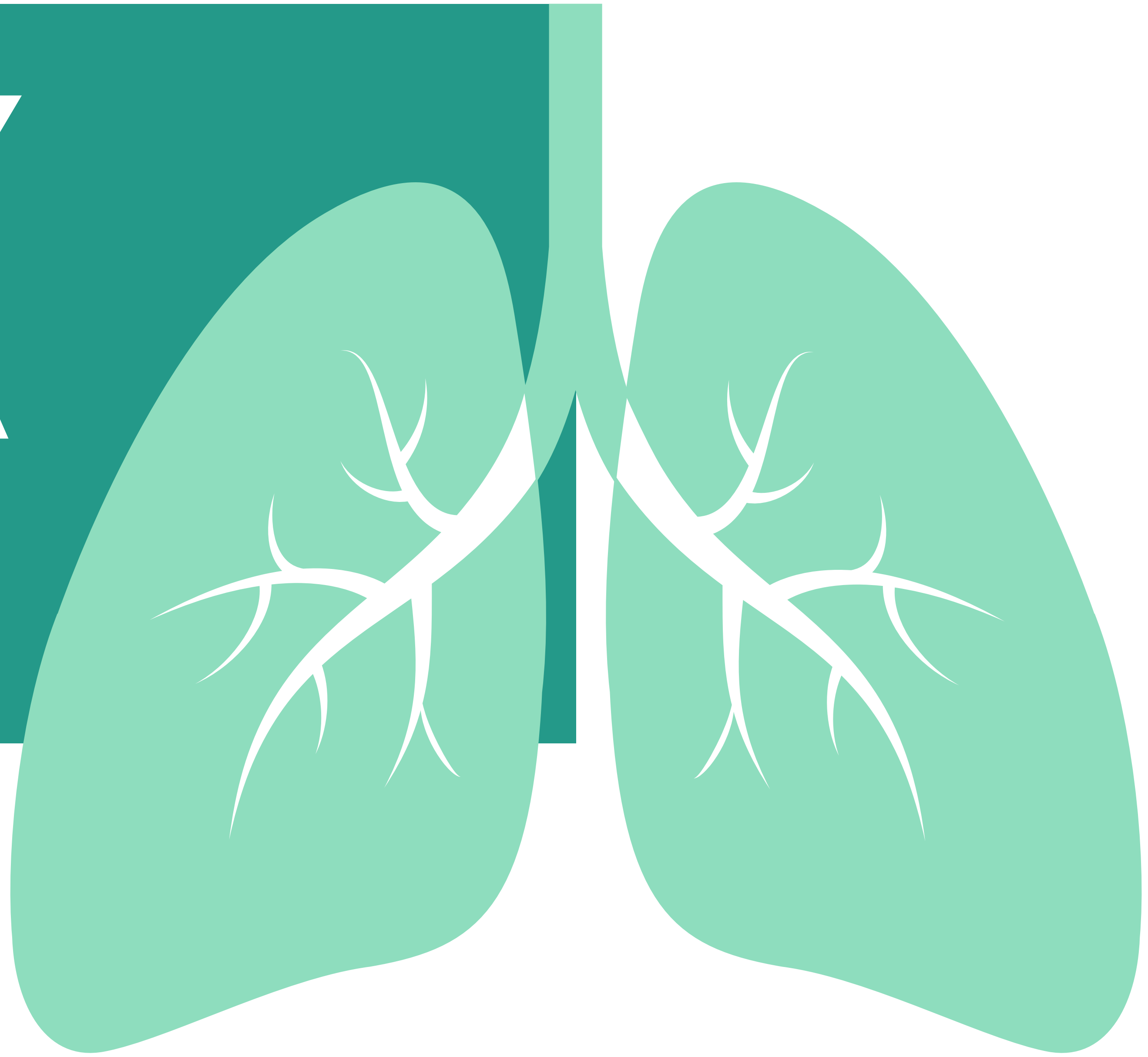
Understanding the Fundamentals of

VETERINARY ANESTHESIA EQUIPMENT



Presented By

Stephanie Garcia

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We will be covering the fundamentals in this order:

- Oxygen Source & Navigation
- Flow Meter & Flow Rates
- Vaporizer & Anesthetic Gas
- Inspiratory Valve / O2 Bypass
- Rebreathing & Non-Breathing Bags & Tubes
- Expiratory Valve / Manometer / Pop-Off Valve
- Scavenger System & CO2 Canister
- Leak Testing & O2 Monitoring

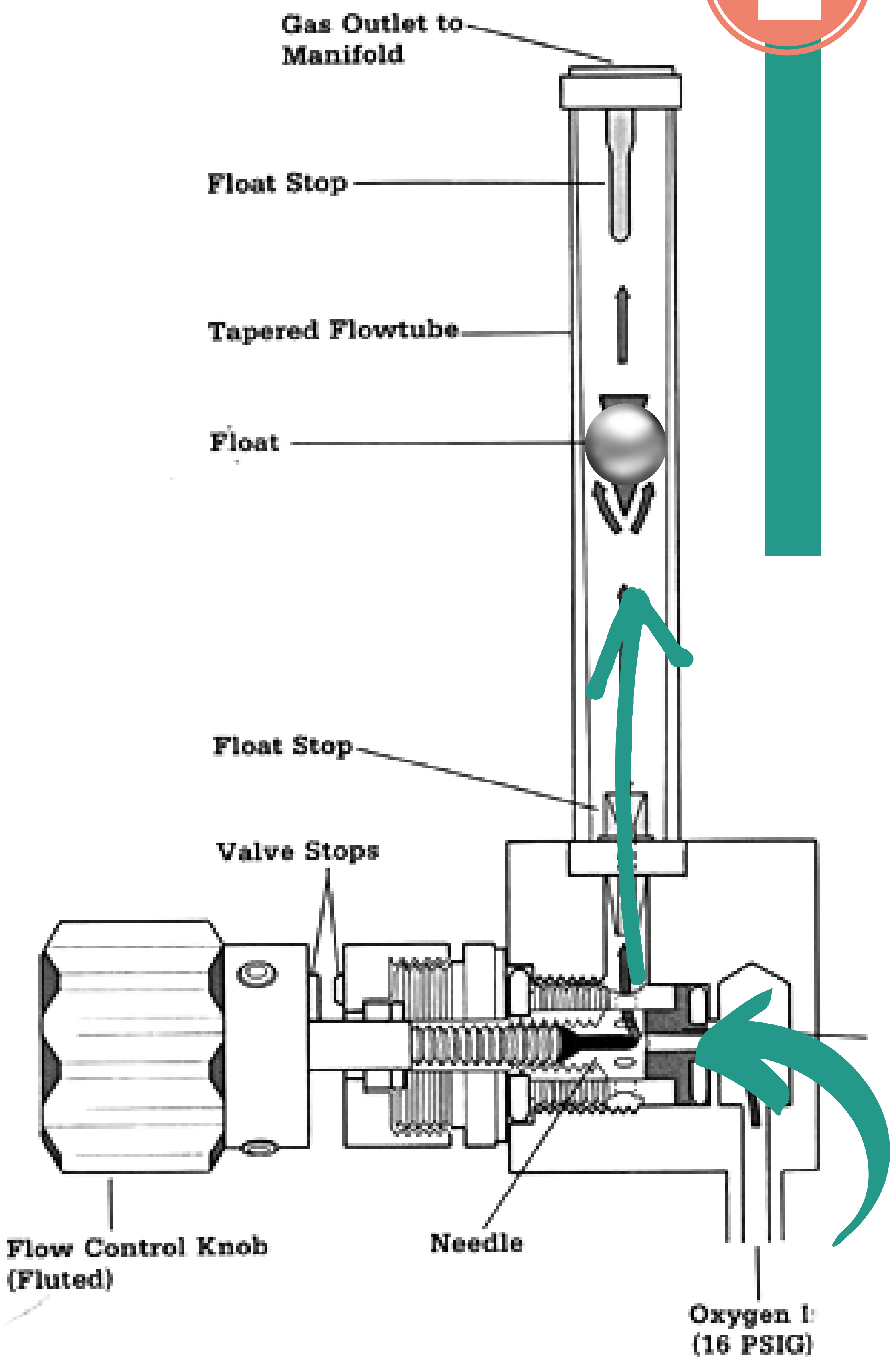
IT ALL STARTS WITH GREEN

- Oxygen tanks and hoses are the color green
- Condensed oxidizing gas classified as : CLASS 2
- 2.2 NON-FLAMMABLE GAS : May Cause or Intensify Fire
- Colorless, odorless & tasteless
- Never oil or grease valves
- Dalco Medical refills and performs maintenance on O2
- Stored in high pressure cylinders located outside

SEMI-CLOSED SYSTEM

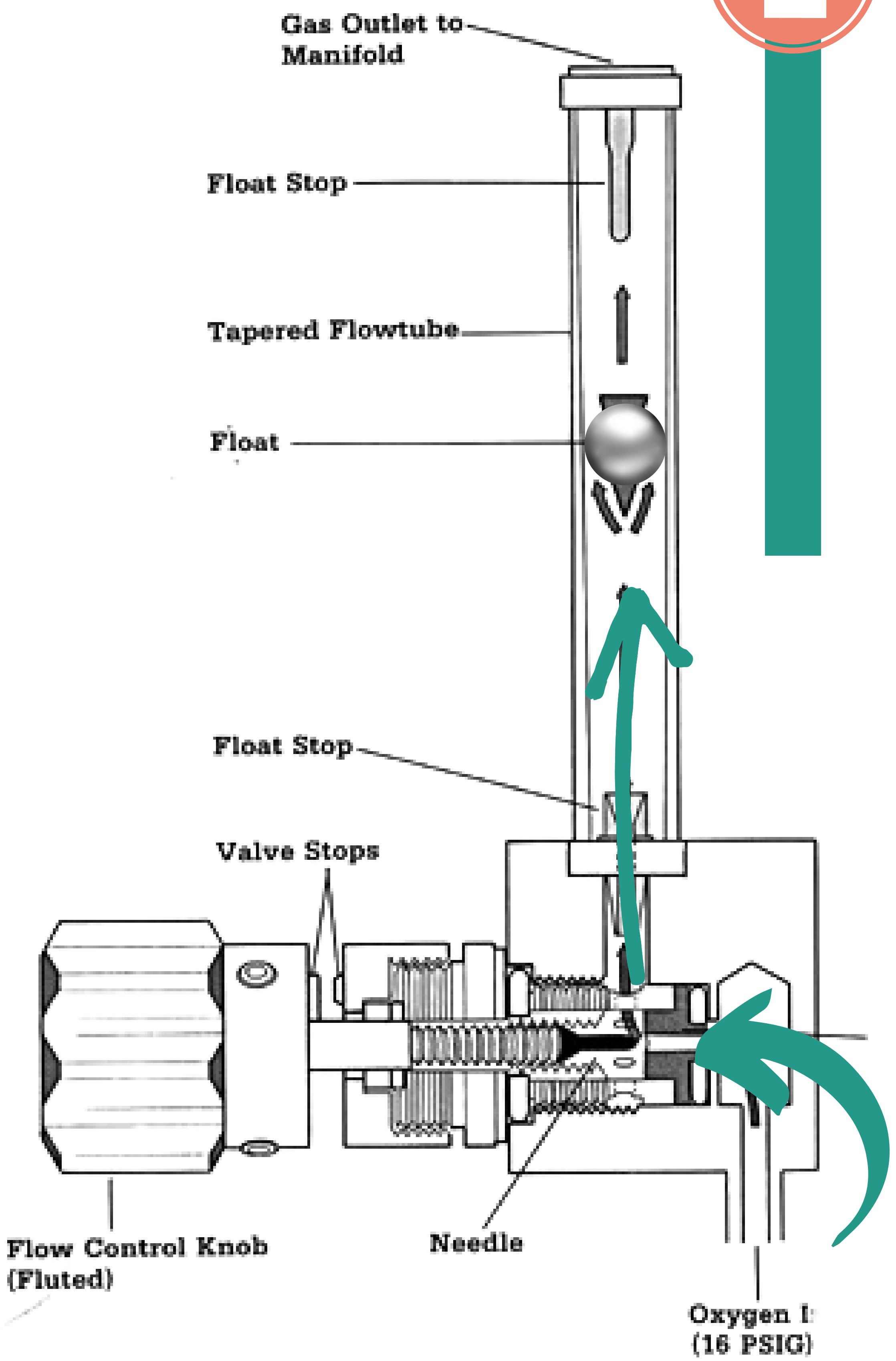
Also Known As a Partial Rebreathing System (Ours is a Midmark VMS PLUS)

- Patient receives a mixture of fresh gas and expired gases filtered through CO2 canister.
- Requires a scavenger system because more air than the patient needs is circulating in the machine.
- Pop-Off Valve Remains Open



1 FLOW METER

- Vertical Glass Cylinder with an indicator that rises with O2
- It must be turned on in order for the patient to receive O2
- It must be turned on in order to deliver anesthesia agents
- Fused Scale Range is between 0.2 - 4.0 LPM or L/Min
- Does not generally require routine maintenance
- Can break from over tightening flow control knob
- The float is read from the center of the floating ball
- If it requires excessive hand tightening to bring down the float, it is damaged and needs to be replaced.



1 FLOW METER

How to Test a Flow Meter for Accuracy:

- Empty the reservoir bag completely
- Close the Pop-Off Valve & Occlude the Y-Piece
- Choose a flow setting that matches the size reservoir bag (e.g., 2 LPM for 2L Bag)
- Accurate if the bag fills completely in 1 minute.

CALCULATING FLOW RATES

UP HIGH FLOW BY

4.5 LPM

MASK INDUCTION

1 -3 LPM <10kg

3 -5 LPM >10kg

CHAMBER

4.5 LPM

ETT INDUCTION & RECOVERY

50 to 100 mL/kg/min with a max of 4.5 LPM

Flows at higher end of this range will result in faster changes in anesthetic depth, because of this it can be used when rapidly trying to adjust rates.

MAINTENANCE

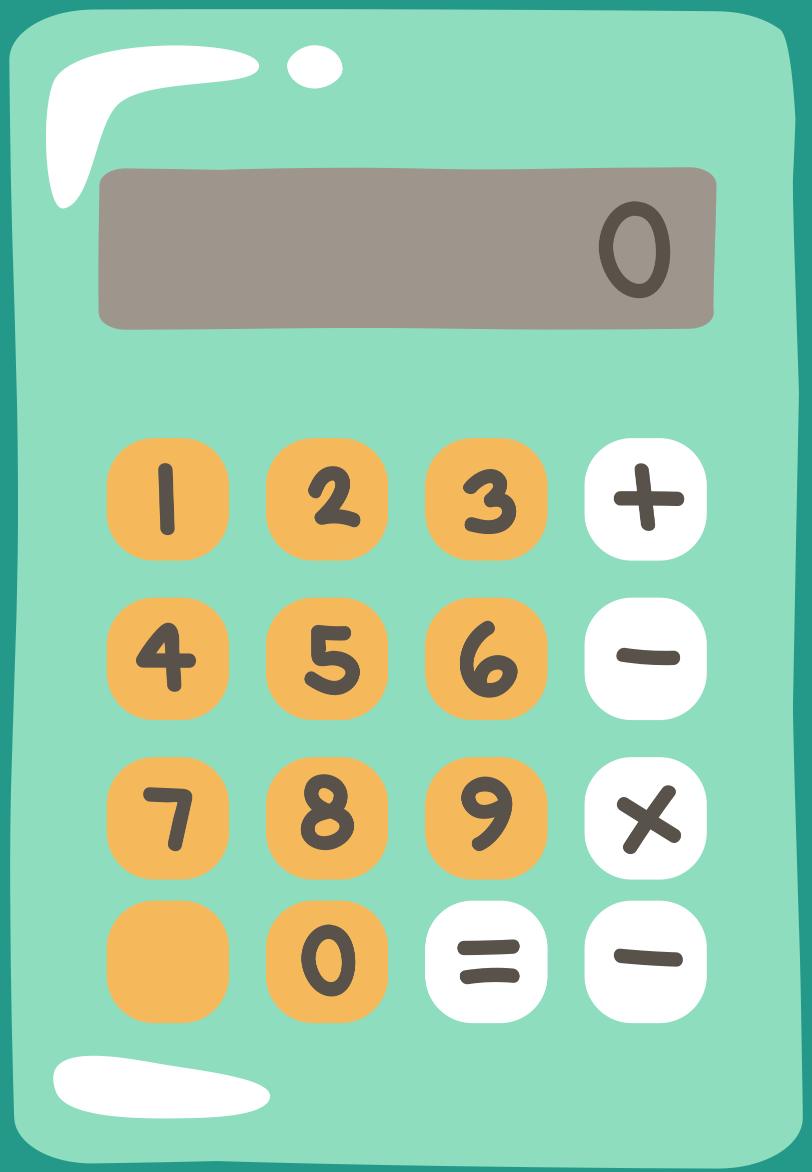
20 to 40 mL/kg/min

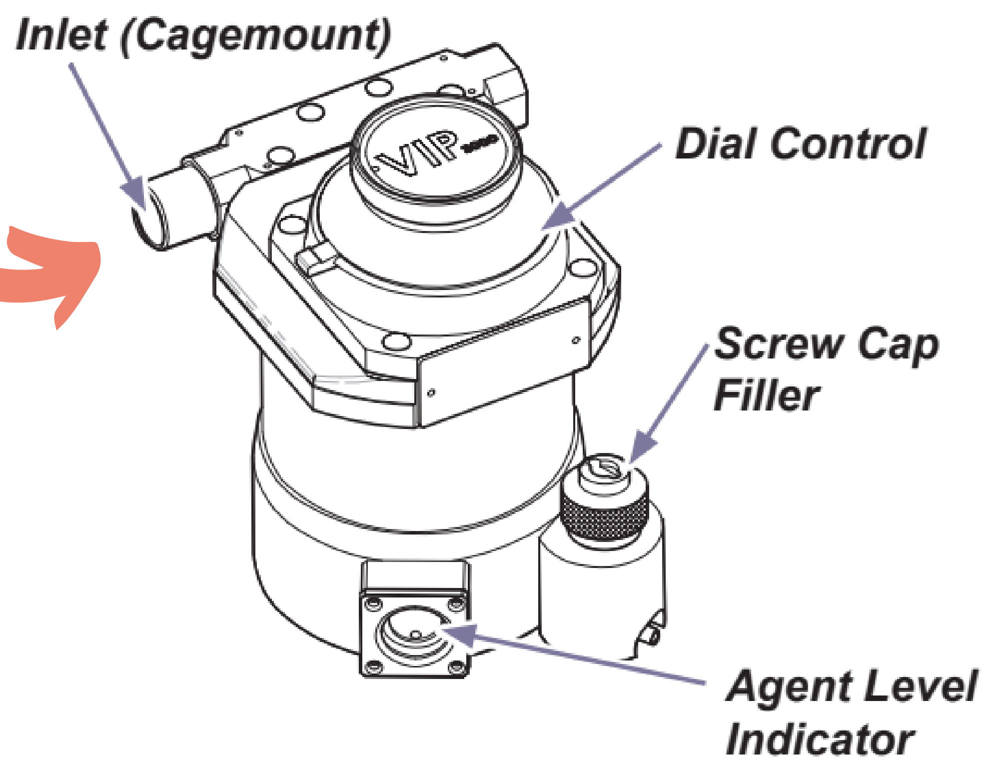
As low as you can while still achieving 98-100% SpO2

NON-REBREATHING - ONLY FOR PATIENTS UNDER 7 kg

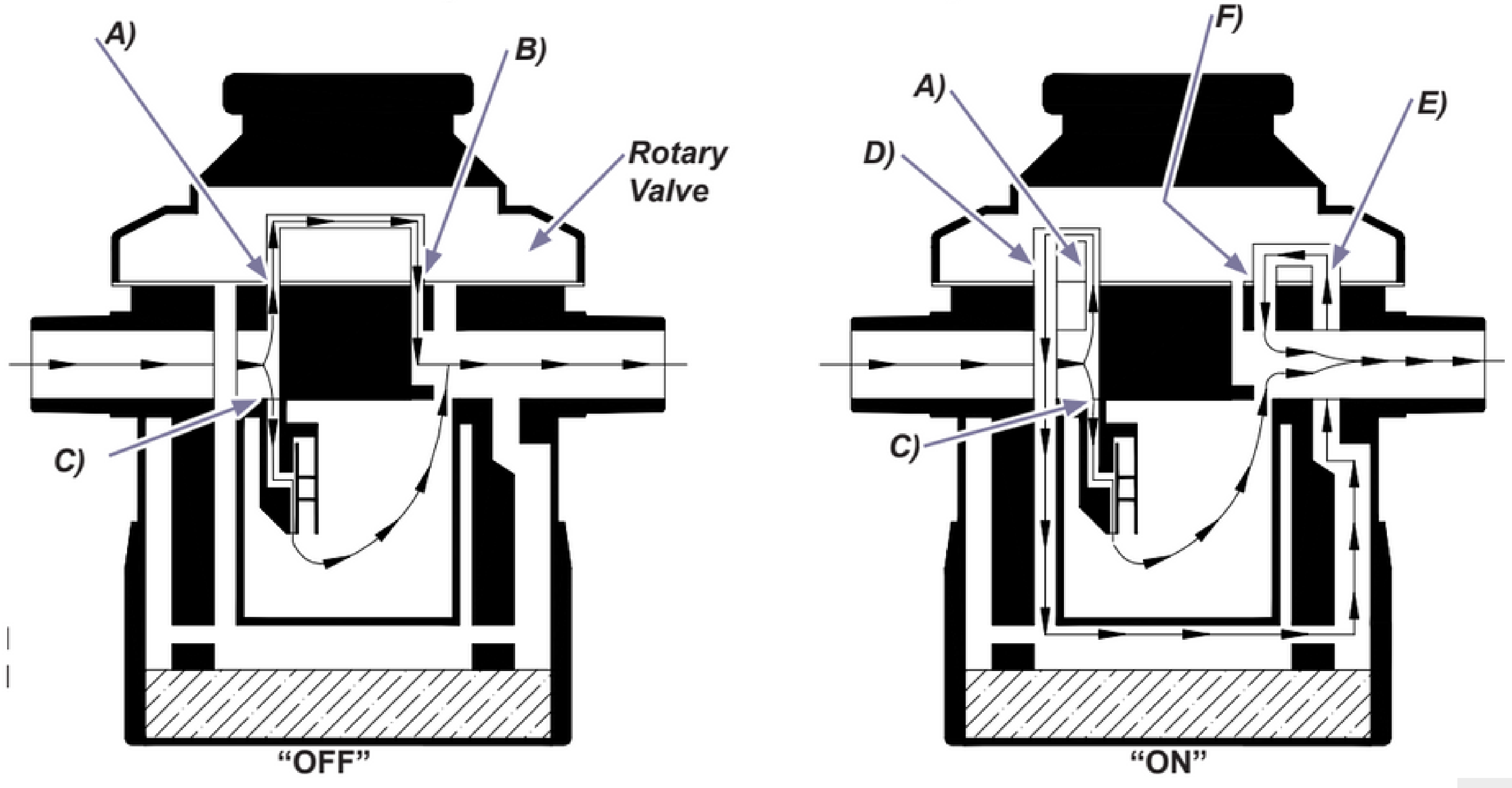
(Generally Patients Under 10 lbs)

0.25 to 1.5 L/min (Approximately 100-300mL/kg/min)





A) Rotary Valve Inlet
B) Rotary Valve Outlet
C) Inlet to Bypass Chamber (Thermostat)
D) Vapor Chamber Inlet
E) Outlet: Vapor Chamber to Calibrated Channel
F) Outlet: Calibrated Channel to Vapor Outlet



2 CALIBRATED VAPORIZERS

Specifically designed and calibrated for each anesthetic agent *(ISO or SEVO)* in

% of anesthetic agent vapor per volume *(V/V)*

- Must be kept upright at all times
- Can only be filled with its own agent
- Can only be filled with the vaporizer off
- Fill according to agent level indicator
- If bone dry, the level will decrease slightly as the wick absorbs the agent.
- Annual maintenance by professional
- Must be OFF when not in use

INSPIRATORY VALVE

The fresh gas inlet is where the mixture of anesthetic agent and O2 enter the rebreathing circuit.

The inspiratory valve is unidirectional. Inside the dome you can see it move as the patient breathes or a breath is given.

O2 BYPASS

The oxygen flush valve is a button or lever that when activated rapidly delivers a large volume of pure oxygen at a flow rate of 35 to 75 L/min directly from the line to the bag bypassing the anesthetic agent and flowmeter.

Always detach hoses from patient before using the flush valve to avoid damaging the patient's lungs.

3

Y CIRCUIT

Most commonly used at CVRC
Inhales through 1 tube and exhalation goes through another
2 Sizes
Large Tubes 25 lbs or >25 lbs
Small Tubes <25 lbs

UNIVERSAL F CIRCUIT

Tube-within-a-tube design
Aids in heat and moisture retention
Exhaled air wraps around blue inner tube to warm it
Faster recovery
Reduces clutter with only 1 tube

Clean both of these with only dilute chlorhexidine, not instrument cleaner because it can be harmful to the lungs and cannot be gas sterilized because it causes tracheal necrosis.

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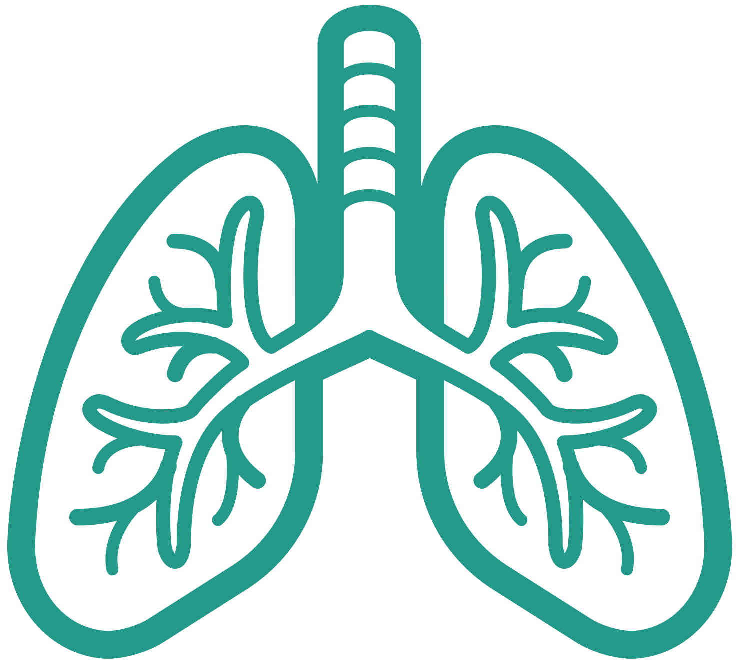
RESERVOIR BAGS



Latex breathing bags can be used to assist in ventilation by pressing on the bag when the pop-off valve is *temporarily* closed.

Guidelines for Selecting a Bag

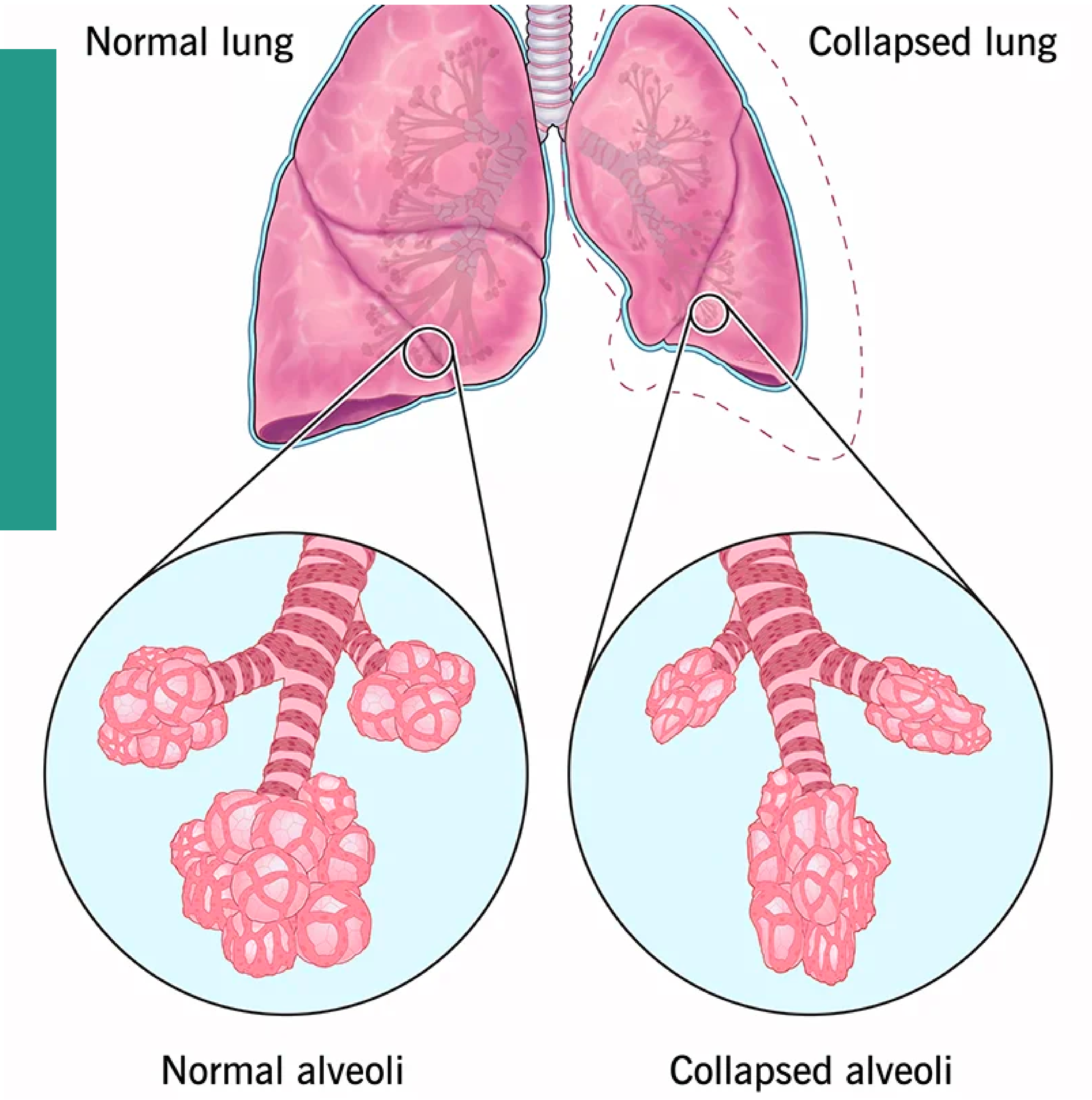
Up to 3kg	500 ml (0.5 Liter)
4 - 7 kg	1 Liter
8-15 kg	2 Liter
16-50 kg	3 Liter
51-150 kg	5 Liter

ATELECTASIS
(A-TEH-LEK-TUH-SIS)

is a condition that occurs to some degree in most anesthetized patients and compromises gas exchange. It is a failure of the lung to expand (inflate) completely.

Bagging helps reinflate the collapsed alveoli
Experts recommend **bagging all anesthetized patients every 5 to 10 minutes to inflate the lungs gently with fresh oxygen and anesthetic.**

This can also help prevent hypercarbia (Elevated CO_2) and hypoxemia (Low SpO_2)



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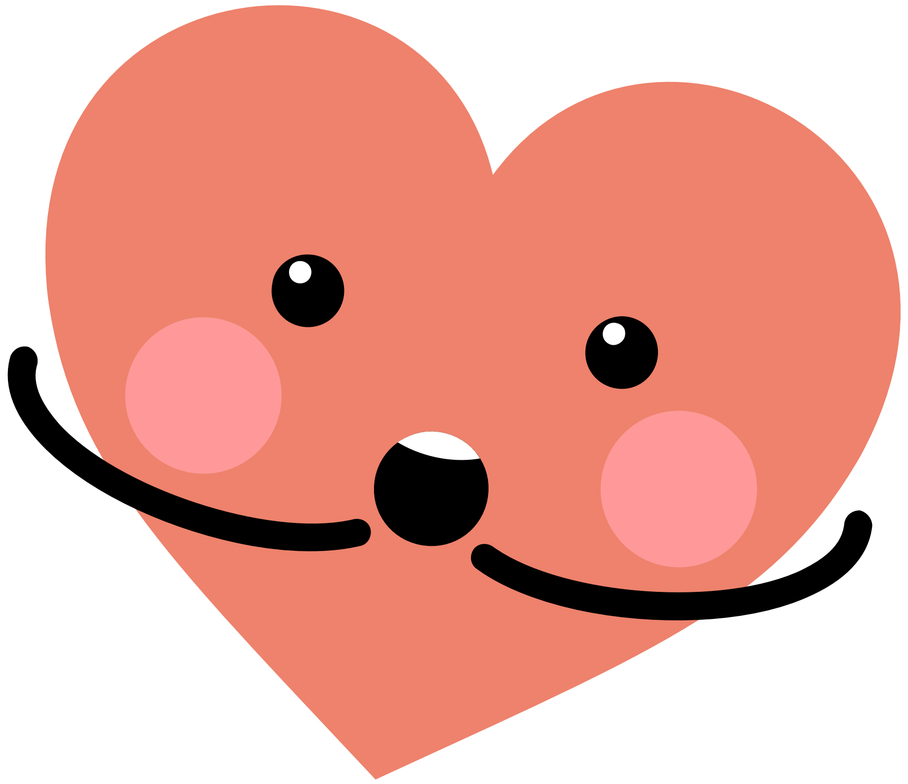
COMPLICATIONS



What happens if you pick the wrong rebreathing bag size?

- Too small = Not enough air to inhale
- Too small = Over inflation during exhalation = Increased pressure
- Oversized makes it hard to see respiration clearly
- Oversized makes it difficult to judge the amount of gas delivered

The bag should be 3/4 full at peak expiration if you chose the right bag.

If the bag becomes tight and over inflates, check that you chose the right size, that your flow rate is appropriate and that your pop off valve is open.

3

MANOMETER

Indicates the pressure of the gases within the breathing circuit and by extension the pressure in the animal's airway and lungs.

This is expressed as centimeters of water or mmHg

Patient Breathing

Reads 0 to 2 cm H2O

Assisted Ventilation

Read 0 to 10 cm H2O, can go to 15-18, but not always necessary

Never exceed 20 cm H2O or risk dyspnea, lung damage or pneumothorax ("popped lung")

4

EXPIRATORY VALVE

Exhaled gases travel through the ET tube and the Y piece and enter the expiratory breathing tube on the left and pass directly into the CO2 canister.

POP-OFF VALVE

This is the point of exit of anesthetic gases from the breathing circuit and enter the scavenging system. By venting excess gas, the pop-off valve prevents build up of excessive pressure.

Excess intrathoracic pressure also dramatically decreases return of blood to the heart, resulting in severely decreased cardiac output.

Use only the temporary pop off valve to give breaths or if using a mechanical ventilator the pop off valve must be closed.

WAGD
WASTE ANESTHESIA GAS DISPOSAL

4

Anesthetic waste moves through the pop-off valve and through the WAGD tube down to the point of discharge outside of the building or via an F/air canister if an alternative scavenging system is not practical or available.

To absorb anesthetic vapors effectively, F/air canisters must be replaced after 12 hours of use or after a weight gain of 50g.

How AAVEC minimizes gas waste:

We avoid using masks to maintain anesthesia.
We maintain proper inflation of our ETT.
We monitor that the reservoir bag inflates and deflates properly or else we make suspect a leak.
We turn off our vaporizer and flowmeter when finished.
We routinely leak test our machines.

CO_2 ABSORBER CANISTER

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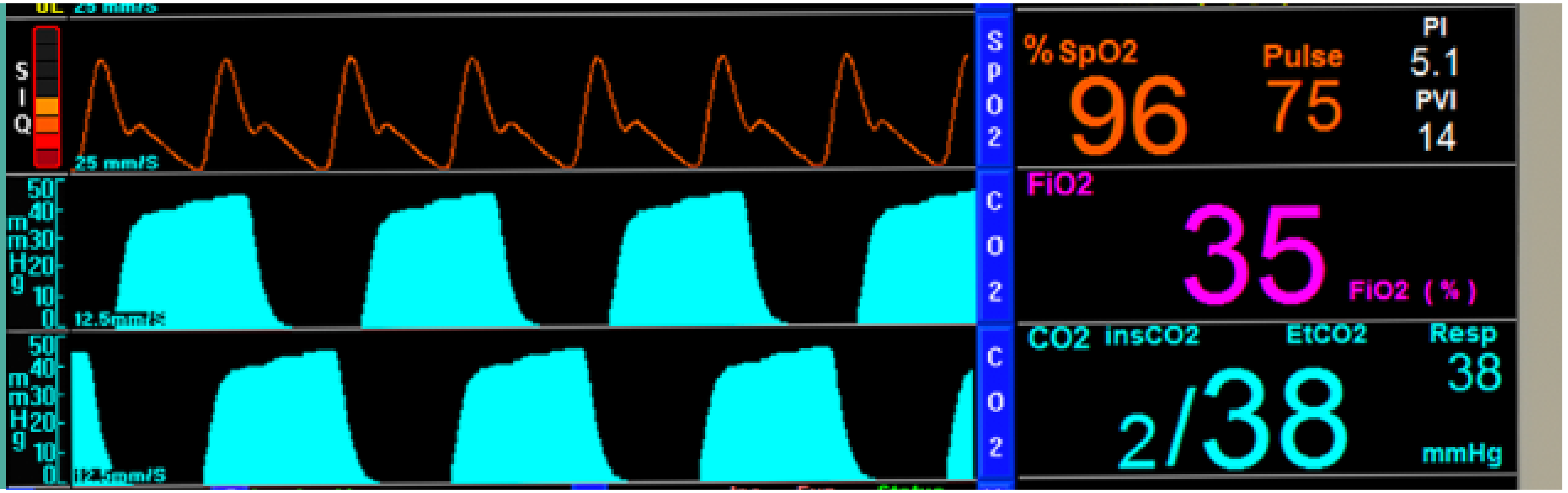
All exhaled gases are directed by the expiratory valve to the carbon dioxide absorber canister before being returned to the patient. The canister holds CO_2 absorbent granules.

When significant amounts of CO_2 are absorbed the heat released by the reaction causes the canister to warm up during use. The water produced by this reaction may serve to humidify the fresh gas.

- May turn violet due to pH indicators when they are exhausted, but it does not always occur or stay violet after a few hours it reverts back to white.
- **Granules should be change Q6-8 hours of use or after 30 days even if has never been used.**
- For AAVEC: If the signature sticker is dated more than 1-2 weeks, it's time to replace the granules.

CORROSIVE: Always wear gloves and don't inhale - Can cause skin, eye and respiratory irritation or damage.

O2 MONITORING



SPO2 %

Oxygen in Blood
Goal: 98-100%

Moisten gauze / tongue or roll the tongue to get more accurate reading

PI & PVI

Perfusion Index
<0.4 Unreliable
Due to Weak Pulse

Pleth Variability Index
Corresponds to the waves and is used for fluid responsiveness in humans

FIO2 %

Concentration of O2 in Gas Mix

Can be 21-50% depending on the patient's needs and conditions

CO2

CO2 Levels

Inhalation
insCO2 goal is 0

Exhalation etCO2 goal is 35 - 45 mmHg

RESP

Respiratory Rate

Goal is 8-12 bpm as long as breaths are adequate or tidal volume is set correctly