
- Ethyl violet is an indicator added to soda lime when it changes from white to violet when it reacts with CO2 and it is not always a reliable indicator
- Signs that the CO2 absorbent is exhausted despite normal color include 1- increased spontaneous breathing rate 2- initial increase in BP and HR followed by a decrease in both 3-increased sympathetic drive 4)respiratory acidosis 5)increased surgical bleeding

- Soda lime is made from calcium hydroxide and water is required for efficient absorption of CO₂ by soda lime
- Baralyme is another CO₂ absorber (similar to soda lime) is 80% barium hydroxide and 20% calcium hydroxide

◇ Manual resuscitation breathing systems

- Self-inflating bag
- Non-rebreather bakve
- Fresh gas input with or without an O₂ reservoir bag

◇ Bellows are classified according to their movement in the expiratory phase

- Ascending/ Standing bellows : ascend during the expiratory phase
- Descending / hanging bellows : descend during the expiratory phase

Remember:

DISS is for the pipeline supply

Pin index system is for the cylinders

Both aim to eliminate the human error



بس المظلل بالصورتين مطلوب (ما شفت عليه سنوات بس الدكتور حكا حفظ)

	Medical Gas Cylinder Sizes and Capacities by Cylinder Size (A-J) and Height (inches)							
	CAPACITIES (L)							
	A/10 in	B/10 in	C/14 in	D/18 in	E/31 in	F/34 in	G/49 in	J/57 in
Oxygen	170	340	680	1360	3400	6800		
Nitrous oxide		450	900	1800	3600	9000		
CO ₂		450	900	1800				
Helium			300		1200			
Air						3200	6400	
O ₂ /helium				600	1200			
O ₂ /CO ₂					1360	3400		
Entonox						3200	6400	

هاي الالوان شفت منها بالسنوات وتكرر والدكتور سواء بالاسئلة او بالمحاضرة شد عفرق الالوان بين US و UK

GAS CYLINDERS –COLOR CODING SYSTEMS – US VS UK			
Gas cylinder	Color (US)		Color ISO (UK)
Oxygen	Green		White
Air	Yellow	Black &	White
Nitrous oxide	Blue		Blue
Entonox® (50/50% O2/N2O)	Not available		Blue & White
Heliox (21/79% Helium/O2)	Brown &	White	Brown & White

ارقام ال FGF مهمة اجت خيارات باسئلة
همة ببساطة

Mapleson A,B = 2 × minute ventilation
Mapleson C,D,E,F = 2-3 × minute ventilation

Mapleson Class	Other Names	Configuration	Respired Fresh Gas Flow		Comments
			Spontaneous	Controlled	
A	Mask attachment		2 × minute ventilation	2-2.5 × minute ventilation	Easy to install. Very light and simple to position. Best suited during controlled ventilation. End-tidal breath system is a modification that requires additional circuit modification & back-breathing system provided under gas scavenging.
B			2 × minute ventilation	2-2.5 × minute ventilation	
C	Waters trap/bag		2 × minute ventilation	2-2.5 × minute ventilation	
D	Mask circuit		2-3 × minute ventilation	1.5-2 × minute ventilation	Best circuit modification: fresh gas tube inside breathing tube.
E	Apnea T-piece		2-3 × minute ventilation	3 × minute ventilation (2.5-3.0)	Expiration tubing should provide a larger volume than that required to prevent rebreathing. Breathing is difficult.
F	Jackson Rees modification		2-3 × minute ventilation	2 × minute ventilation	A Mapleson D with a breathing bag connected to the end of the breathing tube to allow controlled ventilation and scavenging.