BioPak 240R
Closed-Circuit, Self-Contained Breathing Apparatus

Benchman Manual

Approved by
DGMS

DGMS Approval No: SA-10/2010
WARNINGS

1. INTRODUCTION

2. APPARATUS DESCRIPTION

3. TURN AROUND MAINTENANCE PROCEDURE

   3.1 Maintenance Tag
   3.2 Disassembly
   3.3 Cleaning/Disinfection
   3.4 Coolant Canister
   3.5 Oxygen Cylinder
   3.6 Facemask
   3.7 Assembly
   3.8 Refillable CO₂ Canister Filling
   3.9 Constant Flow Test
   3.10 Low Pressure Leak Test/Positive Pressure Leak Test
   3.11 Alarm Test
   3.12 Upper Housing

4. LONG TERM MAINTENANCE PROCEDURE

   4.1 Visual Inspection
   4.2 Demand Valve Functional Test
   4.3 Constant Flow Test
   4.4 Vent Valve Functional Test
   4.5 Low Pressure Leak Test
   4.6 High Pressure Leak Test
   4.7 Emergency Bypass Valve Functional Test
   4.8 Alarm Test
   4.9 Maintenance Tag Validation

5. GENERAL SERVICE PROCEDURES

   5.1 Scheduled Component Inspection
   5.2 System Lubrication
   5.3 Oxygen Cylinder
   5.4 Alarm Battery Replacement Procedure
   5.5 Flow Restrictor Replacement Procedure
   5.6 Factory Service and Training

6. STORAGE GUIDELINES

7. PARTS LISTS

   7.1 Top Assembly
   7.2 AV3500 Facemask Assembly
   7.3 Breathing Hose Set
   7.4 Center Section Lid Assembly
   7.5 Center Section Assembly
   7.6 Diaphragm Assembly
   7.7 Pneumatic Assembly
   7.8 Manifold Assembly
   7.9 Alarm Monitor
   7.10 Oxygen Cylinder
   7.11 Lower Housing Assembly
   7.12 Service Kit
   7.13 Coolant Canister Freeze Form
   7.14 Refillable CO₂ Scrubber Canister
   7.15 Miscellaneous Supplies
   7.16 Optional Attachments

8. APPARATUS SPECIFICATIONS

9. MAINTENANCE LOG SHEET

APPENDIX A: DGMS Approval Letter
WARNINGS

Please Read Carefully and Fully Understand

This manual is for use by personnel trained in the use and care of compressed oxygen, closed-circuit breathing apparatus, and MUST NOT be used as a self-teaching guide by untrained users. Failure to understand or adhere to the BioPak user instructions and BioPak benchman manual may result in injury or death.

Biomarine Inc. has taken great care to ensure that the information in the manual is accurate, complete and clear. However, Training & Technical Support Services will be pleased to clarify any points in the manual and answer questions on Biomarine Inc. breathing apparatus.

The following warnings are in accordance with certifying authority requirements and apply to the use of breathing apparatus in general:

- Breathing apparatus user must be fully trained in the use and care of closed-circuit, self-contained, compressed oxygen breathing apparatus.
- Ensure that the selection of the apparatus type is sufficient for the tasks being undertaken and the hazards likely to be encountered. Please refer to National Regulations for guidance.
- Certain toxic substances which may occur in some atmospheres can be absorbed by the skin. Where these do occur, respiratory protection alone is not sufficient and the whole body should be protected.
- The apparatus must be tested and serviced in accordance with the BioPak 240R Benchman Manual.
- The quality of oxygen used to supply and charge the breathing apparatus must be medical or aviation grade oxygen with a moisture content less than 50 mg/m³ at 207 bar.
- Ensure that a good seal can be obtained between the face and facemask. The wearing of beards, side-burns or spectacles may adversely affect the sealing of a facemask to the wearer’s face.
- The apparatus is not designed for use underwater diving.
- The harness must not be used as a vehicle seat or fall arrest restraint.
- Replacement of the alarm system battery shall be performed in area atmospheres known to be safe and non-explosive.
- The improper use of closed-circuit breathing apparatus carries a risk of carbon dioxide poisoning of user. Users shall be fully trained in recognizing the effects of carbon dioxide poisoning.
- Biomarine Inc. makes no claims concerning the performance of user-supplied carbon dioxide granular media. Biomarine Inc. recommends the use of 1475-grams (minimum) of Intersurgical® Spherasorb 408 mesh carbon dioxide absorbent in each canister.

DISCLAIMER

Failure to comply with these instructions or misuse of the apparatus may result in: death, injury or material damage, and invalidate any warranty or insurance claims.

This manual presents the minimum requirements for BioPak utilization.
1. INTRODUCTION

1.1 Breathable Oxygen

Oxygen used to supply or charge the breathing apparatus must be medical or aviation grade oxygen with a moisture content less than 50 mg/m³ at 207 bar. The composition of suitable oxygen is given below.

**Oxygen:** 99.5% minimum mole

**Carbon Dioxide:** 300 ppm maximum

**Carbon Monoxide:** 10 ppm maximum

The purity/quality of oxygen used to supply and charge breathing apparatus should be tested periodically in accordance with national regulations.

National regulations must be observed.

Personnel dealing with compressed oxygen and compressed oxygen cylinders must be fully trained in the use and handling of compressed oxygen.

1.2 Apparatus Duration

The apparatus will provide the user with 440 liters of compressed oxygen and has been rated as 4-hour duration. Actual duration of the apparatus will vary to factors such as:

- Workload: high work rates will increase consumption rates of oxygen.
- Facemask Seal: poor seal of mask will result in system leaks and high oxygen consumption rates.
- Physical Fitness of Wearer
- System Leaks: leaks in the BioPak system will result in high oxygen consumption.

It is important that all wearers are aware of the above factors and take account of them when assessing BioPak duration.

It is equally important that all wearers understand that the BioPak 240R respirator is a positive-pressure apparatus. Leaks in the apparatus itself or in the seal between the wearer’s face and the facemask will lead to the apparatus adding additional oxygen to maintain positive pressure.

1.3 Personnel Training

Personnel who use closed-circuit, self-contained, positive-pressure, compressed oxygen breathing apparatus must be fully trained in accordance with these instructions and national regulations.

These instructions cannot replace an accredited training course provided by qualified instructors in the proper and safe use of Biomarine Inc. breathing apparatus.

Please contact Training & Technical Support Services or the Indian Distributor for training course details.

Training & Technical Support Services:

**Power Tech Mining Pvt. Ltd.**
27, G. T. Road, Fathepur
Sitarampur-713359
Asansol, Burdwan
West Bengal, INDIA

Ph. No. +91 341 225 9180
Ph. No. +91 341 225 7031
Ph. No. +91 993 305 3744
Fax No. +91 341 225 4763
Fax No. +91 341 225 7031

e-mail: shantanu_powertech@yahoo.com
e-mail: shantanu.choudhury@powertechmining.net

Website: www.powertechmining.net

**Biomarine Inc.**
456 Creamery Way
Exton, PA 19341
United States of America

Tel: +1 610.524.8800
Fax: +1 610.524.8807

Web: BioPak240r.com

1.4 Servicing

The BioPak 240R must be serviced at scheduled intervals by qualified benchmen personnel who have completed a formal training course and hold a current certificate for the service and repair of Biomarine Inc. breathing apparatus.

**Turn Around Maintenance** shall be performed after each use of the BioPak 240R as detailed in this manual.

**Long Term Maintenance** must be performed on a monthly basis, if the BioPak is in constant use; or, on a quarterly basis if the BioPak is being used less than once per month, as defined in this manual.
Electronics Intrinsic Safety Assessment Procedure must be performed each time the batteries are replaced in the alarming system as defined in this manual.

Benchman training and service contracts can be provided by contacting Training & Technical Support Services.

1.5 Spare Parts

Spare parts, accessories, general information and factory service can be obtained by contacting Training & Technical Support Services.

Reference details provided in this manual concerning spare part identification, accessory identification and BioPak factory service.
2. APPARATUS DESCRIPTION

2.1 General

**BioPak 240R** is a closed-circuit, positive-pressure, self-contained breathing apparatus (CCBA) for use in long-duration missions into atmospheres that are immediately dangerous to life and health (IDLH). Applications will include mine rescue, fire-fighting, confined space entry, domestic preparedness, military, tunnel rescue and HAZMAT.

All versions of **BioPak 240R** feature a backpack-style housing that is worn over the shoulders and hips of the wearer. A pressure gauge is supplied to indicate remaining stores of oxygen and two visual alarms and one audible alarm is provided for system status.

The closed-circuit design will recycle the wearer’s exhalation breath by removing carbon dioxide, replacing consumed oxygen, trapping condensation and cooling the breathing gas.

The positive-pressure design will maintain internal breathing gas pressures slightly above external atmospheric pressure. This feature will provide increased protection against the inward migration of external toxins to the wearer.

All external housing components are static dissipative and flame retardant.

**BioPak 240R** is approved to the following Standards:

- Indian Standard as per 10245 (Part 1):1996 and subsequent Amendment 1 September 2007
- Approved by (DGMS) Directorate General of Mines Safety, Approval Number SA-10/2010
- EN 60079-0:2009/08/01 Electrical apparatus for explosive gas part 0: General Requirements
- EN 60079-11:2007/01/01 Explosive Atmospheres-Part11: Equipment protection by intrinsic safety “I”
- EN 60079-26:2007/03/01 Explosive Atmospheres-Part 26: Equipment with protection level (EPL) GA
- IEC 60079-0:2007/10/01 Ed:5 Explosive Atmospheres-Part 0:equipment-General Requirements
- IEC 60079-11:2006/07/01 Ed:5 Explosive Atmospheres-Part 11: Equipment protection by intrinsic safety “I”; CORR 2006/12/08
- EN 60079-26:2006/08/01 Ed:2 Explosive Atmospheres-Part 26: Equipment with protection level (EPL) GA

**BioPak 240R Monitor** is marked Ex ia I/IIC T4 Ma/Ga

-20°C ↔ Tamb ↔ +60°C

**NOTIFIED BODIES:**

Central Institute of Mining and Fuel Research, Council of Scientific and Industrial Research
Barwa Road, Dhanbad-826015
INDIA

Government of India, Ministry of Labour & Employment, Directorate General of Mines Safety
Dhanbad-826001
INDIA

Intertek Testing & Certification Ltd.
Intertek House, Cleeve Road
Leatherhead, Surrey KT22 7SB
United Kingdom

TUV America, Inc.
Industry Service
5 Cherry Hill Drive
Danvers, MA 01923
United States of America

Please contact Biomarine Inc. for further apparatus approval details.

2.2 Harness

The **BioPak** harness is provided as a padded harness to increase wearer comfort. The flame-retardant harness is manufactured from Kevlar™ and Nomex™ materials with stainless steel hardware. The harness is attached directly to the apparatus via locking stainless steel screws.

2.3 Housing

The backpack-style housing is injection molded from a flame-retardant polycarbonate/stainless steel alloy that provides light weight, high strength and static dissipation. The housing consists of a lower portion and an upper portion that
snaps together in a secure fashion without the need for connection hardware.

2.4 Breathing Loop

The breathing loop consists of the breathing chamber, breathing hoses, facemask connector and facemask.

The breathing chamber consists of the center section, center section lid and diaphragm. The spring loaded diaphragm will maintain positive pressure within the apparatus. All oxygen gas additions will occur within the breathing chamber as well as over pressure venting. Carbon dioxide is removed from exhalation gas by the carbon dioxide scrubbers located within the breathing chamber. Excessive moisture will be retained by the moisture containment sponges located within the center section. Inhalation breathing gas cooling will be achieved as the gas travels around the two coolant canisters of the breathing chamber.

2.5 Oxygen Delivery System

Oxygen will be delivered from the oxygen cylinder to the breathing loop through a pressure regulator and manifold system in one of three different methods.

Pressure demand oxygen additions are provided whenever the diaphragm of the breathing chamber reaches the upper level of its travel and depresses the demand valve plunger. Additions will be made at 80 liters/minute whenever the demand valve plunger is depressed. Pressure demand additions occur whenever the wearer consumes more oxygen than is supplied by the constant add.

Constant add oxygen additions are continually added to the breathing loop at an average rate of 1.8 liters/minute. This oxygen addition rate is equivalent to the oxygen consumption rate of a wearer at a moderate work rate.

Emergency add oxygen additions occur whenever the wearer depresses and holds the red emergency bypass button. This add will provide 80-100 liters/minute of oxygen flow and is utilized only for emergency situations.

2.6 Oxygen Cylinder

The oxygen cylinder is a fully wrapped aluminum carbon fibre composite cylinder that is secured into the apparatus via connection to the pressure regulator and a hold down strap. The cylinder will provide containment of the oxygen supply at 207 bar to provide 440 liters of breathable oxygen to the wearer.

2.7 Alarming System

The alarming system consists of a pneumatic pressure gauge and an electronic monitor to provide the wearer with independent and redundant system status indications.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Alarm Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Ok</td>
<td>Flashing Green</td>
</tr>
<tr>
<td>System Fault</td>
<td>Flashing Red</td>
</tr>
<tr>
<td>End of Service Life</td>
<td>Flashing Red</td>
</tr>
<tr>
<td>No Coolant Ice</td>
<td>Flashing Blue</td>
</tr>
<tr>
<td>Low Battery</td>
<td>Flashing Red, Green, Blue</td>
</tr>
</tbody>
</table>

The pressure gauge is mounted on the harness and retained by a snap strap and magnet. Remaining stores of oxygen will be indicated on the gauge and a red band of color will indicate to the wearer when oxygen stores have reached 25% of capacity. The pressure gauge is protected against sudden loss of oxygen stores in the event of gauge line severing by a manual disconnect located at the gauge pass through point of the housing.

The electronic monitor will provide the wearer of indications of system status as listed below through the LED located on the pneumatic pressure gauge and via an 80 dB horn located on the monitor package.
2.8 Facemask

BioPak 240R is approved for use with the AV3500 full facemask, available in small, medium and large sizes.

The facemask is provided with a five point, fully adjustable head harnesses, a magnetic lens wiper, dual voice emitters and a condensation absorption pad.

To prevent fogging during use, the internal surface of the facemask lens must be treated with Anti-Fog spray prior to donning.

The facemask connects to the apparatus via a push button, bayonet hose connection.

The polycarbonate visor of the facemask conforms to EN 166, Grade B for impact resistance.

2.9 Optional Attachments

- Hydration systems provide the wearer with a source of drinking liquid without breaking the seal of the breathing loop to the external atmosphere.

- Facemask magnetic wipers provide single hand wiping of the internal and external facemask lens to remove dirt, condensation and fogging.

- Anti-crush rings provide breathing hose crushing and restriction protection.

- Kevlar™ breathing hose covers provide additional abrasion protection to breathing hoses.

- Radiant heat guards provide additional breathing hose protection against high radiant heat and direct flame contact.

- Phase Change Module (PCM) provides cooling to the breathing gas when ice coolant is not utilized. Note that the PCM is required when the ice coolant is not utilized.

Contact Biomarine Inc. or your local distributor for additional details and supply of optional attachments.
3. TURN AROUND MAINTENANCE PROCEDURE

3.1 Maintenance Tag

Obtain a maintenance tag as supplied with replacement carbon dioxide scrubbers.

The maintenance tag shall be completed as directed in this procedure and then attached to the apparatus, in a consistent and conspicuous location, to show completion of all maintenance steps.

Record the apparatus identification onto the tag.

3.2 Disassembly

Immediately after completion of BioPak use, disconnect the demand and constant add lines to the center section to prevent migration of moisture into the manifold assembly.

Disassemble the apparatus to ready for cleaning and disinfection. Note any apparatus damage and repair as needed. Repairs beyond the scope of the Benchman should be referred to Biomarine Inc.

1. Remove the upper housing.
2. Remove the coolant lids and coolant ice.
3. Remove the oxygen cylinder, making sure the seal washer remains in place, and install the regulator wash cover supplied with the service kit.
4. Remove the facemask adapter from the breathing hoses.
5. Remove the breathing hoses from the breathing chamber.
6. Remove the center section lid.
7. Remove and discard the two Biomarine Inc. carbon dioxide scrubbers and gaskets; or, remove the refillable carbon dioxide scrubber canisters. If the refillable canisters have been utilized, discard the spent carbon dioxide absorbent media making sure to retain the inlet and outlet filters and the lid and housing of the canisters.
8. Remove the moisture sponges and the PCM if used.
9. Disconnect the electrical line and both pneumatic connections to the center section.
10. Remove the four quarter-turn fasteners and remove the center section.

3.3 Cleaning/Disinfection

Use only cleaners and disinfectants that are approved by Biomarine Inc.

The apparatus must be cleaned and disinfected after each use.

DO NOT submerge the electronic monitor housing.

DO NOT allow any fluids to contact the input port of the pressure regulator.

1. Clean the upper and lower housings, ice canisters and coolant lids and all connected components with a mild soap and water mixture if necessary.
2. Mix the disinfectant with clean water as directed on the package.
3. Submerge the facemask, hoses with facemask connector, center section lid, center section, PCM and moisture sponges into the disinfectant solution. Allow the components to be wetted on all surfaces for a minimum of 10-minutes.
4. Thoroughly rinse all components in clean water to remove all disinfection solution.
5. Repeat steps 3 and 4 with the components of the refillable carbon dioxide scrubber canisters, if utilized. DO NOT clean the carbon dioxide scrubber canisters in the same water to be utilized to clean the respirator components. Cleaning of the canister components with the respirator components may lead to respirator contamination by stray carbon dioxide absorption media.
6. Allow all components to dry either by air-drying, oven drying or through the use of a dryer system. Oven drying temperatures shall not exceed 50°C.
7. Date and initial the maintenance tag under *Washed/Disinfected*.

### 3.4 Coolant Canister

The coolant canisters must be frozen before use.

1. Place the cleaned and dried canisters into the freeze form and tighten the nuts.
2. Place the freeze forms onto a level surface in a freezer for a minimum 8-hour period at a temperature of -12°C or less.
3. Date and initial the maintenance tag under *Ice Canister Placed in Freezer*.
4. If the frozen ice canisters are not going to be utilized in the BioPak, do not date and initial the maintenance tag.

### 3.5 Oxygen Cylinder

The oxygen cylinder must be fully charged with oxygen before use.

Oxygen used to supply or charge the breathing apparatus must be medical or aviation grade oxygen with a moisture content less than 50 mg/m³ at 207 bar. The composition of suitable oxygen is given below.

**Oxygen:** 99.5% minimum mole

**Carbon Dioxide:** 300 ppm maximum

**Carbon Monoxide:** 10 ppm maximum

The purity/quality of oxygen used to supply and charge breathing apparatus should be tested periodically in accordance with national regulations.

National regulations must be observed.

Oxygen will enhance the combustion of other materials. Personnel dealing with compressed oxygen and compressed oxygen cylinders must be fully trained in the use and handling of compressed oxygen.

1. Obtain the proper cylinder fill adapter needed to connect the oxygen cylinder to the booster pump.
2. Connect the cylinder to the booster pump and charge to 207 bar pressure with medical or aviation grade oxygen.

### 3.6 Facemask

1. Inspect the components of the facemask and replace as required.
2. Apply a coating of anti-fog spray to the clean and dry interior of the facemask lens. Do not wipe or buff the anti-fog coating.
3. Date and initial the maintenance tag under *Anti-Fogging Agent Applied*.

### 3.7 Assembly

1. Install the center section making sure to properly seat the three springs onto the diaphragm.
2. Lock the center section into position using the four quarter-turn fasteners.
3. Connect the electrical and pneumatic lines to the center section. Verify the presence of an o-ring seal on each pneumatic line connection.
4. Position the fully dry moisture sponges into the center section. The sponges must be fully dry to prevent the growth of mold within the apparatus.
5. If utilized, install the PCM into the breathing chamber on top of the moisture sponges. Date and initial the maintenance tag under *Ice Canister Placed in Freezer* and enter "PCM" on the tag.
6. Install the center section lid and latch to secure. If pre-packing the carbon dioxide scrubbers complete section 3.8 then return to step 7 of this section.

7. Install the breathing hoses to the breathing chamber and secure with clamps making sure the flow direction arrows of the connector are facing up. The hoses are color-coded for ease of assembly. Match the color of the hose with the color on the lower housing as indicated below:

   Inhalation: Orange  
   Exhalation: Yellow

8. Install the storage plug into the facemask connector.

9. Remove the wash plug from the pressure regulator and install the oxygen cylinder. Secure the cylinder with the hold down strap.

3.8 Refillable CO₂ Canister Filling

Biomarine Inc. makes no claims of performance of other user-supplied carbon dioxide absorbent types.

Pre-packed carbon dioxide scrubbers may only be stored in the apparatus for a period no longer than 1-year.

Apparatus that are pre-packed with the carbon dioxide scrubber shall be stored within the specified storage temperature and humidity levels and must be sealed air-tight in the apparatus.

1. Inspect the o-ring of the canister housing to insure that it is properly seated and re-lubricate with Dow-111 if necessary.

2. Install the four inlet filters into the bottom of the canister housing making sure that the inlet holes of the housing are completely covered.

3. Fill the canister with carbon dioxide absorbent media. The canister housing should be vibrated or shaken during filling to ensure that all media has fully settled. Fill the canister to a height no lower than the line around the top perimeter of the canister after vibration.

4. Cover the top of the filled canister with the outlet filter and housing lid.

5. Vigorously shake the canister while holding the top cover in place. Inspect the canister side walls to verify that no gaps have formed between the scrubbing media and the canister side walls as depicted below. If gaps have formed then add more scrubbing media and repeat steps 4 and 5 until no gaps appear.

6. Immediately place the completed scrubber canister into the receptacle of the BioPak.

7. Repeat steps 1 through 8 for the second canister.

8. Install the center lid onto the BioPak and latch to secure.

9. Date and initial the maintenance tag under CO₂ Cartridges Replaced.
3.9 Constant Flow Test

1. Disconnect the constant add feed line to the center section (smaller of the two pneumatic connections) and connect the test flowmeter from the service kit to the open end of the feed line.

2. Open the oxygen cylinder valve and observe flowmeter while holding it in a vertical and level position. The flowmeter shall indicate a flow as per the table below when reading the center of the flowmeter ball. The table provides flow readings for elevations of sea level to 1600 meters and above 1600 meters.

If the flow does not meet the requirements of the table below, the flow restrictor will need replacement.

<table>
<thead>
<tr>
<th>Cylinder Pressure, bar</th>
<th>Flow 0-1600m, lpm</th>
<th>Flow &gt; 1600m, lpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-150</td>
<td>1.8-2.4</td>
<td>1.9-2.6</td>
</tr>
<tr>
<td>150-207</td>
<td>1.9-2.5</td>
<td>2.0-2.8</td>
</tr>
</tbody>
</table>

3. Enter the measured flow rate, date and initial the maintenance tag under Flow Test ____ lpm.

4. Close the oxygen cylinder valve, remove the test flowmeter and reconnect the constant add feed line to the center section.

3.10 Low Pressure Leak Test / Positive Pressure Leak Test

1. Remove the storage plug from the breathing hoses and install the leak test adapter from the service kit.

2. Attach rubber tubing from the service kit between the leak test adapter and the input port of the service kit.

3. Insert two test keys from the service kit in the keyholes in the back of the lower housing.

4. Open the oxygen cylinder valve and depress the bypass valve until the test kit displays a pressure of 8.7 mbar (3.5” water column), then immediately close the oxygen cylinder valve.

5. Activate the emergency bypass valve to empty all gas into the breathing chamber and raise the pressure reading to between 15 and 20 mbar (6 and 8” water column). DO NOT overpressure.

6. After the test gauge stabilizes, note the exact pressure reading of the service kit and allow the apparatus to sit undisturbed for 60-seconds. The apparatus pressure shall not drop
more than 0.2” water column in the 60-second period.

If the oxygen cylinder is not closed the pressure reading will continue to rise and potentially damage the breathing chamber.

If the apparatus pressure drops more than 0.2” in the 60-second there is a leak that must be located and repaired.

7. Remove the leak test adapter to vent the apparatus.
8. Remove the two test keys from the rear of the lower housing.
9. Date and initial the maintenance tag under Low Pressure Leak Test.

3.11 Alarm Test

1. While observing the pressure gauge and TRIM indicator, open the oxygen cylinder valve. The cylinder must be filled with a minimum of 100 bar pressure for this test.
2. When the oxygen cylinder is opened the TRIM indicator shall cycle RED, GREEN, BLUE with the horn sounding. The TRIM will then flash GREEN and the horn will be silent.
3. The pressure gauge will reach full reading in approximately 60-seconds.
4. Close the oxygen cylinder and allow the BioPak to slowly reduce pressure while observing the pressure gauge and LED indications. The LED indication should turn to a flashing red with a horn sounding when the pressure gauge reads between 45-69 bar. The LED indication will cease when the pressure gauge reads under 1.7 bar.
5. Verify that the oxygen cylinder is fully charged to 207 bar and top off if necessary.
6. Date and initial the maintenance tag under O2 Cylinder Replaced/Filled.

3.12 Upper Housing

1. Replace the upper housing onto the apparatus.
2. If the carbon dioxide scrubbers have not been installed into the apparatus then leave the maintenance tag CO2 Cartridges Replaced field blank.

See section 3.8 concerning procedures for pre-packing the carbon dioxide scrubber into the apparatus during turn around maintenance.

3. Tie the completed maintenance tag across the waist belt connector or the carrying handle of the apparatus.
4. Long Term Maintenance Procedure

In addition to normal turn around maintenance, the apparatus shall be visually inspected and pressure tested on a monthly basis, if the apparatus is being used at least once per month; or, quarterly, if the apparatus is used less than once per month or is in long term storage.

A Maintenance Log Sheet is provided in this manual to assist in tracking long-term maintenance procedures.

4.1 Visual Inspection

Remove the upper housing and visually inspect the apparatus for signs of wear, abuse, loose connections or other damage. Repair as necessary.

Verify that the apparatus is properly sealed against the ambient environment by the presence of the storage plug.

4.2 Demand Valve Functional Test

1. Verify that the breathing loop is fully vented of all pressure by removing the storage plug. After all pressure has vented from the breathing loop re-install the storage plug.

2. Open the oxygen cylinder and listen for the sound of gas escaping into the breathing chamber. The sound will last approximately 1-3 seconds. This signals that the demand has properly opened.

3. After 1-3 seconds the sound of gas escaping into the breathing chamber should cease. This signals that the demand valve has properly closed.

The opening pressure of the Demand Valve can be tested by depressing the relief valve. This testing procedure will be demonstrated during Benchman training by an experienced Service Engineer of the local Biomarine Distributor.

4.3 Constant Flow Test

1. Perform the test as described in Section 3.9.

4.4 Vent Valve Functional Test

1. Remove the storage plug, install the leak test adapter and connect the BioPak to the service kit inlet port. Make sure the vent valve of the service kit is closed.

2. Fill the apparatus by depressing the emergency bypass valve in several short bursts. Observe the pressure reading on the service kit. The apparatus pressure should remain at or below 5 mbar (2" water column) pressure after releasing the emergency bypass valve.

4.5 Low Pressure Leak Test

1. Perform the test as described in Section 3.10.

4.6 High Pressure Leak Test

1. Place the apparatus on a flat surface. Ensure that the test keys of the Low Pressure Leak Test have been removed.

2. Open the oxygen cylinder valve and wait until the apparatus pressure gauge has reached its final reading.

3. Inspect each plumbing connection with oxygen safe leak detection fluid by wetting each joint, waiting 60-seconds, then inspecting each joint for the sign of bubble formation. The presence of bubbles will indicate a leak.

4. Repair any leaking joint or replace the leaking components.

5. Close the oxygen cylinder valve and depress the emergency vent valve to depressurize the apparatus.
4.7 Emergency Bypass Valve
   Functional Test

1. Open the oxygen cylinder and depress the emergency bypass valve for 1-2 seconds. The of gas escaping into the breathing shall be heard whenever the valve is depressed and shall cease whenever the valve is released.

2. Close the oxygen cylinder.

4.8 Alarm Test

1. Perform the test as described in Section 3.11.

4.9 Maintenance Tag Validation

1. Inspect the maintenance tag that should be attached to the apparatus waist belt or carrying handle. Verify that all portions of the tag are properly completed.

2. Verify that the apparatus oxygen cylinder is fully charged to 207 bar and top off if necessary.

3. Replace the upper housing.
5. General Service Procedures

5.1 Scheduled Component Inspection

Breathing Diaphragm:

*Annually,* remove the center section and disconnect the diaphragm from the center section by loosening the clamp. Inspect the diaphragm for signs of wear, cracking or rot. Disassemble the vent valve and inspect all components and lubricate as needed. Reference the parts list for proper diaphragm alignment.

Facemask: Inspect all rubber components for signs of wear, tears, rips, cracking or rot.

Breathing Hoses: Inspect for signs of wear, tears, rips, cracking or rot.

O-ring Seals: If the apparatus has passed the high and low pressure leak tests the o-ring integrity is acceptable. It is recommended to perform full system lubrication on an annual basis. Otherwise inspect o-rings at intervals of:

<table>
<thead>
<tr>
<th>O-Ring Description</th>
<th>Uses or Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Section</td>
<td>25 uses annually</td>
</tr>
<tr>
<td>Vent Valve</td>
<td>50 uses annually</td>
</tr>
<tr>
<td>Other</td>
<td>annually</td>
</tr>
</tbody>
</table>

5.2 System Lubrication

Leaks discovered during high and low pressure testing are often caused by damaged or improperly lubricated o-rings. Replace faulty o-rings and follow the guides below for o-ring handling and lubrication.

- Never pry o-rings from glands with a screwdriver. Remove o-rings by hand or using the pick tool provided in the service kit.
- Unless otherwise directed, do not lubricate o-rings while they are still seated within their gland.
- Do not use heavy coats of lubrication. Proper o-ring lubrication will result in a shiny surface without lumps.
- Do not stretch or deform o-rings during handling.
- Visually and by feel, inspect o-ring for signs of damage such as nicks, cuts, tears or abrasion.
- Christo-Lube™ and Dow 111™ are the only lubricants approved for use in the apparatus.
- NEVER lubricate the sealing washer that sits between the oxygen cylinder and the pressure regulator.

5.3 Oxygen Cylinder

The cylinder should be inspected regularly for signs of damage to the outer wrapping. Cylinders that are cracked, flaking or show exposed fibres should be immediately retired from service.

Cylinders will require periodic hydro-static testing per national requirements. Typical intervals are every 5-years from the date of manufacture. Cylinder testing should be conducted by an authorized testing facility.

Cylinders that have been hydro-static testing shall be cleaned for high-pressure oxygen service as per national standards.

Cylinders are to be retired from service 15-years after the date of manufacture.

5.4 Alarm Battery Replacement Procedure

The alarm system battery shall be replaced after 200-hours of use, after 6-months or after the alarm system low battery alarm (RED, GREEN, BLUE) lashes with corresponding horn sounding, whichever occurs first.

1. Remove the upper cover.
2. Disconnect the electrical line to the center section.
3. Use two 7/16” wrenches from the service kit to remove the light guide from the alarm monitor housing. DO NOT allow the fitting anchored to the alarm housing to rotate.
4. Remove the alarm housing from the apparatus. Inspect the housing for cracks or damage. Dust-tight and water-tight integrity are required for use in potentially explosive atmospheres. The alarm module will require replacement if any damage to the housing is discovered.

5. Remove the battery cover. Inspect the cover and gasket for cracks or damage. The battery cover door will need to be replaced if any damage is found.

6. Remove the battery from the alarm housing and replace with a fresh battery. Inspect the interior of the battery compartment for the presence of corrosion, liquid or dust. Clean if necessary or replace the alarm module.

Use only battery types as specified for replacement.

7. Replace the battery cover making sure that the gasket is properly positioned and that the gasket is not damaged in any way.

8. Install the alarm housing into the apparatus.

9. Use two 7/16” wrenches from the service kit to install the light guide from the alarm monitor housing. DO NOT allow the fitting anchored to the alarm housing to rotate.

10. Connect the electrical line from the center section to the alarm housing.

11. Conduct the Alarm Test as described in section 3.10.

12. Install the upper housing.

5.5 Flow Restrictor Replacement Procedure

1. Remove the upper housing.

2. Use the ¼” hex driver from the service kit to the remove the flow restrictor.

3. Use the ¼” hex driver from the service kit to the install a replacement flow restrictor.

4. Perform the high-pressure leak test as directed in long term maintenance.

5. Perform the constant add test as directed in turn around maintenance.

6. Replace the upper housing.

5.6 Factory Service and Training

Factory service and personnel User and/or Benchman Training can be provided by contacting the location listed below or by contacting your Indian Distributor.

Power Tech Mining Pvt. Ltd.
27, G. T. Road, Fathepur
Sitarampur-713359
Asansol, Burdwan
West Bengal, INDIA

Ph. No. +91 341 225 9180
Ph. No. +91 341 225 7031
Ph. No. +91 993 305 3744
Fax No. +91 341 225 4763
Fax No. +91 341 225 7031

e-mail: shantanu_powertech@yahoo.com

e-mail: shantanu.choudhury@powertechmining.net

Website: www.powertechmining.net

Contact the local distributor prior to returning any equipment and provide the following information:

- Apparatus Model Number
- Apparatus Serial Number
- Date of purchase
- Approximate number of uses
- Description of problem
- Actions taken to correct problem
- Contact name, address and phone number with area or country code and email address

Please provide your current email address with all service correspondence.
6. STORAGE GUIDELINES
Follow the guidelines below for proper storage of the apparatus.

- Storage plug shall be installed.
- Never store a wet apparatus. The apparatus shall be fully dry before storage.
- Never store an apparatus that has not been fully cleaned and disinfected.
- Store in a location free from impact that could cause damage to the apparatus.
- Store in the stated conditions of ambient temperature, relative humidity and air pressure.
- Store in a location that will not submerge the apparatus.
- Store in case that may be supplied by Biomarine Inc.
# 7. PARTS LIST

## 7.1 Top Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>-</td>
<td>B7-07-2401-21-0</td>
<td>BioPak 240R Respirator-IN,ST,BW,H</td>
</tr>
<tr>
<td>REF</td>
<td>-</td>
<td>B7-07-2401-22-0</td>
<td>BioPak 240R Respirator-IN,FR,BW,H</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5002-17-0</td>
<td>Facemask Anti-Fog Agent, 2-ounce Spray</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>---</td>
<td>AV3500 Facemask Assembly-See Section 7.3</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B6-02-5002-18-1</td>
<td>Upper Housing Assembly</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>B2-02-4000-39-0</td>
<td>Coolant Lid</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>B6-02-5002-37-0</td>
<td>Ice Canister</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>B2-02-7001-09-0</td>
<td>Breathing Hose Set-See Section 7.3</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>B6-02-5002-04-0</td>
<td>Center Section Lid Assembly-See Section 7.4</td>
</tr>
<tr>
<td>8a</td>
<td>1</td>
<td>B6-02-5003-69-0</td>
<td>Reduced Mass CO₂ Scrubber</td>
</tr>
<tr>
<td>8b</td>
<td>1</td>
<td>B6-02-5003-06-0</td>
<td>Refillable CO₂ Scrubber Canister-See Section 7.14</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>B6-02-5002-07-1</td>
<td>Center Section Assembly-See Section 7.5</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>---</td>
<td>Pneumatic Assembly-See Section 7.7</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>B6-01-5000-05-0</td>
<td>Alarm Monitor-See Section 7.9</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>B6-02-5002-06-0</td>
<td>Black/White Oxygen Cylinder, Empty-See Section 7.10</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>B6-02-5003-81-0</td>
<td>Lower Housing Assembly-See Section 7.11</td>
</tr>
<tr>
<td>15a</td>
<td>1</td>
<td>B2-02-7001-25-0</td>
<td>Harness Assembly-Standard</td>
</tr>
<tr>
<td>15b</td>
<td>1</td>
<td>B2-02-7001-24-0</td>
<td>Harness Assembly-Flame Rated</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>B6-02-5002-40-0</td>
<td>Ice Canister Freeze Form-See Section 7.15</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>B5-06-6000-40-0</td>
<td>User Manual-ENGLISH</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>B5-06-6000-41-0</td>
<td>Benchman Manual-ENGLISH</td>
</tr>
<tr>
<td>19a</td>
<td>opt.</td>
<td>B6-02-5002-63-0</td>
<td>Hard Transit Case (not depicted)</td>
</tr>
<tr>
<td>19b</td>
<td>opt.</td>
<td>B2-02-7000-39-0</td>
<td>Soft Transit Case (not depicted)</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>B2-02-4001-50-0</td>
<td>Storage Plug</td>
</tr>
<tr>
<td>21a</td>
<td>1</td>
<td>B6-02-5002-54-0</td>
<td>Cylinder Fill Adapter, CGA 540 Male</td>
</tr>
<tr>
<td>21b</td>
<td>1</td>
<td>B6-02-5002-55-0</td>
<td>Cylinder Fill Adapter, CGA 540 Female</td>
</tr>
<tr>
<td>21c</td>
<td>1</td>
<td>B6-02-5002-53-0</td>
<td>Cylinder Fill Adapter, G ¾-A Male</td>
</tr>
<tr>
<td>21d</td>
<td>1</td>
<td>B6-02-5002-66-0</td>
<td>Cylinder Fill Adapter, fits Drager Booster Pump</td>
</tr>
<tr>
<td>22</td>
<td>opt.</td>
<td>B6-02-5002-41-0</td>
<td>Phase Change Heat Exchanger (PCM)</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>B2-02-7001-07-0</td>
<td>Moisture Absorbent Pad Set</td>
</tr>
</tbody>
</table>

**Note:**

1. The BioPak 240R respirator is supplied with a cardboard/foam shipping box. Hard or soft transit cases are to be ordered separately. Reference the below listed key for BioPak configuration as listed above.

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>Supplied as DGMS Certified</td>
</tr>
<tr>
<td>ST</td>
<td>Supplied with Standard (non-flame rated) Harness</td>
</tr>
<tr>
<td>FR</td>
<td>Supplied with Flame Rated Harness</td>
</tr>
<tr>
<td>BW</td>
<td>Supplied with Black/White Oxygen Cylinder, certified to PED, DOT &amp; TC</td>
</tr>
<tr>
<td>H</td>
<td>Remote gauge supplied with bar pressure unit markings and hour time markings</td>
</tr>
</tbody>
</table>

2. Reduced Mass CO₂ Scrubbers are supplied four (4) uses per case.
7.2 AV3500 Facemask Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>-</td>
<td>B6-02-5002-14-1</td>
<td>Complete AV3500 Facemask-Small</td>
</tr>
<tr>
<td>REF</td>
<td>-</td>
<td>B6-02-5002-14-2</td>
<td>Complete AV3500 Facemask-Medium</td>
</tr>
<tr>
<td>REF</td>
<td>-</td>
<td>B6-02-5002-14-3</td>
<td>Complete AV3500 Facemask-Large</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B2-02-4001-26-0</td>
<td>Interface Tube</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B2-06-6001-34-0</td>
<td>Adapter Gasket¹</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B6-02-5003-04-0</td>
<td>Adapter Piece</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>B2-02-3300-88-0</td>
<td>Retaining Clip²</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>B2-02-4001-54-0</td>
<td>Push Button</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>B2-02-4001-60-0</td>
<td>Cowling</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>B3-01-1061-07-1</td>
<td>Locking Attachment Screws</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>B6-03-5003-08-0</td>
<td>Magnetic Wiper with Lanyard³</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>B2-02-7001-49-0</td>
<td>Condensation Pad⁴</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>B2-06-6001-70-0</td>
<td>Facemask Storage Bag (not depicted)</td>
</tr>
</tbody>
</table>

Note:

1. Adapter Gasket, item 2, does NOT require lubrication.
2. Coat ends of retaining clip, item 4, with DOW-111 lubricant prior to installation.
3. Moisten pads of wiper, item 8, before use to avoid scratching mask lens. Lanyard free end is to attach to center top mask head harness D-ring.
4. Condensation pad, item 9, is to be installed interior to mask underneath nose cup in chin area.

---

AV3500 Facepiece Adapter Assembly
See Section 7.3

---

Connect to top dead center facemask head harness D-ring
### 7.3 Breathing Hose Set

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>B6-02-5003-15-0</td>
<td>Breathing Hose Set¹</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5003-01-0</td>
<td>Mask Adapter Assembly²</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B4-04-7060-25-0</td>
<td>Mask Adapter O-Ring³</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>B2-02-7001-11-0</td>
<td>Check Valve⁴</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>B2-06-6002-58-0</td>
<td>Mask End Hose Clamp</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>B2-02-7001-09-0</td>
<td>Breathing Hose</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>B2-02-4101-22-0</td>
<td>Anti-Crush Ring</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>B2-06-6000-01-0</td>
<td>BioPak End Hose Clamp</td>
</tr>
</tbody>
</table>

Note:

1. The Complete Breathing Hose Set includes all depicted items.
2. The Mask Adapter Assembly, item 1, includes the check valves and o-ring, items 2 and 3.
3. Lubricate the O-Ring, item 2, with Dow 111, B5-01-3000-11-0, prior to use.
4. DO NOT lubricate the check valves, item 3.
### 7.4 Center Section Lid Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>B6-02-5002-04-0</td>
<td>Center Section Lid Assembly-Complete</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>B2-02-4000-39-0</td>
<td>Coolant Lid</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B6-02-5002-27-0</td>
<td>Center Section Lid¹</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B2-02-4000-72-1</td>
<td>Flow Baffle</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>B3-01-3064-00-1</td>
<td>#6 x 1/2&quot; Self-Tapping Screws</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>B2-02-3100-17-0</td>
<td>Slide Fastener</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>B2-06-6000-06-0</td>
<td>Slide Top Washer</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>B2-06-6000-04-0</td>
<td>Slide Mechanism</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>B2-06-6000-05-0</td>
<td>Slide Guide Plate</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>B3-03-1023-01-0</td>
<td>Slide Bottom Washer</td>
</tr>
<tr>
<td>10</td>
<td>8</td>
<td>B3-01-1022-01-0</td>
<td>Slide Fastening Screw</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>B6-02-5002-92-0</td>
<td>Slide Kit²</td>
</tr>
</tbody>
</table>

**Note:**

1. Center Section Lid, item 2, is supplied with slide mechanisms installed, coolant shells installed, center section washers and instruction manual for installation. The baffle and coolant lids are not supplied.

2. Slide Kit, item 11, will supply one each of items 5 through 10.
### 7.5 Center Section Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>B6-02-5002-07-1</td>
<td>Center Section Assembly-Complete</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B4-04-7060-20-0</td>
<td>Lid O-Ring</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B6-02-5002-24-0</td>
<td>Demand Feed Tube</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>B3-02-0040-00-0</td>
<td>#4-40 Locking Hex Nut</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>B6-02-5002-71-1</td>
<td>Center Section Body Assembly ^5</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>B4-04-7070-03-1</td>
<td>Constant Add Fitting O-Ring ^2</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>B2-02-3300-06-0</td>
<td>Constant Add Fitting ^3</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>B2-02-3300-48-0</td>
<td>Demand Add Fitting ^4</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>B4-04-7060-01-1</td>
<td>Demand Add Fitting O-Ring ^2</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>B2-02-7001-10-0</td>
<td>Demand Valve Gasket ^4</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>B6-02-5002-23-0</td>
<td>Demand Valve Assembly</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>B3-01-0043-00-0</td>
<td>#4 x 3/8&quot; Sealed Flat Head Screw ^4</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>B6-02-5002-05-0</td>
<td>Diaphragm Assembly, See Section 7.8</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>B2-06-6001-47-0</td>
<td>Diaphragm Clamp</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>B4-03-5204-08-0</td>
<td>#10 x 1/8&quot; Tube Male Connector Fitting</td>
</tr>
</tbody>
</table>

**Note:**

1. Indicated components require lubrication with Dow-111 O-Ring Lubricant, B5-01-3000-11-0 prior to installation.
2. Indicated components require lubrication with Christo-Lube O-Ring Lubricant, B5-01-3000-01-0 prior to installation.
3. Install indicated components to a torque of 25-30 in-lbs.
4. Indicated components shall be installed with no lubricant.
5. Center Section Body Assembly, item 4, includes all depicted components with the exception of diaphragm, item 12, and diaphragm clamp, item 13.
### 7.6 Diaphragm Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>B6-02-5002-05-0</td>
<td>Diaphragm Assembly-Complete</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5002-19-0</td>
<td>Flexible Diaphragm</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B2-02-0000-08-0</td>
<td>Vent Cap</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B4-04-7060-05-1</td>
<td>Vent Body O-Ring(^1)</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>B2-02-4100-03-0</td>
<td>Vent Body(^2)</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>B4-04-7060-04-1</td>
<td>Vent Seat O-Ring(^1)</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>B2-06-6001-53-0</td>
<td>Vent Valve Spring</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>B2-02-4000-89-1</td>
<td>Vent Valve Seat</td>
</tr>
</tbody>
</table>

**Note:**

1. Indicated components shall be lubricated with Dow-111 O-Ring Lubricant, B5-01-3000-11-0, prior to installation.
2. Install Vent Body, item 4, hand tight.
### 7.7 Pneumatic Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>---</td>
<td>Pneumatic Assembly</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5002-31-0</td>
<td>Bypass Feed Tube</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B6-02-5002-32-0</td>
<td>Bypass Return Tube</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B6-02-5002-30-0</td>
<td>Oxygen Feed Tube</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>B6-02-5002-03-1</td>
<td>Constant Add Center Section Feed Tube</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>B6-02-5002-02-1</td>
<td>Demand Add Center Section Feed Tube</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>B4-04-5000-00-0</td>
<td>Bypass Valve Push Button</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>B4-04-6570-00-0</td>
<td>Bypass Valve</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>B6-02-5002-00-1</td>
<td>Manifold Assembly, See Section 7.8</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>B6-02-5002-26-1</td>
<td>Oxygen Regulator Assembly</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>B6-02-5002-43-0</td>
<td>Remote Gauge Shut Off Valve Assembly</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>B6-02-5002-45-6</td>
<td>Remote Gauge Assembly-bar/hour</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>B6-02-5002-44-0</td>
<td>Remote Gauge Feed Tube Assembly</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>B4-04-0030-00-0</td>
<td>Cylinder Seal Washer</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>B2-02-3300-14-0</td>
<td>Bypass Valve Spring</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>B4-04-7070-02-1</td>
<td>Constant Add Tube O-Ring</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>B4-04-7070-00-1</td>
<td>Demand Add Tube O-Ring</td>
</tr>
</tbody>
</table>

Note:

1. Oxygen Regulator, Item 9, is supplied as a complete assembly only. Regulator will mount to BioPak lower housing with two #8 x 3/8” Self-Tapping Screws, B3-01-4071-00-0

2. Bypass valve spring, item 14, is to install between the bypass valve and the bypass valve push button. Spring shall seat around the actuator stem of the bypass valve.

3. Indicated components require lubrication with Christo-Lube O-Ring Lubricant, B5-01-3000-01-0, prior to installation.
Low Pressure Warning Area (Red in Color)

bar/hour Gauge Dial Face
Item 11
## 7.8 Manifold Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>B6-02-5002-00-1</td>
<td>Manifold Assembly-Complete³</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5002-21-1</td>
<td>Manifold Block w/ Pressure Switch &amp; Fittings</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B6-02-5002-50-1</td>
<td>Flow Restrictor Assembly-Complete</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>B4-03-5203-01-0</td>
<td>Swivel Elbow Fitting¹</td>
</tr>
</tbody>
</table>

Note:

1. Fittings, Item 5, are supplied on spare tube assemblies.
2. Manifold assembly mounts to lower housing of BioPak using two each of #6 x 3/8" screws, B3-01-1061-01-1, and tooth washers, B3-03-3063-00-0.
7.9 Alarm Monitor

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>B6-01-5000-05-0</td>
<td>Monitoring System Complete</td>
</tr>
<tr>
<td>1,2,3,4</td>
<td>1</td>
<td>B6-02-5002-51-0</td>
<td>Battery Door-Complete</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B2-02-1300-20-0</td>
<td>Battery Door</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B2-02-7001-16-0</td>
<td>Battery Door Gasket</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B2-02-4001-11-0</td>
<td>Battery Door Warning Label</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>B2-02-3000-07-0</td>
<td>Battery Door Captive Screw</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>B1-14-2000-00-0</td>
<td>9Vdc Battery</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>B1-10-3000-03-0</td>
<td>Temperature Sensor Cable (not depicted)</td>
</tr>
</tbody>
</table>

Note:

1. Only the below listed battery types are suitable for use in the Monitoring System. Use of any other battery type will void intrinsic safety rating and certification.

   Energizer #522
   Panasonic #6AM6
   Rayovac #A1604
   Duracell #MN1604
## 7.10 Oxygen Cylinder Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>1</td>
<td>B6-02-5002-06-0</td>
<td>Black/White Cylinder Assembly-Empty</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B2-01-2000-06-1</td>
<td>Black/White Cylinder</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B4-04-7060-00-0</td>
<td>Exterior O-Ring</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B2-02-3300-52-1</td>
<td>Valve Collar</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>B4-04-7060-07-2</td>
<td>Interior O-Ring</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>B6-02-5001-97-0</td>
<td>Valve Assembly</td>
</tr>
</tbody>
</table>

Note:

1. Indicated O-Rings, require lubrication with Christo-Lube Lubricant, B5-01-3000-01-0, prior to installation.
2. Valve Assembly, Item 5, includes valve plus components numbered Item 2 through Item 4. The Valve Assembly shall be installed into the cylinder at a torque of 60 +/- 1 foot-pound.
## 7.11 Lower Housing Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5003-82-0</td>
<td>Lower Housing Shell</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>B2-02-3300-46-1</td>
<td>Diaphragm Springs</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B2-02-4000-68-0</td>
<td>External Oxygen Knob</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>B3-01-1071-03-0</td>
<td>Short Harness Fastening Screws</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>B3-01-0008-00-0</td>
<td>½-Turn Center Section Hold Down Pins</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>B3-03-1073-00-0</td>
<td>Harness Mounting Washers</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>B3-01-4071-00-0</td>
<td>Oxygen Regulator Mounting Screw</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>B3-01-1081-01-1</td>
<td>Manifold Mounting Screw</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>B3-03-3063-00-0</td>
<td>Manifold Mounting Washer</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>B2-02-7001-30-0</td>
<td>Latch Foam Pad</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>B3-01-1042-00-0</td>
<td>Remote Gauge Mounting Screw</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>B2-02-1100-10-0</td>
<td>Remote Gauge Mounting Bracket</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>B3-03-3043-00-0</td>
<td>Remote Gauge Tooth Washer</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>B2-02-7001-21-0</td>
<td>Oxygen Cylinder Hold-Down Strap</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>B2-02-4001-29-1</td>
<td>Kevlar Carrying Handle</td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>B3-01-1071-01-0</td>
<td>Long Harness Mounting Screw</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>B3-02-0040-00-0</td>
<td>Remote Gauge Hex Nut</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>B2-02-1300-05-0</td>
<td>Regulator Support Plate</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>B2-02-1300-29-0</td>
<td>Regulator Support Tube</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>B2-02-1100-11-0</td>
<td>Oxygen Knob Retaining Bracket</td>
</tr>
</tbody>
</table>

Note:

1. Diaphragm Springs, Item 2, install into lower housing by threading onto spring retainer projections.
2. External Oxygen Knob, Item 3, is secured into lower housing with bracket, Item 22.
3. Indicated components are to be installed from the external side of the lower housing shell.
4. Oxygen Bottle Strap, item 16, is to be threaded through the lower housing shell slots for installation.
5. Lower Housing Shell, Item 1, includes the DGMS certification label and hose color-coding.
### 7.12 Service Kit Assembly

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>---</td>
<td>B6-02-5003-79-0</td>
<td>Indian Test Kit-Complete</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5002-57-0</td>
<td>Replacement Case Assembly¹</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B6-02-5002-15-0</td>
<td>Flow Test Fixture</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>B6-02-5000-17-2</td>
<td>Test Key Tool</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>B2-03-3000-01-0</td>
<td>Vent Valve Hand Wrench</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>B2-06-6002-60-0</td>
<td>Demand Port Wash Plug⁺</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>B2-02-5400-04-0</td>
<td>Regulator Wash Plug</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>B2-03-1000-10-0</td>
<td>Combination Pick Tool</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>B2-03-1000-15-0</td>
<td>#00 Phillips Head Screwdriver</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>B2-03-1000-03-0</td>
<td>#1 Phillips Head Screwdriver</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>B2-03-1000-16-0</td>
<td>#2 Phillips Head Screwdriver</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>B2-03-1000-17-0</td>
<td>¼&quot; Hex Driver</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>B2-03-1000-09-0</td>
<td>3/16&quot; Nut Driver</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>B2-03-1000-12-0</td>
<td>5/16&quot; Nut Driver</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>B2-03-1000-04-0</td>
<td>3/8&quot; x 5/16&quot; Open End Wrench</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>B2-03-1000-06-0</td>
<td>7/16&quot; Combination Wrench</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>B2-03-1000-13-0</td>
<td>½&quot; Combination Wrench</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>B2-03-1000-05-0</td>
<td>5/8&quot; x 9/16&quot; Open End Wrench</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>B5-01-3000-03-0</td>
<td>Oxygen Safe Leak-Tec Leak Detection Fluid, 8 ounces</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>B2-02-7001-28-0</td>
<td>Tool Pouch</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>B4-02-6037-00-0</td>
<td>3/8&quot; OD Rubber Tubing²</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>B2-03-1000-20-0</td>
<td>Stop Watch</td>
</tr>
<tr>
<td>24</td>
<td>opt.</td>
<td>B2-03-3000-08-0</td>
<td>Bypass Valve Tool³</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>B2-03-1000-21-0</td>
<td>9/32&quot; Nut Driver</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>B6-02-5003-00-0</td>
<td>PRO Leak Check Adapter Fitting</td>
</tr>
<tr>
<td>27</td>
<td>1</td>
<td>B2-03-1000-22-0</td>
<td>1/8&quot; Slotted Screwdriver</td>
</tr>
<tr>
<td>28</td>
<td>1</td>
<td>B2-03-1000-01-0</td>
<td>3/16&quot; Slotted Screwdriver</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>B2-03-1006-00-0</td>
<td>3/32&quot; T-Handle Hex Key</td>
</tr>
</tbody>
</table>

**Note:**

1. Replacement Case Assembly, item 1, includes the tool kit case complete with internal pressure gauge and associated plumbing plus external shipping box.
2. Order a minimum length of 6-feet of tubing, item 22. Longer lengths are available upon request.
3. The Bypass Valve Tool, item 24, is not supplied with the Tool Kit. The tool is utilized for installation and removal of the entire bypass valve assembly.
4. A total of eight (8) Demand Port Wash Plugs, item 7, are supplied with the tool kit.
### 7.13 Coolant Canister Freeze Form

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>---</td>
<td>B6-02-5002-40-0</td>
<td>Ice Canister Freeze Form-Complete</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B6-02-5002-58-0</td>
<td>Base Assembly</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B2-02-4001-46-0</td>
<td>Freeze Tube</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>B2-02-1100-06-0</td>
<td>Top Plate</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>B3-02-4100-00-0</td>
<td>Wing Nut</td>
</tr>
</tbody>
</table>

**Note:**

1. Earlier versions of the freeze form will have four (4) wing nuts instead of the depicted three (3) wing nuts. Either version will function as desired.
7.14 Refillable Carbon Dioxide Scrubber Canister

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>QTY.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>---</td>
<td>B6-02-5003-06-0</td>
<td>Refillable Carbon Dioxide Scrubber Canister</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>B4-04-7070-15-0</td>
<td>O-Ring Gasket¹</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>B2-02-4001-65-0</td>
<td>Housing</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>B2-02-4001-67-0</td>
<td>Inlet Filter</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>B2-02-4001-74-0</td>
<td>Outlet Filter Foam</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>B2-02-4001-64-0</td>
<td>Lid</td>
</tr>
</tbody>
</table>

Note:

1. O-ring, Item 1, requires lubrication with DOW-111, B5-01-3000-11-0.
7.15 Miscellaneous Supplies

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal Kit (includes all replacement seals &amp; lubricants)</td>
<td>B6-02-5002-14-0</td>
</tr>
<tr>
<td>Seal Kit (includes all replacement seals without lubricants)</td>
<td>B6-02-5002-14-1</td>
</tr>
<tr>
<td>Christo-Lube O-Ring Lubricant (2-ounce tube)</td>
<td>B5-01-3000-01-0</td>
</tr>
<tr>
<td>Dow-111 O-Ring Lubricant (5.3-ounce tube)</td>
<td>B5-01-3000-11-0</td>
</tr>
<tr>
<td>Oxygen Safe Leak-Tec Leak Detection Fluid (8-ounce bottle)</td>
<td>B5-01-3000-03-0</td>
</tr>
<tr>
<td>Disinfectant (75 single-use packets)¹</td>
<td>B6-02-5000-42-0</td>
</tr>
</tbody>
</table>

7.16 Optional Attachments

**Breathing Hose Protective Sleeve, B2-02-7001-22-0:** A Kevlar sleeve that will slide over the exterior of the breathing hose to provide abrasion protection.

**Phase Change Heat Exchanger, B6-02-5002-41-0:** A wedge-shaped canister that will fit between the ice canister housings internal to the respirator breathing chamber. This canister is required whenever the BioPak is utilized without the ice canisters.

**Hard Transit Case, B6-02-5002-63-0:** An injection molded-style carrying/storage case that provides exceptional BioPak 240R storage capabilities.

**Soft Transit Case, B2-02-7000-39-0:** An armored cloth-style carrying/storage case that provides a shoulder strap. Soft case is smaller and lighter than hard case but will not provide the same protection or storage space as the standard hard case.

**Hydration System, B6-02-5002-52-0:** The Hydration System provides a 1.5-liter reservoir and an interface to the AV3000 facemask that will enable the user to drink liquid without breaking the breathing loop seal to the external ambient atmosphere.
8. APPARATUS SPECIFICATIONS

Respirator Type: Self-Contained, Closed-Circuit, Pressure-Demand
Respirator Duration: Certified as entry and escape, 4-hour duration
Size: 584 x 439 x 178 mm
Weight (Fully Charged): 15.0 kg Maximum

Operational Conditions:
- Temperature (4-hour Duration): -5°C to 60°C
  (Reference table of recommended durations in User Manual at higher temperatures)
- Air Pressure: 900 to 1200 hPa
- Relative Humidity: 0 to 100%

Storage Conditions:
- Temperature: 4°C to 50°C
- Air Pressure: 900 to 1200 hPa
- Relative Humidity: 30 to 100%

Oxygen Delivery:
- Constant Add: 1.8 lpm Average
- Demand Add: 80 lpm Minimum
- Emergency Add: 80 lpm Minimum

Oxygen Supply:
- > 99.5% Oxygen by volume
- < 300 ppm Carbon Dioxide
- < 10 ppm Carbon Monoxide
- 50 mg/m³ Water Content Maximum
- Tasteless and Odorless
- 440 liter storage at 207 bar pressure

Battery:
- Power: 9 Vdc
- Life: 200-hours or six months
- Type: Only the below types may be used
  - Energizer 522
  - Panasonic 6AM6
  - Rayovac A1604
  - Duracell MN1604

Carbon Dioxide Scrubber:
- Dual, single use “Solid-Core” canisters
- Non-dusting
- Non-settling
- Non-channeling

Refillable Carbon Dioxide Canisters:
- Provided with each BioPak as dual canisters that will accept granular carbon dioxide absorption media.
- Biomarine Inc. makes no claims concerning the performance of user-supplied carbon dioxide granular media. Biomarine Inc. recommends the use of 1475-grams (minimum) of Intersurgical® Spherasorb 408 mesh carbon dioxide absorbent in each canister.

Tidal Volume: 6.0 liters

Manufacturer: Biomarine Inc.
- A Wholly Owned Subsidiary of Neutronics Inc.
- (formerly named Biomarine-Ntron Inc.)
9. MAINTENANCE LOG SHEET

BioPak Model: BioPak 240R

BioPak Serial Number:

<table>
<thead>
<tr>
<th>Date</th>
<th>Turn Around Maintenance</th>
<th>Long Term Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visual Inspection</td>
<td>Demand Valve Functional Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Constant Flow Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low Pressure Leak Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High Pressure Leak Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bypass Valve Functional Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alarm Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintenance Tag Validation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Comments, Benchman Signature</td>
</tr>
</tbody>
</table>

Page 40 of 42
APPENDIX A: DGMS Approval Letter

[Image of the DGMS Approval Letter]

No S 65019/1/2010-Gen/ 2 2 3 8 Dhanbad, dated the 28-9-2010

From
The Director General of Mines Safety
Dhanbad – 826 001

To
M/s Biomarine Nitron Inc.,
456 Creamery Way
Exton, P.A. 19341
USA

Subject: Approval of Self Contained Oxygen Breathing Apparatus (closed circuit positive pressure) model BIOPAK 240 R manufactured by M/s Biomarine Nitron Inc., USA.

Dear Sirs,

Please refer to your letter no. Nil dated 16.8.2010 on the above subject.

Based on the reports of Practical Performance tests conducted by the Rescue Stations at Sitarampur and Ramgarh and the test reports from Central Mining & Fuel Research Institute, Dhanbad, I by virtue of powers conferred on me under Rule 11(5) of Mines Rescue Rules, 1985, hereby approve Self Contained Oxygen Breathing apparatus (closed circuit positive pressure) model BIOPAK 240 R manufactured by M/s Biomarine Nitron Inc., USA for use in all type of mines in India upto two years i.e. 30.9.2012, subject to the compliance of the following conditions:

1.0 Every apparatus shall strictly conform in every respect to the apparatus which has been tested at CMMR, Dhanbad and tried at Mines Rescue Stations.

2.0 No alteration in design or construction shall be made except with the prior approval in writing of the Director-General of Mines Safety.

3.0 You shall carry out in your works such tests & inspections and shall maintain such records as may be necessary to ensure the quality of the product.

4.0 Every apparatus shall be supplied with:
   
   (a) a certificate to the effect that the unit being supplied has been tested and found suitable for use;
   
   (b) written instructions regarding proper use, care, operation and maintenance of the same;
   
   (c) a copy of this approval letter;
5.0 Approval mark of DGMS, a copy of which is enclosed shall be stamped/etched in conspicuous place on the apparatus. Your approval number is SA-10/2010.

6.0 The apparatus shall be marked by punching or engraving with the following information:
   (a) Month & year of manufacture.
   (b) Identification number.
   (c) Such other details as may be necessary.

7.0 An Officer of DGMS or of the Testing Laboratory may at any time draw samples either from the factory or from the user and get them tested at the cost of manufacturer. If the test reports are not satisfactory, this approval shall be deemed to have been revoked with immediate effect.

8.0 (a) A quarterly return showing the number of orders received and number supplied giving full name and address of the user shall be submitted to this Directorate.

   (b) Any complaint from the consumer(s) about quality of the apparatus shall be expeditiously attended to and brought to the notice of this Directorate immediately. For this purpose an efficient after sales-technical service shall be developed to help the consumer in proper maintenance and care of the apparatus and procurement of spares.

9.0 This approval is subject to following additional conditions:
   (a) This approval is being granted without prejudice to any other provision of any statute, which may be or may become applicable at any time.
   (b) The approval may be amended or withdrawn at any time, if considered necessary in the interest of safety.
   (c) If, at any time, any of the conditions subject to which this approval has been granted is violated or not complied with, the approval shall be deemed to have been revoked with immediately effect.

Yours faithfully,

Sd/-
(S. J. Saha)
Director General of Mines Safety

No. S 65/19/1/2010-Gen/ 2239, Dhanbad, dated 29-9-2010

Copy forwarded for information and necessary action to M/s Power Tech Mining Pvt Ltd., 27, Eathpur, G.T. Road, Silarmpur – 713359, Asansol, Dist. Burdwan (West Bengal).

(S. J. Saha)
Director General of Mines Safety