



## **Benchman Instruction Manual**

### **Biomarine**

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# Certification Approvals

## SCBA NIOSH Certification



**BIOMARINE INCORPORATED**  
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**BioPak 240R**

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

THESE RESPIRATORS ARE APPROVED IN THE FOLLOWING CONFIGURATIONS:

TC- 13F-541	PROTECTION <sup>1</sup>	RESPIRATOR COMPONENTS		CAUTIONS AND LIMITATIONS <sup>2</sup>	JMNOS
		ACCESSORIES	Hydration System Kit D47C033		X
			Facepiece Spectacle Kit B47C022		X
			Facepiece Magnetic Wiper C47C017		X
		MONITORING SYSTEM ASSEMBLY	D47C016		X
		FACEPIECE ANTI-FOG	Spray-On B47C015		X
		ALTERNATE HARNESS ASSEMBLY	Flame-Rated D47C014-02		X
			Non-Flame-Rated D47C014-01		X
		ALTERNATE FULL-FACEPIECE ASSEMBLY	Large D47C013-03		X
			Medium D47C013-02		X
			Small D47C013-01		X
		INTERNAL HEAT EXCHANGER	C47C019		X
		OXYGEN CYLINDER ASSEMBLY	North American D47C012-01		X
		HEAT EXCHANGER ASSEMBLY	C47C011		X
		CARBON DIOXIDE ABSORBANT	C47C010		X
		CENTER SECTION ASSEMBLY	D47C009		X
		PNEUMATIC ASSEMBLY	D47C008		X
		UPPER HOUSING ASSEMBLY	D47C007		X
		LOWER HOUSING ASSEMBLY	D47C006		X
		BREATHING HOSE ASSEMBLY	D47C005		X

**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.

**Carbon Dioxide scrubber NIOSH Certification:**



**BIOMARINE INCORPORATED**

456 CREAMERY WAY, EXTON, PA 19341-2532 USA

PHONE: (610) 524-8800

**CLEAN AIR SCRUBBER**

**CHEMICAL SCRUBBER CANISTER**

**TC-13F-541**

**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 material.

A47C024DLb

REV. B [06/18/07]

Remote Monitoring System (RMS) MSHA Electrical Approval:

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**BIOMARINE - NTRON, INC.**

456 Creamery Way, Exton, PA 19341 USA

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Model: RMS

Permissible Pressure and Temperature  
Monitoring Device



MSHA Approval No: 18-A060028-0

Tested for intrinsic safety in methane-air  
mixtures only.

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**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.

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## Cautions and Limitations

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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 (Cautions and Limitations)

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- 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 240 Revolution.
- Biomarine must perform all repairs beyond the scope of this or the BioPak 240 Revolution Benchman Training manual.
- Prior to using the BioPak 240 Revolution it must be determined that the user is medically fit. The following are some, but not all, medical and psychological conditions that could limit or prevent the use of the BioPak 240 Revolution.
 

Emphysema	Chronic Obstructive Pulmonary Disease
Bronchial Asthma	X-Ray evidence of Pneumonia
Evidence of reduced 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 an SCBA will add to the workload 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.
- The BioPak 240 Revolution is suitable for respiratory protection during entry into and escape from oxygen deficient atmospheres with a temperature range of 5°F (-15°C) to 110°F (43°C). Please note that temperature range pertains to the ability of the SCBA to function under the stated temperature ranges and does not take into account human factors that may limit actual operational temperature range for a specific individual. For more information concerning

human heat stress factors reference Varley Report Heat Stress 04-107.pdf at <http://www.biomarineinc.com/manuals.html>

- The BioPak 240 Revolution is approved when the oxygen cylinder is fully charged with compressed medical or aviation grade oxygen with a moisture content less than 50 mg/m<sup>3</sup> 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. 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.**

**Warning:** The oxygen cylinder shall be filled with the grades of oxygen specified above and no other type of oxygen or gas. The user bears full responsibility for the certification of purity of the oxygen contained within the oxygen cylinder. Should the oxygen cylinder be filled with a gas other than specified above, the cylinder shall be replaced. Always check 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.

- The user of the BioPak bears full responsibility for the certification of purity of compressed oxygen utilized within the oxygen cylinder. **Use of non-approved gasses can result in serious injury or death to the user.**
- Prior to each use of this apparatus a fully charged oxygen cylinder, a fresh charge of carbon dioxide absorbent, frozen ice canisters and the phase change material (PCM) canister must be installed.
- After each use of the SCBA thorough cleaning and disinfection of facepiece, breathing hoses and breathing loop must be completed in accordance with procedures provided in the BioPak 240 Revolution Benchman Instruction manual.
- Use with adequate skin protection when worn in gases or vapors that poison by skin absorption (for example hydrocyanic acid gas).
- Do not use any unapproved facepiece. Use only the facepiece approved for this apparatus. An unapproved facepiece will compromise the protection provided to the user by the SCBA. A good facepiece seal is important to achieving full protection and proper SCBA duration. Users should never wear the BioPak if they have any facial hair. A clean-shaven user will significantly increase his chances of achieving a good facepiece seal. A one-day facial hair growth is sufficient to cause the facepiece not to seal properly which will affect duration.
- Always replace the battery of the Revolution Monitoring System (RMS) in a safe area known to be free of explosive gas mixtures or enriched oxygen atmospheres and with the cylinder valve closed. Replace the battery when the low battery alarm has activated, after 200 hours of use or every 6 months which ever comes first.
- The on-going effectiveness and reliability of any protective breathing equipment is dependent on 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.

***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.
- **Warning:** The battery is to be changed in fresh air only. Do not change battery in hazardous area. Approved for use with one of the following 9-volt alkaline batteries only: Eveready, Inc Energizer #522, Panasonic Industrial Co #6AM6, Rayovac Corporation #A1604, Duracell, Inc. #MN1604.



## Turn-Around Maintenance

**Note:** Turn-Around maintenance procedures should be performed as soon as possible after each use of the SCBA.

1. Obtain a new Turn-Around Maintenance tag. Tags are supplied with the replacement carbon dioxide scrubber. Enter the SCBA unit or an identification number onto the tag.
2. **SCBA Disassembly:**
  - a. Remove the upper housing.
  - b. Remove the oxygen cylinder. Be sure to retrieve the sealing washer that is installed between the oxygen cylinder valve and oxygen regulator. If the lower housing is being washed, always leave the cylinder securely attached to the regulator so that the area remains clean, dry, and free of contamination.
  - c. Remove the coolant lids and ice canisters.
  - d. Remove the two breathing hoses from the breathing chamber and center section lid.
  - e. Remove the center section lid and the carbon dioxide scrubbers and gaskets. Discard BOTH the used scrubbers and scrubber gaskets.

**Note:** The used scrubber consists of limestone and a plastic core. The gaskets consist of silicone rubber. Discard used scrubbers and gaskets as required by local requirements.

**Warning:** Do not reuse previously used CO<sub>2</sub> absorbent cartridges or the rubber gaskets. Failure to replace the CO<sub>2</sub> absorbent material and CO<sub>2</sub> gaskets can lead to serious injury or death.

- f. Disconnect the electrical line and the two plumbing lines to the center section. Remove and save the four (4) quick release pins by twisting counter-clockwise. Remove the center section. To prevent contaminants from entering into the pneumatics and from loosing the o-rings inside the plumbing fittings during turn-around maintenance, cap off the two plumbing connections with the Pneumatic Plug, B6-02-5002-35-0, provided in the test kit.
  - g. Remove the moisture sponges and the Phase Change Material (PCM) canister.
3. **Washing and Disinfecting:**
  - a. If necessary wipe down the upper and lower housing shells and the RMS alarm module to remove accumulated dirt and grime. Set aside to dry. DO NOT submerge the Alarm Module during turn-around maintenance.

**Caution:** The RMS Module IS NOT watertight with the TRIM light pipe connector or the battery door removed.

- b. The lower housing should be cleaned with the cylinder securely attached to the regulator. If the cylinder is removed for washing you must attach the Regulator Wash Cover, B2-02-5400-04-0, provided in the test kit to seal off the regulator from contamination while washing the lower housing. Wipe down the exterior surface of the oxygen cylinder with a clean, dry, lint and oil-free cloth to remove accumulated dirt and grime. With a clean lint free cloth clean the cylinder valve area of all dirt, grime, grease, etc. Inspect the sealing washer for contamination and defects. Remember to keep the sealing washer free of oils (including oils from your fingers and hands), dirt, grime, and contaminants!
- c. Submerge the center section, breathing hoses (with facepiece adapter), center section lid, coolant lids, ice canisters, and moisture sponges and PCM canister into a bath of potable water and cleaning solution. Mix the ready use disinfectant (P/N B6-02-5000-42-0) at one packet per gallon. The AV3000® facepiece should be sprayed with Multi-Wash Disinfectant, B5-01-5000-01-0, and rinsed with clean water.

**Caution:** Clean and disinfect the AV3000® facepiece using the spray Multi-Wash Disinfectant. BEFORE submerging the facepiece in to the rinse water, reseal the edges of the anti-fog insert lens. Failure to do so will allow water to seep between the anti-fog lens and facepiece lens. If this occurs, the anti-fog insert must be discarded and a new one installed. When replacing the anti-fog insert thoroughly clean the facepiece lens area of all adhesive and other contaminants to ensure a good seal and visibility.

- d. Allow all components to remain wetted by the cleaning solution a minimum of ten (10) minutes.
  - e. THOROUGHLY RINSE all components several times with clean water to remove cleaning solution residue.
  - f. Allow all components to air-dry.
  - g. Date and initial the *Washed/Disinfected* section on the Turn-Around Maintenance Tag.
4. **Oxygen Cylinder Charging:** Fill the oxygen cylinder with 3000 psig (207 BAR) of medical or aviation grade oxygen. Oxygen shall have moisture content less than 50 milligrams/cubic meter at 2900 psi (200 BAR).

**Warning:** The oxygen cylinder shall be filled with the grades of oxygen specified above and no other type of oxygen or gas. The user bears full responsibility for the certification of purity of the oxygen contained within the oxygen cylinder. Should the oxygen cylinder be filled with a gas other than specified above, the cylinder shall be replaced. Always check 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 manufacturer. Cylinder inspections by the user as outlined in CGA 6.2 must be done on a regular basis.

5. **Ice Canister Freezing:**

- a. Place the cleaned and DRIED canisters into the freeze forms supplied with each SCBA.
- b. Freeze the ice canisters for a minimum of eight (8) hours before use at a maximum temperature of 10°F (-12°C).
- c. Date and initial *Ice Canister Placed in Freezer* on the Turn-Around Maintenance Tag.

**6. Facepiece:**

- a. Inspect the rubber components for signs of wear, cuts, nicks, or abrasions. Replace facepiece components as required. Ensure the Multi-Wash has been completely rinsed from the facepiece.
- b. Re-seal the perimeter of the anti-fog lens. If the seal is damaged or leaks replace the anti-fog insert.
- c. Apply a coating of Anti-Fog solution to the interior of the facepiece lens and anti-fog insert with the anti-fog spray provided. **Ensure the facepiece is completely dry prior to anti-fog treatment.** A wet facepiece will not anti-fog properly. Do not wipe off prior to storage or use.
- d. Inspect the chamois of the optional wiper. Clean or replace the chamois on both wiper parts as required. Apply anti-fog solution or water to both halves of the chamois before every use to ensure mask lens does not scratch.
- e. Date and initial the *Anti-Fogging Agent Applied* section on the Turn-Around Maintenance Tag.

**7. SCBA Assembly/Carbon Dioxide Scrubber Charging/Flow Test**

- a. Install the center section into the lower housing making sure to align the diaphragm spring retainers with the three lower housing springs. Insert the four retainer pins.
- b. Install the PCM canister onto the center section.

**CAUTION: Failure to install the Phase Change Material (PCM) Canister into the center section prior to use will result in increased breathing gas temperature.**

- c. Install the three moisture sponges onto the top bed of center section. Note that installing wet sponges and closing up the SCBA may lead to mold growth during extended storage periods. To prevent mold growth, install the sponges in a totally dry state and moisten sponges just prior to SCBA use.
- d. Reinstall the oxygen cylinder, making sure to also install the sealing washer onto the oxygen regulator stub, into the lower housing and secure into position with the strap. Ensure the sealing washer is dry, clean, and free of dirt, grime, and oils. **DO NOT LUBRICATE THE OXYGEN SEALING WASHER.**
- e. Pre-packing of CO2 scrubber cartridges is OPTIONAL. **Skip steps e and f if you do not pre-pack.** Inspect the replacement carbon dioxide scrubber package and verify that the expiration date has not passed; and, that the expiration date will not occur during the expected SCBA storage period. Record the expiration date of both scrubbers on the Turn-Around Maintenance Tag.

- f. Open the carbon dioxide scrubber container and install a new gasket, supplied with the scrubbers, into each scrubber location in the center section. Immediately place the fresh scrubber canisters into the center section on top of the gaskets and **immediately install and secure the center section lid, hoses with facepiece adapter and install the facepiece adapter airtight storage plug.**

**Warning:** Do not expose opened CO2 scrubber cartridges to ambient air for more than 20 minutes. Excess exposure of ambient air with the CO2 scrubber cartridges can adversely affect the optimal absorption process and increase the potential for CO2 entering the breathing loop. This could result in injury or death to the user. Do not pre-pack CO2 scrubber cartridges in a wet SCBA.

**Warning:** Install each CO2 canister into the SCBA so that the red end cap is visible on the top side of the canister. **DO NOT** utilize any CO2 canister that is missing the red end cap.

**Warning:** The hoses and facepiece adapter **MUST** be installed with the breathing gas directional arrows facing **UP**. **This ensures the user inhales from the left side and exhales out the right side.** If the breathing gas directional arrows are facing **DOWN** the SCBA will not function properly. Failure to install the breathing hoses and facepiece adapter so the breathing gas directional arrows are facing up can result in serious injury or death.

- g. OPTIONAL: To disable the alarm for flow testing disconnect the electrical connection (Middle connector) from the RMS module body.
- h. Connect the test flowmeter, B6-02-5002-15-0; to the center section constant add feed line (The smaller diameter of the two stainless steel oxygen supply fittings).
- i. Open the oxygen cylinder valve and observe the test flowmeter while holding the test flow meter in a level position. The flow meter shall indicate a flow rate between 1.6 to 2.4 lpm (Read the center of the ball). If the test fails, replace the flow restrictor as described in the long-term maintenance section of this manual. To get the most accurate reading you must have a minimum of 1500 psi (104 bar) in the cylinder.

**CAUTION: The use of non-approved flow meters will result in inaccurate flow readings. Use only the flow meter supplied in the BioPak 240R Test/Service Kit.**

- j. Enter the measured flow rate. Date and initial *Flow Test* \_\_\_\_ *lpm* section on the Turn-Around Maintenance Tag.
- k. Close the oxygen cylinder valve and remove all test equipment. If disabled in step g above, connect the manifold block electrical connection to the RMS main body. **The electronics will not properly operate if the Manifold Block connector is not connected. Do not force the pin connectors when attaching the pinned cable connection.**
- l. Reconnect the constant add feed line to the center section port.
- m. Reconnect the temperature sensor line to the center section.

**8. SCBA Assembly/Low Pressure Leak Testing:**

- a. If not already assembled in section 7, install and secure the center section lid, hoses with face piece adapter with airtight storage plug.
- b. Remove the facepiece adapter airtight plug from the front of the facepiece adapter and install the leak test plug, B6-02-5002-56-0, supplied with the test kit onto the facepiece adapter.
- c. Attach one end of the test kit rubber tubing to the leak test plug and the other end of the rubber tubing to the input port of the test kit.
- d. Insert two test keys, B6-02-5000-17-2, into the keyholes in the back of the lower housing.
- e. Open the oxygen cylinder valve for a minimum of 60 seconds. Oxygen should immediately flow into the breathing chamber. If you do not hear or detect the flow of oxygen into the breathing chamber or if the oxygen flow continues without stopping, the demand valve may have failed and will require testing as described in the Long Term Maintenance section of this manual.
- f. **Close the oxygen cylinder valve** and fully depress the bypass valve. **Immediately use the test kit bleed valve to adjust the SCBA pressure to 6-8-inches water column pressure.** If you attain 6-8-inches water column pressure, proceed with the test. If you do not achieve 6-8-inches of water column, inspect for leaks. **DO NOT OVER PRESSURIZE THE SCBA.**

**Warning:** Do not over pressurize the SCBA. Over pressurization of the SCBA with the test keys installed beyond 8" of water column could damage the vent valve and diaphragm.

**Warning:** Failure to close the oxygen cylinder during this test will allow oxygen to continue to flow into the breathing chamber through the constant add. This will over pressurize the SCBA and may cause the test keys to puncture and damage the vent valve.

- g. Allow the SCBA's pressure to stabilize at 6-8-inches water column of pressure. The test gauge pressure will stop creeping upward when the SCBA reaches stabilization. After one (1) minute, the pressure gauge of the test kit shall indicate no less than 0.2-inches water column pressure below the stabilized starting pressure. If the test gauge pressure continues to increase, the oxygen cylinder may still be open or the SCBA pressure lines are continuing to bleed down. Shut off the cylinder, adjust the test kit gauge to 6-8-inches water column, and repeat test.
- h. After completion of the Low Pressure Leak test vent the pressure from the SCBA using the test kit bleed valve and remove all test equipment from the SCBA. (Rubber tubing, leak test plug, and test keys). **DO NOT FORGET TO REMOVE THE TEST KEYS.**
- i. Replace the leak test plug with the storage plug on the facepiece adapter.
- j. Inspect the oxygen cylinder pressure gauge and verify that it is filled to 3000 psig (207 Bar). Top off the oxygen cylinder if required.
- k. Date and initial *CO2 Cartridges Replaced* and *Low Pressure Leak Test* section(s) on the Turn-Around Maintenance Tag.

**9. RMS Gauge and Tri-Color Indicator Module (TRIM) System Check:**

- a. While looking at the gauge and TRIM, open the oxygen cylinder valve and listen for the alarm test and observe the gauge and TRIM color sequence. (The cylinder must be filled with a minimum of 1500 psig/104 Bar for this test.)
- b. The pneumatic gauge will slowly reach full pressure (approximately 60 seconds). The alarm and TRIM will go through a startup self-check: Alarm, Red, Green, Blue light sequence, then a flashing green light indicating all systems are operational.
- c. The battery has completed its battery check and has battery life for a full four-hour mission if you receive a green flashing light. A low battery alarm is indicated by a Red, Green, Blue light sequence followed by a short alarm chirp and will sound any time the battery will not complete a four-hour mission. Replace the RMS battery and test the alarm function according to the instructions in the General Service Procedure section of this manual if required.
- d. Verify that the oxygen cylinder pressure gauge and the RMS gauge pressure readings match within +/- 10%.
- e. Close the oxygen cylinder valve and depress the bypass valve of the SCBA. Never store the SCBA under pressure. Ensure test keys are removed prior to storage.
- f. Inspect the oxygen cylinder pressure gauge and verify that it is filled to 3000 psig (207 Bar). Top off the oxygen cylinder if required.
  1. Replace the upper housing (and harness if it has been removed).
  2. Date and initial *O2 Cylinder Replaced/Filled* section on the Turn-Around Maintenance Tag.
- g. Tie the completed Turn-Around Maintenance Tag across the waist belt connector of the harness. Stow the SCBA in a clean area that will be isolated from damage. A properly stored SCBA will be one that has been thoroughly cleaned, dried, tested, and all items on the Turn-Around Maintenance Tag properly documented. Any SCBA that fails testing must be clearly identified or "Tagged-Out" of service.

**Warning:** Failure to clean, disinfect, inspect, recharge oxygen cylinder, replace carbon dioxide scrubber canisters, refreeze and insert ice canisters, and installing the PCM canister as stipulated by the Turn Around Maintenance Procedure will result in less than adequate SCBA performance and may lead to user injury or death. **Never seal a wet SCBA from ambient atmosphere or store a wet SCBA in the carrying case or other enclosed container. To prevent mildew or mold infestation, always allow adequate drying time before sealing and storing the SCBA.** If a quick Turn-Around Maintenance has been performed, the SCBA will function and is designed to work wet. However, remove or drain large quantities of water from the breathing chamber, hoses, and facepiece before placing into service.

## Long-Term Maintenance

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In addition to normal Turn-Around Maintenance, the SCBA shall be visually inspected and high-pressure tested on a monthly basis if the SCBA is in constant use; or, on a quarterly basis if the SCBA has been used less than once a month or placed into long-term storage. Constant use is defined as being in use at least once a month. Long-Term maintenance should be performed by a qualified Benchman/Technician.

Appendix A of this manual provides an optional Maintenance Log Sheet to track long-term maintenance cycles. Individual users may design and use their own system to track maintenance histories.

### 1. Visual Inspection

- a. Remove the upper housing from the SCBA.
- b. Visually inspect all components of the SCBA for signs of wear, abuse, cracks, loose connections, or any other damage that may impede proper SCBA function. Replace any component that shows damage or excess wear.
- c. If the SCBA has been stored with CO<sub>2</sub> absorbent pre-packed, verify that the SCBA is sealed from ambient atmosphere by inspecting for the presence of the facepiece storage plug installed in the facepiece adapter attached to the hoses. Check the Turn-Around maintenance tag for a valid shelf-life date for the CO<sub>2</sub> absorbent.

### 2. Demand Valve/Vent Valve/Emergency Bypass Valve/Low Pressure Alarm Functional Tests (DO NOT USE TEST KEYS FOR THESE TESTS)

- a. Replace the facepiece adapter storage plug with the test plug, B6-02-5002-56-0, and connect the test plug to the input port of the test kit using rubber tubing.
- b. Verify that the SCBA has no pressure contained within the breathing chamber by a zero reading on the test kit pressure gauge.
- c. **Demand Valve Functional Test:** Open the oxygen cylinder valve and carefully listen for the sound of gas flowing into the breathing chamber. This will signal that the demand valve is properly admitting oxygen into the breathing chamber when the diaphragm is in its upper-most position. The sound of oxygen flowing into the breathing chamber shall cease within approximately 1-3 seconds. This signals that the demand valve has properly closed as the diaphragm begins to inflate. The demand valve should be inspected and replaced if the demand valve fails to initially open or close when the diaphragm is fully inflated.
- d. **Vent Valve Functional Test:** Fill the SCBA with oxygen by depressing the emergency bypass one time for no more than 2-3 seconds. Observe the test kit pressure gauge. A passing test is indicated by the test gauge remaining at or below 2" of water column.
- e. **Emergency Bypass Functional Test:** Depress the emergency bypass valve for 1 to 2 seconds. The sound of gas flowing into the center section shall be observed. This gas flow shall cease when the bypass valve button is released. Replace the emergency bypass valve should it fail to operate as described.
- f. **Low Pressure Alarm Functional Test:** While observing the RMS Gauge and TRIM turn on the oxygen cylinder. Verify that you have an audible alarm, Red, Green, Blue flashing lights, and finally a Green flashing light. Wait approximately 60 seconds or until the RMS gauge reaches maximum pressure. Turn off the oxygen cylinder and allow the BioPak to slowly reduce system pressure.. The low oxygen alarm must activate between 650-1000 psig and is indicated by a flashing red light and audible alarm. The RMS will automatically power down once the system pressure has dropped below 25 psig.
- g. Vent the SCBA of pressure. Remove all test equipment and reinstall the facepiece adapter storage plug.

- h. Verify that the oxygen cylinder contains 3000 psig (207 Bar) of pressure. Ensure the oxygen cylinder is turned off.
  - i. Replace the upper housing on the SCBA.
3. **High-Pressure Leak/RMS and Cylinder Gauge Testing (DO NOT USE TEST KEYS FOR THESE TESTS)**
- a. Place the SCBA on a flat surface and verify it is sealed against ambient atmospheres by the presence of the installed facepiece storage plug in the facepiece adapter. Open the oxygen cylinder. Wait until the RMS gauge has time to fully pressurize. Verify that the oxygen cylinder pressure gauge and the RMS gauge pressure readings are within +/- 10% of each other.
  - b. Open the SCBA oxygen cylinder valve and allow the SCBA to pressurize. **DO NOT USE THE TEST KEYS FOR THIS TEST.** Inspect each plumbing connection joint with leak detection fluid, B5-01-3000-03-0. Leak detection fluid that is not approved for use with oxygen may damage the SCBA and will void your warranty. Inspection is performed by wetting the area to be tested with the detection fluid; and, allowing the fluid to sit undisturbed for approximately one (1) minute. The continual formation of bubbles will indicate the presence of a leak.
  - c. Tighten any fitting that exhibits a leak; or, replace faulty components that are causing the leak. Retest any repairs. Note that the oxygen cylinder valve should be closed and the SCBA fully depressurized when making repairs. Use care when tightening compression fittings and be careful not to over tighten.
  - d. Close the oxygen cylinder valve and depress the emergency bypass valve after completing testing and repairs have been completed.
4. **Turn-Around Maintenance Validation**
- a. Verify that a fully completed Turn-Around Maintenance tag is tied between the buckles of the SCBA harness waist belt. Should the Turn-Around Maintenance Tag be missing, incomplete or dated more than one-year prior, perform the full Turn-Around Maintenance procedure.



## General Service Procedures

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### Scheduled Component Replacement

In order to maintain proper SCBA function it is recommended that the below listed components be replaced after the stated number of SCBA uses or time period.

Component	Part Number	Replacement
Battery (Use only from approved list)	B1-14-2000-00-0	200 hours or 6 months
CO <sub>2</sub> Scrubber Gasket <sup>1</sup>	B2-02-7001-15-0	1 use
CO <sub>2</sub> Scrubber <sup>2</sup>	B5-01-5000-00-0	1 use
Facepiece Anti-Fog Lens	B2-02-0000-30-0	Approximately 20 uses
Oxygen Cylinder Seal Washer	B4-04-0030-00-0	As needed
Center Section Lid O-Ring	B4-04-7060-20-0	As needed
Oxygen Cylinder (North American) <sup>3</sup>	B2-01-2000-06-0	15 years

1. CO<sub>2</sub> scrubber gaskets are provided packaged with each carbon dioxide scrubber.
2. CO<sub>2</sub> scrubber part number, B5-01-5000-00-0, will provide a total of four (4) uses.
3. Cylinders are required to be hydrostatically tested by a DOT approved testing facility every five years from the date of manufacture in order to remain in service for the full 15-year life span. Date of manufacture is identified on the cylinder label.

The BioPak and RMS are designed with no factory mandatory component rebuild or replacements required during their lifetime of 20 years. However, certain components will require replacement over time due to wear or damage. The Long-Term and Turn-Around Maintenance procedures will aid the Benchman in the identification of worn or damaged components. It is recommended that after a period of five (5) years the Benchman pay particular attention and provide additional inspection to the parts list below.

**Breathing Diaphragm:** 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.

**Facepiece:** Thoroughly inspect the rubber portions of the facepiece for signs of wear, tears, rips, cracking, or rot.

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

**O-Ring Seals:** In general, if the SCBA has passed the high and low-pressure leak tests it can be assumed that o-ring seal integrity is acceptable. It is recommended to perform full system seal lubrication at a minimum of once a year.

### System Lubrication

Proper lubrication of all o-ring seals is essential to the reliable operation of the SCBA. An o-ring seal that has degraded will appear as a leak during low or high-pressure leak test procedures. O-ring damage can result from wear, misalignment, or improper use of lubricant. Observe the following precautions when servicing o-ring seals.

- Never pry an o-ring from its seat with a screwdriver. Carefully remove the o-ring by hand or with the pick tool provided in the test kit.
- Unless otherwise directed, do not lubricate an o-ring when it is still within its seat.
- Do not apply heavy coats of lubricant to o-ring. Proper o-ring lubrication will result in a shiny surface without lumps of lubricant.
- Do not stretch or otherwise deform the large center section lid o-ring when applying DOW-111. Apply a very thin coat of DOW-111 to the large o-ring. Over lubrication causes the o-ring to "roll" or "pinch" from its channel when installing the center section lid.

- Prior to lubricating any o-ring, visually inspect the o-ring under a bright light for signs of damage such as nicks, cuts, tears or abrasion. Inspection can also be made by the fingertips while lubricating the o-ring to feel for inconsistencies in the o-ring surface.
- Christo-Lube and Dow-111 are the only o-ring lubricants that shall be utilized on the SCBA components. Never use petroleum jelly or other types of lubricants. Use the proper lubricant as specified by the illustrated parts list. Never use Dow-111 on any o-ring seal that comes in contact with high-pressure oxygen. Use only Cristo-Lube on high-pressure o-rings. High pressure is defined as regulated pressure or higher. Using the improper type of lubricant creates serious safety hazards with the potential for combustion.
- **NEVER EVER**, apply lubricant to the sealing washer that sits between the oxygen cylinder and the oxygen pressure regulator. Be careful not to deposit oils or other contaminants from your hands and fingers when handling the sealing washer.

It is recommended to inspect and re-lubricate the below listed o-ring seals after the specified number of SCBA uses or age.

O-Ring Description	Uses/Age
Center Section Lid O-Ring	every 25 uses
Vent Valve O-Rings	every 50 uses
Other O-Rings	every 1-year

## ***Oxygen Cylinder***

There are no user serviceable components on the oxygen cylinder assembly. The cylinder should be externally inspected regularly for signs of damage to the outer wrapping. Cylinders that are cracked, flaking or show exposed fibers should immediately be retired from service. The BioPak cylinders are DOT/TC approved and require hydrostatic testing every five (5) years. Every BioPak cylinder will have the last date of hydrostatic testing marked directly on the cylinder itself. Testing must be conducted by a DOT certified testing facility. To find an authorized DOT authorized hydrostatic test facility please visit:

[http://hazmat.dot.gov/sp\\_app/approvals/hydro/hydro\\_retesters.htm](http://hazmat.dot.gov/sp_app/approvals/hydro/hydro_retesters.htm)

Following completion of any hydrostatic test the cylinder shall be cleaned for high-pressure oxygen service to remove any introduced contaminants. Contaminates that may be left behind during hydrostatic testing could present a fire and explosion danger.

Should the oxygen cylinder experience an impact event it is suggested that the cylinder be replaced or inspected at regular intervals according to Compressed Gas Association standard CGA 6.2. CGA 6.2 can be supplied to the benchman upon request.

## ***RMS Gauge and Tri-Color Indicator Module (TRIM)***

Other than replacement of the battery, there are no user serviceable components in the RMS gauge, alarm module, or TRIM. The RMS alarm module is sealed to prevent entry of moisture and to provide immunity against RFI/EMF interference. Attempts to open the RMS module will result in the loss of seal integrity and is not covered under warranty. While the RMS housing has a watertight seal, do not submerge the RMS during Turn-Around or Long-Term Maintenance.

## ***RMS Alarm Module Battery Replacement***

**Warning:** To maintain the intrinsic safety certification of the monitoring system use only Biomarine approved 9-volt batteries listed on the specifications page of this manual. Replacement of battery must be made in a safe area known to be free of explosive gas mixtures and enriched oxygen. Always replace battery with the RMS system in a non-powered state, oxygen cylinder turned off and no oxygen in the SCBA breathing loop.

1. Remove the upper cover from the SCBA.
2. Disconnect the temperature cable from the center section and pull the module straight out of the SCBA lower housing.
3. Perform the Intrinsic Safety Assessment Procedure (listed below).
4. Inspect the RMS alarm module housing for signs of damage. Remove the battery cover from the rear of the sensor unit by unthreading the two screws located on the battery door. Inspect the battery door for signs of wear or damage. Dust-tight and water-tight integrity are required for use in potentially explosive atmospheres. Inspect the interior of the battery compartment for the presence of liquid, dust or corrosion. Replace the RMS if damaged, or the enclosure integrity is compromised.
5. Pull the battery out of the housing using the pull strap. Discard the spent battery.
6. Install a fresh battery from the approved list of 9-volt batteries (part number B1-14-2000-00-0) into the battery holder aligning positive with positive and negative with negative.
7. Inspect the gasket of the battery cover (Part number B2-02-7001-16-0) and verify that it does not show any signs of damage. Replace the cover if necessary.
8. Replace the battery door onto the RMS Alarm Module and secure using the two battery door screws. Ensure the screws are secure but do not over tighten.
9. Reinstall the temperature cable to the center section and install the RMS module into its holder.
10. Reinstall the upper cover of the SCBA.

## ***RMS Module Intrinsic Safety Assessment Procedure***

1. Inspect the RMS module enclosure for cracks or damage. Dust-tight and water-tight integrity are required for use in potentially explosive atmospheres.
2. When changing battery:
  - a. Inspect battery door and gasket for cracks or damage.
  - b. Inspect the interior of the battery compartment for the presence of corrosion, liquid or dust.
  - c. Replace the RMS if damaged or enclosure integrity is compromised.
3. Test alarm function according to procedures in Long Term Maintenance. Verify full functionality.
4. Replace the RMS monitor if the above criteria are not met.
5. Verify that the Remote Gauge Port fitting is not loose. If fitting is loose or when replacing monitor, tighten fitting to 1/8 turn beyond finger-tight.

### ***Flow Restrictor Replacement Procedure***

In the event the SCBA fails flow testing during Turn-Around or Long-term Maintenance the flow restrictor is most likely clogged and will require replacement.

1. Remove the upper housing of the SCBA.
2. Use the ¼" hex driver from the tool kit to remove the flow restrictor from the manifold block mounted to the lower housing of the SCBA.
3. Discard the clogged flow restrictor, head gasket and o-ring.
4. Install a new restrictor assembly, B6-02-5002-50-0, into the manifold block and tighten hand-tight with the ¼" hex driver supplied in the service kit. Do not over tighten.
5. Perform the high-pressure leak test described in Long Term Maintenance.
6. Perform the flow test described in Turn-Around Maintenance.
7. Replace the upper housing of the SCBA.

## ***Factory Service and Training***

The design of the BioPak 240 Revolution is intentionally simplistic so that service procedures will be easy to perform by a trained Benchman/Technician. Should a service situation arise that requires factory service or assistance the Benchman/Technician can gain support from the contact information listed below.

USA Factory: ***Biomarine-Ntron Incorporated***  
***ATTN: Service Department***  
456 Creamery Way  
EXTON, PA 19341-2532 USA  
PHONE: (610) 524-8800, Monday through Friday, 9-5 Eastern Time  
FAX: (610) 524-8807  
WEB: <http://www.biomarineinc.com>  
EMAIL: [service@biomarineinc.com](mailto:service@biomarineinc.com)

To allow us to better serve your needs and to help you troubleshoot your particular problem, please include in all service correspondence the information listed below:

- BioPak Model Number
- BioPak Serial Number
- Date of BioPak Purchase
- Approximate Number of BioPak Uses
- Description of BioPak Problem
- Actions taken attempting to correct the BioPak problem
- Contact name, address, phone number with area or country code and e-mail address
- PLEASE provide your current e-mail address with all service correspondence

## Troubleshooting Guide

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The following is provided as a guide for the Benchman/Technician to troubleshoot the BioPak. Problems or issues that arise that cannot be corrected by the Benchman/Technician with assistance from this manual should be referred to the factory.

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### **Problem: Mask fogging during use.**

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*Probable Causes:*

1. Anti-Fog lens insert not installed or damaged.
2. Anti-Fog agent not applied or applied incorrectly.

*Remedy:*

1. Install or replace the Anti-Fog Lens, B2-02-0000-30-0.
  2. Reapply the Anti-Fog Agent, B6-02-5002-17-0.
  3. Employ the use of the Magnetic Wiper, part number B6-02-5002-10-0.
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### **Problem: Not achieving full 4-hour duration of BioPak during use.**

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*Probable Causes:*

1. Poor or leaking facepiece seal.
2. Oxygen cylinder opened prior to donning facepiece.
3. Bypass valve over used or utilized to attempt to clear facepiece lens.
4. User under heavy workloads or extreme ambient conditions.
5. Leak in BioPak.
6. Pressure Regulator Failure.

*Remedy:*

1. Readjust the facepiece. User should train for proper facepiece seal using a quantitative fit test. The facepiece seal will be difficult, if not impossible, to achieve if the user has any facial hair or is wearing glasses that interfere with proper facepiece fit. The user should be clean-shaven and should utilize optional spectacle mounting kits if glasses are worn.
2. Do not open the oxygen cylinder valve until after the facepiece has been donned. If the oxygen cylinder valve is opened prior to donning the facepiece excessive loss of the oxygen stores will result.
3. Use of the bypass valve in an attempt to clear the facepiece will result in excessive loss of oxygen stores and will not aid in clearing the lens. The bypass valve should only be utilized in emergency situations since it will dump unrestricted flow directly into the breathing loop and will not conserve the oxygen stores. Properly apply anti-fog material or utilize the magnetic wiper, part number B6-02-5002-10-0, to clear the facepiece lens of dirt, fog, moisture, etc.
4. Whenever the user is under heavy workloads or placed into a hot environment, the body will require a higher than usual intake of oxygen. Such situations may serve to shorten the duration of the BioPak below the 4-hour rating.
5. Leaks in the breathing loop, the low-pressure system and the high-pressure system will serve to shorten BioPak duration. Inspect the SCBA according to procedures provided under Turn Around and Long Term Maintenance.
6. In the rare event of pressure regulator failure, the user should following the emergency procedures described in the User's Manual and immediately evacuate the area. Replace the pressure regulator immediately.

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**Problem: High breathing resistance during exhalation.**

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*Probable Causes:*

1. Facepiece exhalation valve sticking closed.
2. Diaphragm springs in breathing chamber are not properly seated or damaged.
3. Vent valve in breathing chamber not opening properly.

*Remedy:*

1. Inspect the check valve and free it up if possible or replace the facepiece adapter assembly as required.
2. Remove the breathing chamber from the BioPak. Inspect the position of the diaphragm springs and verify that the free ends of the springs are positioned over and around the diaphragm spring receptacles. Replace the spring if it appears damaged.
3. Remove, clean, inspect and replace worn or damaged components in the vent valve. Note that excessive lubrication on the vent seat o-ring seal may cause valve sticking and result in a higher breathing resistance.

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**Problem: High breathing resistance during inhalation.**

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*Probable Causes:*

1. Facepiece inhalation check valve sticking closed.
2. Diaphragm springs in breathing chamber are missing or damaged.
3. Demand valve in breathing chamber has failed.

*Remedy:*

1. Inspect the check valve and free it up if possible or replace the facepiece adapter assembly as required.
2. Remove the breathing chamber from the BioPak. Replace the springs if they appear damaged or install the springs if they are missing.
3. Replace the demand valve in the center section.

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**Problem: Alarm indications of remaining service time not functioning correctly.**

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*Probable Causes:*

1. Monitoring system battery has expired.
2. Monitoring system electrical cable not installed.
3. Monitoring system has failed.

*Remedy:*

1. Replace the monitoring system battery and test alarm function according to procedures in Long Term Maintenance.
2. Inspect the monitoring system electrical connections. Make sure the connectors are clean and fully engaged and secured to their connections.
3. Contact the factory for a replacement monitoring system.

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**Problem: Breathing gas is uncomfortably warm during use.**

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*Probable Causes:*

1. User is unfamiliar with conditions of BioPak supplied atmospheres.
2. Frozen ice canisters have not been installed into the coolant shells.
3. User is working in high ambient temperatures.
4. PCM canister is missing.

*Remedy:*

1. The BioPak will typically supply breathing gas to the user at temperatures below 90°F (32°C) throughout the 4-hour duration. Breathing gas temperatures will be cool at the start of BioPak use and will continually rise as the user workload increases and as the frozen ice canisters begin to thaw.
2. Install the FROZEN icepacks into the coolant shells. The ice canisters must be frozen for a period no less than eight (8) hours prior to use and should only be installed into the coolant shells just prior to donning the BioPak.
3. Should the user be exposed to high ambient temperatures, the temperature of the supplied breathing may rise above 90°F (32°C). The BioPak 240 Revolution will allow the exchange of spent ice canisters for frozen ice canisters in the hazardous area without breaking into the breathing loop. Thus it is suggested that a supply of frozen ice canisters be kept on hand when utilizing the SCBA in applications of high ambient heat.
4. Install the PCM canister.

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**Problem: Facepiece fails positive and/or negative testing during user donning.**

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*Probable Causes:*

1. Poor facepiece fit.
2. Inhalation and/or exhalation check valves missing in facepiece.
3. Inhalation and/or exhalation check valves damaged in facepiece.
4. Improper positive and negative test check conducted.

*Remedy:*

1. Adjust facepiece to gain a good facepiece seal. Remove any facial hair such as beards, moustaches, side burns and hair that may impede the ability of the facepiece to seal to the face.
2. Replace the facepiece adapter assembly.
3. Replace the facepiece adapter assembly
4. Properly conduct the positive and negative test check.

**Users are encouraged to visit Biomarine on the worldwide web at <http://www.biopak240R.com> for product updates and various downloadable documents including Material Safety Data Sheets (MSDS), manuals, and other materials.**



## BioPak 240R Specifications

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Respirator Type:	Self-Contained, Closed-Circuit, Pressure-Demand
Respirator Duration:	Certified as entry and escape, 4-hour duration
Protection:	Positive Pressure
Size:	23.0 x 17.3 x 7.0" (584 x 439 x 178 mm)
Weight: Ready to use	34 pounds (15.4 kg)
Alarms:	Green LED: Status Ok Red LED: Alarm Condition Blue LED: Insert Ice Reminder Audible Alarm: Alarm Condition
Operational Temperature Range <sup>1</sup> :	5 to 110 °F (-15 to 43 °C)
Storage Temperature Range:	40 to 90°F (4 to 32°C)
Approvals:	NIOSH: TC-13F-541 MSHA: 18-A060028-0  US DOT-E11194 per DOT-CFFC Standards Transport Canada TC-SU 5303
Power:	(1) 9-volt dc battery required for monitoring system Energizer #522 Panasonic #6AM6 Rayovac #A1604 Duracell #MN1604
Oxygen:	440 liters @ 3000 psi/207 bar Medical Grade or Aviation Grade Oxygen Moisture content less than 50 mg/m <sup>3</sup> at 3000 psi/207 bar
Tidal Volume:	Over 6 liters
Carbon Dioxide Scrubber:	Dual, single use Calcium Hydroxide cartridges Non-dusting, non-settling, non-channeling, non-hazardous
Cooling:	Dual, Sterile, Distilled water ice canisters capable of replacement without breaking breathing loop. Fixed phase change material canister.
Expected Battery Life:	At ambient temperature above 40° F, 200 hours or 6 months whichever comes first.

<sup>1</sup>Stated operational temperature range pertains to the ability of the SCBA equipment to function under the stated temperature ranges and does not take into account human factors that may limit actual operational temperature range of a specific individual. For more information concerning human heat stress factors reference the **Varley Report Heat Stress 04-107.pdf** located on the Biomarine website at <http://www.biomarineinc.com/manuals.html>.

## Warranty

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

THE SOLE LIABILITY OF BIOMARINE FOR ALL PURPOSES SHALL BE TO REPLACE, AT THE SOLE OPTION OF BIOMARINE, DEFECTIVE PARTS APPEARING WITHIN THE THREE OR ONE-YEAR PERIOD AS APPLICABLE. BIOMARINE SHALL PROVIDE PARTS AT ITS OWN EXPENSE BUT ALL LABOR SHALL BE AT THE EXPENSE OF 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 THIRTEEN (13) MONTHS FROM THE DATE OF PURCHASE, WHICHEVER OCCURS SOONER; AND
2. THE BUYER SUBMITS PROOF OF DATE OF PURCHASE WITH INVOICE OR EQUIVALENT DOCUMENTATION; AND
3. THE DEFECTIVE GOODS ARE PROMPTLY RETURNED BY BUYER, AT THEIR SOLE EXPENSE TO BIOMARINE AT: 456 CREAMERY WAY, EXTON, PA 19341 USA; AND
4. THE EQUIPMENT HAS NOT BEEN ALTERED; AND
5. THE DEFECT OCCURS UNDER CIRCUMSTANCES OF PROPER USE IN ACCORDANCE WITH ALL INSTRUCTIONS AND MANUALS PROVIDED TO THE BUYER.

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

Buyer shall be responsible for insuring that the goods are functioning properly at all times and shall not use any goods which are not functioning properly. If buyer uses 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 and anti-fog lens inserts which are considered "consumable item", and as such are not covered by the terms of these warranties. No waiver, alteration or modification of the terms of these provisions shall be valid unless in writing and signed by an executive officer of Biomarine.

These warranties shall not apply to accessories or devices purchased by Biomarine and attached to or made part of the goods except that Biomarine warrants 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.

## **Illustrated Parts Lists**

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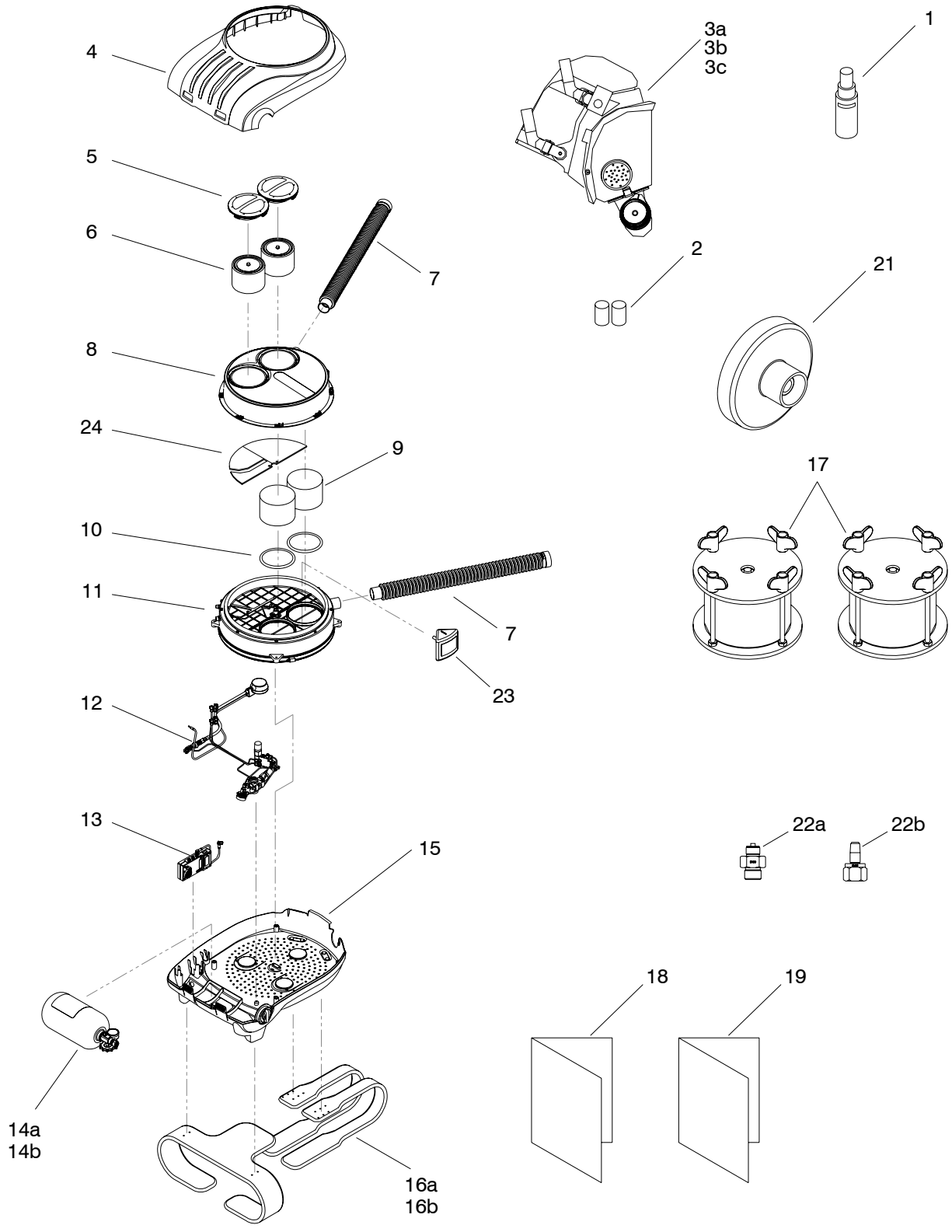
The following pages will provide exploded part lists for the various assemblies within the BioPak 240 Revolution. The Benchman is to utilize these part lists for component ordering and as a guide for SCBA service. All parts listed within the following pages are available directly from the factory or any Biomarine authorized agent or dealer.

**A. Top Assembly**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	-	B7-07-2401-04-0	BioPak 240 Revolution Complete <sup>1</sup>
REF	-	B7-07-2401-02-0	BioPak 240 Revolution Complete <sup>2</sup>
1	1	B6-02-5002-17-0	Facepiece Anti-Fogging Agent, 2 oz. Spray
2	opt.	B6-02-5002-10-0	Magnetic Facepiece Wiper
3a	1	B6-02-5002-09-0	Small Facepiece Assembly, See Section B
3b	1	B6-02-5002-09-1	Medium Facepiece Assembly, See Section B
3c	1	B6-02-5002-09-2	Large Facepiece Assembly, See Section B
4	1	B6-02-5002-18-0	Upper Housing Assembly
5	2	B2-02-4000-39-0	Coolant Lid
6	2	B6-02-5002-37-0	Ice Canister
7	2	B2-02-7001-09-0	Breathing Hose, See Section C
8	1	B6-02-5002-04-0	Center Section Lid Assembly, See Section D
9	1	B5-01-5000-00-0	CO <sub>2</sub> Scrubber Canister <sup>3</sup>
10	2	B2-02-7001-15-0	CO <sub>2</sub> End Gasket <sup>4</sup>
11	1	B6-02-5002-07-0	Center Section Assembly, See Section E
12	1	---	Pneumatic Assembly, See Section G
13	1	---	RMS Monitoring System, See Section I
14a	1	B6-02-5001-98-0	North American O <sub>2</sub> Cylinder-Empty, See Section J
14b	1	B6-02-5001-98-1	North American O <sub>2</sub> Cylinder-Full, See Section J
15	1	---	Lower Housing Assembly, See Section K
16a	1	B2-02-7001-25-0	Harness Assembly-Non-Flame Rated
16b	1	B2-02-7001-24-0	Harness Assembly-Flame-Rated
17	2	B6-02-5002-40-0	Ice Canister Freeze Form
18	1	B5-06-6000-14-0	User Manual-ENGLISH
19	1	B5-06-6000-15-0	Benchman Manual-ENGLISH
20a	opt	B6-02-5002-63-0	Hard Storage Case (not depicted)
20b	opt	B2-02-7000-39-0	Soft Storage Case (not depicted)
21	1	B2-02-4000-90-0	Facepiece Storage Plug
22a	1	B6-02-5002-54-0	Cylinder Fill Adapter, CGA540-Male
22b	1	B6-02-5002-55-0	Cylinder Fill Adapter, CGA540-Female
23	1	B6-02-5002-41-0	Internal Phase Change (PCM) Heat Exchanger
24	1	B2-02-7001-07-0	Moisture Absorbent Pad Set

**Note:**

1. Includes North American Cylinder, Non-Flame-Rated Harness, NIOSH Certification.
2. Includes North American Cylinder, Flame-Rated Harness, NIOSH Certification.
3. CO<sub>2</sub> Scrubber Canister, part number B5-01-5000-00-0, will supply four sets of canisters and gaskets for four separate single uses.
4. CO<sub>2</sub> End Gasket, part number B2-02-7001-15-0, can be purchased individually. Gaskets are also supplied within each single use package of the CO<sub>2</sub> Scrubber Canister.

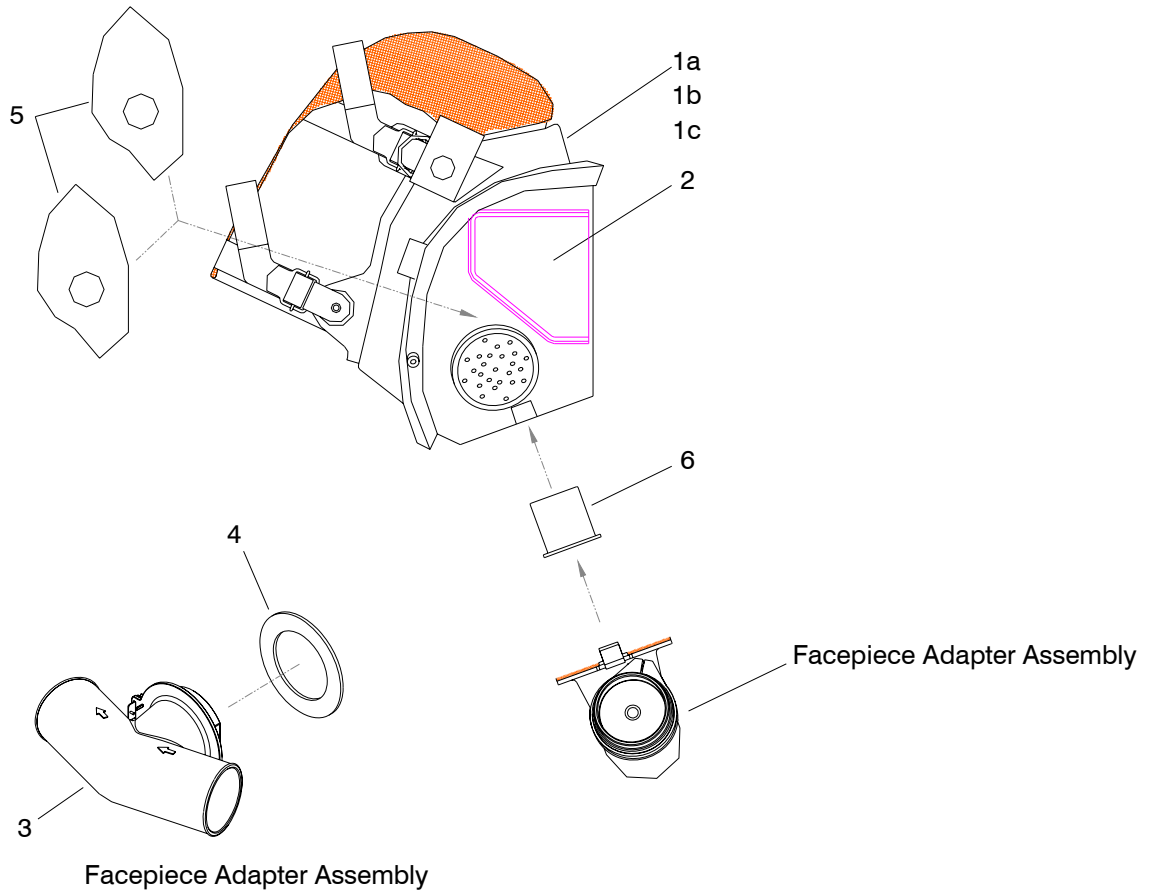


**B. Facepiece Assembly**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
1a	1	B6-02-5002-09-0	Small Facepiece-Complete <sup>1</sup>
1b	1	B6-02-5002-09-1	Medium Facepiece-Complete <sup>1</sup>
1c	1	B6-02-5002-09-2	Large Facepiece-Complete <sup>1</sup>
2	1	B2-02-0000-30-0	Anti-Fog Lens Insert
3	1	B6-02-5002-38-0	Facepiece Adapter Assembly <sup>2</sup>
4	1	B2-06-6001-34-0	Facepiece Adapter Gasket
5	2	B2-02-7001-33-0	Nose Cup Insert
6	1	B2-02-4001-26-0	Interface Tube
7	1	B2-06-6001-70-0	Facepiece Storage Bag (not depicted)

Note:

1. Complete facepiece does not include adapter assembly defines by items 3 through 5.
2. Adapter assembly includes check valve holders and check valves factory installed. It is not recommended for users to attempt to replace check valves within the adapter assembly without direct factory support.

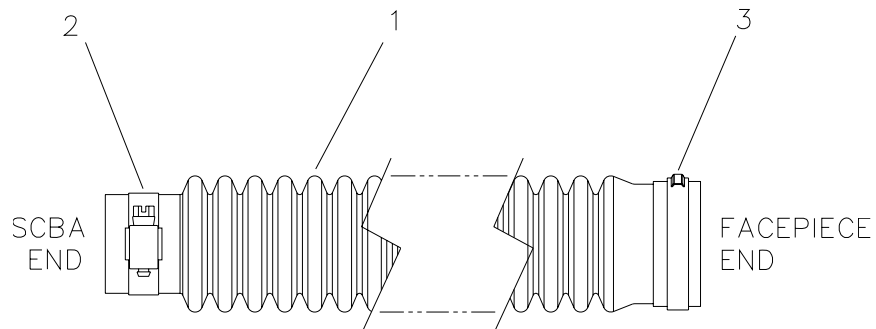


### C. Breathing Hose

ITEM #	QTY.	PART NUMBER	DESCRIPTION
1	2	B2-02-7001-09-0	Breathing Hose
2	2	B2-06-6000-01-0	Worm Gear Hose Clamp
3	2	B2-06-6001-60-0	Stepless Ear Clamp
Opt	1	B2-03-1000-11-0	Stepless Ear Clamp Installation Ratchet Tool

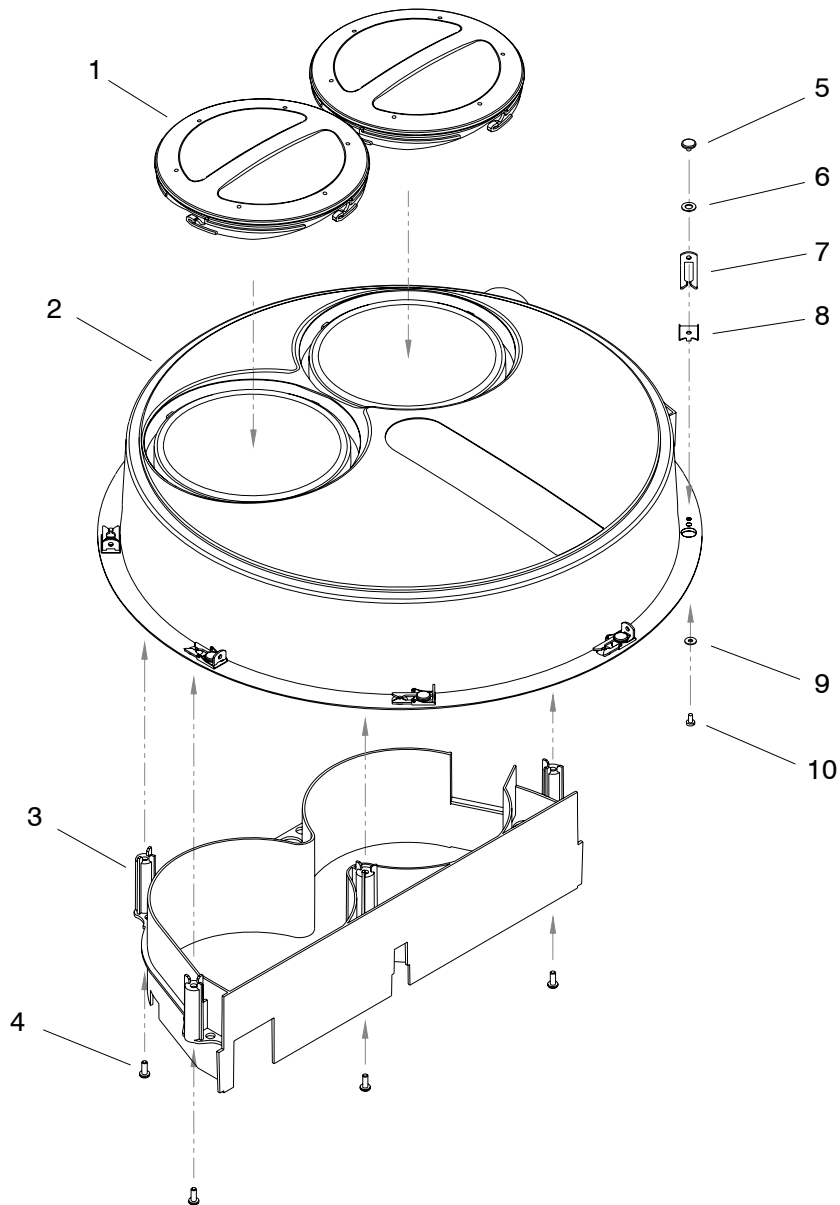
Note:

1. Quantities above reflect require for two hose assemblies per BioPak.



**D. Center Section Lid Assembly**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5002-04-0	Center Section Lid Assembly-Complete
1	2	B2-02-4000-39-0	Coolant Lid
2	1	B6-02-5002-27-0	Center Section Lid
3	1	B2-02-4000-72-0	Flow Baffle
4	4	B3-01-3064-00-1	#6 x 1/2" Self-Tapping Screws
5	8	B2-02-3100-17-0	Snap-Slide Fastener
6	8	B2-06-6000-06-0	Snap-Slide Washer
7	8	B2-06-6000-04-0	Snap-Slide Latch
8	8	B2-06-6000-05-0	Snap-Slide Guide
9	8	B3-03-1023-01-0	Snap-Slide Flat Washer
10	8	B3-01-1022-01-0	Snap-Slide Screw



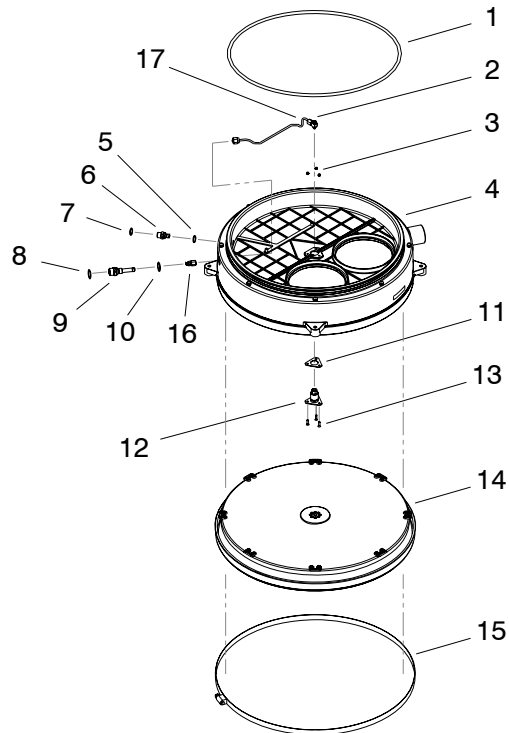


**E. Center Section Assembly**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5002-07-0	Center Section Assembly-Complete
1	1	B4-04-7060-20-0	Lid O-Ring <sup>1</sup>
2	1	B6-02-5002-24-0	Demand Feed Tube
3	3	B3-02-0040-00-0	#4-40 Locking Hex Nut
4	1	B6-02-5002-22-0	Center Section Body Assembly
5	1	B4-04-7070-03-1	Constant Add Fitting O-Ring <sup>2</sup>
6	1	B2-02-3300-06-0	Constant Add Fitting <sup>3</sup>
7	1	B4-04-7070-02-1	Constant Add Tube O-Ring <sup>2</sup>
8	1	B4-04-7070-00-1	Demand Add Tube O-Ring <sup>2</sup>
9	1	B2-02-3300-48-0	Demand Add Fitting <sup>3</sup>
10	1	B4-04-7060-01-1	Demand Add Fitting O-Ring <sup>2</sup>
11	1	B2-02-7001-10-0	Demand Valve Gasket <sup>4</sup>
12	1	B6-02-5002-23-0	Demand Valve Assembly
13	3	B3-01-0043-00-0	#4 x 3/8" Sealed Flat Head Screw <sup>4</sup>
14	1	B6-02-5002-05-0	Diaphragm Assembly, See Section F
15	1	B2-06-6001-47-0	Diaphragm Clamp
16	1	B4-03-5204-08-0	#10 x 1/8" Tube Male Connector Fitting <sup>4</sup>
17	1	B2-02-3100-24-0	Demand Flow Restrictor Plate <sup>5</sup>

**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. Consult with factory concerning proper installation of Demand Flow Restrictor, item 17.

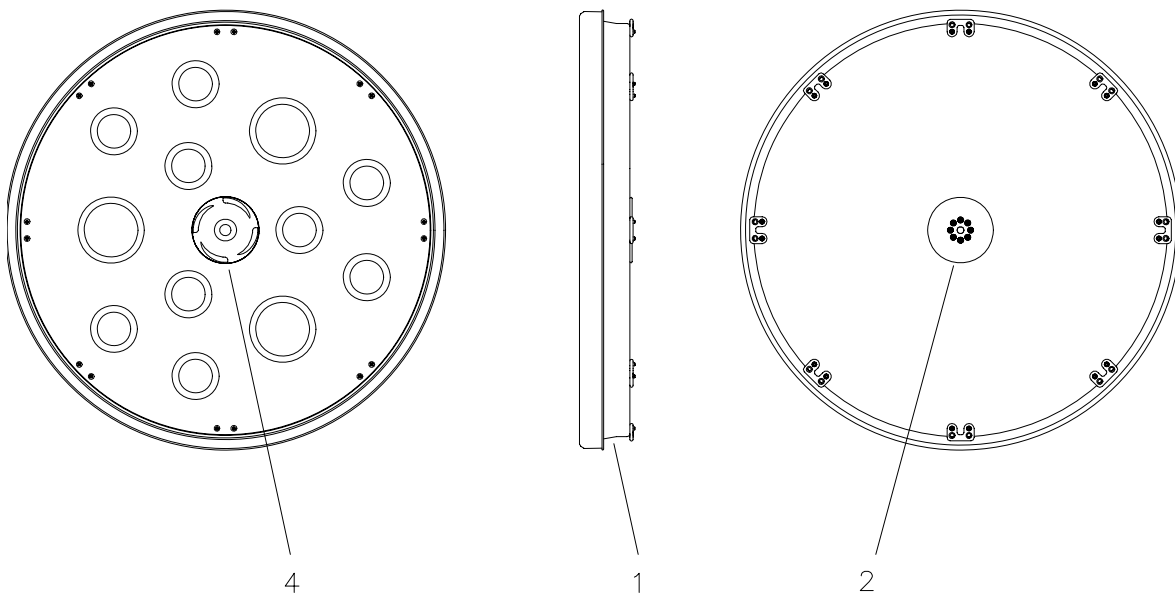
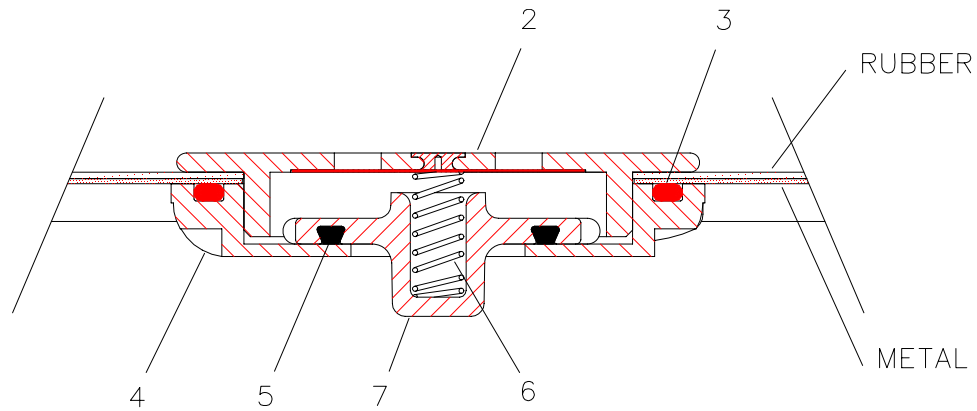


**F. Diaphragm Assembly**

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

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.

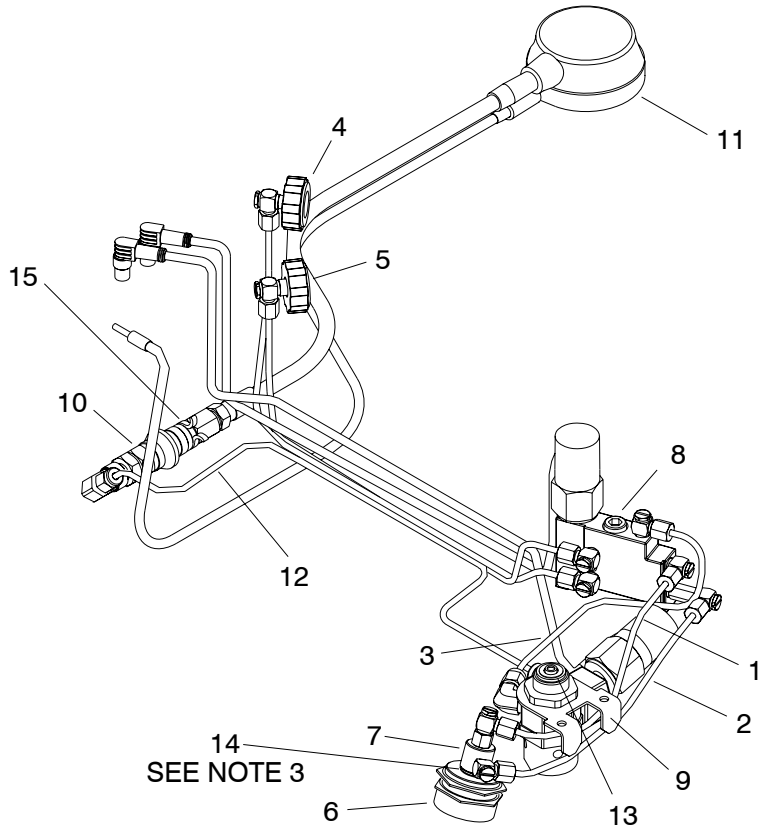


**G. Pneumatic Assembly**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	---	Pneumatic Assembly
1	1	B6-02-5002-31-0	Bypass Feed Tube
2	1	B6-02-5002-32-0	Bypass Return Tube
3	1	B6-02-5002-30-0	Oxygen Feed Tube
4	1	B6-02-5002-03-1	Constant Add Center Section Feed Tube
5	1	B6-02-5002-02-1	Demand Add Center Section Feed Tube
6	1	B4-04-5000-00-0	Bypass Valve Push Button
7	1	B4-04-5570-00-0	Bypass Valve <sup>1</sup>
8	1	B6-02-5002-00-0	Manifold Assembly, See Section H
9	1	B6-02-5002-26-0	Oxygen Regulator Assembly <sup>3</sup>
10	1	B6-02-5002-43-0	Remote Gauge Shut Off Valve Assembly
11	1	B6-02-5002-45-0	Remote Gauge Assembly
12	1	B6-02-5002-44-0	Remote Gauge Feed Tube Assembly
13	1	B4-04-0030-00-0	Bodok Cylinder Seal Washer
14	1	B2-02-3300-14-0	Bypass Valve Spring
15	1	B2-02-4001-13-0	Remote Gauge Lock Out Clip

Note:

1. Bypass Valve, Item 7, to install into bypass push button using one tooth washer, supplied with valve, installed between valve and push button.
2. Oxygen Regulator, Item 9, is supplied as a complete assembly only. Regulator will mount to SCBA lower housing with two #8 x 3/8" Self-Tapping Screws, B3-01-4071-00-0
3. Spring, item 14, is to install between the bypass valve and bypass valve push button with spring surrounding valve stem.



SEE NOTE 3



**I. RMS Monitoring System**

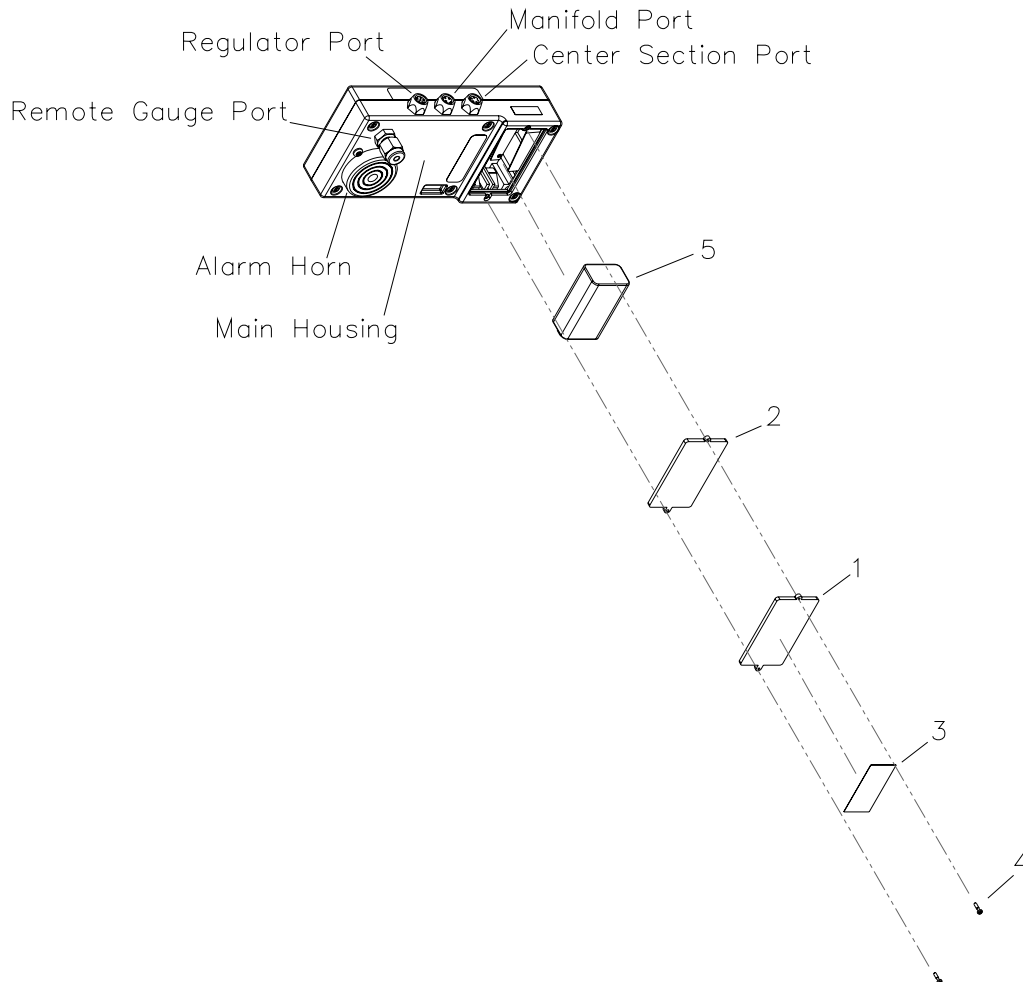
ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-01-5000-05-0	Monitoring System Complete
1	1	B2-02-1300-20-0	Battery Door
2	1	B2-02-7001-16-0	Battery Door Gasket
3	1	B2-02-4001-11-0	Battery Door Warning Label
4	2	B2-02-3000-07-0	Battery Door Captive Screw
5	1	B1-14-2000-00-0	9Vdc Battery <sup>3</sup>
6	1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

Note:

1. The Pressure Switch cable is supplied as part of Manifold Assembly.
2. The Pressure Transducer cable is supplied as part of the Oxygen Regulator Assembly.
3. 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

4. THERE ARE NO USER SERVICABLE PARTS WITHIN THE MAIN HOUSING OF THE MONITORING SYSTEM. DO NOT ATTEMPT TO OPEN MAIN HOUSING OR HOUSING SEAL WILL BE BREACHED AND INTRINSIC SAFETY RATING AND CERTIFICATION WILL BE VOID.

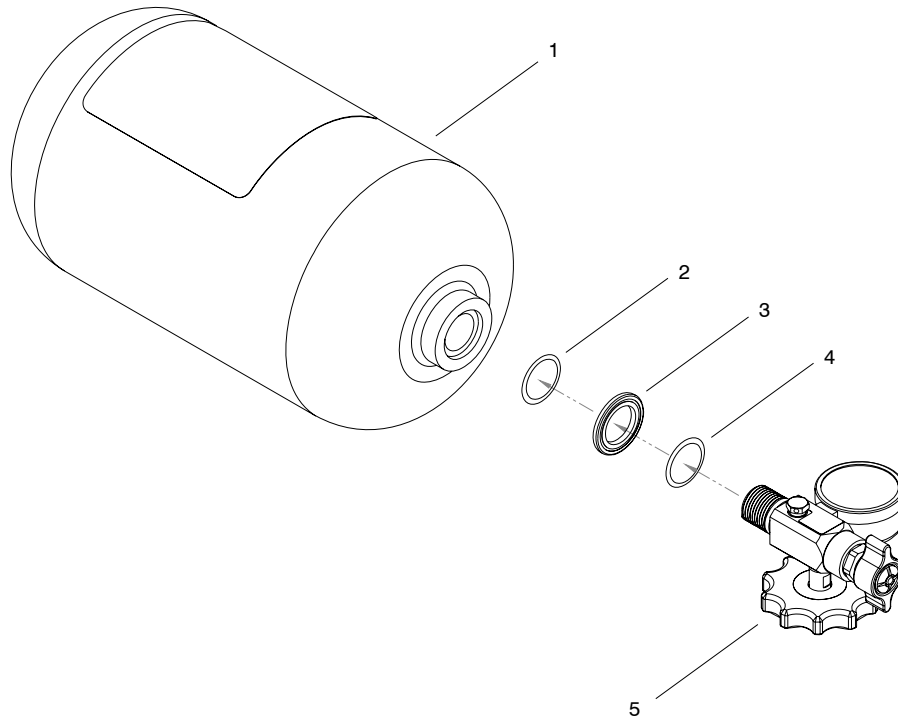


**J. Oxygen Cylinder Assembly**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5001-98-0	North American (Green) Cylinder Assembly-Empty
REF	1	B6-02-5001-98-1	North American (Green) Cylinder Assembly-Full
1	1	B2-01-2000-06-0	Green Cylinder
2	1	B4-04-7060-00-0	Exterior O-Ring <sup>1</sup>
3	1	B2-02-3300-52-1	Valve Collar <sup>2</sup>
4	1	B4-04-7060-07-2	Interior O-Ring <sup>1</sup>
5	1	B6-02-5001-97-0	Valve Assembly <sup>2</sup>

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.

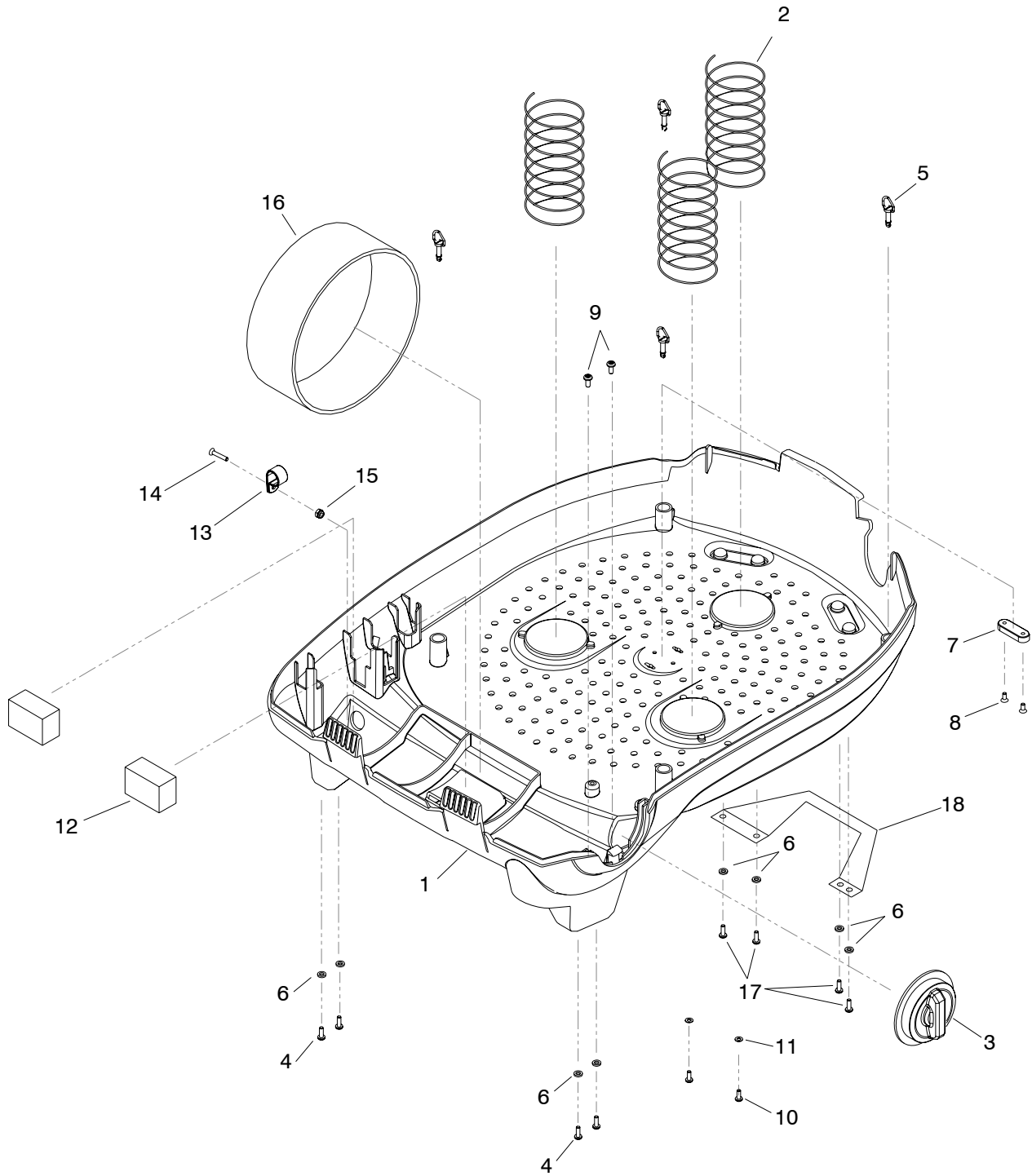


**K. Lower Housing Assembly**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
1	1	B6-02-5002-28-0	Lower Housing Shell, NIOSH Labeled
2	3	B2-02-3300-46-0	Diaphragm Springs <sup>1</sup>
3	1	B2-02-4000-68-0	External Oxygen Knob <sup>2</sup>
4	4	B3-01-1071-03-0	Harness Waist Belt Fastening Screws <sup>3</sup>
5	4	B3-01-0008-00-0	¼-Turn Center Section Hold Down Pins
6	8	B3-03-1073-00-0	Harness Mounting Washers <sup>3</sup>
7	1	B2-02-1300-27-0	Vent Spacer
8	2	B3-01-1063-00-0	Vent Spacer Mounting Screw <sup>3</sup>
9	2	B3-01-4071-00-0	Oxygen Regulator Mounting Screw
10	2	B3-01-1061-01-1	Manifold Mounting Screw <sup>3</sup>
11	2	B3-03-3063-00-0	Manifold Mounting Washer <sup>3</sup>
12	2	B2-02-7001-30-0	Latch Foam Pad
13	1	B2-06-6001-08-0	Remote Gauge Mounting Clamp
14	1	B3-01-1073-02-0	Remote Gauge Mounting Screw <sup>3</sup>
15	1	B3-02-4070-01-0	Remote Gauge Mounting Nut
16	1	B2-02-7001-21-0	Oxygen Cylinder Hold-Down Strap <sup>4</sup>
17	4	B3-01-1071-01-0	Harness Shoulder Strap/Handle Mounting Screws
18	1	B2-02-4001-29-1	Carrying handle

**Note:**

1. Diaphragm Springs, Item 2, install into lower housing by threading onto spring retainer projections.
2. External Oxygen Knob, Item 3, snaps into position within lower housing.
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.



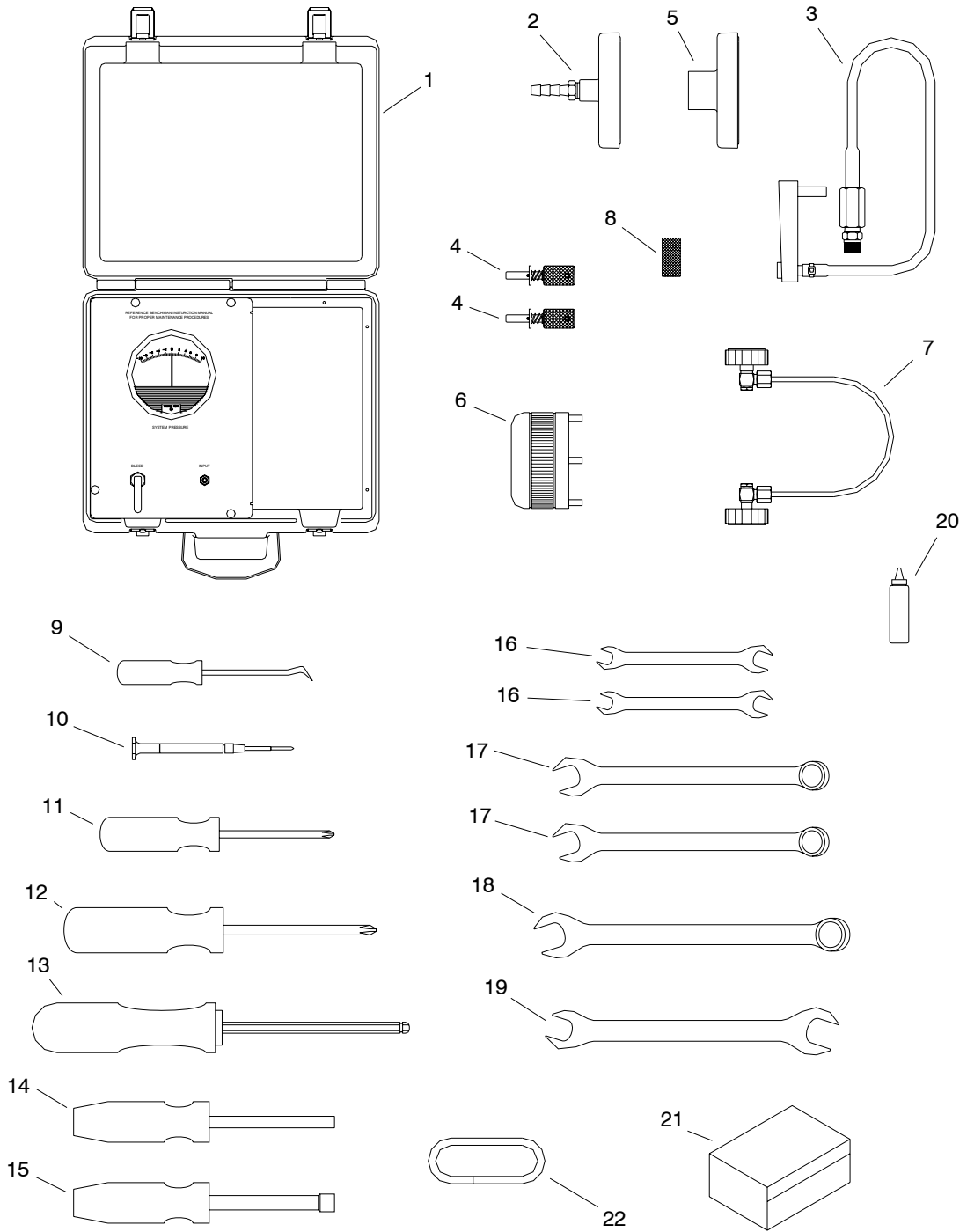


**L. Tool Kit**

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5002-16-0	Tool Kit-Complete
1	1	B6-02-5002-57-0	Replacement Case Assembly <sup>1</sup>
2	1	B6-02-5002-56-0	Leak Check Adapter Fitting
3	1	B6-02-5002-15-0	Flow Test Fixture
4	2	B6-02-5000-17-2	Test Key <sup>2</sup>
5	1	B2-02-4000-90-2	System Drying Adapter Fitting
6	1	B2-03-3000-01-0	Vent Valve Hand Wrench
7	1	B6-02-5002-35-0	Center Section Pneumatic Plug
8	1	B2-02-5400-04-0	Regulator Wash Cover
9	1	B2-03-1000-10-0	Combination Pick Tool
10	1	B2-03-1000-15-0	#00 Phillips head Screwdriver
11	1	B2-03-1000-03-0	#1 Phillips Head Screwdriver
12	1	B2-03-1000-16-0	#2 Phillips Head Screwdriver
13	1	B2-03-1000-17-0	¼" Hex Driver
14	1	B2-03-1000-09-0	3/16" Nut Driver
15	1	B2-03-1000-12-0	5/16" Nut Driver
16	2	B2-03-1000-04-0	3/8" x 5/16" Open End Wrench
17	2	B2-03-1000-06-0	7/16" Combination Wrench
18	1	B2-03-1000-13-0	½" Combination Wrench
19	1	B2-03-1000-05-0	5/8" x 9/16" Open End Wrench
20	1	B5-01-3000-03-0	Leak Detection Fluid
21	1	B2-02-7001-28-0	Tool Pouch
22	1	B4-02-6037-00-0	3/8" OD Rubber Tubing <sup>3</sup>

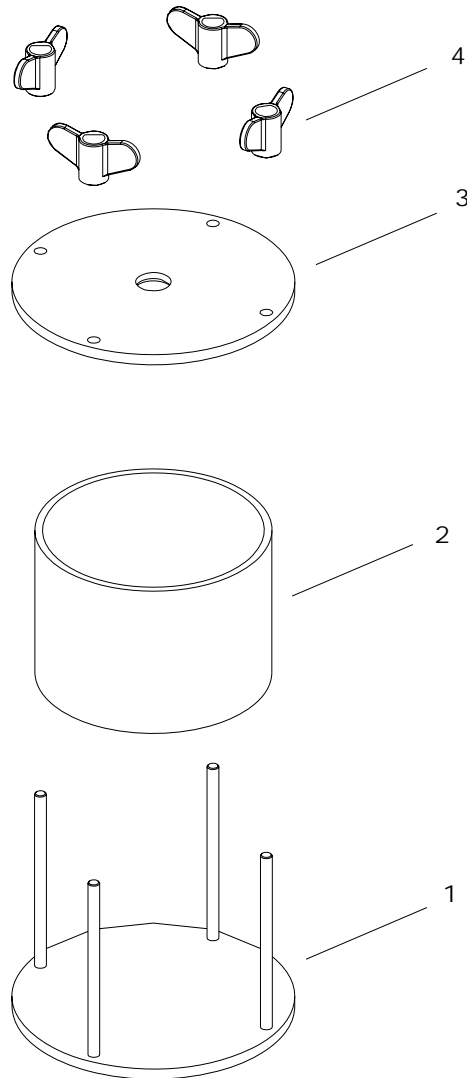
## Note:

1. Replacement Case Assembly, item 1, includes the tool kit case complete with internal pressure gauge and associated plumbing plus external shipping box.
2. A total of two (2) test keys, item 4, are required for proper testing of the BioPak 240R.
3. Order a minimum length of 6-feet of tubing. Longer lengths are available upon request.



**M. Ice Canister Freeze Form**

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



**N. Miscellaneous Supplies**

<b>DESCRIPTION</b>	<b>PART NUMBER</b>
Test Kit (includes test equipment and tools)	B6-02-5002-16-0
Seal Kit (includes all replacement seals & lubricants)	B6-02-5002-14-0
Christo-Lube O-Ring Lubricant (2-ounce tube)	B5-01-3000-01-0
Dow-111 O-Ring Lubricant (5.3-ounce tube)	B5-01-3000-11-0
Leak-Tec Leak Detection Fluid (8-ounce bottle)	B5-01-3000-03-0
Disinfectant (75 single-use packets) <sup>1</sup>	B6-02-5000-42-0
Multi-Wash Disinfectant with Spray <sup>2</sup>	B5-01-5000-01-0

**Note:**

1. Packet disinfectant is suitable for cleaning and disinfecting all components of the BioPak with the exception of the facepiece. Use the Multi-Wash Disinfectant only on the facepiece.

Multi-Wash Disinfectant is suitable for cleaning and disinfecting all components of the BioPak including the facepiece.

## O. Accessory Components

The following will provide a brief description of available accessory components for the BioPak 240R. New accessory components are being developed as needs arise. To get a full listing of available accessory components consult with the local Biomarine representative or check the Biomarine website at <http://www.biopak240R.com>.

**Flame-Rated Harness Chest Belt Extender, B2-02-7001-34-1:** Provides harness chest belt length extension to increase available size range of harness.

**Flame-Rated Harness Waist Belt Extender, B2-02-7001-35-1:** Provides harness waist belt length extension to increase available size range of harness.

**Standard Harness Chest Belt Extender, B2-02-7001-34-0:** Provides harness chest belt length extension to increase available size range of harness.

**Standard Harness Waist Belt Extender, B2-02-7001-35-0:** Provides harness waist belt length extension to increase available size range of harness.

**SCBA Kickstand, B6-02-5002-48-0:** Provides support to stand the BioPak 240R in a near vertical position on a flat surface such as a work surface.

**Soft Carrying Case, B2-02-7000-39-0:** An armored, nylon bag that will stow the BioPak 240R and facepiece. Includes handles and shoulder strap for carrying.

**Hard Transit Case, B6-02-5002-63-0:** A rigid case that will provide storage of the BioPak 240R and facepiece. Includes wheels, handles and internal protective foam.

**Facepiece Kevlar Neck Strap, B2-06-6001-64-0:** Kevlar strap that will connect to clips on the facepiece assembly. Strap will allow facepiece to hang from user's neck when BioPak 240R is being worn but not active.

**Facepiece Magnetic Lens Wiper, B6-02-5002-10-0:** Magnetic wiper system that includes two wiping mechanisms that will wipe both the internal and external surfaces of the lens at once with lens pass throughs.

**Replacement Wiper Chamois, B2-02-4000-85-0 :** A sheet of ten (10) replacement, adhesive-backed chamois cloths.

**Facepiece Spectacle Kit, B6-02-5002-42-0:** Frame that will install into the interior of the facepiece to hold prescription lens.

**Breathing Hose Kevlar Sleeve, B2-02-7001-22-0:** Sleeve will totally surround breathing hose to provide abrasion and cut resistance. Manufactured from the same Kevlar material as the facepiece head harness.

**Breathing Hose Anti-Crush Ring, B2-02-4101-22-0:** Flame-resistant, injection-molded rings that will nestle within the convolutions of the breathing hose to provide crush resistance when carrying equipment over the shoulder. Recommend a minimum of 5 rings per breathing hose.

