

BIOPAK 240 REVOLUTION



BioPak 240R-NIOSH

Closed-Circuit, Self-Contained Breathing Apparatus

User Instructions

CERTIFICATION APPROVALS	3
Respirator NIOSH Approval Label	3
ExtendAir® CO ₂ Chemical Scrubber NIOSH Approval Label	4
OrbSorb® CO ₂ Chemical Scrubber NIOSH Approval Label	4
RMS MSHA Electrical Approval	5
CAUTIONS AND LIMITATIONS	6
S-SPECIAL OR CRITICAL USER'S INSTRUCTIONS	6
1. INTRODUCTION	9
1.1 Breathable Oxygen	9
1.2 Apparatus Duration	9
1.3 Personnel Training	9
1.4 Servicing	9
1.5 Spare Parts	10
2. APPARATUS DESCRIPTION	10
2.1 General	10
2.2 Harness	10
2.3 Housing	10
2.4 Breathing Loop	10
2.5 Oxygen Delivery System	11
2.6 Oxygen Cylinder	11
2.7 Alarming System	11
2.8 Facemasks	12
2.9 Optional Attachments	12
3. PREPARATION FOR USE	13
3.1 Maintenance Tag Inspection	13
3.2 Mask Preparation	13
3.3 Moisture Sponge Preparation	13
3.4 PCM Installation	13
3.5 OrbSorb® Carbon Dioxide Scrubber Installation	14
3.6 Breathing Chamber Lid Installation	14
3.7 Coolant Canister Installation	15
4. DONNING THE APPARATUS	16
4.1 Donning the Apparatus	16
4.2 Donning the Facemask	16
4.3 Activate Oxygen Supply	17
5. PRACTICAL USE	18
5.1 Breathing the Apparatus	18
5.2 Speaking	18
5.3 Alarming System	18
5.4 Coolant Replacement	18
5.5 Emergency Bypass	18
5.6 Emergency Operation	18
5.7 Low Temperature Operation	19
5.8 Facemask Fogging	19
6. DOFFING THE APPARATUS	19
6.1 Doffing Instructions	19
7. APPARATUS SPECIFICATIONS	20
8. WARRANTY	21

CERTIFICATION APPROVALS

Respirator NIOSH Approval Label:



456 CREAMERY WAY, EXTON, PA 19341-2532 USA
PHONE: (610) 524-8800; FAX: (610) 524-8807; WEB: www.BioPak240R.com

BioPak 240R

CLOSED-CIRCUIT, PRESSURE-DEMAND, ENTRY AND ESCAPE, SELF-CONTAINED BREATHING APPARATUS

THESE RESPIRATORS ARE APPROVED ONLY IN THE FOLLOWING CONFIGURATIONS:

RESPIRATOR COMPONENTS			JMMOS	JMMOS
CAUTIONS AND LIMITATIONS ²				
ACCESSORIES	Spray-On Anti-Fog	B47C015	x	x
	Hydration System Kit	D47C033	x	x
	Facepiece Spectacle Kit	B47C022	x	x
	Facepiece Magnetic Wiper	C47C017	x	x
MONITORING SYSTEM	RMS	D47C016	x	x
ALTERNATE HARNESS ASSEMBLY	Flame-Rated	D47C014-02	x	x
	Non-Flame-Rated	D47C014-01	x	x
ALTERNATE FULL-FACEPIECE	AV3500 Large	D47C054-03		x
	AV3500 Medium	D47C054-02		x
	AV3500 Small	D47C054-01		x
	AV3000 Large	D47C013-03	x	
	AV3000 Medium	D47C013-02	x	
	AV3000 Small	D47C013-01	x	
INTERNAL HEAT EXCHANGER	PCM	C47C019	x	x
ALTERNATE OXYGEN CYLINDER	International	D47C012-02	x	x
	North American	D47C012-01	x	x
HEAT EXCHANGER	Ice Canister	C47C011	x	x
ALTERNATE CARBON DIOXIDE ABSORBENT	OrbSorb®	D47C055	x	x
	ExtendAir®	C47C010	x	x
CENTER SECTION		D47C009	x	x
PNEUMATIC ASSEMBLY		D47C008	x	x
UPPER HOUSING		D47C007	x	x
LOWER HOUSING		D47C006	x	x
BREATHING HOSE		D47C005	x	x
PROTECTION ¹			240-MIN/3000 PSIG/SC/PD	240-MIN/3000 PSIG/SC/PD
TC-			13F-541	13F-684

A47C003D1g
ECO 9652
REV. G [February 2013]

1 PROTECTION
PD-Pressure-Demand SC-Self-Contained
2 CAUTIONS AND LIMITATIONS

- J-Failure to properly use and maintain this product could result in injury or death.
- M-All approved respirators shall be selected, fitted, used and maintained in accordance with MSHA, OSHA and other applicable regulations.
- N-Never substitute, modify, add or omit parts. Use only exact replacement parts in the configuration as specified by the manufacturer.
- O-Refer to User's instructions, and/or maintenance manuals for information on use and maintenance of these respirators.
- S-Special or critical User's instructions and/or specific use limitations apply. Refer to User's instructions before donning.

ExtendAir® Carbon Dioxide Chemical Scrubber NIOSH Approval Label:



BIOMARINE INCORPORATED
456 CREAMERY WAY, EXTON, PA 19341-2532 USA
PHONE: (610) 524-8800

CLEAN AIR SCRUBBER
CHEMICAL SCRUBBER CANISTER
TC-13F-541 and TC-13F-684



CAUTIONS AND LIMITATIONS

1. Approved for use only in replacing or refilling chemical scrubber part number C47C010.
2. Not approved for use after indicated expiration date.
3. **Do not re-use scrubber materials.**

A47C024DLd
REV. D [12/07/2011]

OrbSorb® Carbon Dioxide Chemical Scrubber NIOSH Approval Label:



BIOMARINE INCORPORATED
456 CREAMERY WAY, EXTON, PA 19341-2532 USA
PHONE: (610) 524-8800

CLEAN AIR SCRUBBER
CHEMICAL SCRUBBER CANISTER
TC-13F-541 and TC-13F-684



CAUTIONS AND LIMITATIONS

1. Approved for use only in replacing or refilling chemical scrubber part number D47C055.
2. Not approved for use after indicated expiration date.
3. **Do not re-use scrubber materials.**

A47C077DLb
REV. B [12/07/2011]

Remote Monitoring System (RMS) MSHA Electrical Approval:

BIOMARINE - NTRON, INC.
456 Creamery Way, Exton, PA 19341 USA

Model: RMS
Permissible Pressure and Temperature
Monitoring Device



MSHA Approval No: 18-A060028-0
Tested for intrinsic safety in methane-air
mixtures only.

Warnings:

The battery is to be changed in
fresh air only.

MSHA approved for use with one of the
following 9-Volt batteries only:

Eveready, Inc. Energizer # 522
Panasonic Industrial Co. # 6AM6
Rayovac Corp. # A1604
or Duracell, Inc. # MN1604

The connectors can only be connected
to Biomarine BP240R Breathing
Apparatus.

CAUTIONS AND LIMITATIONS

- J** - Failure to properly use and maintain this product could result in injury or death.
- M** - All approved respirators shall be selected, fitted, and maintained in accordance with NIOSH, MSHA, OSHA, and other applicable regulations.
- N** - **Never substitute, modify, add, or omit parts. Use only exact replacement parts in the configuration as specified by Biomarine.**
- O** - Refer to User's instructions, and/or maintenance manuals for information on use and maintenance of these respirators.
- S** - Special or Critical User's Instructions and/or specific use limitations apply. Refer to User's instructions before donning.

S-SPECIAL OR CRITICAL USER'S INSTRUCTIONS

Please Read Carefully and Fully Understand

- All users of the Self-Contained Breathing Apparatus (SCBA) must be trained by Biomarine Qualified Instructors in the donning, operation, inspection and emergency use procedures of the BioPak 240R.
- Biomarine, or a qualified Biomarine representative, must perform all repairs beyond the scope of this or the BioPak 240R Benchman manual.
- **Prior to using the BioPak 240R it must be determined that the user is medically fit. The following lists some, but not all, medical and psychological conditions that could limit or prevent the use of the BioPak 240R.**

Emphysema	Chronic Obstructive Pulmonary Disease
Bronchial Asthma	X-Ray evidence of Pneumonia
Evidence of reduce pulmonary function	Coronary Artery Disease
Severe or progressive hypertension	Epilepsy-Grand Mal or Petit Mal
Pernicious Anemia	Diabetes-Insidious or Mellitus
Breathing difficulties when wearing a SCBA	Abnormal or ruptured ear drum
Claustrophobia or anxiety when wearing a SCBA	Pacemaker or other Cardiac Conditions
- **Compressed Oxygen Hazard:** Always handle oxygen cylinders with care to prevent damage. Do not allow oil, grease or other foreign materials to come in contact with cylinder, cylinder valve or cylinder pressure regulator to prevent possible ignition. Do not open the cylinder valve in the presence of open flame, sparks or high radiant heat. Failure to follow these recommendations could result in personal injury or death.
- **Oxidizing Agent Hazard:** Oxygen will enhance the combustion of other materials so that materials that normally will not burn in air may burn in oxygen-rich atmospheres; and, materials that do burn in air will burn more vigorously and at a higher temperature in oxygen-rich atmospheres. Oxygen will not cause materials to ignite without the presence of an ignition source.
- **Work Load Stress Factors:** The use of a SCBA will add to the work load and stress of the user. The user must be capable of determining when excessive ambient temperatures and high workloads will lead to physical exhaustion and/or collapse.
- **Low Temperature Operation:** The BioPak 240R is suitable for respiratory protection during entry into and escape from oxygen deficient atmospheres in temperature as low as -5°F (-20°C) **providing:** 1) If the BioPak is stored in low temperatures it must be fully dry and NOT have the carbon dioxide scrubber pre-packed into the breathing chamber; and 2) the carbon dioxide scrubber is stored at temperatures above 32°F (0°C) and is only installed into

the BioPak just prior to use. Prior to donning a cold BioPak, verify that the cylinder is securely connected to the pressure regulator.

- The BioPak 240R is approved only with the oxygen cylinder is fully charged with compressed medical or aviation grade oxygen with moisture content less than 50 mg/m³ at 3000 psi (207 bar). Allow the oxygen cylinder to cool after filling to determine the correct pressure. Do not substitute any other gas type for the specified oxygen. The user bears full responsibility for the purity of oxygen contained in the BioPak 240R oxygen cylinder. The use of non-approved gasses can result in injury or death. If the oxygen cylinder is improperly filled with any gas other than oxygen, the cylinder must be replaced. **A foreign gas may cause cylinder corrosion.**
- Always check the BioPak 240R oxygen cylinder for a current hydrostatic test date. DOT requires carbon fiber wrapped, aluminum cylinders be tested by an approved facility on a 5-year cycle from the date of manufacture. Cylinder inspections by the user as outlined in CGA 6.2 must be done on a regular basis.
- Prior to each use of the BioPak 240R, a fully charged oxygen cylinder, a fresh charge of carbon dioxide absorbent, frozen ice canisters, moisture control sponges and the phase change module (PCM) must be installed.
- After each use of the BioPak 240R, a thorough cleaning and disinfection of the facemask, breathing hoses and breathing loop must be completed in accordance with procedures provided in the BioPak 240R Benchman manual.
- Use with adequate skin protection when worn in atmospheres that contain gases or vapors that poison by skin absorption (for example hydrocyanic acid gas).
- Do not use an unapproved facemask. Use only the facemasks approved for the BioPak 240R. An unapproved facemask will compromise the protection provided to the user by the BioPak 240R. A good facemask seal is important to achieving full protection and duration. Users should conform to MSHA/NIOSH guidelines concerning facial hair and use of the facemasks. A clean-shaven user will significantly increase the chances of achieving an adequate face seal.
- The on-going effectiveness and reliability of any protective breathing equipment is dependent upon the user/owner's standard of care in maintaining the equipment and the user's expertise in using the equipment.
- Personnel who intend to use protective breathing equipment in a dangerous atmosphere must have the proper training, temperament and experience to be able to function safely.
- The user shall periodically inspect the TRIM display as described in this manual to determine the status of the respirator oxygen supply.
- ***Intrinsic Safety Consideration for Model/Type RMS permissible Pressure and temperature Monitoring Device:***
 - Read manual before use.
 - The connectors of the monitoring device may only be connected to a Biomarine BioPak 240R Breathing Apparatus oxygen regulator, manifold block and breathing chamber. The fiber optic cable may only be connected to the BioPak 240R remote gauge assembly.
 - Tested for intrinsic safety in methane-air mixtures only.
 - The battery is to be changed in fresh air only. Do not change battery in hazardous areas. Approved for use only with the battery types specified in this manual.

- The use of the OrbSorb® carbon dioxide chemical scrubbers **must always** include the installation of the moisture pad provided with the scrubber. Failure to install the moisture pad as described in this manual can lead to scrubber flooding and elevated inhalation concentrations of carbon dioxide that may lead to injury or death.
- **Carbon Dioxide Chemical Scrubber:** Users ARE NOT permitted to mix versions of the OrbSorb® within a BioPak. Scrubber canisters installed into the BioPak for use must be of exactly the same shape and type.

DISCLAIMER

This manual presents the minimum recommended procedures for maintaining the BioPak 240R. End users are free to implement additional procedures and tests above and beyond the scope of this manual as they see fit or as may be required for specific locations or applications, provided these procedures meet all criteria presented in the manual.

Failure to follow the minimum procedures presented in this manual may violate government or agency approvals as well as void the manufacturer's warranty.

Contact Biomarine with any questions pertaining to customized procedures or questions concerning the procedures stipulated in this manual.

1. INTRODUCTION

1.1 Breathable Oxygen

Oxygen used to supply or charge the breathing apparatus must be medical or aviation grade oxygen with moisture content less than 50 mg/m³ at 3000 psi (207 bar). The composition of suitable oxygen is given below and provides the maximum level of contaminants in the source oxygen acceptable for use in the BioPak.

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 for a 4-hour according to specifications of 42CFR84. 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 and reduced BioPak duration.

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 breathing apparatus.**

Please contact **Training & Technical Support Services** or your local distributor for training course details.

Training & Technical Support Services:

Biomarine Inc.

456 Creamery Way
Exton, PA 19341
United States of America

Tel: 1 610.524.8800

Fax: +1 610.524.8807

Web: www.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** breathing apparatus.

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

Electronics Intrinsic Safety Assessment Procedure must be performed each time the batteries are replaced in the alarming system as defined in the **BioPak 240R Benchman 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 are provided in the **BioPak 240R Benchman Manual** concerning spare part identification, accessory identification and BioPak factory service.

The BioPak 240R-NIOSH User and Benchman manuals can be provided in electronic format upon request.

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 may include mine rescue, fire-fighting, confined space entry, domestic preparedness, military, tunnel rescue and HAZMAT.

All versions of the **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 user'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.

The **BioPak 240R** is approved to the USA standards illustrated by the approval labels in the beginning of this manual

2.2 Harness

The **BioPak** harness is padded 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 is lightweight, high-strength and static-dissipative. 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 gas cooling is achieved as the gas travels around the two coolant canisters of the breathing chamber and past the internal phase change module (PCM).

2.5 Oxygen Delivery System

Oxygen is 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 rates up to 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. The emergency 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 3000 psi (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.



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 20-25% 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 alarm horn located on the monitor package.

<u>Condition</u>	<u>Alarm Action</u>
System Ok	Flashing Green
System Fault	Flashing Red Horn Sounding
End of Service Life (Low Oxygen)	Flashing Red Horn Sounding
Ice Reminder	Flashing Blue
Low Battery	Flash Red, Green, Blue Horn Sounding

2.8 Facemasks

BioPak 240R is approved for use with the **AV3000** and **AV3500** full facemask, which conforms to NIOSH requirements for use with a SCBA. The **AV3500** is supplied as standard. The **AV3000** can be supplied upon request.

The AV3500 facemask is provided with five-point, fully adjustable head harnesses and requires no use of Anti-Fogging agents due to a permanently mounted anti-fog film. Speech diaphragms are provided to allow verbal communication and all masks are provided with a magnetic wiper that is for optional user utilization.

The polycarbonate visor of all masks conforms to GGG-M-125d for impact resistance.



AV3000 Mask



AV3500 Mask

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.
- 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.



3. PREPARATION FOR USE

Prior to donning the apparatus the wearer shall conduct the following procedures to ready the apparatus for use.

3.1 Maintenance Tag Inspection

C47D138, REV. B [03/2013]			
BIOPAK 240 REVOLUTION TURNAROUND MAINTENANCE TAG			
UNIT NO: <u>0031246</u>			
WASHED/DISINFECTED	DATE	INT.	
	6/24/13	WRF	
O2 CYLINDER REPLACED/FILLED	6/24/13	WRF	
FLOW TEST <u>1.8</u> lpm	6/24/13	WRF	
CO2 CARTRIDGES REPLACED	6/24/13	WRF	
SERIAL #: <u>R2013-728-1122544</u>			
EXPIRATION DATE: <u>JUNE/2014</u>			
MASK INSPECTION	6/24/13	WRF	
ICE PLACED IN FREEZER	6/24/13	WRF	
LOW PRESSURE LEAK TEST	6/24/13	WRF	
 WARNING			
<ul style="list-style-type: none"> * INSTALL FROZEN ICE PRIOR TO USE. * REFER TO USER MANUAL AND/OR MAINTENANCE MANUAL FOR INFORMATION ON USE AND MAINTENANCE OF THIS RESPIRATOR. * RESPIRATOR IS SUITABLE FOR USE ONLY BY PROPERLY TRAINED PERSONNEL. * FAILURE TO PROPERLY USE AND MAINTAIN THIS RESPIRATOR COULD RESULT IN INJURY AND DEATH. 			

Locate and inspect the maintenance tag that should be attached to the apparatus. Verify that all items on the tag are properly dated and initialed. **If the maintenance tag is missing or not properly completed the apparatus MUST NOT be placed into service until full turn around maintenance has been completed as specified in the BioPak 240R Benchman Manual.**

3.2 Mask Preparation

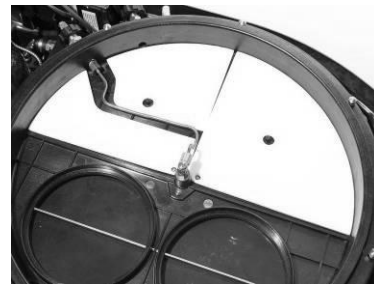
The AV3500 mask DOES NOT require the application of anti-fogging agents of any kind.

If the optional magnetic wiper is utilized, soak both chamois surfaces of the wiper pieces with water and install onto the lens of the facemask so that the chamois side of each piece in is direct contact with the lens.

3.3 Moisture Sponge Preparation



Prop the BioPak to a level position as depicted above. This provides for greater ease of work on the BioPak.

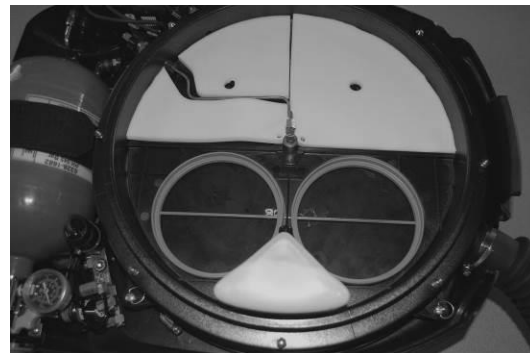


Remove the moisture sponges from the breathing chamber and wet until supple. Wring out excess water and replace into the breathing chamber. If the sponges are not pre-wetted prior to use the breathing air to the wearer will be slightly warmer than usual.

Note: Wetting of the moisture sponges prior to use is an OPTIONAL procedure.

3.4 PCM Installation

Install the PCM canister into the center section as depicted below.



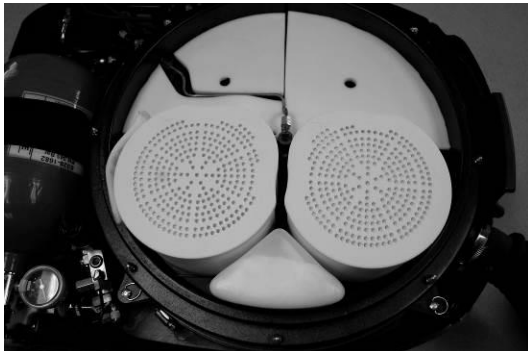
3.5 OrbSorb® Carbon Dioxide Scrubber Installation



Inspect the expiration date of the carbon dioxide scrubber to ensure that it is not expired. Record the serial number of the scrubber onto the back of the maintenance tag.

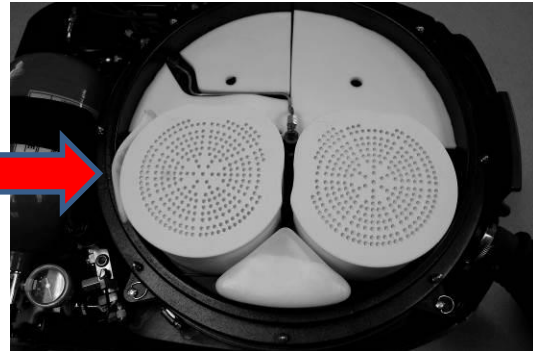
Open the sealed bag and inspect each canister to verify the presence of an o-ring properly seated into the lower groove.

Position each canister into the center section as depicted below. The arrow of each canister shall be directed towards the center point of the center section.



After installation, verify that the o-ring of each canister is fully seated into the cup of the center section.

Position the moisture pad supplied with the canister into the center section as depicted below.



WARNING: Failure to install the moisture pad will result in scrubber flooding and caused elevated carbon dioxide levels in the inhalation gas that could lead to injury or death.

WARNING: Users ARE NOT permitted to mix versions of the OrbSorb® within a BioPak. Scrubber canisters installed into the BioPak for use must be of exactly the same shape and type.

3.6 Breathing Chamber Lid Installation

Verify that the large o-ring of the breathing chamber is properly lubricated. Install the lid onto the top of the breathing chamber making to properly align. Secure the lid into position by locking the eight (8) slide locks over the studs.

3.7 Coolant Canister Installation

Remove the coolant lids from the center section lid and insert a fully frozen ice canister into each location. Replace the coolant lids.



Recommended Safe Duration with Respect to Ambient Temperatures

Recommended apparatus duration of use:

<u>Ambient Temperature</u>	<u>Recommended Safe Duration</u>
105 to 140°F 41 to 60°C	1-hour
141 to 194°F 61 to 90°C	15-minutes
+194°F +90°C	6-minutes

4. DONNING THE APPARATUS

4.1 Donning the Apparatus

Specialist Users (such as Emergency Services) may operate alternative donning procedures that conform to the relevant statutory regulations.

1. Check that the shoulder and waist harness straps are fully slackened.
2. Pass right arm through the shoulder strap and repeat for the left arm.



3. Bend over and pull down on the two shoulder strap adjustments to position the apparatus on the shoulders.



4. Connect the waist belt straps together and pull the adjust straps forward to snug the apparatus to the hips.
5. Connect and adjust the harness chest strap.



6. Position and secure the pressure gauge to the magnet of the shoulder strap and secure with the snap strap.



7. Flip the breathing hoses over the shoulders and secure hose to the harness using the hose straps.

Position of the hose straps can be adjusted for optimal head movement.

The apparatus can be adjusted to rest either on the hips or shoulders of the wearer by adjustment of the shoulder straps.

4.2 Donning the Facemask

1. Check that the head harness straps are fully slackened.



2. Hold the head-harness lower straps, place chin in chin-cup and pull straps over back of head, brushing hair away from face seal.



3. Adjust the facemask top strap so that the mask is at the correct level with the face and the head-harness pad is in the center of the back of the head, then tighten harness straps in sequence, **Bottom, Middle, Top**. DO NOT over-tighten.



4. Depress the push button of the facemask front port and insert the breathing hose adapter into the port. Release the push button and tug and the breathing hose adapter to ensure that it securely anchored.



3. With two hands collapse the **inhalation** hose and inhale. Proper sealing of the **exhalation check valve** will result in the facemask being pulled in toward the face.

4.3 Activate Oxygen Supply



1. Reach back and turn the green oxygen knob located on the right side of the apparatus house to its full counterclockwise position.
2. Inspect the pressure gauge and LED. The pressure gauge shall read a minimum of 3000 psi (207 bar) pressure to achieve full apparatus duration. The TRIM monitor shall initially flash **RED, GREEN, BLUE** with the horn sounding. The LED shall then flash **GREEN** to signal acceptable system status. If after 5-10 minutes of operation the LED flashes **BLUE**, this is a reminder to check that the coolant canisters have been installed. This is a self-cancelling alarm that will return the LED to flashing **GREEN** after 5-minutes.

DO NOT place the apparatus into service if the pressure gauge or TRIM indicator is not functioning as described above or if the TRIM indicator is flashing **RED**.



4. With two hands collapse the **exhalation** hose and exhale. Proper sealing of the **inhalation check valve** will result in the facemask being pushed away from the face.

DO NOT place the apparatus into service if the check valves do not pass the tests of steps 3 and 4.



5. Depress the red emergency bypass for 1-2 seconds and release. Verify the sound of oxygen gas additions into the breathing chamber while the button is depressed and that the oxygen additions cease when the button is released.

DO NOT place the apparatus into service if the emergency bypass valve does not pass the above test.

5. PRACTICAL USE

5.1 Breathing the Apparatus

There is no need to accelerate or deepen normal breathing rates. The apparatus will automatically adjust oxygen additions to match the needs of the user.

5.2 Speaking

The facemasks are provided with speaking diaphragms that will transmit sound from the interior of the facemask to the external surrounding environment. Speak slightly louder and slower than normal making every effort to clearly pronounce words. Do not shout.

Optional voice amplification devices can be attached to the facemask prior to donning to enhance clarity of speech. Contact **Biomarine** or your local distributor for details and supply.

5.3 Alarming System

The wearer should frequently inspect the pressure gauge and LED throughout the duration of the mission.

Should the pressure gauge indicate pressure in the **RED** colored area of the gauge, the end of service life of the apparatus is near; and, the wearer shall retire to a safe location as quickly as possible to doff the apparatus.

Should the LED flash **RED** and/or the horn sounds, the wearer shall retire to a safe location as quickly as possible to doff the apparatus.

5.4 Coolant Replacement

If the breathing air becomes uncomfortable to the wearer the coolant canisters can be replaced without doffing the apparatus or breaking into the breathing loop.

Replacement of the ice canisters while wearing the apparatus will require assistance.

1. Remove the coolant covers from the breathing chamber lid.
2. Remove the spent coolant canisters from the breathing chamber lid.
3. Install replacement, frozen, coolant canisters into the breathing chamber lid.

4. Replace the coolant lids to the breathing chamber lid.

5.5 Emergency Bypass



The emergency bypass is for emergency use only.

DO NOT attempt to use the emergency bypass to cool the breathing gas or clear the facemask of fogging.

Depress in 1-2 second periods for optimal use.

Continued use of the emergency bypass will shorten apparatus duration.

5.6 Emergency Operation

Follow the procedures below in event of the described emergency situation.

Equipment Failure

Should any component of the apparatus experience a failure or should the apparatus upper housing become dislodged, the wearer shall immediately retire to safe location to doff the apparatus.

Gauge Line Severing



Should the gauge line feeding the pressure gauge become severed the apparatus will begin to leak oxygen. To stop the loss of oxygen reach back and pull up on the quick disconnect fitting to release the gauge line and stop the leak. The wearer shall immediately retire to a safe location and doff the apparatus.

5.7 Low Temperature Operation

Use of the BioPak in temperatures below freezing should only be made when the carbon dioxide scrubber has been maintained at temperatures above freezing and installed into the BioPak just prior to use. **Storage of the carbon dioxide scrubber below freezing will retard the start of the absorption reaction and place the user in danger of carbon dioxide poisoning.**

5.8 Facemask Fogging

The mask requires no application of any type of anti-fogging agent. The internal surface of the lens is covered with a permanent anti-fog laminate that will prevent fogging. The user can still employ the use of the magnetic wiper to clear dirt or sheeting water from the lens. Utilization of the magnetic wiper on the mask will not remove the laminate film or affect its anti-fogging properties.

6. DOFFING THE APPARATUS

6.1 Doffing Instructions

1. Retire to a known safe location.
2. Close the oxygen cylinder by rotating the green housing knob to its full clockwise position.
3. Doff the apparatus.

DO NOT remove the apparatus until well clear of the hazardous area.

If wearing a gas-tight chemical suit, DO NOT remove until decontamination procedures are complete.

To prevent the growth of germs, bacteria and mold, conduct turn around maintenance on the apparatus as quickly as possible.

7. APPARATUS SPECIFICATIONS

Respirator Type:	Self-Contained, Closed-Circuit, Pressure-Demand
Respirator Duration:	Certified as entry and escape, 4-hour duration
Size:	23.0 x 17.3 x 7.0 inches (584 x 439 x 178 mm)
Weight (Fully Charged):	34 pounds (15.4 kg)
Operational Conditions ¹ :	Temperature: -5°F to 104°F (-20°C to 40°C) Relative Humidity: 0 to 100%
Storage Conditions:	Temperature: 40° to 90°F (4°C to 32°C) 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/m ³ Water Content Maximum Tasteless and Odorless 440 liter storage at 3000 psig (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
Tidal Volume:	> 6.0 liters
Apparatus Approval:	NIOSH #TC-13F-541 (AV3000 Mask) NIOSH #TC-13F-684 (AV3500 Mask)
Monitor Approval:	MSHA 18-A060028-0
Cylinder Approval:	US DOT-E11194 per DOT-CFFC Standards Transport Canada TC-SU 5303
Expected Battery Life:	At ambient temperature above 40°F (4°C), 200 hours or 6-months

Note:

1. Operating temperature range provided above is the standard 4-hour duration with PCM installed. For extreme temperature ranges, the BioPak should be configured with ice coolers and utilized as directed below:

<u>Ambient Temperature</u>	<u>Recommended Safe Duration of Use</u>
105 to 140°F 41 to 60°C	1-hour
141 to 194°F 61 to 90°C	15-minutes
+194°F +90°C	6-minutes

The above temperature/duration figures are derived from human endurance limits and not from the endurance limit of the BioPak.

8. 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. THIS WARRANTY DOES NOT APPLY TO OXYGEN CYLINDER HYDROSTATIC TESTING FOR PERIODIC RECERTIFICATION OF THE PRESSURE VESSEL OR CONSUMABLES.

THE SOLE LIABILITY OF BIOMARINE FOR ALL PURPOSES SHALL BE TO REPLACE OR REPAIR, AT THE SOLE OPTION OF BIOMARINE, DEFECTIVE PARTS APPEARING WITHIN THE THREE (3)-YEAR PERIOD AS APPLICABLE. BIOMARINE SHALL PROVIDE PARTS AT ITS OWN EXPENSE BUT ALL LABOR SHALL BE AT THE EXPENSE OF THE 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 THIRTY-SEVEN (37) 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 EQUIPMENT IS OPERATED AND MAINTAINED 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 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. The buyer shall assume all such risks.

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 goods when they are not functioning properly, then 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 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 from the rightful claim of any third person by way of infringement or patents or other proprietary information or disclaims any warranty against such infringement.

The terms of these warranties shall apply to the product sold by Biomarine, except absorbent, filters, batteries and anti-fog lens inserts which are considered "consumable items", 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 the (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.

(This page left intentionally blank.)