

BIOPAK 240 REVOLUTION

The most significant advance in
SCBA technology in over a decade!



BIOPAK 240 REVOLUTION

BioPak 240R Overview



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Closed Circuit



Open Circuit



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Open Circuit



- 60 minute rated, uses compressed AIR
- 79% Nitrogen, 21% Oxygen, 2,400 L @ 4,500 psi, 88 cubic feet of AIR
- 21% is Oxygen or 18.5 ft³ of O₂
- 79% of the volume is wasted space
- All exhaled breath goes to atmosphere
- Limited durations - less than 60 minutes



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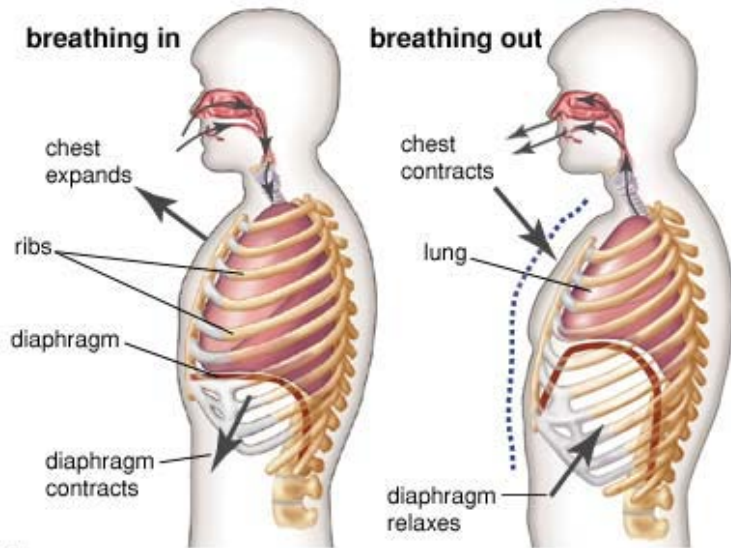
Closed Circuit



- 4-hour rating, uses compressed OXYGEN
- 100% Oxygen, 440 L @ 3000 psi, 15.6 ft³
- 100% usable breathing gas
- All exhaled breath is recycled & re-breathed after CO₂ is removed
- Extended duration capable of 4 hours



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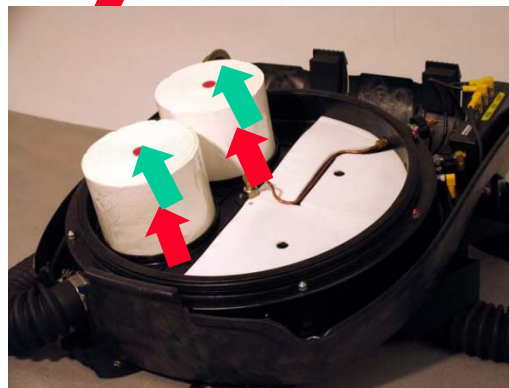
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Human Respiration

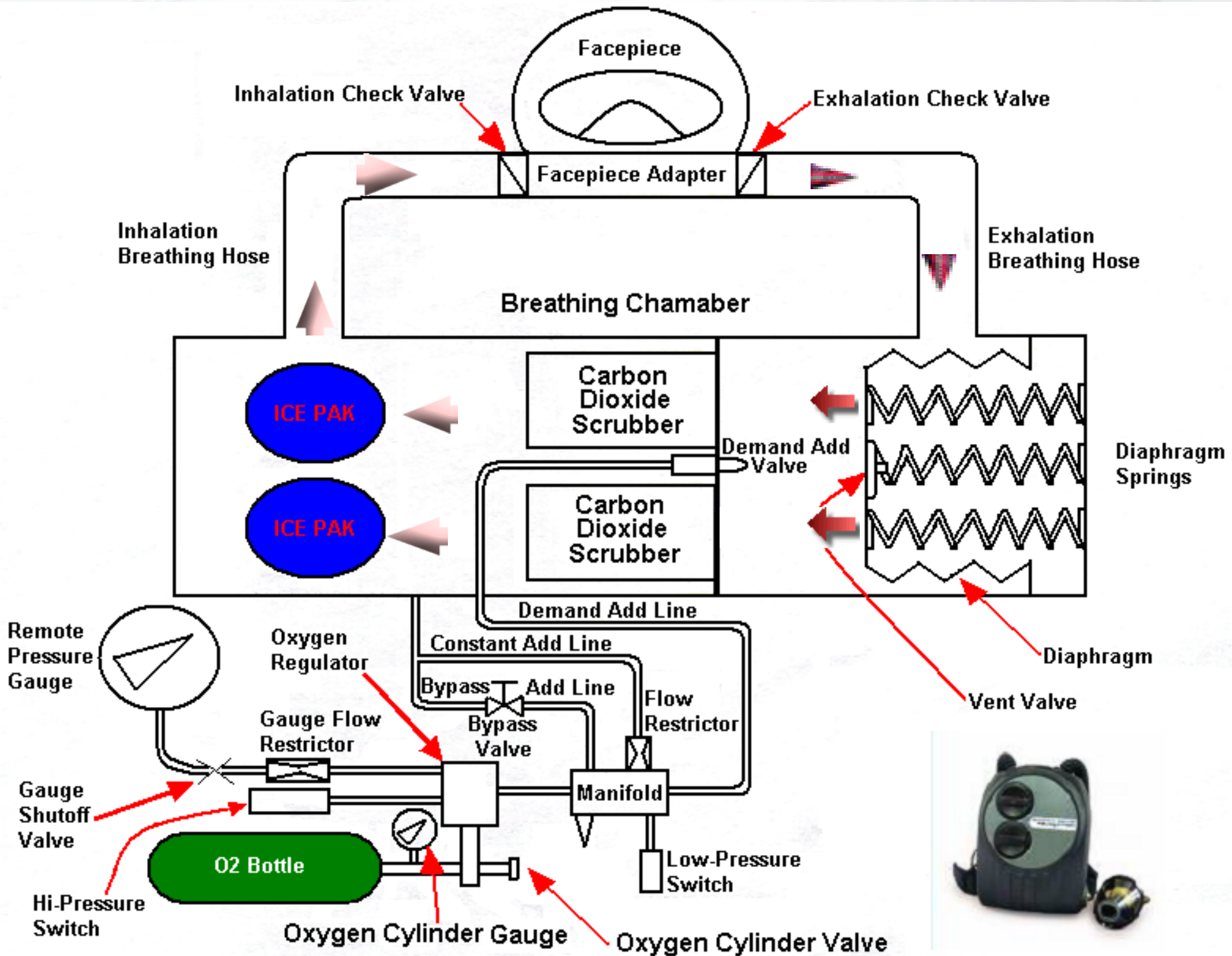
- Oxygen is the “fuel” that makes the body go
- Each breath we consume approximately 4-6% of oxygen by volume
- We naturally consume more oxygen the harder we work
- The more oxygen we consume, the more CO₂ we exhale
- We exhale unused oxygen at all work rates
- “Mouth to Mouth” CPR works as a result of these facts

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How Does It Work? The Breathing Loop



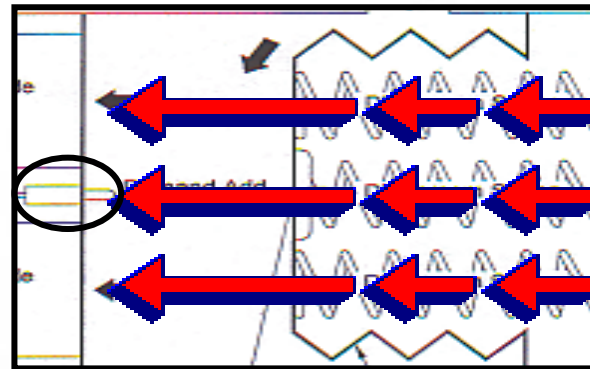
- Check valves in face piece adapter control flow direction
- EXHALE out the RIGHT side of the face piece adapter
- INHALE from the LEFT side of the face piece adapter
- Breathing chamber has two sections: Lower (**Black Bad Gas**) & Upper (**Gray Good Gas**)
- On EXHALATION gas enters bottom chamber, on INHALATION gas travels up through CO₂ scrubbers, exits as pure O₂, moves to cooling side and in the face piece via INHALATION hose



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Oxygen Demand Add

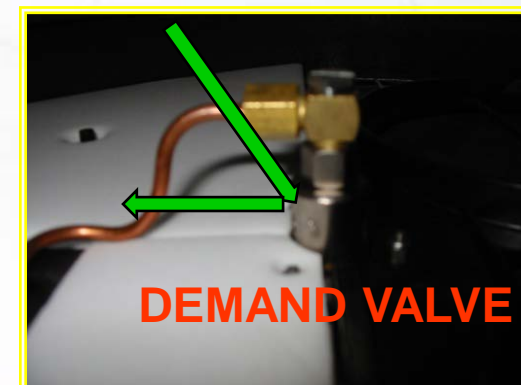
- When a user consumes oxygen in the respirator the internal volume of the breathable gas in the breathing chamber counter lung (diaphragm) will decrease. This decrease in volume will result in the breathing chamber diaphragm springs pushing the diaphragm further up into the chamber. This would occur at very high work loads and breathing rates.



- If the volume is reduced enough the diaphragm will trigger the release of oxygen at up to 100 lpm through actuation of a mechanical demand valve located within the breathing chamber.

- Pressure demand adds of oxygen will occur in short bursts and will serve to maintain positive pressure in the respirator and replenish oxygen volumes. The user may hear the demand valve open but will not feel anything.

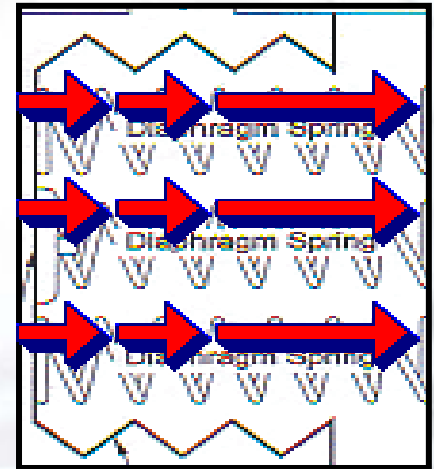
Oxygen exits here



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Relief or Vent Valve

- Should the internal volume of the breathing chamber expand beyond the normal operating volume, the diaphragm will be forced against the rear housing vent spacer. This occurs when the user is at rest. At rest consumption rates are about 0.5 lpm. The BioPak 240R flow averages approximately 1.8 lpm. The surplus 1.3 lpm expands the counter lung to the point where the relief valve opens. With a tidal volume over 6.0 liters it will begin venting approximately 4 – 5 minutes after the user's consumption rate reaches 0.5 lpm.



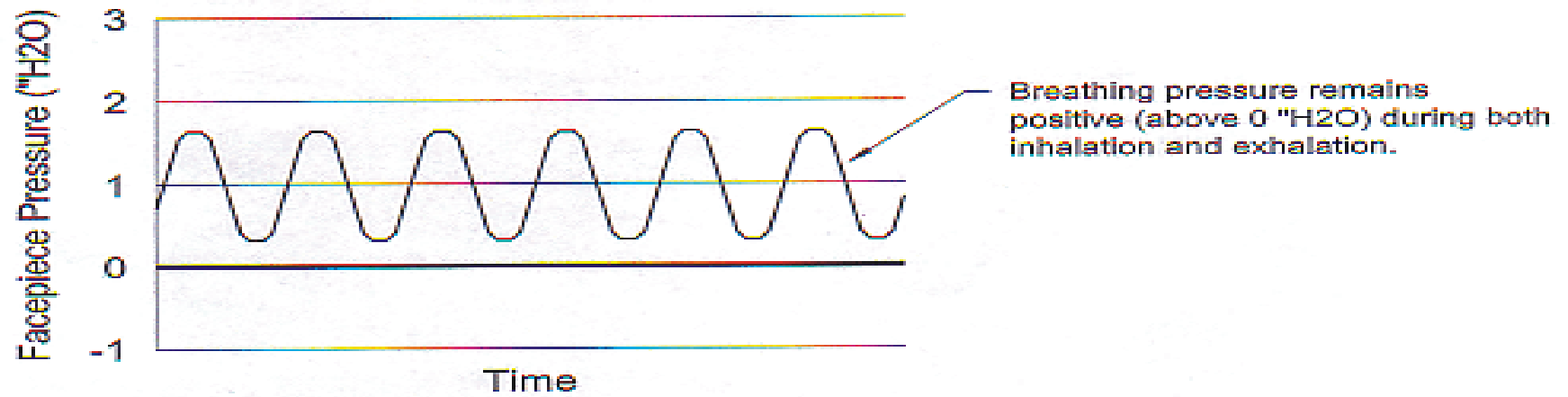
- A mechanical relief valve will be actuated via contact with the rear housing to momentarily vent excess gas. This valve serves to maintain internal breathing pressures to a comfortable level. The excess gas vents through the rear of the BioPak 240R and contains exhaled gases or dirty gas – CO₂ and unused Oxygen. The user generally will never hear or feel the venting process.



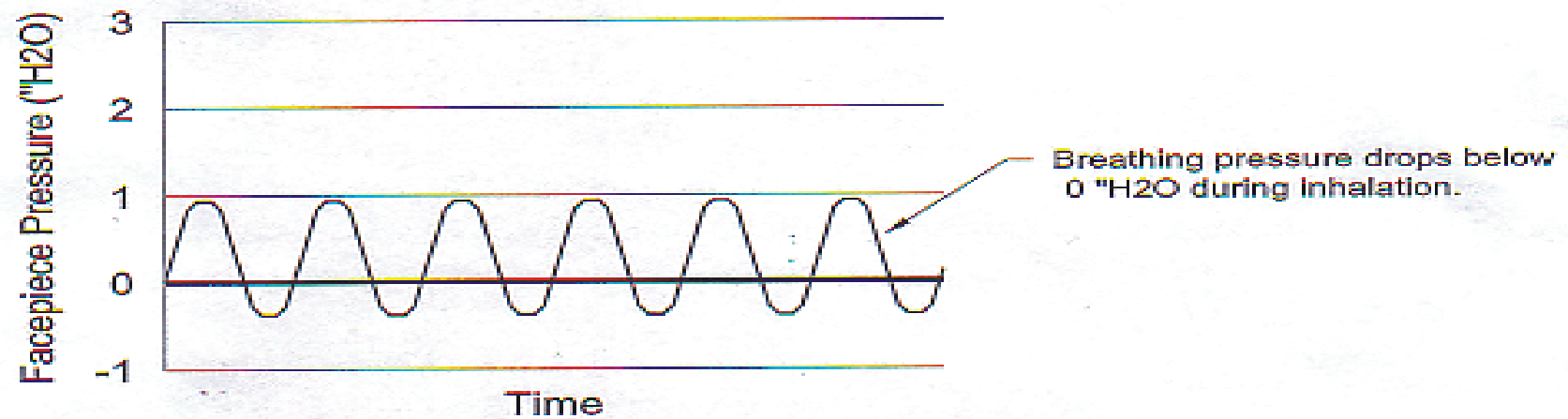
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The BioPak 240R is a Positive Pressure SCBA

- Pressure inside the face piece is above ambient pressure
- Helps prevent ingress of contaminants
- Face piece seal and fit is vital to ensure duration needs are met
- Facial hair will significantly reduce duration
- **REBREATHERS DO NOT HAVE A FIRST BREATH ACTIVATION FEATURE**
- Oxygen is immediately flowing when the oxygen cylinder is opened
- Face piece must be donned prior to turning on oxygen cylinder
- If oxygen is turned on and face piece is not donned, the demand valve will be flowing wide open. The oxygen cylinder will be empty in a matter of minutes



Positive Pressure Breathing Trace



Negative Pressure Breathing Trace

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Face Piece Preparation

- Ensure inside lens is CLEAN & DRY prior to applying anti-fog spray
- Apply two coats of the anti-fog spray, allow to dry between coats
- DO NOT WIPE OR BUFF, slight haze or film must be present
- Haze will slightly dissipate during initial 10 – 15 minutes of use
- Use magnetic wiper as an emergency backup only
- When wiper is used area wiped will rapidly fog
- Tested at an ambient temperature swing of 110 degrees (-40 to 70 degrees F) with no fogging

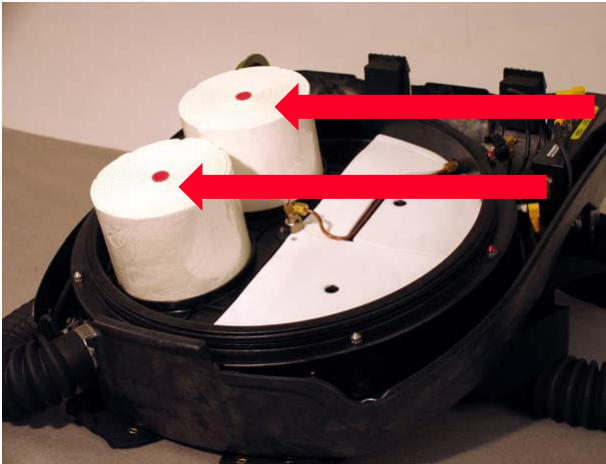
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Moisture Control Sponges

- Thoroughly wet moisture control sponges. Remove excess water by thoroughly squeezing each sponge
- Insert sponges in breathing chamber
- Wetted sponges will aid in cooling and absorb moisture more effectively
- NEVER store wetted sponges in unit – MOLD & MILDEW can be hazardous if inhaled
- Thoroughly disinfect using approved anti-bacterial, allow to completely air dry. Store in unsealed plastic bag

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CO₂ Cartridge Installation

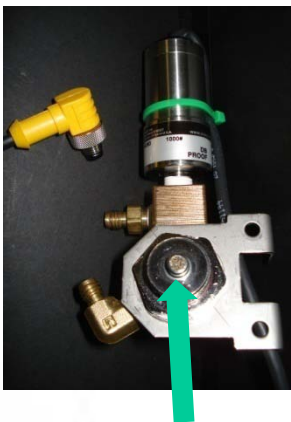
- Place rubber gasket on breathing chamber sealing edge, use no lubricant
- Check expiration date on scrubber canister
- Remove cartridges from canister & bag, leave outside wrap, DO NOT DROP. Damaged cartridges will allow CO₂ to bypass cartridge
- Insert cartridges on rubber gasket with RED CAP UP
- Ensure cartridge exposure to ambient air is limited to < 20 minutes
- Secure lid to breathing chamber and seal face piece adapter with cap

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Oxygen Cylinder

- Perfect fill = 3000 psi (207 bar), use only Medical or Aviation Grade Oxygen
- Keep entire valve and sealing area, including sealing washer, free of contaminants – Your finger prints contain OIL and is a FUEL!
- Never lubricate oxygen sealing washer!!!!!!!
- Service life of Carbon Fiber Wrapped cylinders are 15 years, with a 5-year hydro cycle
- Use the same washer seal on your booster pump manifold to prevent damage to yellow cylinder knob and DO NOT OVERTIGHTEN!



Sealing Washer

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Pneumatics:

Flow Restrictor

Manifold Assembly

Relief Valve
(EN Units only)

Bypass feed

Emergency
Bypass

O₂ Feed

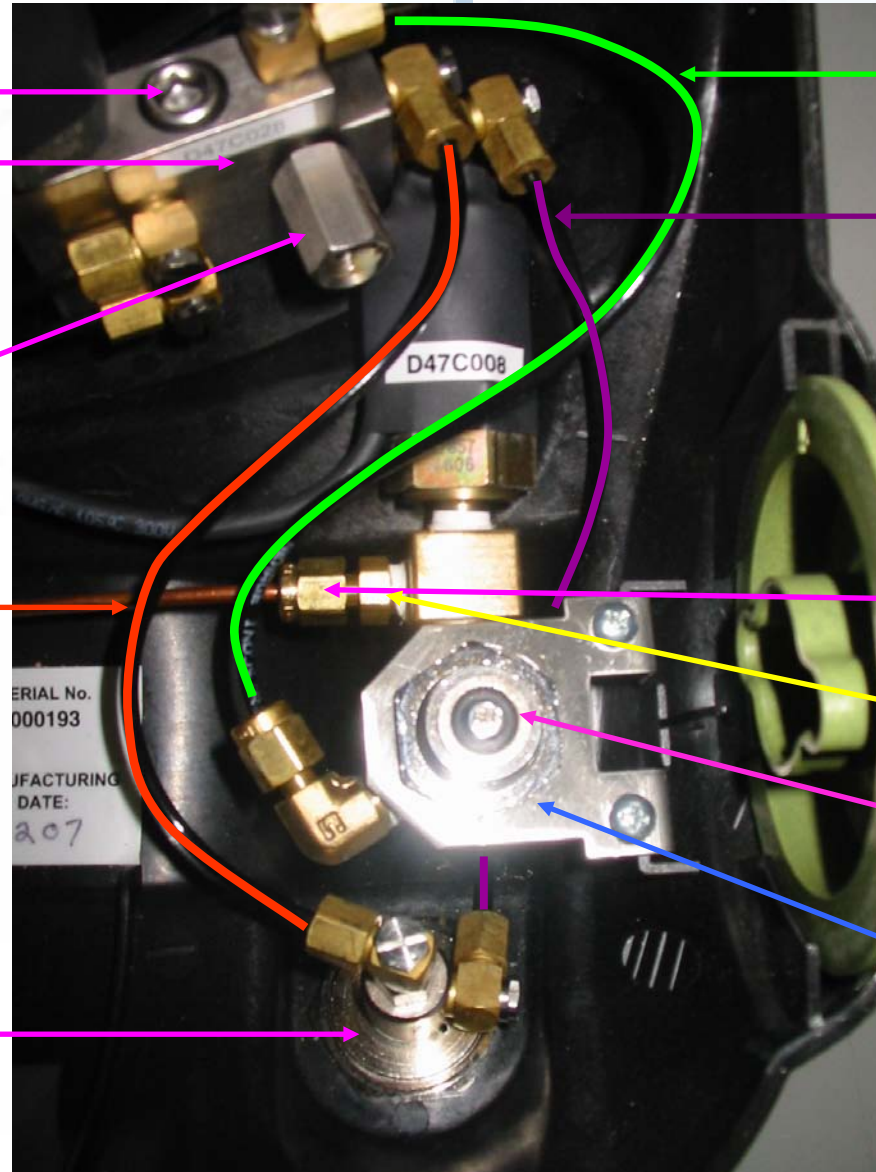
Bypass Return

Remote Gauge Feed

Gauge Line Flow Restrictor

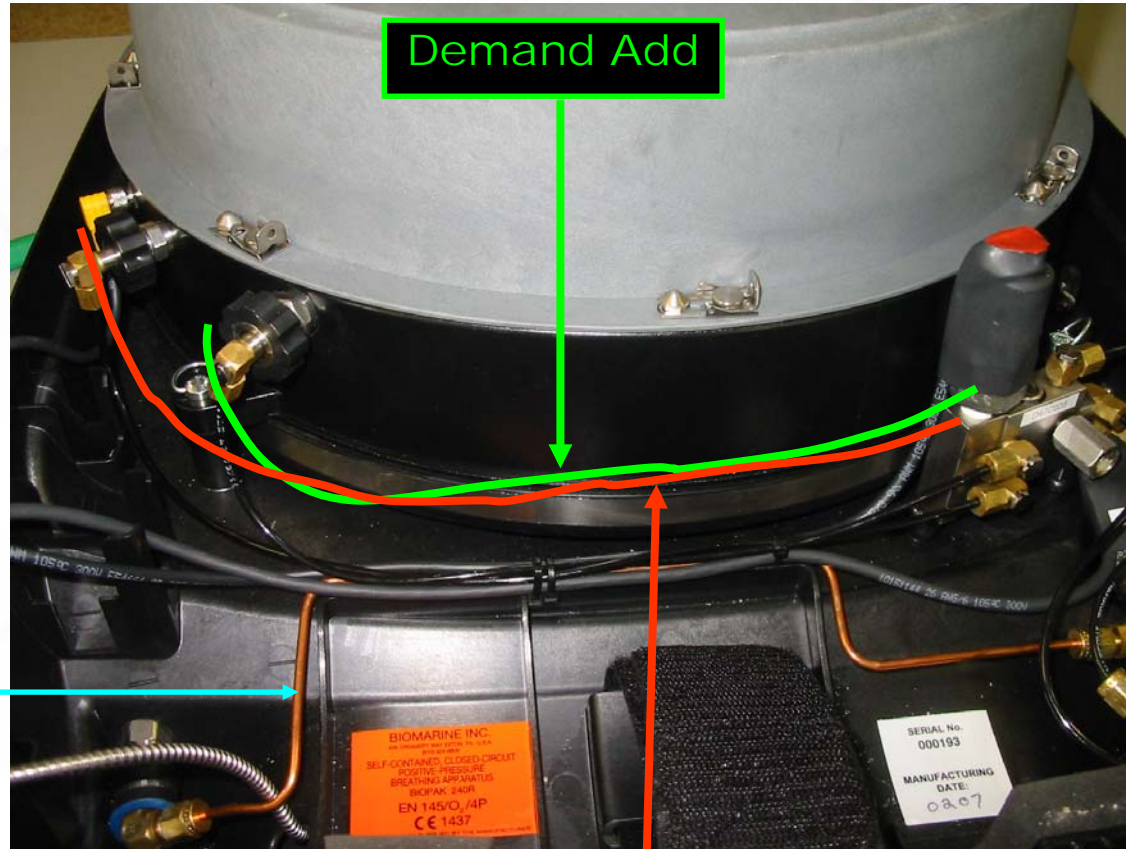
Cylinder Washer Seal

O₂ Regulator



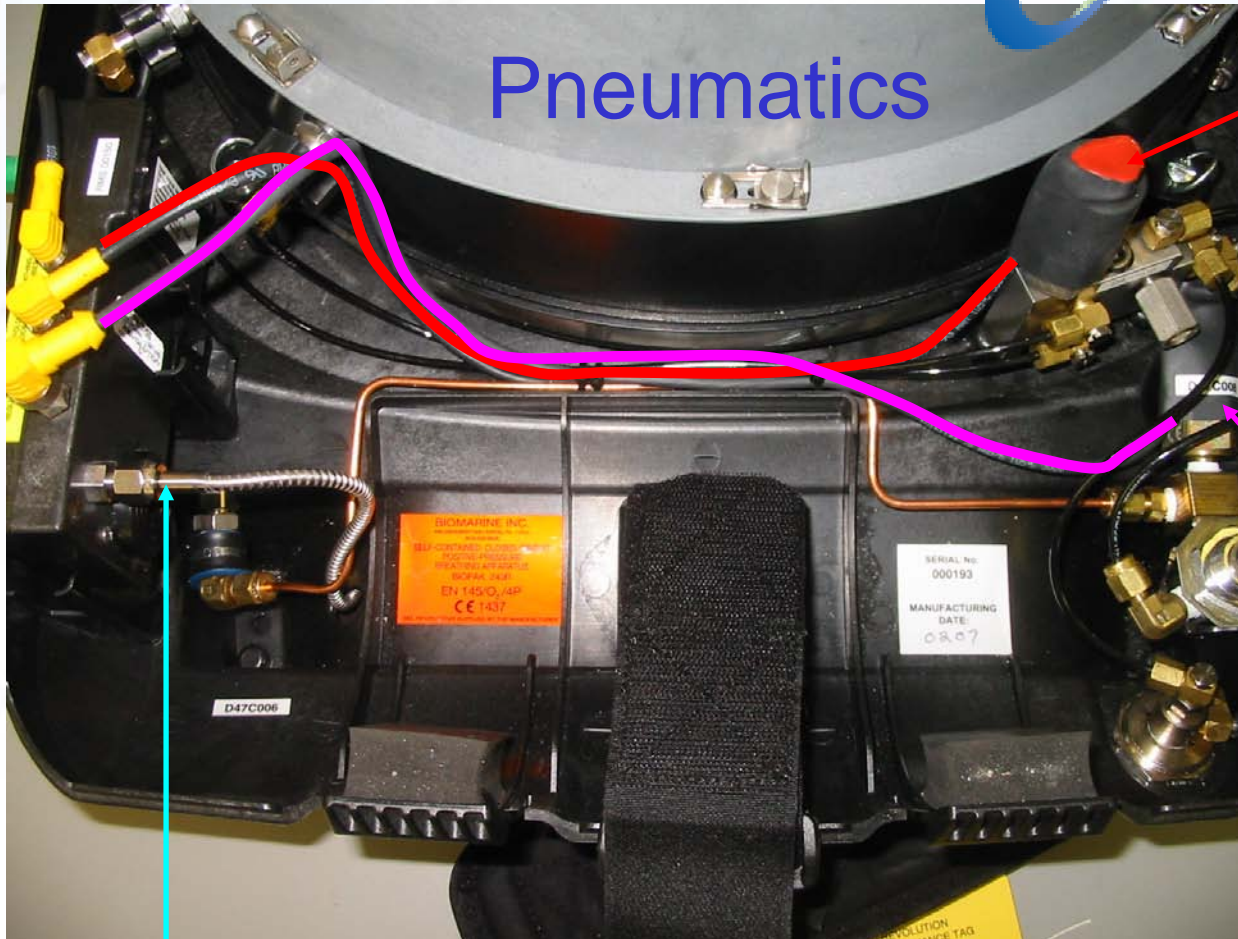
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Pneumatics:



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Pneumatics



FIBER OPTICS

Low Pressure Switch

Connected from the manifold block to the RMS.

Low Pressure Switch turns power on/off

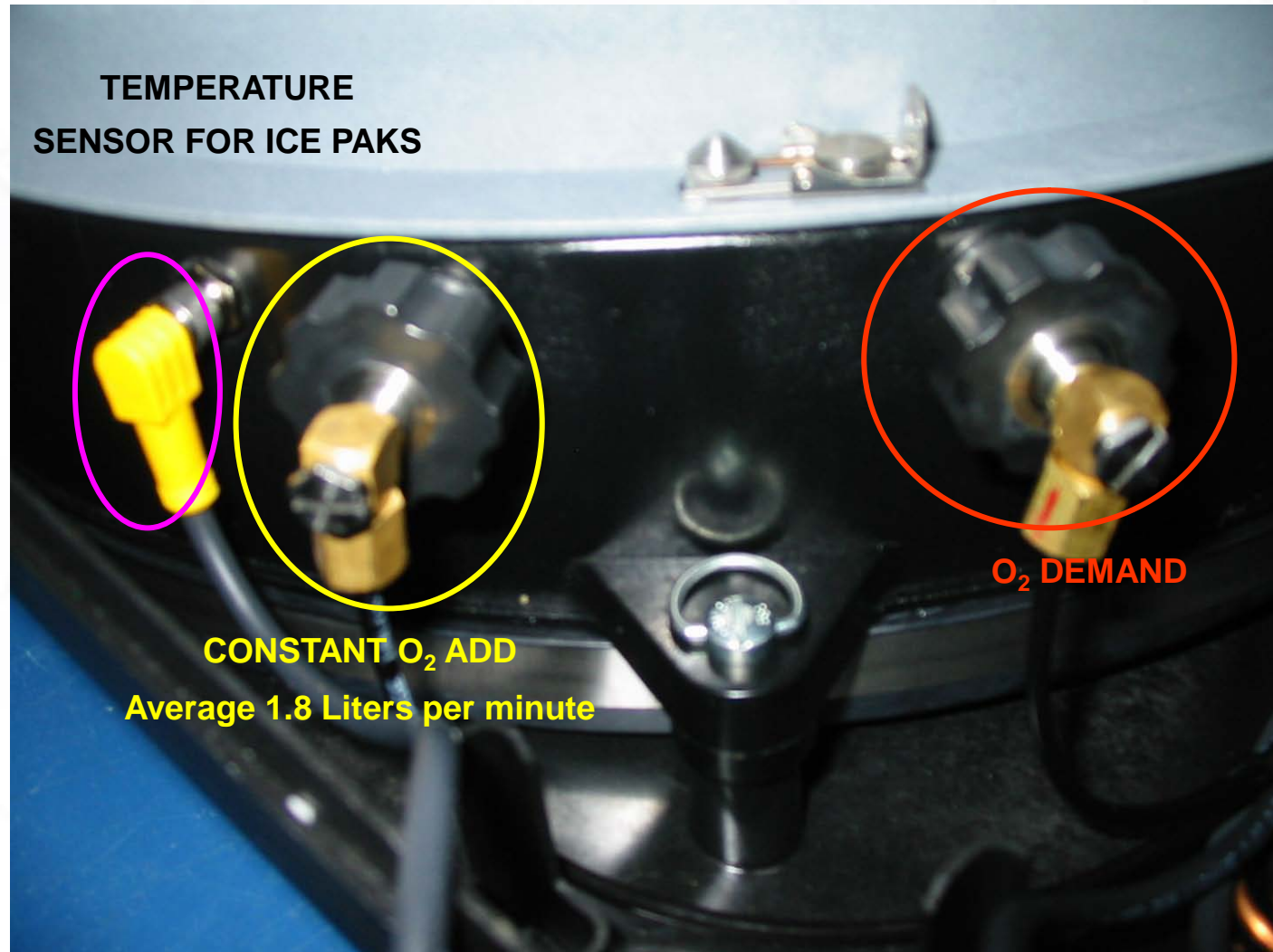
High Pressure Switch

Connected from the O2 regulator to the RMS.

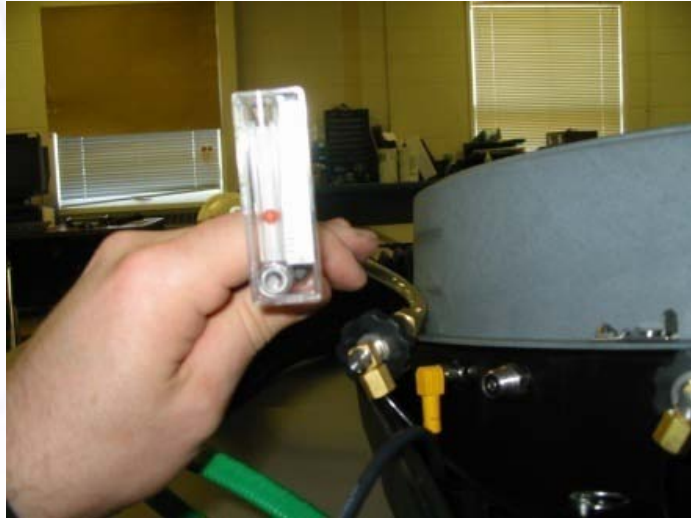
Controls Low Oxygen & TRIM alarm

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Constant & Demand Add Plus Temperature Sensor



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Oxygen Constant Flow Test

- Ensure BioPak 240R is sealed and hose adapter plug is installed
- Connect the flow-meter to the center section constant add feed line. The left & smaller diameter of the two O₂ supply fittings.
- Open the O₂ cylinder valve and observe the test flow-meter while holding the flow-meter in a level position. Reading the center of the ball, the flow should be 1.8 to 2.4 lpm. At elevations above 3,500 ft the flow-meter can read approximately 10% higher. If the test fails, tag out apparatus and have a Benchman repair. To get the most accurate reading you must have a minimum of 1500 psi (104 bar) in your cylinder.
- Close the O₂ cylinder valve and remove all test equipment.

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Low Pressure Leak Test

- Remove the face piece adapter plug from the face piece adapter and install the leak test plug into the face piece adapter. To prevent leaks ensure adapter plug edges are flush
- Attach one end of the test rubber tubing to the leak test plug and the other end to the input port of the test kit
- Insert two test keys into the keyholes on back of the lower housing
- Open/Close cylinder. Use bypass until reaching 8 inches water column pressure. Use the bleed valve on the test kit and bleed between 6-8 inches water column pressure and observe for 60 seconds. **DO NOT OVER PRESSURIZE!** Damage to diaphragm and relief valve may occur.
- Do not begin timed test until all pressure is bled from the BioPak pneumatics. Repeated actuation of by-pass will accomplish this
- After completion of the low pressure leak test, vent the pressure from the SCBA using the test kit bleed valve & remove all test equipment from the SCBA. **DO NOT FORGET TO REMOVE THE TEST KEYS!** Replace the storage plug on the face piece adapter.



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Tri-Color Indicator Module (TRIM)

Initial Start Up – Cycling of **Red**, **Green**, **Blue** of light & Horn Sounding.
This situation is not an exit alarm state.

Low Monitor Battery – **Red**, **Green**, **Blue** flashing light with a horn chirp.
This is an exit alarm state.

Check Ice Reminder – **Blue** flashing light after initial 5 minutes. Check to see if ice is installed.

System Fault – **Red** flashing light with horn sounding.
This is an exit alarm state.

Low Oxygen – **Red** flashing light with horn sounding. *This is an exit alarm state.*

Normal Function – **Green** flashing light.
This is not an exit alarm state.



Turn-Around Maintenance: Wash, Disinfect, and Dry



- Use only the approved Germicidal Detergent
- One packet per gallon
- Rinse thoroughly
- Air dry or use drying system

Turn-Around Maintenance:

Wash, Disinfect, and Dry



- Wash face piece, hose set, PCM & moisture control pads
- Breathing chamber (Cap ports & don't over extend diaphragm)
- Rinse thoroughly, air dry or use drying system
- Remember – if your breath touched it – wash it!

Quick & Effective Drying Option

- Portable electric dryer
- Dries 6 BioPaks at a time
- Assemble wet BioPak, attach face piece adapter cap, attach inhalation hose end to dryer.
Dry moisture control pads separately
- Two speeds – high & turbo!
- Use caution when drying fewer than 6 BioPaks. Output is up to 86 CFM. Open one or more manifold ports to lower air flow to protect diaphragm & check valves



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The Biomarine BioPak 240R

A true revolution in 4-hour rebreathers:

- Better performance, greater safety, and lighter weight.
- Easier to operate and maintain than any other unit on the market
- Worldwide Safety Approvals from:
NIOSH, MSHA, EN-145/136 and MA



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