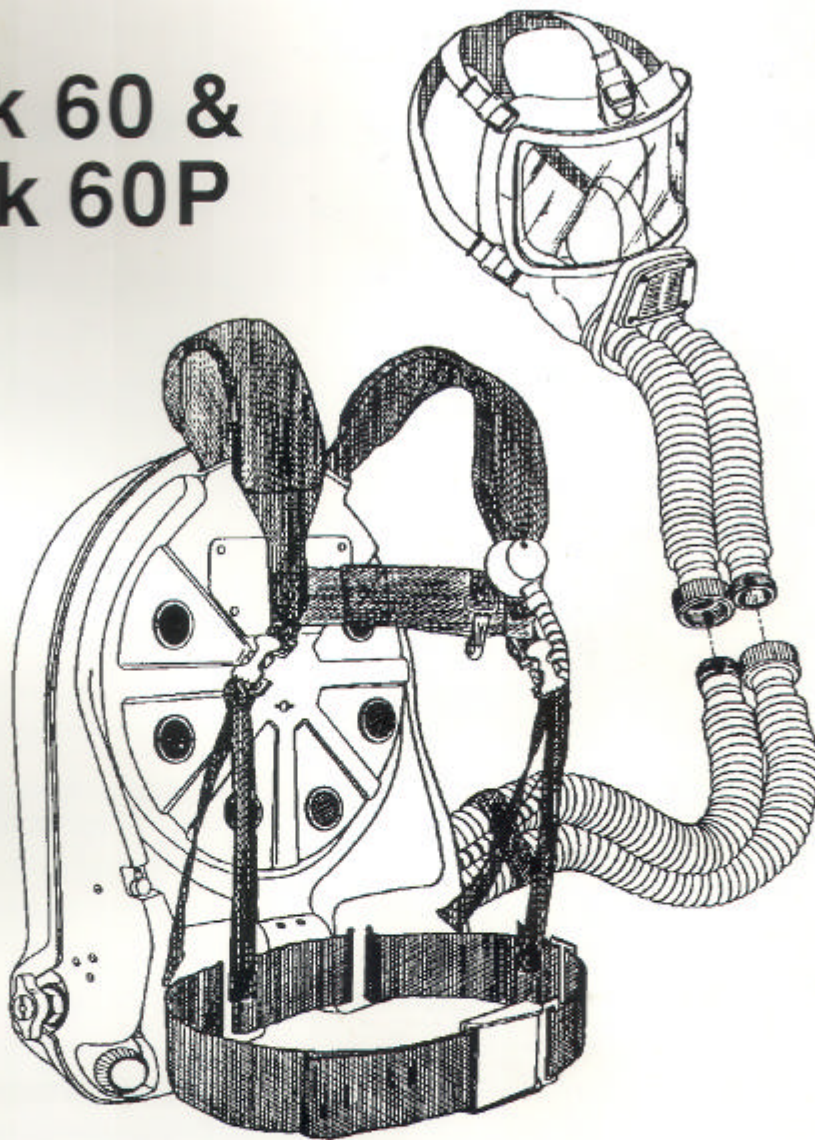


BioPak 60 & BioPak 60P



Operation & Maintenance Manual

(10/1/93)

P/N: B5-06-6900-01-0

Revision: D

BIOMARINE

Table of Contents

I BioPak 60 Description	1
Introduction	1
Specifications	1
BioPak 60 Explained	2
II How to Use the BioPak 60	7
Introduction	7
Controls and Displays	7
Pre-Use Inspection	8
Donning the BioPak 60	8
Speaking Diaphragm Use	10
Normal BioPak Operation	10
Emergency Operation	11
Doffing the BioPak 60	11
III TurnAround Maintenance	12
BioPak 60 Disassembly	12
Washing & Disinfecting	13
Oxygen Cylinder Replacement	13
Flow Test	14
Carbon Dioxide Absorbent Replacement	14
BioPak 60 Reassembly	15
Anti-Fog Agent Application	15
TurnAround Maintenance Tag	15
IV Periodic Long Term Maintenance	16
Testing Procedure	16
Scheduled Component Replacement	18
Recommended Spare Parts	18
Troubleshooting	19

V BioPak 60 Benchman's Training	20
Lubrication	20
Oxygen Cylinder	20
Regulator Assembly	21
Emergency ByPass Valve	21
Alarm Whistle Tone Stem Adjustment	21
Flow Restrictor	21
Breathing Chamber	21
Straps	22
Facemask	23
VI Illustrated Assemblies And Parts Lists	24
BioPak 60 Assembly	24
Oxygen Cylinder Assembly	25
Facemask Assembly	26
Lower Housing Assembly	28
Breathing Chamber Assembly	30
Diaphragm Assembly	32
Absorbent Canister Assembly	33
Breathing Chamber Lid Assembly	34
ByPass Valve Assembly	35
Harness Assembly	36
Accessories & Options	37
BioPak Warranty	38
VII Appendices	39
Appendix A: Oxygen Cylinder Filling Procedure	39
Appendix B: Monthly Maintenance Log Sheet	40

BioPak 60 Description

A. Introduction

The BioPak 60 is a closed-circuit SCBA (Self-Contained Breathing Apparatus) for use in contaminated or oxygen-deficient atmospheres. The BioPak 60 can be used in atmospheres that are totally oxygen-deficient. Because of the positive pressure in the facemask, the BioPak 60 can be used in atmospheres that contain toxic gases or vapors.

This manual describes the operation and maintenance of the BioPak 60. You can take advantage of all the engineering and safety features that have gone into your BioPak if you:

1. Understand the unit, its controls, and the manner in which it operates.
2. Maintain the unit properly.
3. Follow the check list on the TurnAround Maintenance Tag, included with each bag of SodaSorb Absorbent, every time the BioPak 60 is used.

The BioPak 60 must be used as a part of a complete respirator protection program. An excellent guide to establishing such a program is "A Guide to Industrial Respiratory Protection," HEW Publication No. (NIOSH) 76-189.

B. Specifications

Duration: 1 Hour (60 Minutes)

Protection Factor: Positive Pressure provides a protection factor (PF) of 20,000

Size: 18.5 x 13.8 x 6.6 inches (470 x 351 x 168 mm)

Weight: 25 lb (11.4 kg) fully charged with facemask, hoses

Oxygen Cylinder: 6.77ft³ (192 liters) at 2250 PSIG.

End of Service Alarm: 92 db, 5mHZ whistle gives 45-60 second signal when 25% of rated duration (approximately 15 minutes) remains in oxygen cylinder

Approvals: NIOSH/MSHA approvals TC-13F-85 and TC-13F-229 for use in temperatures as low as -15°F (-26°C)

Materials of Construction:

Shell: High impact, fire retarding Noryl^R

Hoses: Neoprene

Facemask: silicone rubber with field replaceable polycarbonate lens, headstrap, and quick release buckles (optional anti-fogging lens insert available).

C. BioPak 60 Explained

The arrows on the diagram show the direction of the gas flow. When the ON/OFF valve is opened, oxygen is continuously supplied to the breathing chamber. When the user inhales, breathing gas flows from the breathing chamber into the inhalation hose to the facemask. When the user exhales, the breath passes through the exhalation hose, through the CO₂ (carbon dioxide) absorber, where CO₂ is removed, and into the breathing chamber.

If the user requires additional breathing gas, the Diaphragm actuates the Demand Valve to automatically supply more oxygen. If the user's exhalation causes the breathing diaphragm to fully expand, excess gas vents out of the breathing chamber through the Relief Valve. The breathing chamber is maintained at a slight positive pressure with respect to ambient pressure by a Compression Spring which pushes on the Diaphragm.

Oxygen Cylinder

Oxygen supply for the BioPak 60 is carried in a green steel cylinder located in the bottom of the unit. It contains 6.77 cubic feet (192 liters) of 100% Medical Grade Oxygen at 2250 psi. From this cylinder, the oxygen flows through the pressure regulator.

Regulator Assembly

The oxygen cylinder valve fits into the regulator yoke assembly. The factory adjusted regulator reduces the pressure from the oxygen cylinder to approximately 110-120 PSIG.

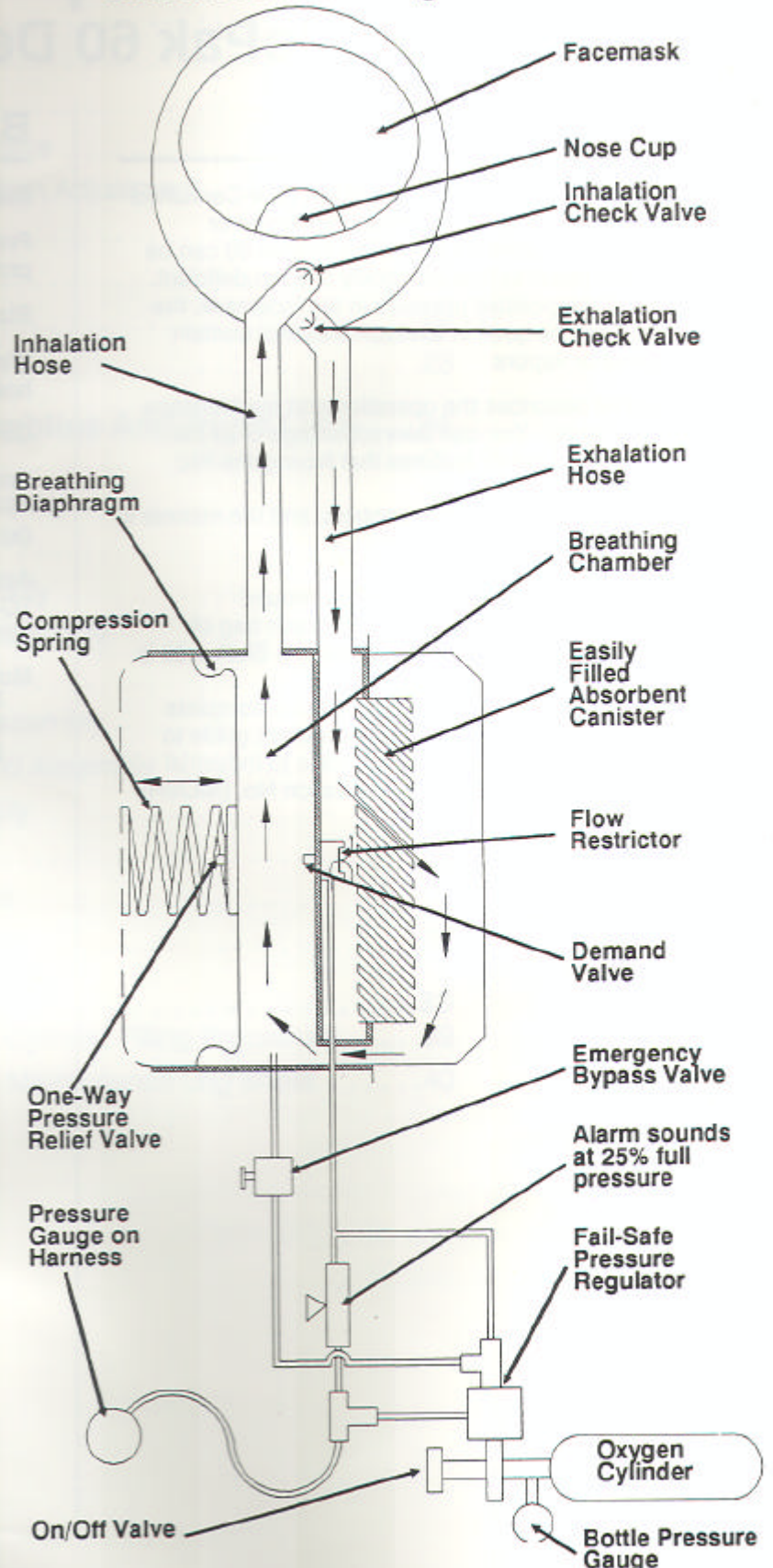
Emergency ByPass Valve

The Emergency ByPass Valve Button is for emergency use only. In the event of system failure, this valve bypasses the constant Flow Restrictor and Demand Valve. It can be manually operated if the user is not getting enough breathing gas, allowing oxygen to flow directly into the breathing chamber.

Alarm Whistle

An alarm whistle sounds a 92 DB tone for approximately 45 to 60 seconds when the oxygen cylinder pressure drops to approximately 25% of its service capacity (about 550-600 PSIG). When the alarm sounds, the user has about 15 minutes of working time left in the BioPak 60.

BioPak 60 Flow Diagram



The Breathing Chamber

The Breathing Chamber provides a reservoir for breathing gas and is the heart of the BioPak 60. It consists of the Flow Restrictor, Diaphragm, Demand Valve, Pressure Relief Valve and the Absorbent Canister.

The Flow Restrictor

The Flow Restrictor provides a constant flow of O₂ into the breathing chamber at 1.9 LPM. This constant flow represents the "make-up" oxygen needed to replace the oxygen used by the body. At 1.9 LPM, this is 4-6 times the oxygen required for people "at rest."

Human Metabolic Oxygen Requirements

The human body uses the following approximate amounts of oxygen based on various work loads.

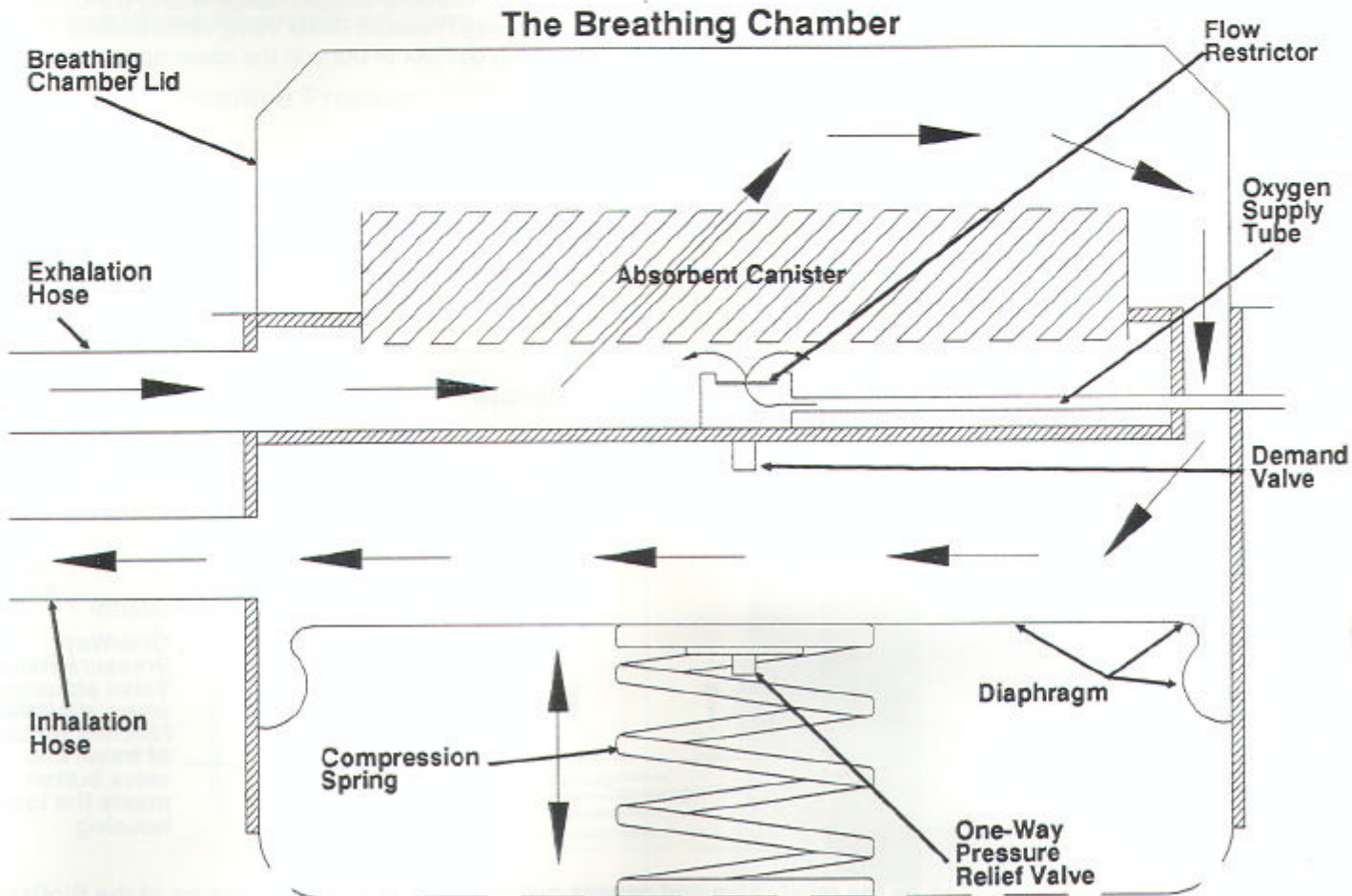
Rest	0.2 to 0.5 LPM
Light work	0.75 to 1.0 LPM
Moderate work	1.0 to 1.5 LPM
Heavy work	1.5 to 2.0 LPM
Extremely heavy work	2.0 to 3.0 + LPM

With a constant flow of 1.9 LPM, the BioPak 60 provides sufficient oxygen for "Rest" up to "Heavy" work situations without requiring additional oxygen from the Demand Valve.

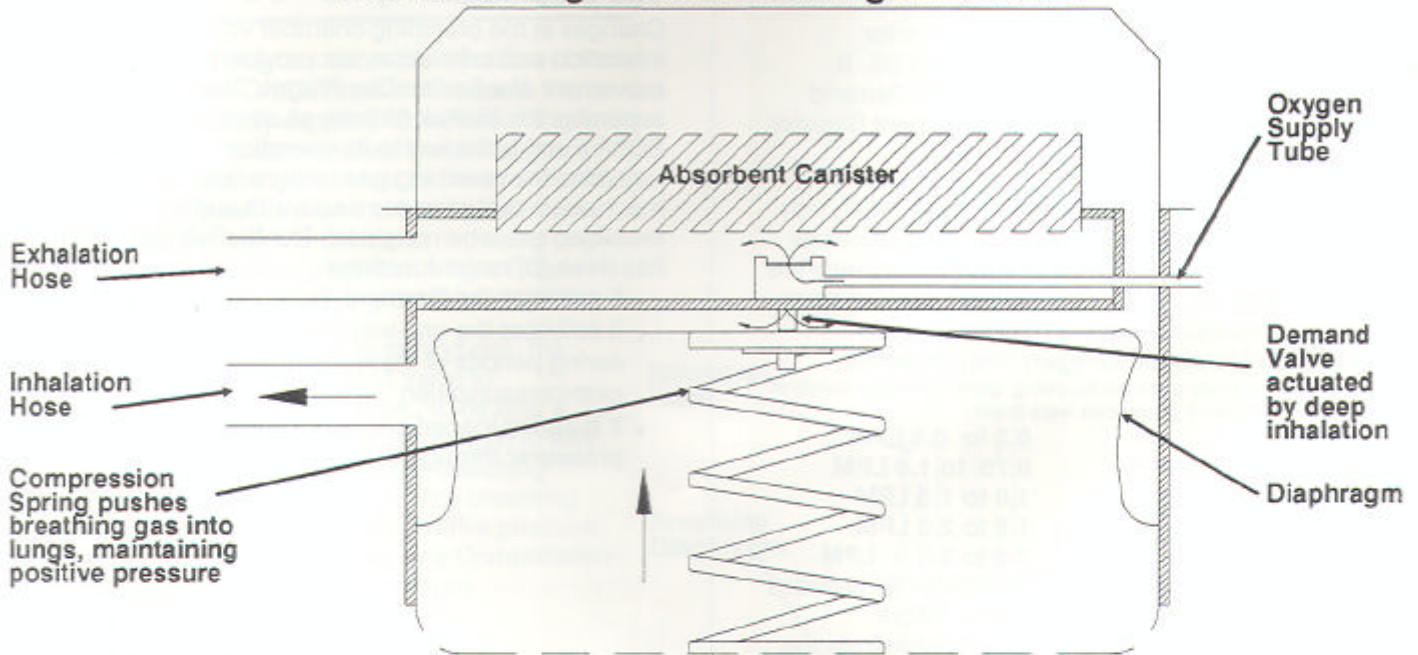
The Diaphragm

Changes in the breathing chamber volume, caused by inhalation and exhalation, are provided for by the movement of a flexible Diaphragm. The Diaphragm separates the BioPak 60 from all other closed-circuit SCBA's and is the key to its operation. The Diaphragm regulates the breathing gas mixture, and is the mechanism that provides users with additional breathing gas when required. The BioPak Diaphragm has three (3) major functions.

- It activates the **Demand Valve** during heavy work.
- It activates the one-way **Pressure Relief Valve** during periods of inactivity to prevent over-pressurization.
- It is spring loaded and thus maintains a "positive pressure" through the system.



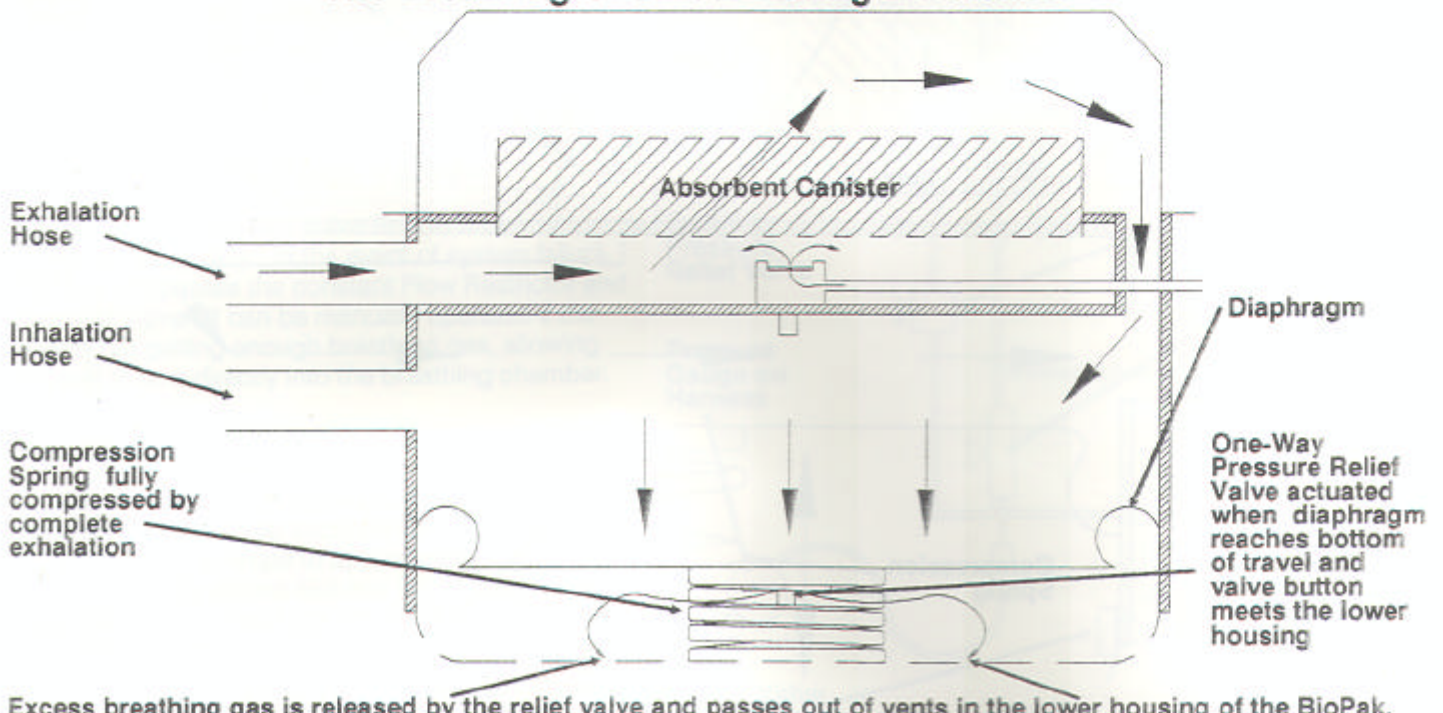
The Breathing Chamber During Inhalation



The Demand Valve
For the "Very Heavy" work loads when metabolic oxygen requirements exceed 1.9 LPM, the Demand Valve delivers as much oxygen as is required. As the Diaphragm is pushed up to the top of the breathing chamber, it activates the Demand Valve to give a quick addition of Oxygen. The Demand Valve is also an automatic "back-up" if the Flow Restrictor were to fail.

The Pressure Relief Valve
To prevent over-pressurization at reduced work levels when the metabolic oxygen usage is only 0.2-0.5 LPM, the one-way Pressure Relief Valve vents excess breathing gas out of ports in the lower housing.

The Breathing Chamber During Exhalation



Excess breathing gas is released by the relief valve and passes out of vents in the lower housing of the BioPak.

Anti-Anoxia Valve

Located where the exhalation hose enters the breathing chamber, the Anti-Anoxia valve blocks the exhalation hose whenever the BioPak 60 is turned off. When the BioPak 60 is turned on, the pressure driven valve opens the breathing circuit. If the BioPak 60 is donned without being turned on, the user will experience difficulty exhaling into the BioPak 60.

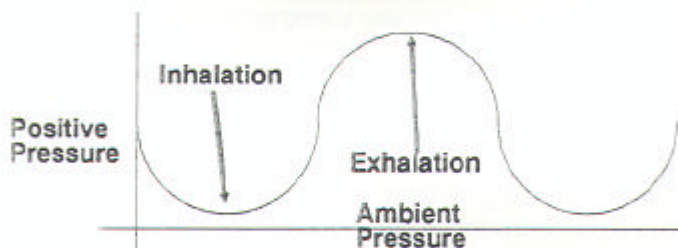
Positive Pressure in the BioPak 60

The BioPak 60 system incorporates a Positive Pressure operating system, where the pressure within the entire system, including the facemask, is greater than ambient pressure. This eliminates the outside, potentially contaminated, environment from being exposed to the user.

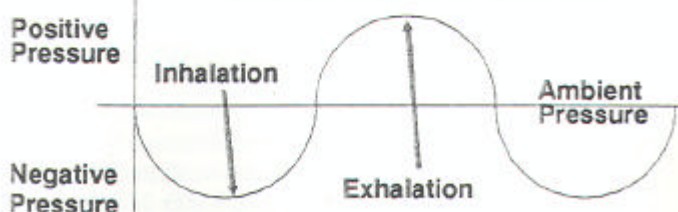
- Pressure in facemask is maintained above outside pressure.
- Leakage will be outward rather than inward.
- Facemask fit is still extremely important to maximize duration.

Negative Pressure systems actually have a lower pressure inside the mask than outside the mask when the user inhales. This allows contaminants to leak inwards from the outside environment during inhalation.

Positive Pressure SCBA



Negative Pressure SCBA



Protection Factors

A measure of how well a mask protects the operator is called a **Quantitative Fit Test**. This test yields what is called a "Protection Factor." The higher the protection factor the better the unit will protect a person from inhaling airborne contaminants.

$$\text{Protection Factor (PF)} = \frac{\text{Concentration of Particles Outside Mask}}{\text{Concentration of Particles Inside Mask}}$$

$$\text{ex: PF} = \frac{1000 \text{ PPM Outside Mask}}{10 \text{ PPM Inside Mask}} = 100$$

The BioPak 60 has a protection factor of 20,000.

Facemask

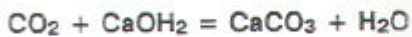
The Facemask contains an oral/nasal cup and check valves which minimize mask dead air space. This prevents CO₂ buildup during periods of shallow breathing. The facemask has a speaking diaphragm to aid in communication. The silicone rubber facemask has a wide sealing surface and fits most faces. It is necessary to test facemask fit and adjustment before using the BioPak 60. Care must be taken to keep the inhalation and exhalation valves clean and free from dirt. An optional Anti-Fog inner lens insert may be used to prevent fogging during use (B2-06-6000-57-0).

Standard Facemask



CO₂ Absorbent Canister

From the facemask, the exhaled breath returns through the Exhalation hose to the middle of the Breathing Chamber where more oxygen is continuously added at 1.9 LPM by the Flow Restrictor. Then the breathing gas mixture travels up through the Absorbent Canister. In the Absorbent Canister, Carbon Dioxide (CO₂) which is generated by the human body as a by-product of metabolism, is chemically removed from the breathing gas mixture. It is important to scrub this out of the recycled breathing gas as it can be toxic over a period of time. The BioPak 60 uses SodaSorb to absorb CO₂ by the following equation:



or: Carbon Dioxide + Calcium Hydroxide =
Calcium Carbonate (Limestone) + Water

or: Base + Acid = Salt

SodaSorb comes in sealed 2.5 lb. bags. **THE ABSORBENT MUST BE REPLACED EACH TIME THE BIOPAK 60 HAS BEEN USED OR THE CYLINDER REQUIRES REFILLING.** The absorbent has a dye indicator in it for medical applications. This dye may turn the foam pad purple, but this is normal. **ONLY USE THE ABSORBENT ONCE AND THROW IT AWAY! BY THE TIME IT HAS CHANGED COLOR, THE ABSORBENT HAS LONG SINCE LOST ITS ABILITY TO ADEQUATELY REMOVE CARBON DIOXIDE!**

The foam pad and the spring-loaded canister lid put even pressure on the absorbent. This prevents the absorbent from shifting around and allowing "channelling."

Cooling

The BioPak 60 has two coolant rings in the lid of the Breathing Chamber. These sealed rings are filled with sodium phosphate crystals. A "Euteric Salt," these crystals melt to absorb heat from the breathing gas. The sodium phosphate recrystallizes when the unit cools and is ready for another use.

II How to Use the BioPak 60

A. Introduction

This section explains the controls and displays, checkout procedure, and donning and use of the BioPak under normal and emergency operation conditions. It also explains warning signs that the user must understand and the required action to be taken when such conditions arise.

B. Controls and Displays

The user must be familiar with the controls and displays of the BioPak 60.

Oxygen Cylinder Valve (ON/OFF)

The oxygen cylinder valve must be opened immediately **AFTER donning the facemask**. Oxygen is wasted if the valve is turned on sooner.

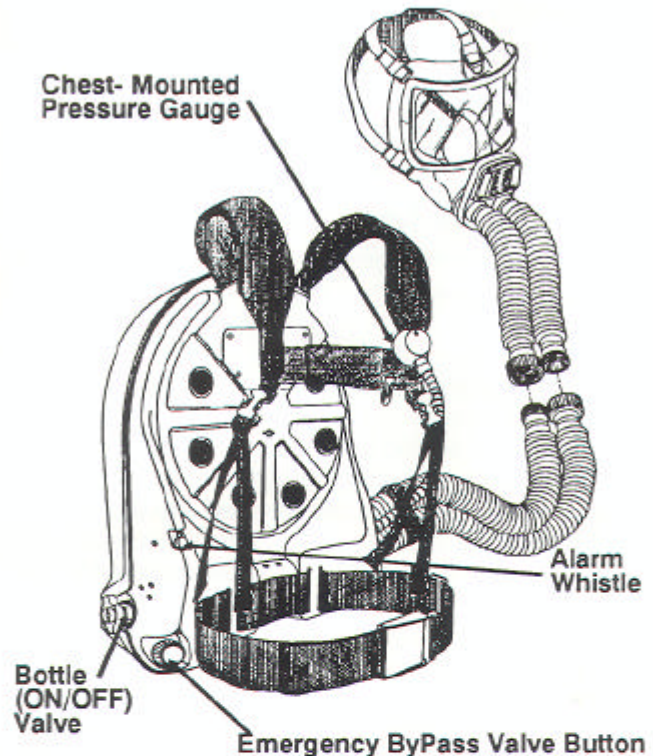
Emergency ByPass Valve Button

This valve is for emergency use only. If sufficient oxygen is not available to permit the user to inhale a full breath, the Demand Valve may not be functioning properly. Push the ByPass Valve button for about **2 seconds** to add oxygen directly to the Breathing Chamber. Repeat the use of the Bypass Valve as required. If it is necessary to frequently use the ByPass Valve, the user must exit the contaminated area immediately and have the BioPak 60 serviced.

CAUTION: EXCESSIVE USE OF THE EMERGENCY BY-PASS VALVE WILL SIGNIFICANTLY DECREASE THE DURATION OF THE BIOPAK 60. THIS VALVE SHOULD ONLY BE USED FOR EMERGENCIES. IT WILL NOT CLEAR FOGGED FACEMASKS!

Alarm Whistle

An alarm whistle sounds a 92 db tone for approximately 45 to 60 seconds when the oxygen cylinder pressure drops to approximately 25% of its service capacity (about 550-600 PSIG). When the alarm sounds, the user has about 15 minutes of working time left in the BioPak 60. The alarm whistle is a small, cylindrical assembly located between the pressure regulator and the breathing chamber inside the BioPak 60. But the alarm has an external alarm tone stem located above



the oxygen cylinder valve which, when covered, causes a distinct change in sound. This provides a method for any individual within a group using BioPaks to determine if his BioPak 60 has sounded the alarm.

CAUTION: ONE TIME ALARM FOR APPROXIMATELY ONE MINUTE! The entire work crew should prepare to terminate work allowing sufficient time to exit the area.

Start Up Alarm Chirp

When the BioPak 60 is turned on, the user should hear a chirp from the alarm to signal that it is working properly. A chirp will also be heard after the unit is turned off if more than 600 PSIG is left in the oxygen cylinder.

Pressure Gauge

This unit is provided with a chest mounted pressure gauge, located on the shoulder strap, which the user can observe to determine the approximate service life remaining. The chest mounted gauge indicates service life only when oxygen cylinder valve is open.

Approximate Pressure readings

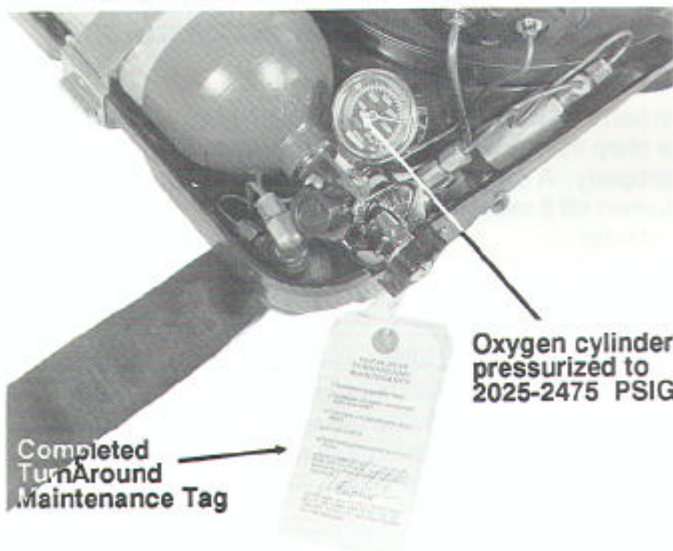
- 2250 PSIG = 60 minutes
- 1700 PSIG = 45 minutes
- 1125 PSIG = 30 minutes
- 550 PSIG = 15 minutes

If gauge line were to be severed, the Gauge Line Flow Restrictor would limit flow to allow a safe, immediate exit from the hazardous area.

YOU MUST IMMEDIATELY LEAVE THE HAZARDOUS AREA IF A GAUGE LINE IS SEVERED!

C. Pre-Use Inspection

1. Obtain BioPak 60
 2. Make sure that a valid Turnaround Maintenance Tag (Less than 1 year old) is attached to the oxygen cylinder valve. This tag assures that the following procedures have been performed:
 - The BioPak 60 has been cleaned and disinfected
 - The absorbent canister has been refilled with fresh CO₂ Absorbent and inserted into the Breathing Chamber.
 - The oxygen cylinder has been pressurized to 2250 \pm 10% PSIG (2025 - 2474 PSIG) as indicated by the cylinder gauge.
 - The BioPak 60 has been Flow-Tested.
 - The alarm whistle works.
 - The facemask lens has been cleaned and coated with the anti-fogging agent.
- If the Turnaround Maintenance Tag is missing, the BioPak 60 must be completely inspected to assure that all steps of Turnaround Maintenance have been properly completed. **The SodaSorb Absorbent MUST be replaced if the Turnaround Maintenance Tag is missing.**



3. Inspect the BioPak 60.
 - (a) All connections tight
 - (b) Inhalation hose is screwed to the exhalation hose or facemask is in place.

WARNING: If a Turnaround Maintenance Tag is present on the BioPak 60, but you suspect that the BioPak 60 was not sealed properly, REPLACE THE SODASORB ABSORBENT! IF A HOSE IS FOUND OPEN TO THE ATMOSPHERE, DO NOT USE THE BIOPAK: REPLACE THE SODASORB ABSORBENT!

4. Ensure oxygen cylinder gauge is reading 2250 \pm 10% PSIG (2025 - 2474 PSIG) .
5. Coat the inside of the facemask with the anti-fogging cloth (B6-02-5000-08-0) and lightly buff the lens with a clean, soft cloth until it is clear enough to see through. Excessive buffing may diminish the anti-fog qualities. When properly buffed, enough Anti-Fog should remain on the inside of the lens so that your finger will leave a slight streak if you wipe it across the lens.
6. The BioPak 60 is now ready for service.

D. Donning the BioPak 60

1. Place BioPak 60 face down with top toward you.
2. Lengthen the shoulder straps so that the free ends extend two or three inches.
3. Grasp the body of the BioPak 60 approximately midway between the top and bottom. The shoulder straps should be outside of your arms.



4. Raise unit over head, bend over and guide shoulder straps onto shoulders.

NOTE: BE CAREFUL TO AVOID BACK INJURY!



5. Lean forward slightly and tighten shoulder straps by pulling down and away from the body as you straighten up.



6. Buckle and adjust waist strap.



7. Loosen the shoulder straps to let the weight of the BioPak 60 rest on your hips, not your shoulders. The shoulder straps should be loose enough to allow you to slip your hand underneath.
8. Connect the chest strap, do not overtighten; it will constrict breathing.



NOTE: The BioPak 60 can also be donned using the "Coat Method".

9. Insert spectacle kit, if required.

10. Don facemask.
 - (a) Before donning, loosen two upper and two lower straps so that harness can easily be donned.
 - (b) Place harness over head and position face seal against the face while pulling down on the back of the harness. If necessary, smooth the top of the harness by rubbing the palm of the hand over it.
 - (c) Tighten lower straps by pulling gently and simultaneously.
 - (d) Tighten upper straps by pulling gently and simultaneously.
 - (e) Tighten top strap by pulling gently

CAUTION: A POOR FACEMASK SEAL WILL CAUSE A SIGNIFICANT DECREASE IN DURATION AND PROTECTION FACTORS. BEARDS AND EYEGLASSES THAT BREAK THE FACEMASK SEAL ARE AGAINST OSHA & MSHA REGULATIONS AND VOID THE NIOSH APPROVAL OF THE BIOPAK 60.

11. Perform negative pressure check by blocking the inhalation hose with your hand and inhaling. If you cannot inhale, mask fit is good. However, if mask leaks when you inhale with the inhalation port covered, adjust mask for better fit or check the exhalation valve.
12. Perform positive pressure check by covering the exhalation hose with your hand and exhaling. The facemask should be pushed from your face by the pressure of your exhalation. If the mask is not pushed away, check the inhalation valve.
13. Connect the facemask.
 - (a) Unscrew hoses from each other
 - (b) Connect hoses
14. **After the mask is donned and fully connected, open the oxygen cylinder valve fully counterclockwise.**
 - (a) Listen for alarm whistle chirp.
 - (b) If alarm whistle fails to chirp, get another BioPak.
15. Verify chest-gauge pressure of $2250 \pm 10\%$ PSIG
16. Tear off the TurnAround Maintenance Tag.



E. Speaking Diaphragm Use

- Talk a little louder than normal
- Don't shout
- Enunciate words
- Speak clearly and slowly
- **DO NOT TALK FAST**

F. Normal BioPak Operation

The user must be familiar with the normal conditions that occur while using the BioPak 60. Depending on the activity level of the user and the surrounding temperature, the BioPak 60 may provide somewhat warmer and more humid gas than conventional open-circuit, pressure demand type devices. The BioPak operates at approximately 100% humidity. The moist breathing gas mixture also helps to keep the user's mucous membranes from drying out. This makes the wearer more comfortable and prevents dry, sore throats that are often a side-effect of using air bottles.

G. Emergency Operation

The Emergency ByPass Valve is used manually to supply oxygen to the breathing chamber in the event of failure of the Demand Valve or Flow Restrictor. If inhalation resistance increases due to the depletion of the breathing gas supply in the breathing chamber, add a 2-second burst of oxygen by pushing the ByPass Valve button. Add additional bursts as required to maintain an adequate supply of breathing gas.

WARNING: The ByPass Valve is intended for emergencies only and WILL NOT clear facemask fogging. WASTEFUL use of the ByPass Valve seriously reduces the duration of the BioPak 60.

Emergency Actions

Equipment failure, such as a blocked line.

Try ByPass, exit area and obtain another BioPak

Severed pressure gauge.

Exit area and obtain another BioPak

"Over-Actuation" of Demand Valve inside BioPak

Leak in system - exit area & obtain new BioPak.

Bad facemask seal - adjust facemask fit.

User warning symptoms that require Immediate Attention.

Any feeling of nausea, dizziness or illness.

Rapid pressure drop on chest mounted gauge.

Any difficulty inhaling or exhaling.

Smoke or other contaminants in the facemask.

If any of these signs are present, **EXIT THE CONTAMINATED AREA IMMEDIATELY!**

Regulator Failure

The regulator is designed to fail open. While extremely rare, regulator failure may be detected as excess pressure in the facemask and constant venting of excess pressure by the Relief Valve with every breath. This will result in a drastic decrease in available working time so **LEAVE THE AREA IMMEDIATELY AND OBTAIN ANOTHER BIOPAK.** A failing regulator will also be identified by a high flow during the "Flow Test" part of "TurnAround Maintenance."

H. Doffing the BioPak 60

WARNING: Most breathing apparatus malfunctions are directly traceable to careless handling after use. Many years of trouble-free operation are possible if reasonable care is given to the BioPak 60.

1. Coat Method
 - (a) Close oxygen cylinder valve
 - (b) Remove facemask by pushing forward on the buckles to loosen straps.
 - (c) Unfasten chest and waist straps and lean forward slightly at the waist.
 - (d) Loosen one shoulder strap, and allow the other shoulder strap to slide from the shoulder while swinging the BioPak 60 around to your front.



- (e) Remove unit and set it down.
2. Over-The-Head Method
 - (a) Close oxygen cylinder valve
 - (b) Remove facemask by pushing forward on the buckles to loosen straps.
 - (c) Unfasten chest and waist straps.
 - (d) Loosen shoulder straps
 - (e) Lift BioPak 60 over your head
 3. Perform the turnaround maintenance as outlined in section III before reuse. Store the unit in its carrying case or other safe location. **DO NOT STORE IN AN EXCESSIVELY WARM OR COLD ENVIRONMENT (store between 32°F and 85°F).**

III

TurnAround Maintenance

Perform the TurnAround Maintenance procedures as soon as possible after each use of the BioPak 60 as outlined below.

A. BioPak 60 Disassembly

Before disassembling the BioPak 60, make sure the outside of the BioPak 60 is clean, so that the inside of the breathing gas loop is not contaminated. Clean the harness and exterior parts of the BioPak with a sponge and a mild soap solution, then wipe dry.

- (a) Place the BioPak on a flat surface and remove the case cover.
- (b) Slide the breathing chamber cover snap latches away from the four retainer pins and remove the cover by pressing it up around the edges with your fingers and down with your thumbs on the breathing hose connections (using the same method to remove the absorbent canister as illustrated below). **DO NOT PRY UP ON THE LID WITH A SCREWDRIVER** because this will result in damage to the O-Ring and Breathing Chamber.



- (c) Lift the carbon dioxide absorbent canister from the BioPak 60 by pressing it up around the edges of the plastic rim with your fingers and down with your thumbs on the breathing chamber.
- (d) Remove the canister cover by sliding the cover snap latch away from the retainer set pin and lifting the cover.

- (e) Remove the filter pad, empty the contents of the canister in the trash (used SodaSorb is essentially just limestone) and wipe the canister clean of particles. **THE ABSORBENT MUST BE REPLACED EACH TIME THE BIOPAK 60 HAS BEEN USED OR THE OXYGEN CYLINDER REQUIRES REFILLING.** The absorbent has a dye indicator in it for use in medical applications. This dye may turn the foam pad purple, but this is normal. **ONLY USE THE ABSORBENT ONCE AND THEN THROW IT AWAY! BY THE TIME IT HAS CHANGED COLOR, THE ABSORBENT HAS LONG SINCE LOST ITS ABILITY TO ADEQUATELY REMOVE CARBON DIOXIDE! DO NOT REUSE THE ABSORBENT!**
- (f) After removing the carbon dioxide absorbent canister, check the sealing O-Rings on the inside and outside perimeter of the absorber well for abrasions or cuts. Wipe the O-Rings with a clean cloth to be sure they are clean and dry, then apply a thin film of lubricant to them.

CAUTION: Either Cristo-lube (MCG-111) or Silicone (DOW-111) Lubricant May Be Used on these large O-Rings. **DO NOT USE AN OIL-BASE LUBRICANT. DO NOT USE DOW-111 ON HIGH PRESSURE OXYGEN LINES.** Maintaining adequate lubrication on the large O-Rings will help assure proper performance and prevent premature failure.

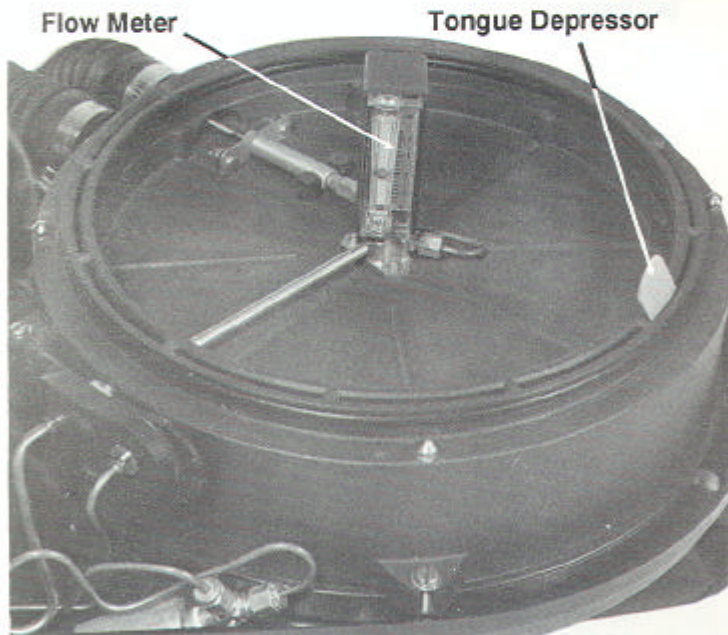
- (g) Wipe out any particles of carbon dioxide absorbent remaining in the canister well.

NOTE: IT IS RECOMMENDED THAT THE OXYGEN CYLINDER REMAIN IN THE BIOPAK 60 THROUGHOUT DISINFECTION PROCEDURES. THIS WILL PREVENT WATER AND CONTAMINANTS FROM ENTERING THE REGULATOR DURING DISINFECTION (a regulator dust cap is available).

D. Flow Test

The oxygen constant flow is preset at the factory to 1.9 LPM. To test the flow,

- (a) Remove the outer case cover, the Breathing Chamber Lid, and the CO₂ Absorbent Canister. This exposes the Flow Restrictor which is the top side of the Demand Valve assembly.
- (b) Slip the BioPak Flowmeter (B6-02-5000-16-0) over the Flow Restrictor.
- (c) Using a wooden tongue depressor, hold the diaphragm away from the Demand Valve.
- (d) Open the refilled oxygen cylinder valve and measure the flow. The flow should be at least 1.9 LPM at sea level, adjusted for the user's local geographic elevation. If not, see the "Troubleshooting" (page 19) section of this manual.
- (e) Check off "FLOW TEST" on the BioPak 60 TURNAROUND MAINTENANCE tag.



E. Carbon Dioxide Absorbent Replacement

- (a) Use the disinfected and dried absorbent canister (unless the unit is being turned around for immediate reuse by the same operator).
- (b) Refill the canister with one bag of SodaSorb absorbent (2.5 lbs or 1.1 kg., B5-01-3000-00-0) to the fill line indicated. Shake the canister back and forth on a tabletop to settle the granules and distribute the particles so that the surface is level with the fill line marking inside the canister. Add more SodaSorb if required.

IMPORTANT NOTE: DO NOT EXPOSE THE CO₂ ABSORBENT TO THE ATMOSPHERE FOR MORE THAN A TOTAL OF ONE HOUR DURING RECHARGING AND/OR SERVICING. IF A BIOPAK 60 HAS BEEN STORED FOR MORE THAN ONE YEAR, THE CO₂ ABSORBENT MUST BE REPLACED AND THE OXYGEN PRESSURE CHECKED.

IMPORTANT NOTE: SODASORB BAGS HAVE A SHELF-LIFE OF FIVE (5) YEARS WHEN SEALED. The expiration date (Month/Year) is marked on both the Sodasorb bags and cases.

- (c) Check to make sure that the sponge filter is not compressed. Remember that the sponge filter is used to keep the absorbent in place so that it does not shift & lead to "channelling." Replace with a new sponge filter if the old filter is less than 1/8" of an inch thick over the absorbent or less than 1/32" of an inch at the edges (replace any filter that does not overlap the edge of the tray). Reinstall the filter, replace & lock the canister cover. The foam filter should push up slightly through the holes in the stainless canister cover. If it does not, check the filter and add more SodaSorb.
- (d) With the stainless cover down & locked, shake the absorbent canister hard. You should not hear movement of the absorbent.
- (e) Press the canister into place in the well and replace the Breathing Chamber cover. Ensure that the 4 cover snaps engage properly.

CAUTION: Either Cristo-lube (MCG-111) or Silicone (DOW-111) Lubricant May Be Used on these large O-Rings. DO NOT USE AN OIL-BASE LUBRICANT. DO NOT USE DOW-111 ON HIGH PRESSURE OXYGEN LINES. Maintaining adequate lubrication on the large O-Rings will help assure proper performance and prevent premature failure.

- (f) Check off "CARBON DIOXIDE ABSORBENT REPLACEMENT" on the BioPak 60 TURNAROUND MAINTENANCE tag.

F. BioPak 60 Reassembly

- (a) Screw the inhalation to the exhalation hose, or connect the facemask to the BioPak 60 to seal it for storage.

WARNING: IT IS CRITICAL THAT THE BIOPAK 60 IS TOTALLY SEALED BEFORE STORAGE. IF A HOSE REMAINS OPEN TO AIR, THE BIOPAK 60 CANNOT BE USED BECAUSE THE CARBON DIOXIDE ABSORBENT MAY BE EXPENDED.

- (b) Replace the BioPak 60 cover, and return the unit to the carrying case or other safe place. **DO NOT STORE IN AN EXCESSIVELY WARM OR COLD ENVIRONMENT (store between 32°F and 85°F).**

G. Anti-Fog Agent Application

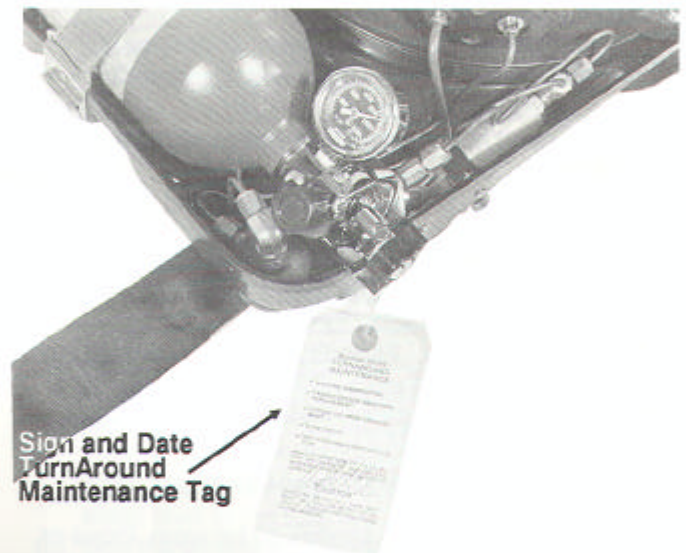
- (a) Coat the inside of the facemask with the anti-fogging cloth (B6-02-5000-08-0).
- (b) Lightly buff the lens with a clean, soft cloth until it is clear enough to see through. Excessive buffing may diminish the anti-fog qualities. When properly buffed, enough Anti-Fog should remain on the inside of the lens so that your finger will leave a slight streak if you wipe it across the lens.

NOTE: THE PROPER APPLICATION OF ANTI-FOG AGENT IS CRITICAL TO THE OPERATION OF THE BIOPAK 60. BECAUSE OF THE LONG DURATION OF ITS USE, THE BIOPAK 60 IS PRONE TO FOGGING. IT IS SUGGESTED THAT ANTI-FOG AGENT ALSO BE APPLIED BEFORE EACH USE.

- (c) Check off "ANTI-FOG AGENT APPLICATION" on the BioPak 60 TURNAROUND MAINTENANCE tag.

H. TurnAround Maintenance Tag

- (a) Make sure that all the boxes are checked off on the BioPak 60 TURNAROUND MAINTENANCE tag.
 - WASHING/DISINFECTING
 - OXYGEN CYLINDER REPLACEMENT
 - FLOW TEST
 - CARBON DIOXIDE ABSORBER REPLACEMENT
 - ANTI-FOGGING AGENT APPLICATION
- (b) Sign and date the TurnAround Maintenance Tag.
- (c) Secure the TurnAround Maintenance Tag, which comes with each bag of SodaSorb Absorbent (B5-01-3000-00-0), to the oxygen cylinder valve.



F. BioPak 60 Reassembly

- (a) Screw the inhalation to the exhalation hose, or connect the facemask to the BioPak 60 to seal it for storage.

WARNING: IT IS CRITICAL THAT THE BIOPAK 60 IS TOTALLY SEALED BEFORE STORAGE. IF A HOSE REMAINS OPEN TO AIR, THE BIOPAK 60 CANNOT BE USED BECAUSE THE CARBON DIOXIDE ABSORBENT MAY BE EXPENDED.

- (b) Replace the BioPak 60 cover, and return the unit to the carrying case or other safe place. **DO NOT STORE IN AN EXCESSIVELY WARM OR COLD ENVIRONMENT (store between 32°F and 85°F).**

G. Anti-Fog Agent Application

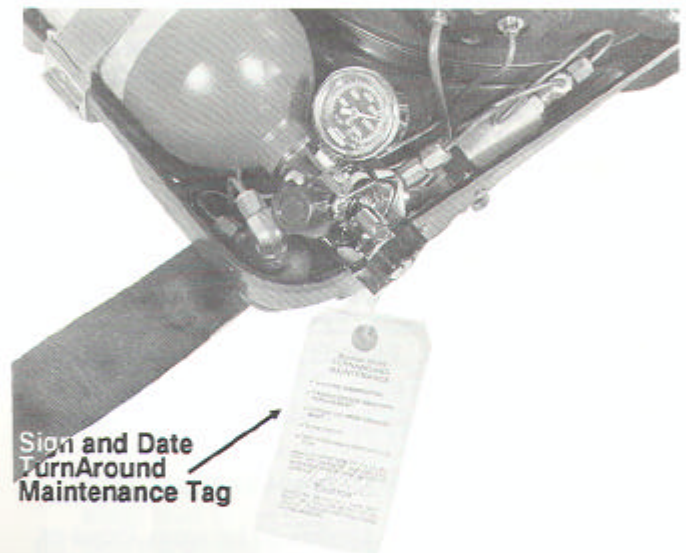
- (a) Coat the inside of the facemask with the anti-fogging cloth (B6-02-5000-08-0).
- (b) Lightly buff the lens with a clean, soft cloth until it is clear enough to see through. Excessive buffing may diminish the anti-fog qualities. When properly buffed, enough Anti-Fog should remain on the inside of the lens so that your finger will leave a slight streak if you wipe it across the lens.

NOTE: THE PROPER APPLICATION OF ANTI-FOG AGENT IS CRITICAL TO THE OPERATION OF THE BIOPAK 60. BECAUSE OF THE LONG DURATION OF ITS USE, THE BIOPAK 60 IS PRONE TO FOGGING. IT IS SUGGESTED THAT ANTI-FOG AGENT ALSO BE APPLIED BEFORE EACH USE.

- (c) Check off "ANTI-FOG AGENT APPLICATION" on the BioPak 60 TURNAROUND MAINTENANCE tag.

H. TurnAround Maintenance Tag

- (a) Make sure that all the boxes are checked off on the BioPak 60 TURNAROUND MAINTENANCE tag.
 - WASHING/DISINFECTING
 - OXYGEN CYLINDER REPLACEMENT
 - FLOW TEST
 - CARBON DIOXIDE ABSORBER REPLACEMENT
 - ANTI-FOGGING AGENT APPLICATION
- (b) Sign and date the TurnAround Maintenance Tag.
- (c) Secure the TurnAround Maintenance Tag, which comes with each bag of SodaSorb Absorbent (B5-01-3000-00-0), to the oxygen cylinder valve.



IV Periodic Long Term Maintenance

A. Testing Procedure

In addition to the routine inspections and TurnAround Maintenance, the following procedures are to be performed monthly on units in constant use.

- Visual Inspection
- Plumbing (High Pressure Leak Test)
- Constant Flow Test
- Breathing System Leak Test

For units stored for extended periods, the test procedure frequency may be extended to quarterly, biannually or annually, provided the following conditions are met:

- Units are stored in an acceptable environment.
- All other monthly inspections and operability checks are performed.
- TurnAround Maintenance has been performed after use.

* NOTE: A sealed BioPak 60 may be stored up to one year and still be ready for use. Only under circumstances where the BioPak 60 has been stored for 6-12 month (but not more than 12 months) may the Periodic Maintenance schedule be extended to biannually or annually. Periodic Maintenance must be performed on no less than a monthly basis if the BioPaks are in regular (daily, weekly or monthly) use.

Complete Visual Inspection

Visually inspect the entire BioPak 60 for worn, loose or missing parts, and parts that could fail under use. Replace any parts that are questionable.

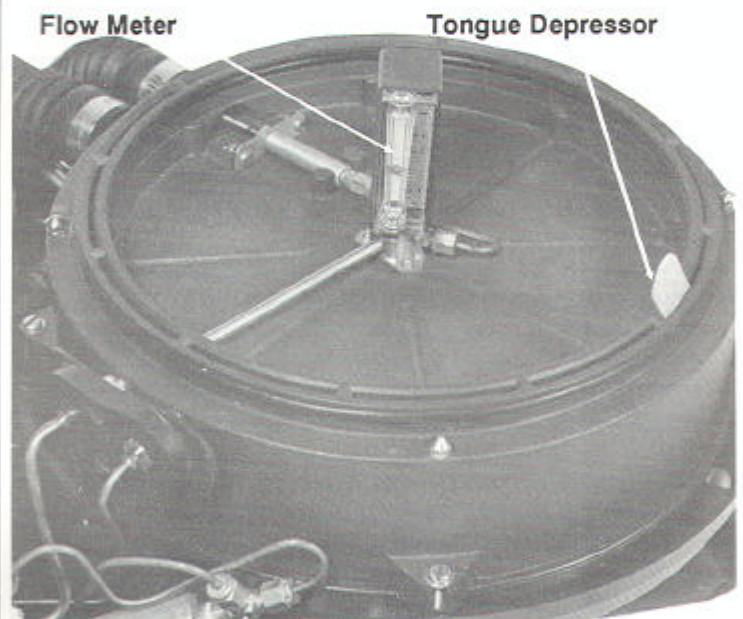
Plumbing (High Pressure) Leak Test

- Place the BioPak on a flat surface. Remove the cover and the facemask assembly.
- Install a fully charged cylinder in the unit.
- Remove the outer case cover, the Breathing Chamber Lid, and the CO₂ Absorbent Canister. This exposes the Flow Restrictor which is the top side of the Demand Valve assembly.
- Using a wooden tongue depressor, hold the diaphragm away from the Demand Valve.
- Turn on the oxygen cylinder.
- Check each plumbing joint with "Leaktec" (B5-01-3000-03-0) or a concentrated OXYGEN COMPATIBLE leak testing solution. Look for bubbles to indicate a leak.

Constant Flow Test

The oxygen constant flow is preset at the factory to 1.9 LPM. To test the flow,

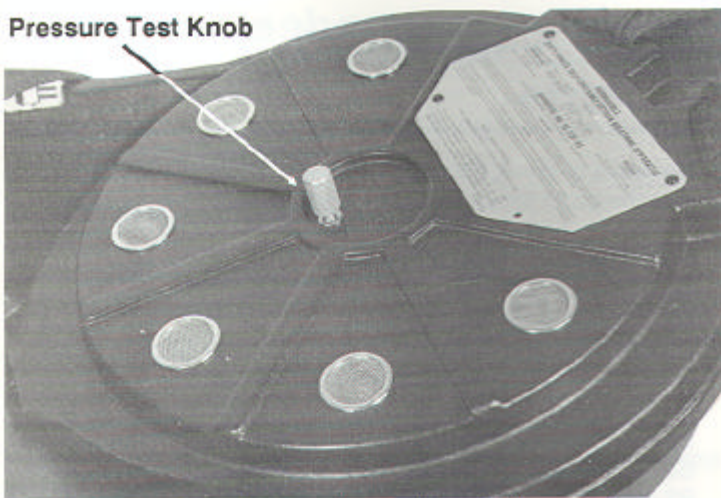
- Remove the outer case cover, the Breathing Chamber Lid, and the CO₂ Absorbent Canister. This exposes the Flow Restrictor which is the top side of the Demand Valve assembly.
- Slip the BioPak Flowmeter (B6-02-5000-16-0) over the Flow Restrictor.
- Using a wooden tongue depressor, hold the diaphragm away from the Demand Valve.
- Open the refilled oxygen cylinder valve and measure the flow. At 2250 PSIG, the flow should be at least 1.9 LPM at sea level, adjusted for the user's local geographic elevation. If not, see the "Troubleshooting" section (page 19).



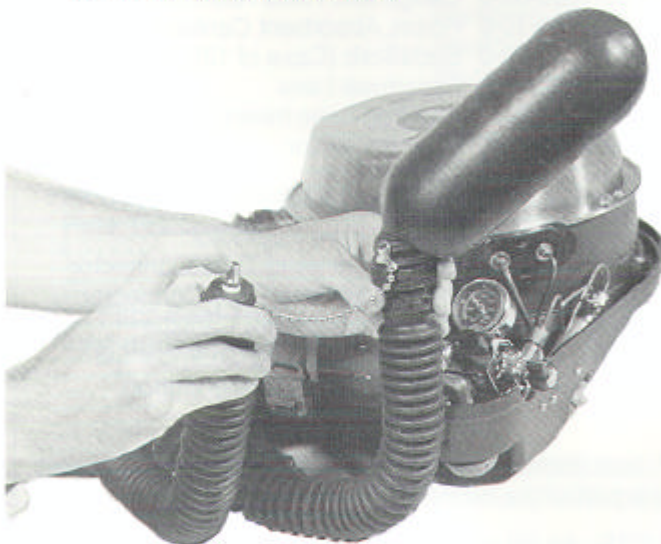
Breathing System (Low Pressure) Leak Test

- Disconnect the inhalation and exhalation hoses from the facemask and connect the hoses to the leak test fixture.
- Insert the Pressure Test Knob (B6-02-5000-17-0) into the hole in the back of the unit as shown below and turn it 1/4 turn to lock in place.

Pressure Test Knob



- (c) Open the cylinder valve until the balloon on the test fixture just lightly pressurizes to about a 45 degree angle (NOTE: The Emergency ByPass Valve may be used to inflate the balloon). If the balloon overinflates, vent some gas through the vent valve on the test fixture.



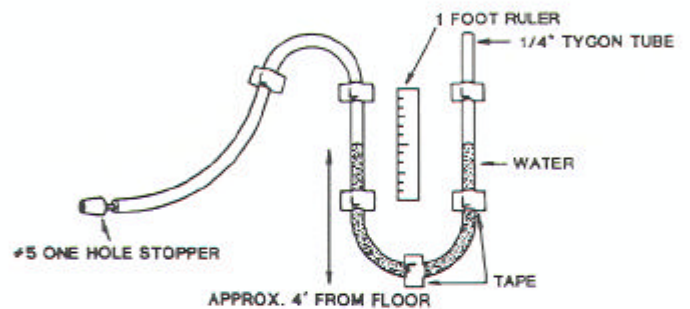
- (d) Close the cylinder valve and **DEPRESS THE BYPASS VALVE TO VENT THE INTERNAL PRESSURE**. If gas escapes from around the Red ByPass Push-button, replace the button O-Ring as described in "Emergency ByPass Valve" on page 22.
- (e) Observe the balloon for 2 minutes; if it does not significantly drop from approximately 45° to 0°, the breathing system has no leaks. **NOTE:** look for a gross drop from 45° to 0°; a drop from 45° to 35° is insignificant.
- (f) Disconnect the test fixture and **REMOVE THE PRESSURE TEST KNOB FROM THE BACK OF THE BIOPAK 60**.
- (g) Reconnect the facemask or seal the BioPak 60 by screwing the inhalation to the exhalation hose.

Sign and Date Maintenance Tag

After completing the four steps of periodic maintenance, sign and date the back of the TurnAround Maintenance Tag and fill out the Monthly Maintenance Log Sheet for the BioPak (reference Appendix B).

Facemask Fit Test

The BioPak 60 is a positive pressure device, which means that in the event of poor facemask fit, the leakage should be outward. If excessive leakage occurs, duration will be greatly decreased. This test is good for training an individual in adjusting the facemask for the best fit. Instead of making a water manometer yourself as described below, a manometer or magnehelic gauge may be used to see if the mask will maintain a pressure of 6" H₂O.



- (a) Tape a piece of Tygon tubing (approximately 8 feet in length) to a wall as shown above. Insert a stopper and add water to the tubing as shown. Tape a 1-foot ruler to the wall so that the 6 inch mark (the midpoint of the ruler) lines up with the water level in the tubing.
- (b) Don the facemask, without the breathing hoses attached, and tighten the straps. Breathe normally.
- (c) Insert the test fixture stopper into the end of the exhalation hose.
- (d) Take a deep breath and slowly exhale into the facemask, building up pressure, while noting the position of the water. Note the reading on the ruler for the right and left columns of water when leakage first occurs around the facemask edges.
- (e) Stop exhaling and note where the water columns come to rest. For a good facemask fit, each column should displace at least 3 inches of water (a total displacement of 6 inches between the two water levels).

B. Scheduled Component Replacement

NO BioPak 60 parts have to be replaced on a mandatory basis. However, after a period of time, some parts may need to be replaced due to wear. The three tests described in "Periodic Long Term Maintenance" will reveal the parts to be replaced if a unit fails to pass the tests. It is recommended that the user visually inspect the following parts more frequently than usual for signs of wear after 5 years.

Parts Requiring Frequent Visual Inspection After 5 Years

Part Number Description
 B6-02-5000-36-0 Diaphragm Assembly
 Inspect Diaphragm for cracks or signs of excessive wear.

Mask Assemblies & Hoses

B6-02-5000-09-0 Facemask & Hoses
 B6-02-5000-63-0 Exhalation Hose, Center Section Side
 B6-02-5000-59-0 Exhalation Hose, Facemask Side
 B6-02-5000-62-0 Inhalation Hose, Center Section Side
 B6-02-5000-58-0 Inhalation Hose, Facemask Side
 B2-02-7100-01-0 Gasket, Hose Connector
 Inspect for cuts, nicks or tears in facemasks. Check for cracks and abrasion on breathing hoses.

All O-Rings

Inspect all O-Rings. Make sure that they are not nicked, cut and have not taken a seat so that they have "squared off" and will not seat properly. Make sure that all O-Rings are properly lubricated with the correct lubricant. Check the Emergency ByPass Valve Button O-Ring (B4-04-7070-07-0) for "Blow-By" and replace if necessary.

Frequently Replaced Parts:

Part Number	Description	Qty	Frequency
B2-02-7100-10-0	Foam Pad Absorbent Canister	1	20 Uses
B3-03-0006-01-0	Stat-O-Seal	1	50 Uses
B4-04-7060-02-0	O-Ring, Absorbent Canister (Large O-Ring)	1	50 Uses
B4-04-7060-03-0	O-Ring, Breathing Chamber Lid (Large O-Ring)	1	50 Uses
B4-04-7060-06-0	O-Ring, Coolant Canister End Cap	1	50 Uses
B2-06-6000-57-0	Anti-Fog Insert 1 (optional)	1	20 Uses

C. Recommended Spare Parts

Because of wear, damage or loss, it is recommended that the parts listed below be kept on hand by the user.

Part Number	Description
B6-02-5000-12-0	Oxygen Cylinder Assembly, Filled
B3-03-0006-01-0	Stat-O-Seal
B6-02-5000-63-0	Exhalation Hose, Center Section Side
B6-02-5000-59-0	Exhalation Hose, Facemask Side
B6-02-5000-62-0	Inhalation Hose, Center Section Side
B6-02-5000-58-0	Inhalation Hose, Facemask Side
B2-06-6000-24-0	Clamp, Facemask Hoses
B6-02-5000-36-0	Diaphragm Assembly
B2-02-7100-01-0	Gasket, Hose connector
B2-02-0000-01-0	Harness, BioPak 60
B2-02-4100-21-0	Retainer Pin Long, Harness
B2-02-4100-20-0	Retainer Pin Short, Harness
B2-02-4100-22-0	Retainer Pin Cap
B2-05-1000-02-0	Gauge and Hose Assembly
B2-02-7100-10-0	Foam, Absorbent Canister
B5-01-3000-00-0	SodaSorb (Case of 12)
B2-02-4400-00-0	Facemask Lens
B2-06-6000-57-0	Anti-Fog Lens Insert
B2-02-0000-16-0	Flow Restrictor
B2-02-7100-06-0	Check Valve
B4-04-0000-00-0	Demand Valve*
B4-04-7070-01-0	O-Ring, Flow Restrictor*
B4-04-7070-00-0	O-Ring, Demand Tube Connector*
B4-04-7070-02-0	O-Ring, ByPass Tube Connector*
B4-04-7060-02-0	O-Ring, Absorbent Canister
B4-04-7060-03-0	O-Ring, Breathing Chamber Lid*
B4-04-7070-07-0	O-Ring, ByPass Valve Button

* Included with Spare Parts Kit (B6-02-5000-28-0) that is a part of the BioPak 60 Service Kit.

NOTE: All old style part numbers are cross-referenced with new Biomarine part numbers in the exploded drawings in the back of this manual.

D. Troubleshooting

Generally, repairs are limited to tightening leaky connections and replacing defective parts. The table below lists some potential problems and describes symptoms and remedies.

Pressure Test Knob

Troubleshooting Chart

SYMPTOM	PROBLEM	REMEDY
Mask Fogging	Anti-Fog Solution Not Applied Anti-Fog Solution Rubbed Off	Apply Anti-Fog Solution before each use Buff Anti-Fog Solution until clear enough to see through. When properly buffed, enough Anti-Fog should remain on the lens so that your finger will leave a streak if you wipe it across the lens.
	Missing or Loose Lens Insert	Replace optional Anti-Fog Insert
Fail Breathing System Leak Test:	Breathing Hose Leak	Tighten hose connections Replace hose connections Replace hose or hoses
	Pressure Relief Valve Leakage	Clean all seating surfaces Replace Relief Valve O-Rings Replace Relief Valve assembly
	Breathing Chamber O-ring Leak	Replace O-Rings
	Breathing Chamber Leak Pressure System Leaks	Check for cracks in Diaphragm & chamber Tighten Demand & ByPass tube fittings Replace leaking component Check for leaks in Balloon Test Fixture
Fail Oxygen Constant Flow Rate Test:	Flow Restrictor Clogged Demand Valve malfunction Regulator malfunction	Replace Flow Restrictor Replace Demand Valve Replace Regulator
Fail Face Seal Test Test during Donning:	Poor Facemask fit Check Valve leakage	Adjust Facemask for better fit Clean all seating surfaces Check for proper installation of Check Valves Replace Check Valves
High Exhalation Resistance:	Exhale Check Valve sticking Pressure Relief Valve sticking	Clean or replace Check Valve Clean & Lubricate seating surfaces of Relief Valve Replace Pressure Relief Valve
	Anti-Anoxia Valve failure	Adjust or replace Anti-Anoxia Valve
High Inhalation Resistance:	Inhale Check Valve sticking Demand Valve Failure	Clean or replace Check Valve Replace Demand Valve
Gas escaping Oxygen Bottle:	Bad seal between oxygen bottle & regulator	Replace Stat-O-Seal
Lack of Adequate Duration:	Bad Facemask Seal BioPak Turned On before donning the mask ByPass Used to Clear Mask	Readjust facemask, try facemask fit test procedure Wait until the facemask is donned to turn on BioPak The ByPass Valve will not clear a fogged facemask Make sure that antifog solution is applied before donning the BioPak
	Leak in the Breathing Gas Loop	Tighten all connections; do a Breathing System Leak Test

V

BioPak 60 Benchman's Training

A. Lubrication

Proper lubrication of the O-Rings is essential to the reliable operation of the BioPak 60. **Either Cristo-lube (MCG-111) or Silicone (DOW-111) Lubricant May Be Used on low pressure O-Rings. DO NOT EVER USE AN OIL-BASE LUBRICANT. DO NOT USE DOW-111 ON HIGH PRESSURE OXYGEN LINES.**

Breathing Chamber & Absorbent Canister O-Rings

The two large O-Rings in the center section are the two most important O-Rings to lubricate. Proper lubrication will assure the long life of these O-Rings, and it will make it easy to remove the Breathing Chamber lid and the Absorbent Canister.

Large O-Ring Removal

The large O-Rings must be removed for proper lubrication. Do not simply wipe the lubricant onto the O-Rings while they remain in their grooves. **DO NOT PRY AT THE LARGE O-RINGS WITH A SCREWDRIVER. THIS WILL CUT THE O-RINGS AND POSSIBLY DAMAGE THE BREATHING CHAMBER.** To remove the outer O-Ring, place both thumbs about 2-3 inches apart on the O-Ring and push them together. The O-Ring will bunch-up, and you will be able to easily remove it. To remove the inner O-Ring, place both thumbs on the O-Ring about 2-3 inches apart, and pull your thumbs apart. The O-Ring will stretch into the center section. To lubricate, place a dab of lubricant on your thumb and forefinger. Work the O-Ring through the lubricant, feeling for any cuts or nicks. **Either Cristo-lube (MCG-111) or Silicone (DOW-111) Lubricant May Be Used.**

Vent Valve O-Rings

If the vent valve is removed for replacement, or to replace the diaphragm, all the O-Rings should be lubricated. This will also facilitate assembly. **Either Cristo-lube (MCG-111) or Silicone (DOW-111) Lubricant May Be Used.**

Coolant Canister O-Ring

The Coolant Canister O-Ring should be kept lubricated often, to keep it in place during disassembly, and to facilitate proper sealing. **Either Cristo-lube (MCG-111) or Silicone (DOW-111) Lubricant May Be Used.**

Demand & ByPass Tube O-Rings

The two O-Rings where the Demand & ByPass Tubes enter the Breathing Chamber should be kept lubricated. This will also help to prevent the loss of these O-Rings during routine maintenance. **CAUTION: ONLY Cristo-lube (MCG-111) Lubricant May Be Used on these high pressure O-Rings. DO NOT USE DOW-111 SILICONE LUBRICANT.**

B. Oxygen Cylinder

Oxygen Cylinder Filling Procedure

See Appendix A

Hydrostatic Test Dates

The oxygen cylinder assembly typically does not require maintenance. However, it **MUST** be periodically hydrostatically tested every 5 years. The date of the first, and subsequent testings, are stamped into the top of the steel cylinder, near the valve assembly. The cylinder must be retested before five (5) years have passed from the last date stamped in the cylinder. For example, if the date on the new cylinder label is Sept. 1989, the cylinder must be retested by September 31, 1994.

Star

When a hydrostatic test date includes a star, that indicates that the first hydrostatic test may be extended to 10 years from the date stamped into the cylinder, and the cylinder may only be filled with oxygen. All subsequent hydrostatic tests must be performed at the normal five (5) year interval.

Plus Sign

When a hydrostatic test date includes a plus sign (+), that indicates that the cylinder may be filled 10% over the cylinder's rated pressure.

Hydrostatic Testing Services

Check with your local oxygen supplier for hydrostatic testing services. If you do not have a local hydrostatic testing service, Biomarine can perform this service.

C. Regulator Assembly

The Regulator Assembly has no user adjustable parts in it and typically does not fail. However, if a unit will not pass a flow test due to high or low flow, and the Flow Restrictor and Demand Valve have been replaced, the Regulator Assembly (B6-02-5000-61-0) may need replacement.

D. Emergency ByPass Valve

The Emergency ByPass Valve requires service only if it fails to work, or excess "Blow-By" of oxygen is felt when it is depressed. The Emergency ByPass Valve is a Schraeder valve inside of the red plastic assembly that extends out of the bottom corner of the BioPak below the Alarm Whistle Tone Stem.

Replacing the Schraeder Valve

If the Emergency ByPass Valve fails to work, it is necessary to replace the Schraeder valve.

- (a) Use the ByPass Valve Tool (B2-03-3000-02-0), included in the Service Kit, to remove the plastic ring around the push button of the ByPass Valve.
- (b) The Schraeder valve may be removed using the Demand Valve Tool (B2-03-3000-03-0) included in the Service Kit.

Replacing ByPass Valve O-Ring

The ByPass Valve O-Ring must be replaced if oxygen is felt escaping around the Emergency ByPass Valve when the valve is depressed.

- (a) Use the ByPass Valve Tool (B2-03-3000-02-0), included in the Service Kit, to remove the red plastic ring around the push button of the ByPass Valve.
- (b) The O-Ring (B4-04-7070-07-0) found on the Valve Button (B2-02-0000-12-0) should be replaced if its edges are excessively "squared-off."
- (c) The O-Ring should be lightly lubricated **ONLY with Cristo-Lube** prior to reassembly.

E. Alarm Whistle Tone Stem Adjustment

If the Alarm Whistle does not chirp on start-up, it is most likely out of adjustment.

- (a) First check to see if oxygen is escaping from the small hole in the tone stem assembly when the cylinder is turned on. If oxygen does come out check if the cylinder has pressure in it and then continue to the next step.
- (b) Loosen the small allen wrench screw in the tone stem assembly so that the whistle can slide.
- (c) Position the notch in the whistle so that it covers 1/2 of the small hole in the tone stem.
- (d) Tighten the allen wrench screw
- (e) Turn on cylinder to check for chirp from whistle.
- (f) Continue with slight adjustments until the whistle produces the loudest tone.

F. Flow Restrictor

If the BioPak 60 will not produce a minimum flow of 1.9 LPM with at least 2250 PSI in the oxygen cylinder, then the Flow Restrictor may require replacement.

- (a) Remove the upper housing from the BioPak 60, the metal Breathing Chamber lid and the Absorbent Canister to expose the Flow Restrictor.
- (b) Loosen and remove the Flow Restrictor using a 9/16" open end wrench. Do not lose the O-Ring on the Flow Restrictor.
- (c) Remove O-Ring from old Flow Restrictor, lubricate it lightly **ONLY with Cristo-Lube** and put it on new Flow Restrictor. Insert new Flow Restrictor and tighten.
- (d) Perform Flow Test

G. Breathing Chamber

To perform the following maintenance steps on the Diaphragm, Pressure Relief Valve and Demand Valve, the Breathing Chamber must be removed from the BioPak 60.

- (a) Remove the upper housing from the BioPak 60, the metal Breathing Chamber lid and the Absorbent Canister.

- (b) The Demand and the Bypass tubes both attach to the Breathing Chamber with hand-tightened fittings. Remove the protective cover from these two fittings and loosen by hand. When both fittings are removed, small O-Rings will be exposed in the fitting on the Breathing Chamber. **Make sure that these O-Rings are seated in the fittings so that they are not lost when the Breathing Chamber is removed.** A little Cristo-Lube lubricant will help to keep these O-Rings in their seats.
- (c) Remove the four screws that hold the Breathing Chamber to the BioPak 60 housing.
- (d) The Breathing Chamber can now be removed.

Diaphragm Assembly

The Diaphragm Assembly is located at the bottom of the Breathing Chamber. It is held in place by a large clamp and must be removed to service the Demand Valve and the Pressure Relief Valve.

- (a) Mark the Diaphragm by drawing a line across the clamp and Diaphragm continuing on to the Breathing Chamber. This indelible line will allow you to realign the Diaphragm and hose clamp in the same place when you reassemble the unit.
- (b) Loosen the hose clamp from the Diaphragm and remove it.
- (c) Set the Breathing Chamber on a flat surface with the Diaphragm up, carefully lift the Diaphragm off of the Breathing Chamber.
- (d) Closely examine the Diaphragm for nicks, cuts or signs of stress that would require replacement.

Pressure Relief Valve

The Pressure Relief Valve is a one-way valve located in the center of the Diaphragm. To test the Pressure Relief Valve, hold the inside of the Diaphragm up to your mouth and gently blow, no air should leak through. Next, depress the white button on the backside (outside) of the Diaphragm. The Pressure Relief Valve should allow air to pass through when the valve is depressed. If it does not, it should be replaced. The Diaphragm can be replaced as an entire assembly which includes the Pressure Relief Valve. Or, the Valve can be replaced as follows.

- (a) With the Diaphragm off of the Breathing Chamber take the special spanner wrench (B2-03-3000-01-0) and fit it into the holes on the Valve on the outside of the Diaphragm.
- (b) With one hand on the inside of the Diaphragm pushing outward, unscrew the primary layer of the Pressure Relief Valve from the Diaphragm.
- (c) Unscrew the secondary valve body from the Diaphragm with your hand.

- (d) Reverse the above procedure for reassembly. **Caution: springs should be installed per the diaphragm illustrated on page 32.**
- (e) Test the Pressure Relief Valve as described above.

Demand Valve

The Demand Valve is located in the top of the Diaphragm side of the Breathing Chamber, directly underneath the Flow Restrictor Assembly. The Demand Valve is a Schraeder valve actuated by the Diaphragm. If the Demand Valve sticks open or flutters excessively it may require replacement. Unscrew the Demand (Schraeder) Valve with the tool provided in the BioPak 60 service kit (B2-03-3000-03-0). Reverse the above procedure for installation. When installation is complete, make sure that the Demand Valve is not threaded too deeply into its assembly for the Diaphragm to contact. Also, visually inspect the part of the Pressure Relief Valve that actuates the Demand Valve. If the small metal disk in the middle of the inside of the Pressure Relief Valve assembly is deeply pitted, then it will not properly actuate the Demand Valve. Replace the Pressure Relief Valve assembly if the metal disk is deeply pitted.

H. Straps

It is easy to replace a strap that has torn or worn through use. Each strap is secured to the lower housing of the BioPak by a Retainer Pin and Cap.

- (a) Locate the Retainer Pin and Retainer Cap that attaches the strap to the BioPak. **NOTE:** It is suggested that the Breathing Chamber be removed to access the top Retainer Pins for the Shoulder Harness.
- (b) **CAREFULLY** pull the Retainer Cap off of the Retainer Pin by grasping both ends of the Pin Assembly and pulling gently until the Retainer Cap pops off. **NOTE:** Be careful that your hands don't hit any sharp objects or high pressure piping when the cap comes loose.
- (c) Pull the old strap through the hole in the lower housing of the BioPak.
- (d) Work a new strap through the hole in the lower housing. **MAKE CERTAIN THAT THE STRAP IS NOT TWISTED!**
- (e) Push the Retainer Pin through the loop in the end of the new strap.
- (f) Reattach the Retainer Cap to the end of the Retaining Pin.
- (g) Pull the new strap tight and make sure that it is not twisted.
- (h) Reassemble the BioPak.

I. Facemask

Replacing The Lens

The polycarbonate lens may be easily replaced if it is scratched or crazed. **NOTE:** The use of alcohol and sanitizing wipes containing alcohol to disinfect the facemask can cause the lens to craze.

- (a) Remove the two screws in the lens bezel
- (b) Remove the lens bezel and the lens.
- (c) It is recommended that a facemask fit test be performed after installation of a new lens (reference page 17).

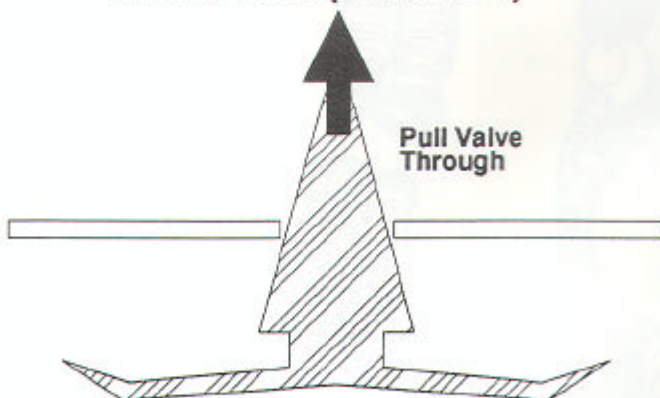
Check Valve Replacement

The Inhalation and Exhalation Check Valves are located in the facemask. They must be replaced if they become distorted and do not seat properly. The valves can be visually inspected by pulling the chin cup of the mask down to show the valves.

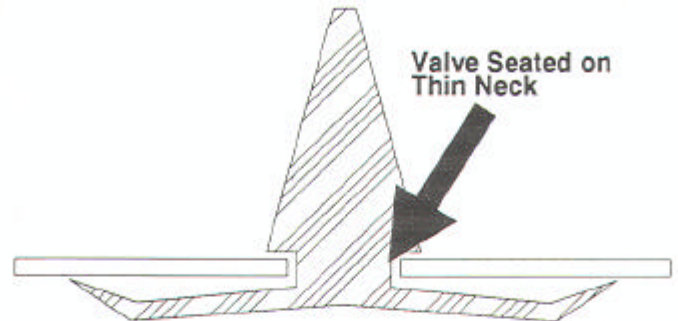
Exhalation Valve Replacement

- (a) The Exhalation Valve is the uppermost of the two valves. To remove it, either pull the tip of the valve through the seating hole, or cut the tip of the valve off and remove the valve from the Speaking Diaphragm side.
- (b) Remove the Speaking Diaphragm to expose the front of the Exhalation Valve. **BE VERY CAREFUL. THE SPEAKING DIAPHRAGM IS VERY DELICATE AND CAN EASILY BE DAMAGED!** Remove any part of the valve that is left.

Check Valve(Side View)



Check Valve(Side View)



- (c) Push the tip of a new valve through the center hole and pull through until it seats on its narrow center (neck) section. **DO NOT PULL THE NEW VALVE ALL THE WAY THROUGH!**
- (d) Cut excess material from the long, thin tip of the valve if required.
- (e) Reassemble the Speaking Diaphragm assembly

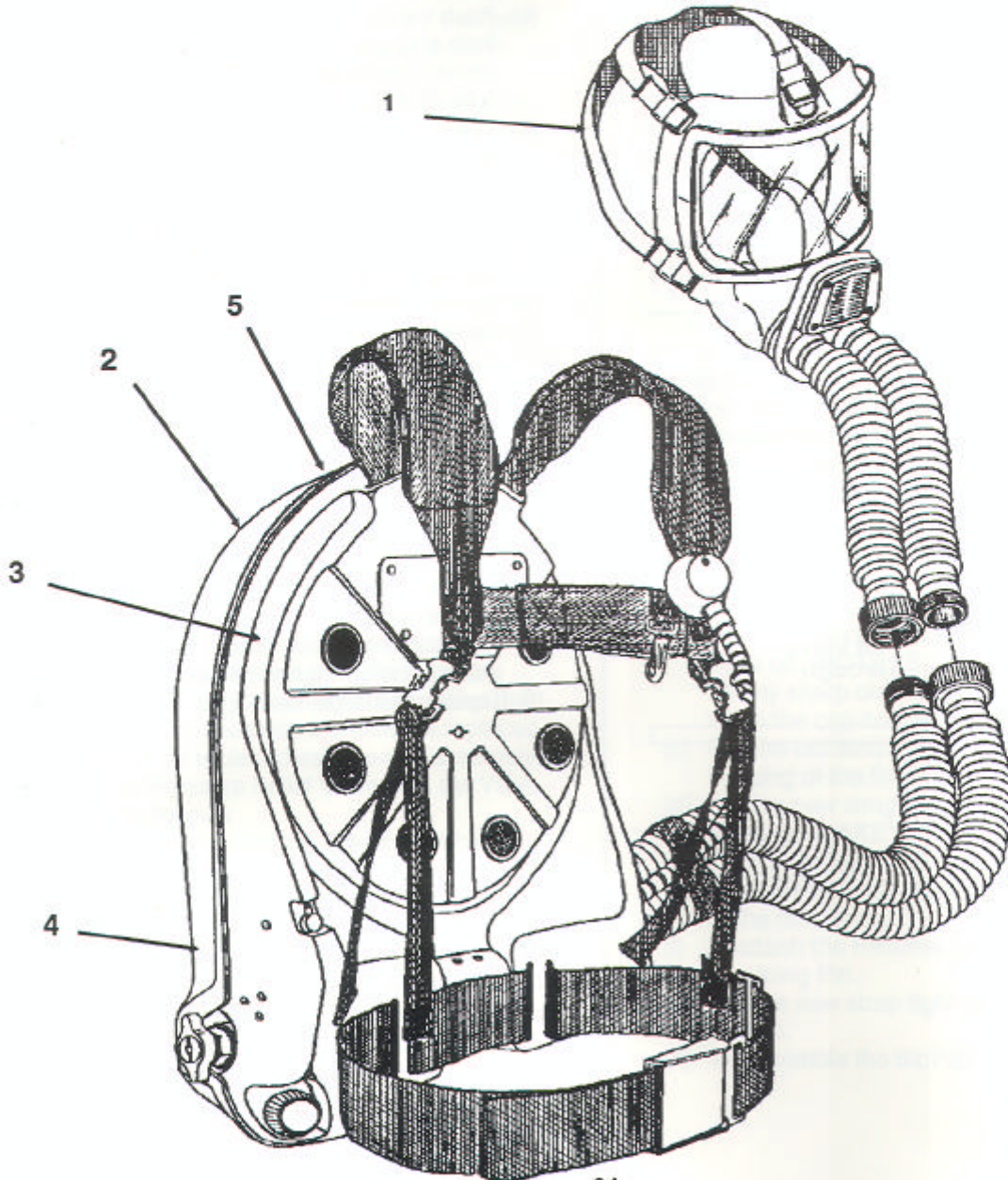
Inhalation Check Valve Replacement

- (a) Pull the Inhalation Valve (the lower of the two valves) out of the facemask.
- (b) Cut excess material from the long, thin tip of the valve if required.
- (c) Push in new valve into the bottom hole until it pops into place. If this cannot be accomplished by thumb pressure alone, move onto the next step.
- (d) Unscrew the large, black plastic plug adapter from the front of the facemask assembly. **BE SURE TO USE A LARGE FLATHEAD SCREWDRIVER SO THAT THE PLASTIC SCREW IS NOT DAMAGED.**
- (e) Pull the new Inhalation Valve through the center hole until it seats by reaching through the plug adapter hole with needle-nosed pliers.
- (f) Replace the large, black plastic plug adapter.

VI Illustrated Assemblies And Parts Lists

A. BioPak 60 Assembly

QTY	ITEM #	DESCRIPTION	OLD PART #	ORDER PART #
		BioPak 60 Complete w/Facemask & Case	60-801A	B7-07-0600-00-0
		BioPak 60P Complete w/Facemask & Case	60-801P	B7-07-0600-03-0
1	1	Facemask Assembly Complete w/hoses	400-464G1	B6-02-5000-09-0
1	2	Upper Housing Assembly	400-284G2	B6-02-5000-45-0
1	3	Lower Housing Assembly, BioPak 60/60P	400-303G1/G2	see page 28-29
1	4	Label, Notice (middle bottom of upper housing)	201-589	B2-02-7000-10-0
1	5	Label, Caution (inside top of upper housing)	201-258	B2-02-1000-01-0

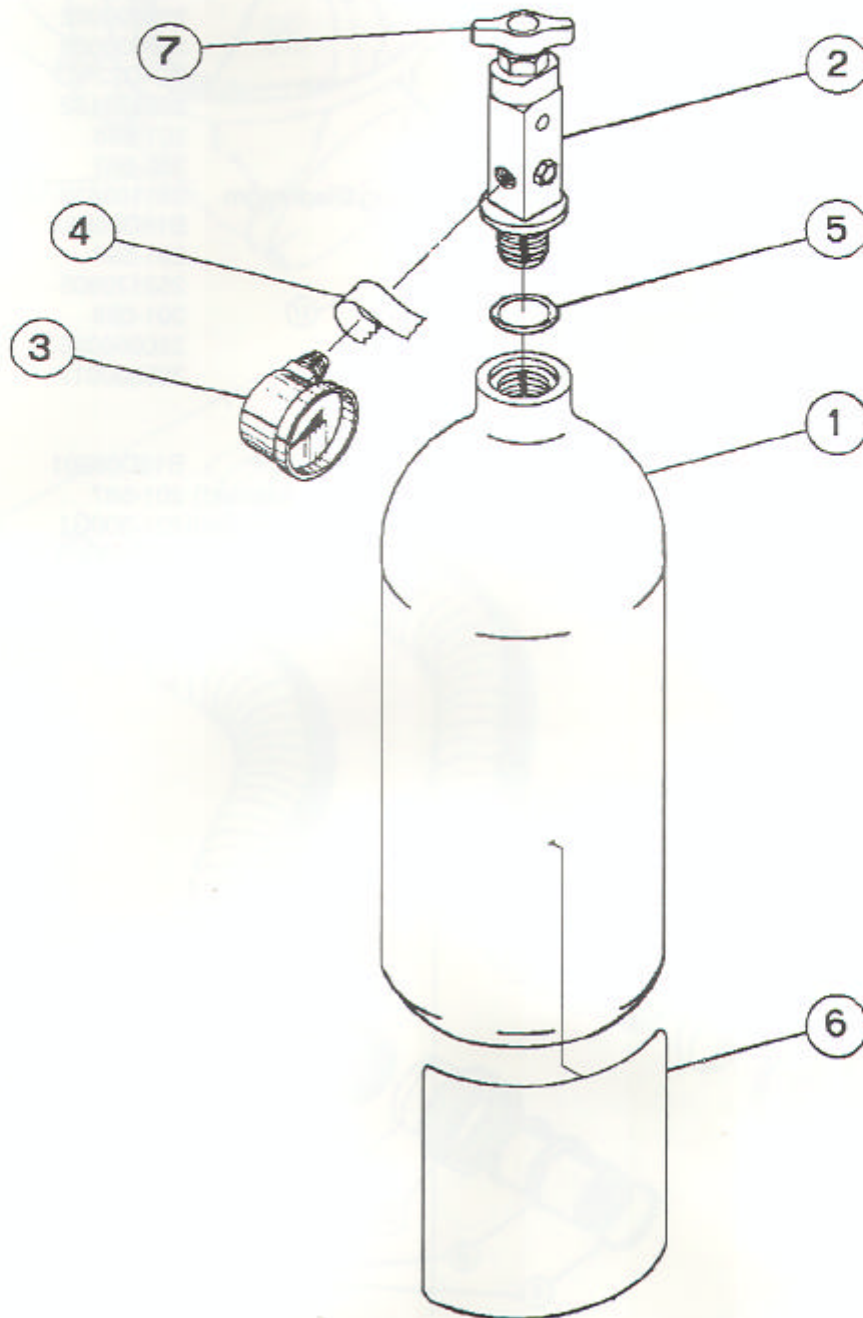


B. Oxygen Cylinder Assembly

NOTE: B6-02-5000-12-0 is a BioPak 60 oxygen cylinder filled with oxygen. For air shipment, B6-02-5000-12-1 is recommended, because it is the same assembly, but it is not filled with oxygen.

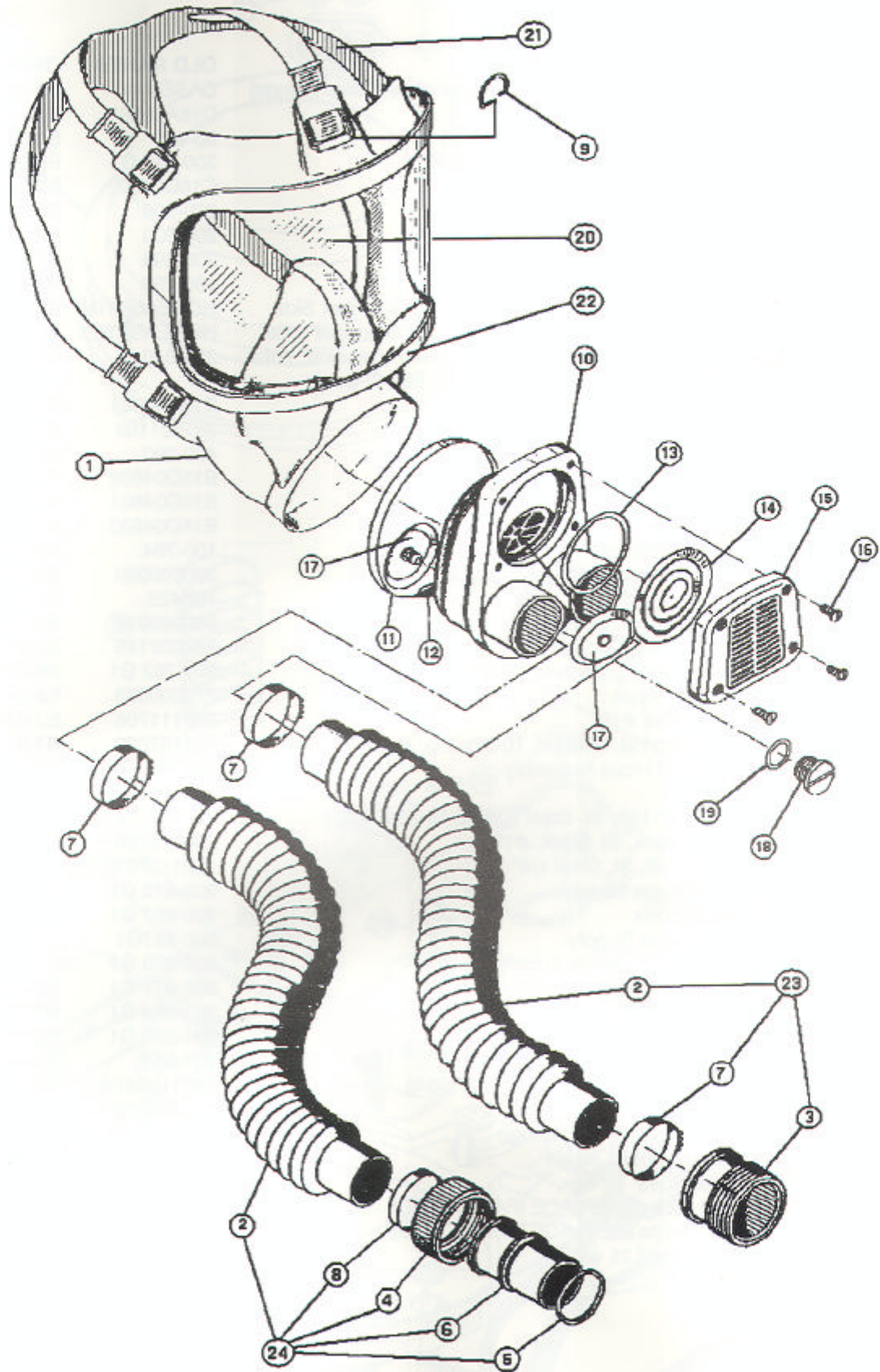
QTY	ITEM #	DESCRIPTION
1	1	Bottle
1	2	Valve Assembly
1	3	Gauge
REF	4	Tape, Teflon .25 Wide
1	5	O-Ring
1	6	Label
REF	7	Knob, Valve

OLD PART #	ORDER PART #
3EC74-2E	B2-01-2000-01-0
KVB3650-75	B4-04-5500-01-0
B16D08301	B2-05-1000-01-0
250000027	B5-07-1000-00-0
252475210	B4-04-7060-00-0
201-279	B2-02-7000-13-0
6521S	B2-06-6000-71-0



C. Facemask Assembly

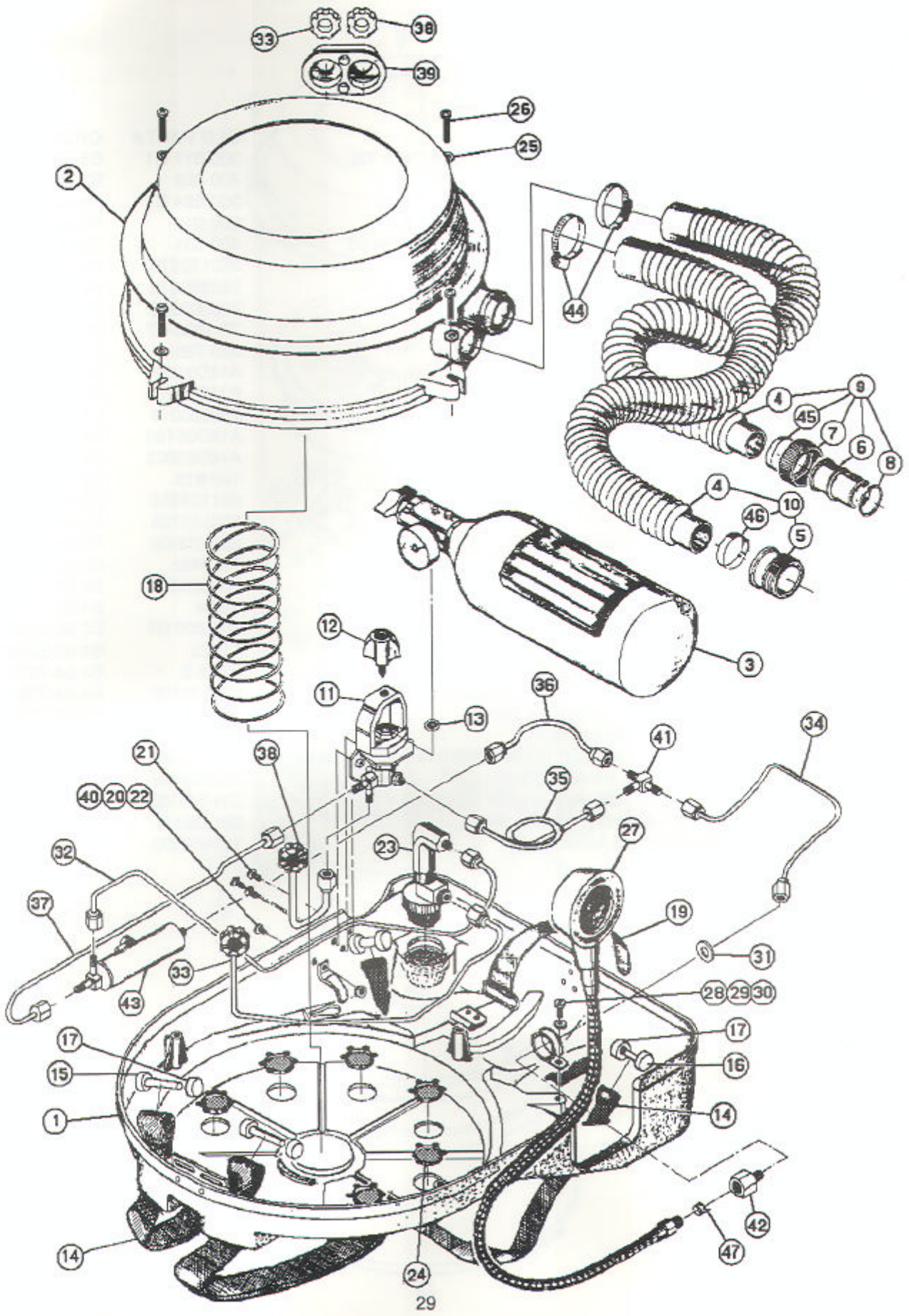
QTY	ITEM#	DESCRIPTION	OLD PART#	ORDER PART #
1	1	Facemask (Silicone Rubber Skirt ONLY)	380000016	B2-06-6000-45-0
2	2	Hose, Breathing (Inhalation & Exhalation is the same)	C16D07801	B2-02-7000-08-0
1	3	Adapter, Hose, Male	200-898	B2-02-1300-04-0
1	4	Nut, Connector, Female	200-899	B2-02-1300-00-0
1	5	Gasket, Hose Connector	100-758	B2-02-7100-01-0
1	6	Connector, Hose	200-900	B2-02-1300-01-0
3	7	Clamp, Breathing Hose (REPLACE IF REMOVED)	280000079	B2-06-6000-24-0
1	8	Clamp, Breathing Hose (REPLACE IF REMOVED)	280000078	B2-06-6000-07-0
1	9	Mask Retainer Clip	201-284	B2-02-3300-16-0
1	10	Adapter Assembly, Mask	400-452	B6-06-5000-54-0
1	11	Strap, Ligarex	280000062	B2-06-6000-46-0
1	12	Lock, Ligarex	280000063	B2-06-6000-44-0
Not Shown		Tool, Ligarex	B24D22401	B2-03-3000-04-0
1	13	O-Ring, Speaking Diaphragm	252170132	B4-04-7070-05-0
2	14	Disc, Speaking Diaphragm	201-598	B2-02-3300-17-0
1	15	Cover, Speaking Diaphragm	300-883	B2-02-4100-32-0
4	16	Screw, Pan Hd. Phlp. #4-40x.38, Speaking Diaphragm	281103612	B3-01-1041-01-0
2	17	Check Valve	B16D05601	B2-02-7100-06-0
1	18	Plug, Adapter	201-599	B2-02-4100-31-0
1	19	O-Ring, Plug Adapter	253170905	B4-04-7060-08-0
1	20	Lens, Facemask (ONLY)	301-058	B2-02-4400-00-0
1	21	Headstrap (ONLY)	380000025	B2-06-6000-58-0
1	22	Lens Frame Assy. w/Screws (ONLY)	380000017	B2-06-6000-59-0
1	23	Inhalation Hose Assembly, Facemask Side		B6-02-5000-58-0
1	24	Exhalation Hose Assembly, Facemask Side		B6-02-5000-59-0
Option, Not Shown		Spectacle Kit	B16D06901	B2-06-6000-64-0
Option, Not Shown		High Impedence Microphone Assmby (Factory installed)	201-587	B6-01-5000-00-0
Option, Not Shown		Low Impedence Microphone Assembly (Factory installed)	201-300G1	B6-01-5000-01-0
Option, Not Shown		Anti-Fog Lens Insert	370000009	B2-06-6000-57-0



D. Lower Housing Assembly

QTY	ITEM#	DESCRIPTION	OLD PART#	ORDER PART #
1	1	Lower Housing, Sub-Assembly (shell w/riveted fittings)	CASE60	B6-02-5000-51-0
1	2	Breathing Chamber Assembly	D16A00501	See page 30-31
1	3	Oxygen Bottle Assembly (FILLED)	60-400	B6-02-5000-12-0
REF.	3	Oxygen Bottle Assembly (UNFILLED)	300-619 G1	B6-02-5000-12-1
1	4	Hose, Breathing	C16D07802	B2-02-7000-12-0
1	5	Adapter, Hose	200-898	B2-02-1300-04-0
1	6	Connector, Hose	200-900	B2-02-1300-01-0
1	7	Nut, Connector	200-899	B2-02-1300-00-0
1	8	Gasket, Hose Connector	100-758	B2-02-7100-01-0
1	9	Inhalation Hose Assembly, Breathing Chamber Side	HOSEASSYIN	B6-02-5000-62-0
1	10	Exhalation Hose Assembly, Breathing Chamber Side	HOSEASSYEX	B6-02-5000-63-0
1	11	Regulator Assembly Complete (Includes bracket, yoke, yoke screw, regulator, pipe fittings, Stat-O-Seal)	200-840	B6-02-5000-61-0
1	12	Knob, Regulator	B16D07301	B2-02-0000-17-0
1	13	Stat-O-Seal	287001103	B3-03-0006-01-0
1	14	Harness, BioPak 60	400-290	B2-02-0000-01-0
2	15	Retainer Pin Long, Harness	B16D04802	B2-02-4100-21-0
2	16	Retainer Pin Short, Harness	B16D04801	B2-02-4100-20-0
1	17	Retainer Cap, Harness	B16D04803	B2-02-4100-22-0
	18	Spring, Compression	100-764	B2-02-3300-02-0
	19	Retaining Strap Assembly, Oxygen Cylinder	280000080	B2-06-6000-50-0
1	20	Clamp	10A425	B2-02-0000-15-0
3	21	Screw, Pan Hd. St. Steel	280002014	B3-01-1061-03-0
1	22	Nut, Lock #6-32	287002125	B3-02-4060-00-0
1	23	Valve Assembly, Bypass (See Page 35)	300-762 G1	B6-02-5000-56-0
6	24	Plug, Vent Type	212000033	B2-06-6000-15-0
4	25	Washer, Flat #10	286111706	B3-03-1083-00-0
4	26	Screw, Pan Hd. St. Steel, 10-32x 1.00 lg.	281107632	B3-01-1081-00-0
1	27	Gauge and Hose Assembly	200-974 G1	B2-05-1000-02-0
1	28	Clamp	280000081	B2-06-6000-68-0
1	29	Screw, Pan Hd., St. Steel (CRES/10-32x.38 lg.)	281107212	B3-01-1081-01-0
1	30	Washer, Lock, St. Steel. #10	286213706	B3-03-2083-00-0
1	31	Washer, Flat, St. Steel 1/4"	286113707	B3-03-1103-00-0
1	32	Tube, Bypass Supply	300-870 G1	B2-02-5000-08-0
1	33	Tube, Bypass	300-867 G1	B2-02-5000-14-0
1	34	Tube, Gauge Supply	300-587G1	B2-02-5000-09-0
1	35	Tube, High Pressure Supply	200-970 G1	B2-02-5000-10-0
1	36	Tube, Alarm (High Pressure Supply)	200-971 G1	B2-02-5000-11-0
1	37	Tube, Alarm (Low Pressure Supply)	201-564 G1	B2-02-5000-13-0
1	38	Tube, Demand/Free Flow	201-320 G1	B2-02-5000-12-0
1	39	Anti-Rotation Collar	201-667	B2-02-7100-05-0
1	40	Screw, Pan Hd. St. Steel, 6-32 x .50 lg.	2861104616	B3-01-1061-02-0
1	41	Union Tee	250300022	B4-03-5202-00-0
1	42	Restrictor Assembly, Gauge	100-793 -03	B2-02-0000-19-0
1	43	Valve Assembly, Alarm	201-590 G1	B6-02-5000-47-0
2	44	Clamp, Hose	280000060	B2-06-6000-01-0
1	45	Clamp, Hose (REPLACE IF REMOVED)	280000078	B2-06-6000-07-0
1	46	Clamp, Hose (REPLACE IF REMOVED)	280000079	B2-06-6000-24-0
A/R	47	Teflon Tape (.25 wide)	250000027	B5-07-1000-00-0

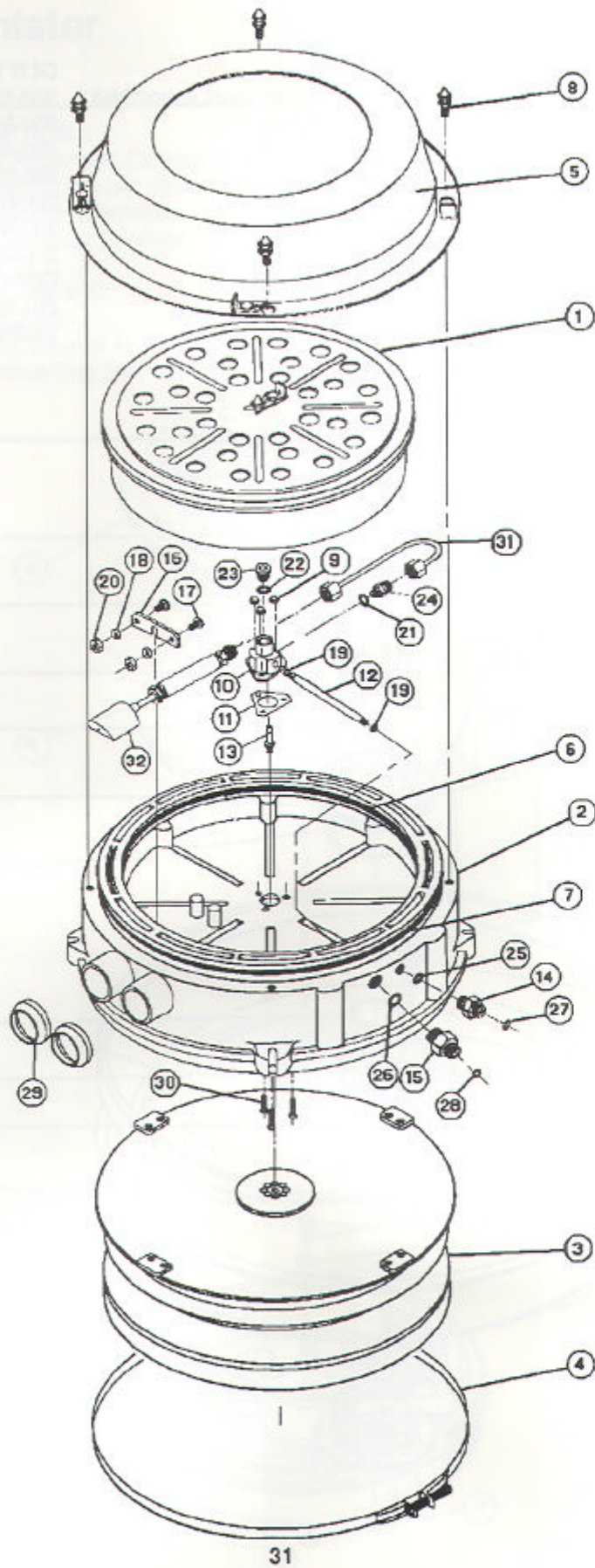
BioPak 60 & 60P Operation & Maintenance Manual (10/1/93)



E. Breathing Chamber Assembly

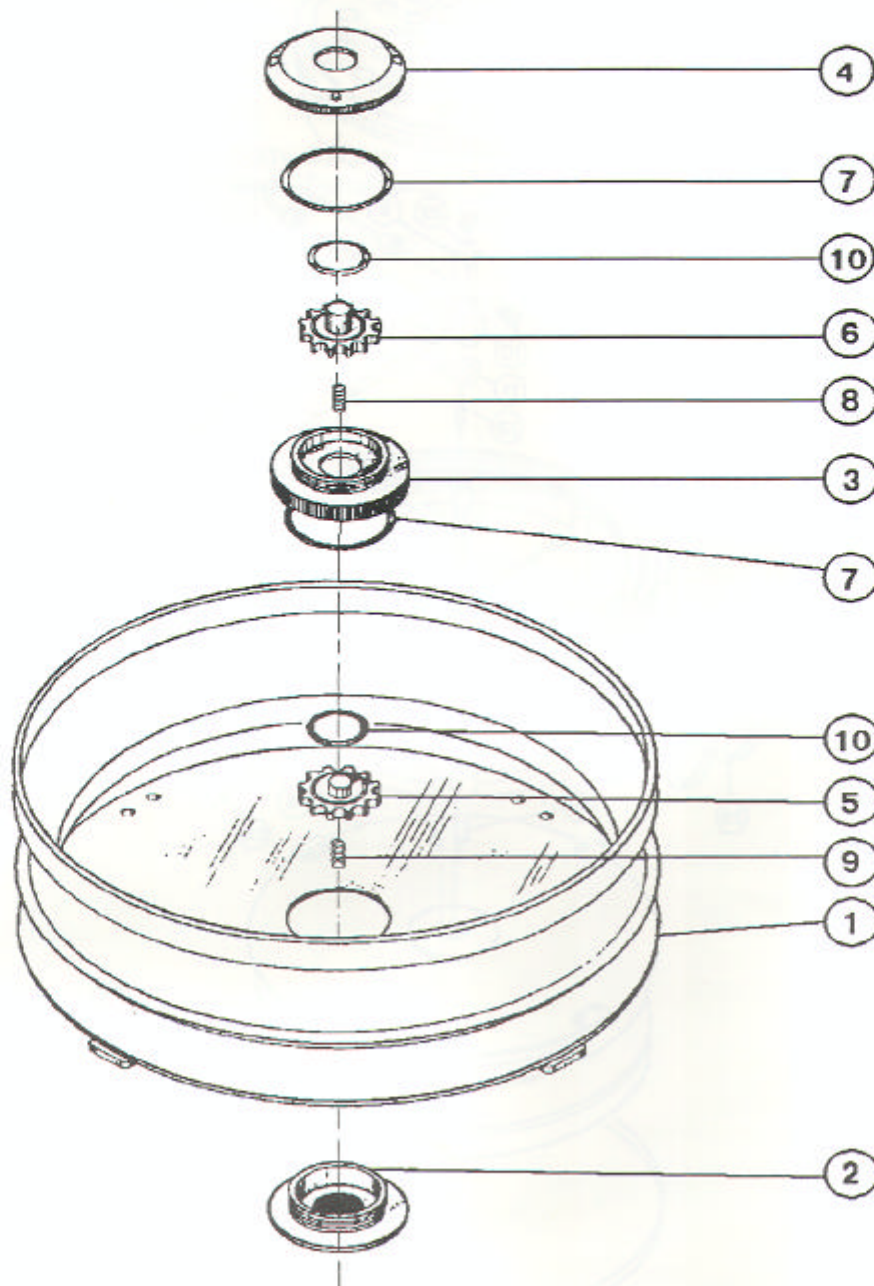
QTY	ITEM#	DESCRIPTION	OLD PART#	ORDER PART #
REF	1	Absorbent Canister Assembly (See Page 33)	300-617 G1	B6-02-5000-55-0
1	2	Breathing Chamber-Machined	400-282	B2-02-0000-10-0
1	3	Diaphragm Assembly (See Page 32)	300-534 G1	B6-02-5000-36-0
1	4	Clamp, Diaphragm	200-945	B2-06-6000-19-0
1	5	Breathing Chamber Lid Assembly, BioPak 60	400-301	See Page 34
1	6	O-Ring, Absorbent Canister	252170376	B4-04-7060-02-0
1	7	O-Ring, Breathing Chamber Lid	252350378	B4-04-7060-03-0
4	8	Stud	280002002	B2-06-6000-02-0
3	9	Nut, Lock	79-1660-40	B3-02-0040-00-0
1	10	Housing, Demand Valve	300-735	B2-02-5100-02-0
1	11	Gasket, Demand Valve	A16D01601	B2-02-7100-03-0
1	12	Tube, Connector	B16D05201	B2-02-3300-04-0
1	13	Valve, Demand	250000014	B4-04-0000-00-0
1	14	*Male Connector Body, ByPass	A16D05103	B2-02-3300-06-0
1	15	*Male Connector Body, Demand	A16D05003	B2-20-3300-05-0
1	16	Bracket, Anti-Anoxia	100-815	B2-02-3300-18-0
2	17	Screw, Pan Hd. Mach. #6-32 x .50	281104616	B3-01-1061-02-0
2	18	Washer, Flat #4	286113703	B3-03-1043-00-0
2	19	O-Ring, Demand Tube	252170006	B4-04-7070-07-0
2	20	Nut, Lock	79NM62	B3-02-4060-00-0
1	21	Gasket	280000048	B2-06-6000-09-0
1	22	O-Ring, Flow Restrictor	3-904	B4-04-7070-01-0
1	23	Restrictor, Flow	200-820 G1	B2-02-0000-16-0
1	24	Connector, Tube #10-32 to 1/8	11923	B4-03-5204-04-0
1	25	O-Ring (3-902), ByPass Tube Connector Body	H802-2	B4-04-7070-03-0
1	26	O-Ring, Demand Tube Connector Body	252170109	B4-04-7060-01-0
1	27	O-Ring (2-008), ByPass Tube	H800-2	B4-04-7070-02-0
1	28	O-Ring, Demand Tube	252170011	B4-04-7070-00-0
2	29	Ring, Hose Support (Eastman 910 required to attach)	B16D05301	B2-02-4100-10-0
3	30	Screw, Seal #4-40 x .38	280002005	B3-01-0043-00-0
1	31	Tube Assembly, Anti-Anoxia	201-317-03	B2-02-5000-15-0
1	32	Valve Assembly, Anti-Anoxia	201-262 G1	B6-02-5000-49-0
REF	33	Eastman 910 Adhesive	160000003	B5-01-3000-05-0

* Torque - 25-30 in./lbs.



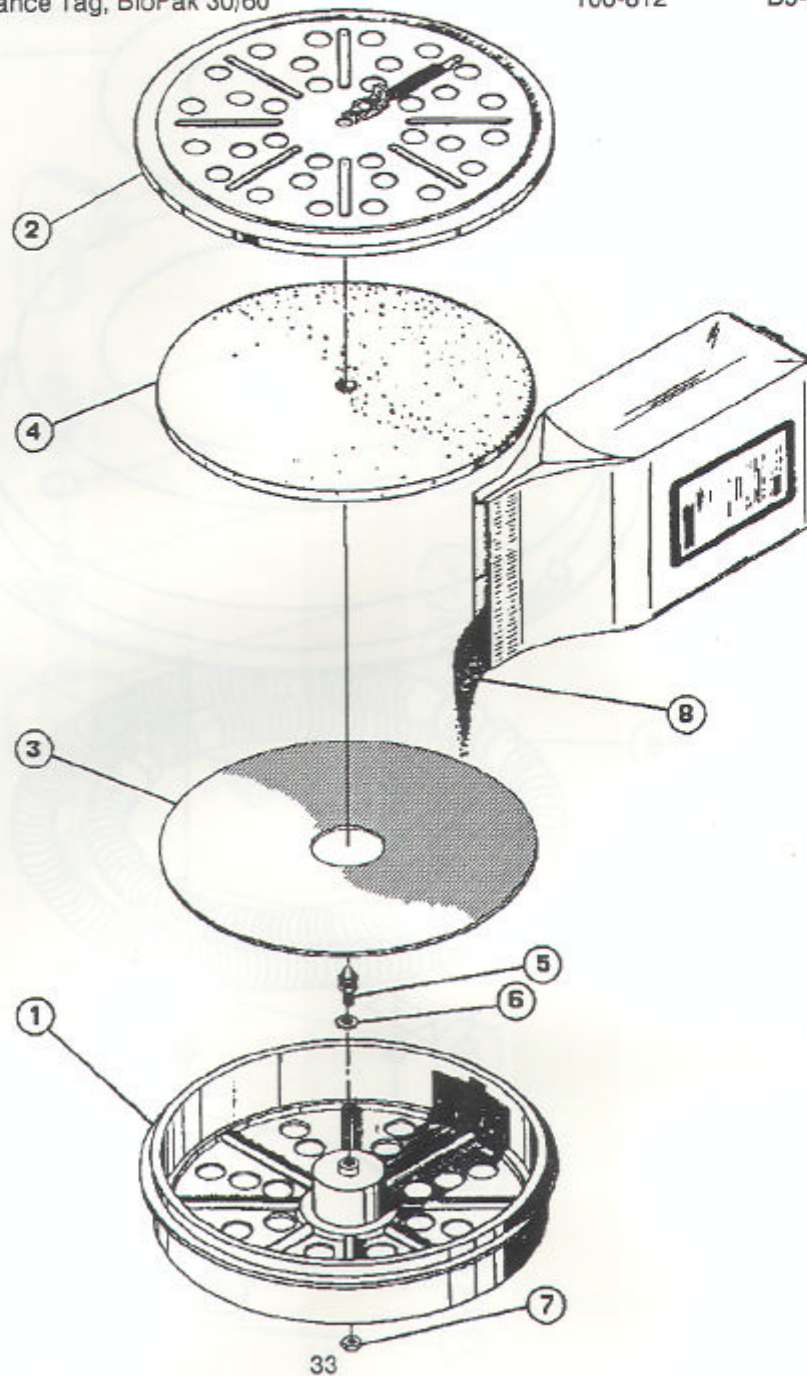
F. Diaphragm Assembly

QTY	ITEM#	DESCRIPTION	OLD PART#	ORDER PART #
1	1	Diaphragm Sub-Assembly (w/o Relief Valve Assembly)	300-534 G2	B6-02-5000-41-0
1	2	Cap Assembly	200-981 G1	B6-02-5000-34-0
1	3	Body, Valve-Secondary	200-952	B2-02-4100-04-0
1	4	Body, Valve-Primary	200-951	B2-02-4100-03-0
1	5	Seat, Valve-Secondary	200-954	B2-02-4100-06-0
1	6	Seat, Valve-Primary	200-953	B2-02-4100-05-0
2	7	O-Ring, 3/32 x 2.00 I.D.	2-136-C873-70	B4-04-7060-05-0
1	8	Spring, Compression	C02400200690	B2-06-6000-20-0
1	9	Spring, Red	201-801	B2-02-3300-14-0
2	10	O-Ring, 3/32 x .79 I.D.	252545117	B4-04-7060-04-0



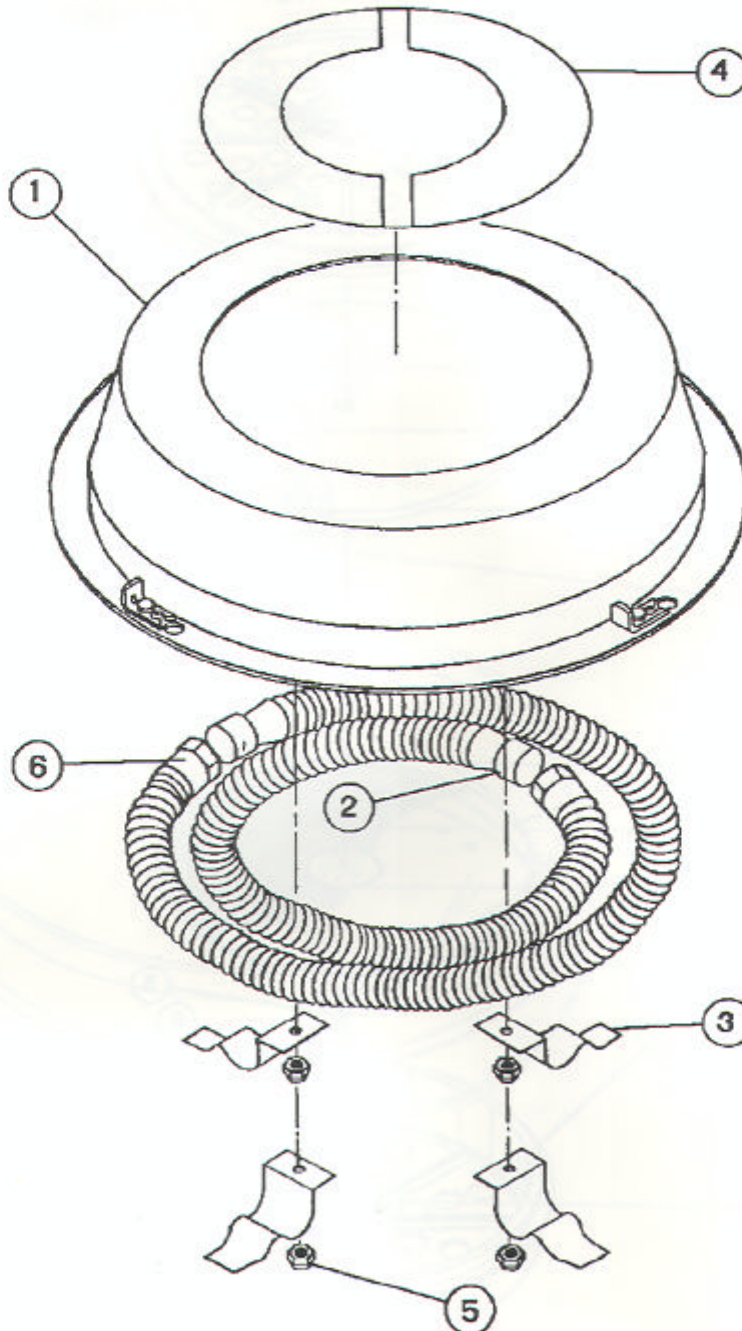
G. Absorbent Canister Assembly

QTY.	ITEM #	DESCRIPTION	OLD PART#	ORDER PART #
1	1	Housing, Absorbent Canister	C16D06801	B2-02-4100-00-0
1	2	Cover, Sub-Assembly, Absorbent Canister	C16A02801	B6-02-5000-33-0
1	3	Filter, Absorbent Canister	B16D04201	B2-02-7100-11-0
1	4	Foam, Absorbent Canister	B16D04301	B2-02-7100-10-0
1	5	Fastener	280002002	B2-06-6000-02-0
1	6	Washer, Lock #10	286213706	B3-03-2083-00-0
1	7	Nut, Hex, Plain	285110607	B3-02-1080-00-0
REF.	8	Sodasorb, Case of 12 with Maintenance Tags	60-20012	B5-01-3000-00-0
Not Shown	9	Maintenance Tag, BioPak 30/60	100-812	B5-06-6000-04-0



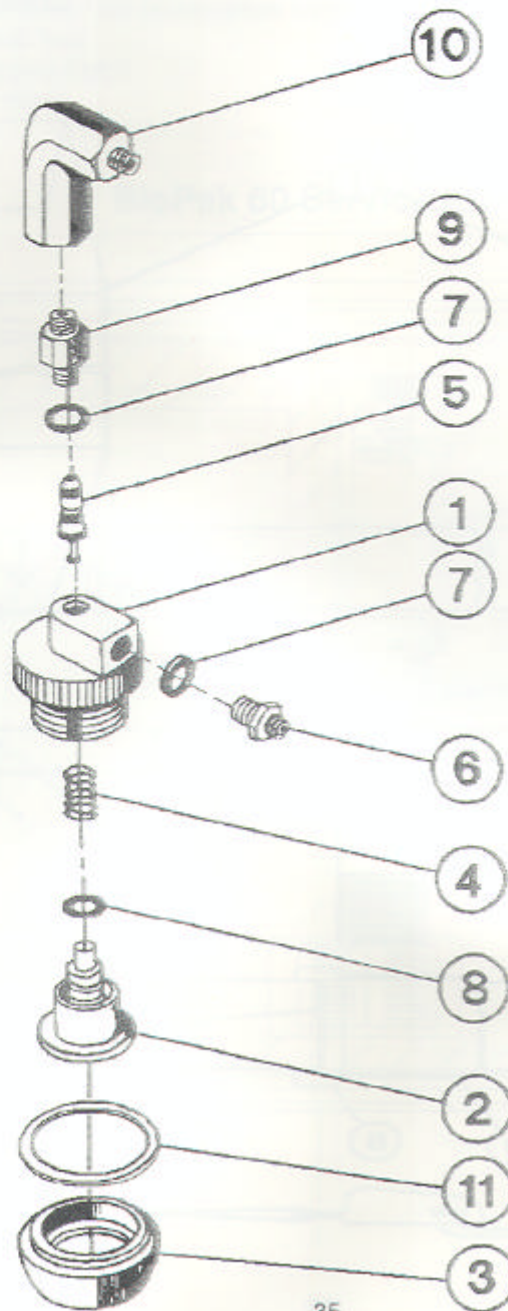
H. Breathing Chamber Lid Assembly

QTY	ITEM#	DESCRIPTION	OLD PART#	ORDER PART#
1	1	Lid, Breathing Chamber BioPak 60 (without label & Heat Exchanger Assemblies)	400-301G3/G4	B6-02-5000-57-0
1	2	Heat Exchanger Assembly-Inner	201-059G2	B6-02-5000-11-0
4	3	Retainer, Heat Exchanger	201-600	B2-02-3300-20-0
1	4	Label, Logo, BioPak 60	201-056	B2-02-7000-11-0
4	4	Label, Logo, BioPak 60P	B16D08101	B2-02-7000-22-0
4	5	Nut, Lock #8-32	280017909	B2-02-0070-00-0
1	6	Heat Exchanger Assembly-Outer	201-059G1	B6-02-5000-10-0



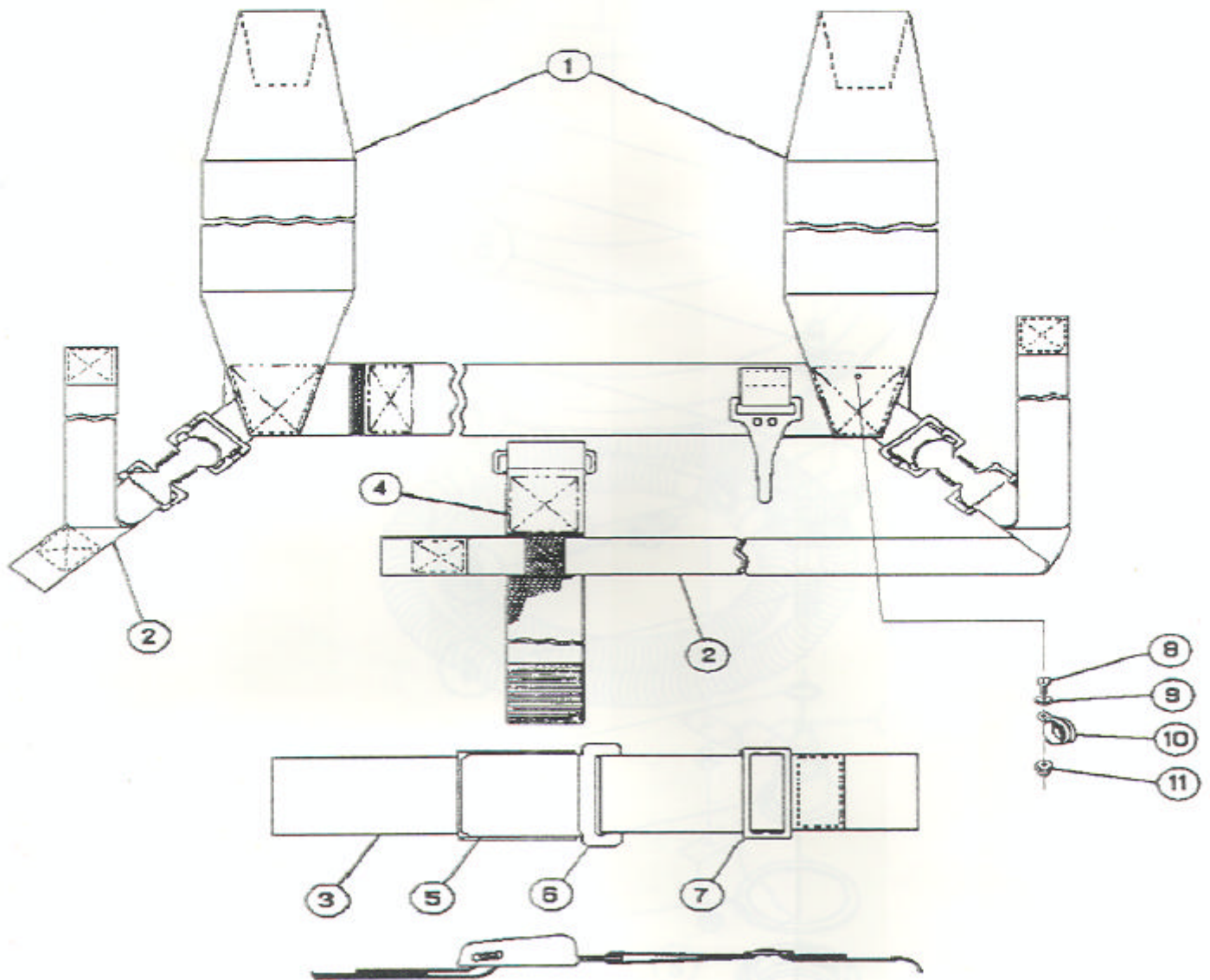
I. ByPass Valve Assembly

QTY	ITEM#	DESCRIPTION	OLD PART#	ORDER PART #
1	1	Body, Valve	C16D05701	B2-02-4100-19-0
1	2	Button, Valve	B16D05801	B2-02-0000-12-0
1	3	Guard, Valve	B16D05901	B2-02-4100-18-0
1	4	Spring, Compression	288001101	B2-06-6000-13-0
1	5	Valve Core	250000014	B4-04-0000-00-0
1	6	Connector, Male	2-2ZHBA-B	B4-03-5204-02-0
2	7	O-Ring, Connector	253170902	B4-04-7070-03-0
1	8	O-Ring, Button	252170006	B4-04-7070-07-0
1	9	Holder, Valve - Modified	A16D02401	B2-02-5400-01-0
1	10	Elbow, Female	2-2DBZ-B	B4-03-5203-00-0
1	11	Washer, Phenolic	280000066	B3-03-0006-00-0



J. Harness Assembly

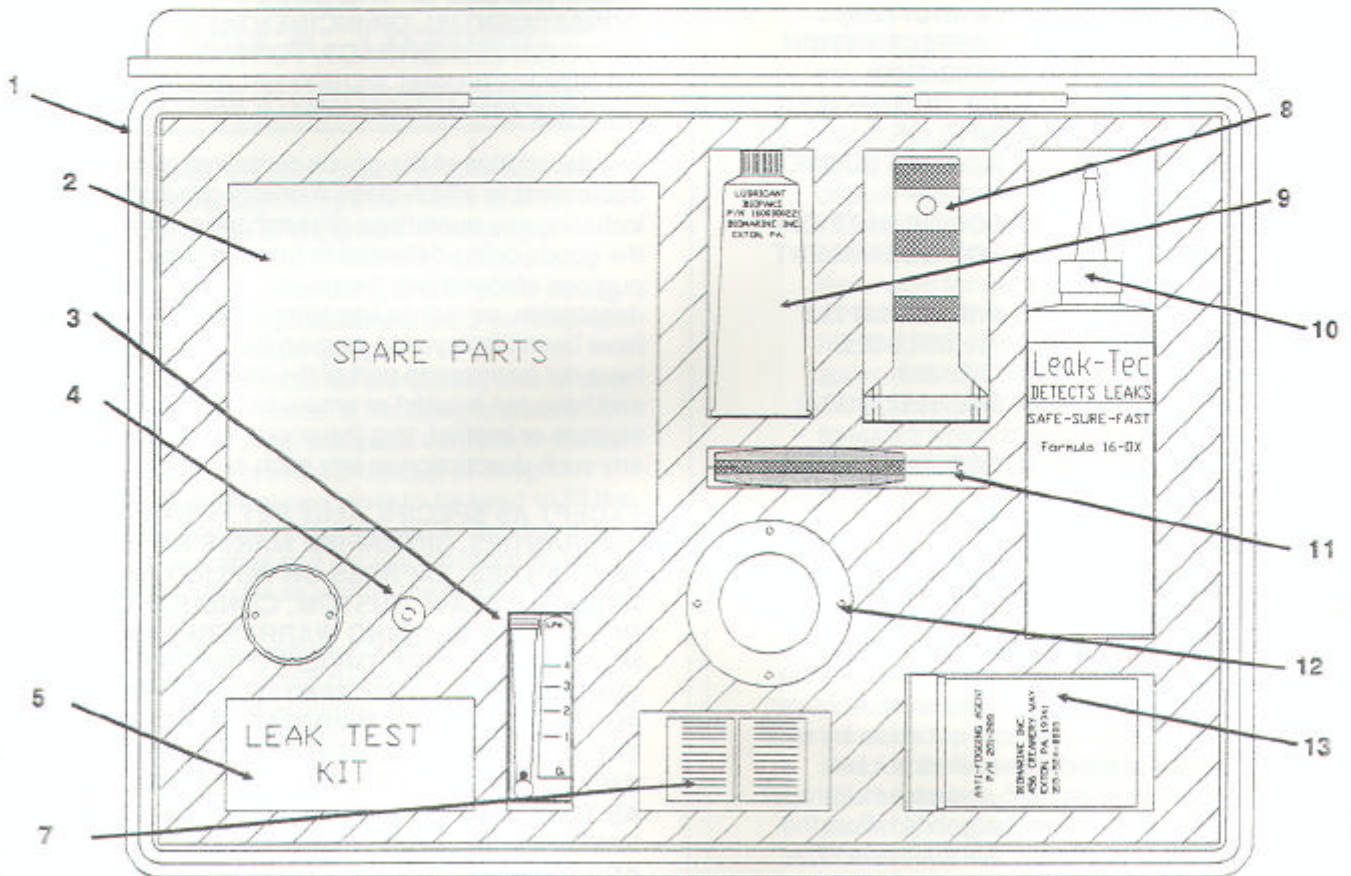
QTY	ITEM #	DESCRIPTION	OLD PART #	ORDER PART #
1	1	Shoulder Harness Assembly (Complete)	400-290G1	B2-02-0000-01-0
Option		Shoulder Harness Assembly (Optional Heavy duty, high heat & flame resistant)		B6-02-5000-50-0
1	2	Shoulder Adjust	400-447G2	B2-02-0000-23-0
1	3	Waist Strap	400-447G3	B2-02-0000-24-0
1	4	Hose Retainer	400-447G4	B2-02-0000-25-0
1	5	Buckle, Aluminum	501151-401	B2-06-6000-48-0
1	6	Connector	442851	B2-06-6000-49-0
1	7	Slide - 2"	5048	
1	8	Screw, Pan Hd. St. Steel, 6-32 x .50 lg.	281104616	B3-01-1061-02-0
1	9	Washer, Flat, #6	286113704	B3-03-1063-00-0
1	10	Clamp	280000033	B2-06-6000-12-0
1	11	Nut, Lock #6-32	287002125	B3-02-4060-00-01



K. Accessories & Options

QTY	ITEM#	DESCRIPTION	OLD PART#	ORDER PART #
1	Nt Shown	BioPak 60 Carrying Case - Molded	300-871	B2-01-4100-00-0
1	1	BioPak 60 Service Kit	400-540G1	B6-02-5000-30-0
1	2	BioPak 60 Spare Parts Kit	201-898G1	B6-02-5000-28-0
1	3	Flowmeter	201-872G1	B6-02-5000-16-0
1	4	Pressure Test Knob	200-982G1	B6-02-5000-17-0
1	5	Leak Test Fixture (Balloon), BioPak 60 ONLY	201-286G1	B6-02-5000-18-0
Not Shown	6	Replacement Balloon for Leak Test Fixture	200-757	B2-02-7000-17-0
100	7	Quatsyl-256 Disinfectant (100 pieces) (NOTE: 4 packets only included in spares kit for samples)	201-900G2	B6-02-5000-42-0
1	8	ByPass Valve Tool	B16D08801	B2-03-3000-02-0
1	9	Cristo-Lube Lubricant	160000022	B5-01-3000-01-0
1	10	Leak-Tec	16-OX-02	B5-01-3000-03-0
1	11	Demand Valve Tool (screwdriver type)	B17D07501	B2-03-3000-03-0
1	12	Vent Valve Tool	201-847G1	B2-03-3000-01-0
1	13	Anti-Fogging Agent	201-228	B6-02-5000-08-0
Option		Transfill Valve	45-401	B6-02-5000-43-0

BioPak 60 Service Kit



L. BioPak Warranty

Biomarine warrants, subject to the terms below, that the goods will be free from defects in design, materials, and workmanship for a period of three (3) years from the date that the goods are purchased by buyer, with the exception of rubber components. Rubber and silicone rubber components are similarly warranted for a period of one (1) year from the date of purchase. **THIS WARRANTY DOES NOT APPLY TO OXYGEN CYLINDER HYDROSTATIC TESTING FOR PERIODIC RECERTIFICATION OF THE PRESSURE VESSEL.**

THE SOLE LIABILITY OF BIOMARINE FOR ALL PURPOSES SHALL BE TO REPLACE, AT THE SOLE OPTION OF BIOMARINE, DEFECTIVE PARTS APPEARING WITHIN THE THREE OR ONE-YEAR PERIOD AS APPLICABLE. BIOMARINE SHALL PROVIDE PARTS AT ITS OWN EXPENSE BUT ALL LABOR SHALL BE AT THE EXPENSE OF BUYER. BIOMARINE SHALL HAVE NO OBLIGATION FOR REPLACEMENT UNLESS:

- 1. BIOMARINE HAS RECEIVED WRITTEN NOTICE OF THE ALLEGED DEFECT WITHIN THIRTY (30) DAYS FOLLOWING THE DISCOVERY OF THE DEFECT OR THIRTEEN (13) MONTHS FROM THE DATE OF PURCHASE, WHICHEVER OCCURS SOONER; AND**
- 2. THE BUYER SUBMITS PROOF OF DATE OF PURCHASE WITH INVOICE OR EQUIVALENT DOCUMENTATION; AND**
- 3. THE DEFECTIVE GOODS ARE PROMPTLY RETURNED BY BUYER, AT THEIR SOLE EXPENSE, TO BIOMARINE AT: 456 CREAMERY WAY, EXTON, PA 19341, USA; AND**
- 4. THE EQUIPMENT HAS NOT BEEN ALTERED; AND**
- 5. THE DEFECT OCCURS UNDER CIRCUMSTANCES OF PROPER USE IN ACCORDANCE WITH ALL INSTRUCTIONS AND MANUALS PROVIDED TO THE BUYER.**

It shall be the responsibility of the buyer to read carefully and abide by all instructions provided to the buyer in the instruction manual or elsewhere. If buyer, and the employees of the buyer, did not abide by such instructions, then the alleged defect shall not be deemed to have arisen under circumstances of proper use. The instructions for use of the goods reflect the opinion of experts based on field use and tests. The instructions should be followed carefully. It is impossible, however, to eliminate all risks inherently associated with the use of the goods. Unintended consequences may result because of such factors as

weather conditions, the presence of other materials, or the use or manner of application of the goods, all of which are beyond the control of Biomarine. All such risks shall be assumed by buyer.

Buyer shall be responsible for insuring that the goods are functioning properly at all times and shall not use any goods which are not functioning properly. If buyer uses the goods when they are not functioning properly, than buyer agrees to defend, indemnify and hold Biomarine harmless against all losses damages and injuries to persons or property as a result of the use of the malfunctioning goods.

These warranties do not extend to the goods if they have been subjected to misuse, neglect or accident, including extended exposure to direct flames and/or caustic chemical products, after its delivery to buyer, nor does it extend to any item that was modified or altered after its delivery to buyer.

IN NO EVENT WILL BIOMARINE BE LIABLE FOR ANY LOSS OR DAMAGE DIRECTLY OR INDIRECTLY ARISING FROM THE DEFECTS OR FROM THE USE OF THE GOODS OR FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE, OR FOR PERSONAL INJURY OR PROPERTY DAMAGE OR ANY FINANCIAL LOSS.

Any description of the goods contained in any documents to which these warranty provisions related, including any quotations or purchase orders relating to the goods being delivered to buyer, are for the sole purpose of identifying the goods, and any such description, as well as any sample or model which may have been displayed to or seen by buyer at any time, have not been made part of the basis of the bargain and have not created or amounted to any warranty, express or implied, that the goods would conform to any such description or any such sample or model.

EXCEPT AS SPECIFICALLY SET FORTH IN THESE WARRANTIES, BIOMARINE MAKES NO WARRANTIES, EXPRESS OR IMPLIED, WHETHER ARISING BY LAW, CUSTOM, CONDUCT OR USAGE OF TRADE, INCLUDING WARRANTIES AS TO MERCHANTABILITY, OR AS TO THE FITNESS OF THE GOODS FOR ANY PARTICULAR USE OR PURPOSE, AND ANY WARRANTIES SET FORTH IN THESE WARRANTIES ARE IN LIEU OF SUCH IMPLIED WARRANTIES, INCLUDING WARRANTIES AS TO MERCHANTABILITY AND FITNESS FOR PARTICULAR USE OR PURPOSE AND THE RIGHTS AND REMEDIES PROVIDED HEREIN ARE EXCLUSIVE. THESE WARRANTIES SHALL RUN TO THE BUYER ONLY AND SHALL NOT BE CONSTRUED AS A CONDITION.

Biomarine does not warrant that the goods are free of the rightful claim of any third person by way of infringement of patents or other proprietary information and disclaims any warranty against such infringement.

The terms of these warranties shall apply to the product sold by Biomarine, except absorbent, filters and anti-fog lens inserts which are considered "consumable item", and as such are not covered by the terms of these warranties. No waiver, alteration or modification of the terms of these provisions shall be valid unless in writing and signed by an executive officer of Biomarine.

These warranties shall not apply to accessories or devices purchased by Biomarine and attached to or made part of the goods except that Biomarine warrants that (i) the installation of such items in the completed product shall so conform to the installation instructions of the manufacturers thereof as not to invalidate such applicable warranties on such items as are obtained by Biomarine from such manufacturers, and (ii) the workmanship incorporated in such installation shall be free from defects.

M. Appendix A: Oxygen Cylinder Filling Procedure

If oxygen cylinders are filled offsite, proper care must be taken to ensure that the cylinder valve and seat remain clean and free of impurities. The oxygen cylinder valve should be covered with a clean, clear plastic bag before and after filling and anytime during storage. The following procedure should be followed for on-site oxygen cylinder filling.

1. The filling area should be completely free of any grease or oil products. If the filling is done in a small confined area, adequate ventilation should be provided to prevent a buildup of oxygen.
2. Only USP medical oxygen is to be used to fill the BioPak cylinders. Other grades of oxygen may contain impurities and excess moisture which can affect the cylinder as well as the plumbing on the BioPak.
3. Before filling any cylinder, it should be visually inspected for physical damage (CGA pamphlet C-10). Damaged cylinders should be returned to a hydrostatic test facility or Biomarine for inspection and retesting.

4. Before filling any cylinder, check the hydrostatic test date on the cylinder. Only oxygen cylinders with a current hydrostatic test date may be filled. If the test date is over 5 years old (unless there is a star in the date, in which case the hydrostatic test date is ten years from the first date stamped on the cylinder), do not refill the cylinder. It should be returned to your local hydrostatic test facility or Biomarine for retesting.
5. Make a special effort to see that the cylinders are not completely drained of oxygen prior to refilling. At least 100 PSI should be maintained in the cylinder at all times. If the pressure is zero there is a good chance that ambient air has entered the cylinder. This could contaminate the oxygen with other gases as well as let moisture into the cylinder.
6. All Cylinders that show zero pressure on the gauge must be purged and vacuumed to remove any contaminant or moisture that may have entered due to the lack of pressure in the cylinder. It is suggested that these cylinders be returned to Biomarine for the purge and vacuum cycles.
7. It is also a good practice to crack the cylinder valve slightly and then close it before connecting to the cascade system for refilling. This will blow out any dust or moisture that may have accumulated in the valve. When doing this, the valve opening should be turned away from your face to avoid injury to the eye that could result if a small piece of dust was blown from the valve.
8. The temperature in the filling and storage areas should be maintained at approximately 70°F. A high room temperature during filling will result in an actual cylinder pressure which may be several hundred PSI lower once the cylinder cools to approximately 70°F. A low room temperature during filling will result in an actual cylinder pressure which may be several hundred PSI higher once the cylinder warms to approximately 70°F. This can be dangerous because the gas will expand when warmed and raise the cylinder pressure beyond its service rating. For this same reason, no cylinder should be stored above 70°F.
9. During the filling cycle, the temperature in the cylinder will rise in proportion to how fast the cylinder is filled. Because of this a two step filling process must be used. After filling the cylinder to the service pressure rating on the cylinder, it should be allowed to cool approximately 70°F for 15-20 minutes. The pressure on the gauge will probably drop several hundred PSI as the cylinder cools. After the waiting period, fill the cylinder to the rated pressure once more. This time the pressure should hold at the desired level.

10. It is very important that you follow the above procedures to ensure the safe use and operation of the oxygen cylinders and the BioPak SCBA. Any questions about the filling procedures or the safe use of this equipment should be immediately referred to the local distributor or Biomarine Inc.

N. Appendix B: Monthly Maintenance Log Sheet

It is recommended that a monthly maintenance log be maintained for each BioPak 60. An example is provided.

BioPak Monthly Maintenance Log Sheet

BioPak Serial Number: _____

Date	Visual Check (P/F)	Plumbing Test (P/F)	Flow Check (LPM)	Balloon Test (P/F)	Technician's Signature/Comments