BioPak 240R-NIOSH

Closed-Circuit, Self-Contained Breathing Apparatus

Benchman Manual

47C091, Revision **D**
April 2018

CERTIFICATION APPROVALS

Respirator NIOSH Approval Label:

BIOMARINE INCORPORATED, A WHOLLY OWNED SUBSIDERARY OF NEUTRONICS INC.
456 CREAMERY WAY, EXTON, PA, 19341-2532 USA
PHONE: (610) 524-8800 FAX: (610) 524-8807 WEB: www.NeutronicsInc.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					
TC-	PROTECTION [1]			CAUTIONS AND LIMITATIONS [2]			
13F-541	240-MIN/3000 PSIG/SCPD	BREATHING HOSE	D47C005		X	X	X
13F-684	240-MIN/3000 PSIG/SCPD	LOWER HOUSING	D47C006		X	X	X
13F-959	240-MIN/3000 PSIG/SCPD	UPPER HOUSING	D47C007		X	X	X
		PNEUMATIC ASSEMBLY	D47C008		X	X	X
		CENTER SECTION	D47C009		X	X	X
		CARBON DIOXIDE ABSORBENT	OrbSorb®		X	X	X
		HEAT EXCHANGER	Ice Canister		X	X	X
		ALTERNATE OXYGEN CYLINDER	North American, BODOK Seal		X	X	X
			International, BODOK Seal		X	X	X
			North American, O-Ring Seal		X	X	X
			International, O-Ring Seal		X	X	X
		INTERNAL HEAT EXCHANGER	PCM		X	X	X
		ALTERNATE FULL FACEPIECE	AV3000 Small	D47C013-01	X		
			AV3000 Medium	D47C013-02	X		
			AV3000 Large	D47C013-03	X		
			AV3500 Small	D47C054-01		X	
			AV3500 Medium	D47C054-02		X	
			AV3500 Large	D47C054-03		X	
			PRO PP Small	043671-01			X
			PRO PP Small with Drink Port	043671-02			X
			PRO PP Medium	043671-03			X
			PRO PP Medium with Drink Port	043671-04			X
		ALTERNATE HARNESS ASSEMBLY	Non-Flame-Rated	D47C014-01	X	X	X
			Flame-Rated	D47C014-02	X	X	X
			OTS Flame-Rated	47C092	X	X	X
		MONITORING SYSTEM	RMS	D47C016	X	X	X
		ACCESSORIES	Facepiece Magnetic Wiper	C47C017	X	X	X
			AV3000/AV3500 Facepiece Spectacle Kit	D47C022	X	X	
			AV3000/AV3500 Hydration System Kit	D47C033	X	X	
			Spray-On Anti-Fog	B47C015	X	X	X
			AVIWT Communication Interface	027341	X	X	
			PRO PP Facepiecce Spectacle Kit	B47C075			X
			PRO PP Hydration System Kit	043703			X
					JMNOS	JMNOS	JMNOS

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.

A47C003DLj
rev. j [march 2018]

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

CHEMCIAL SCRUBBER CANISTER

TC-13F-541

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 material.

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

United States Department of Labor
MSHA
Mine Safety and Health Adminstration

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 – Refer to the AVIWT Communication Interface User Instructions and MSHA Conditions of Use for Sentinel Mesh Handset documents to ensure that intrinsic safety approval is maintained when utilizing the optional communication system of section 2.9.

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 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 temperatures as low as -5^{o}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 fully charged with compressed medical or aviation grade oxygen with moisture content less than 50 mg/m^3 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 this 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 must 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 carbon dioxide chemical scrubber **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

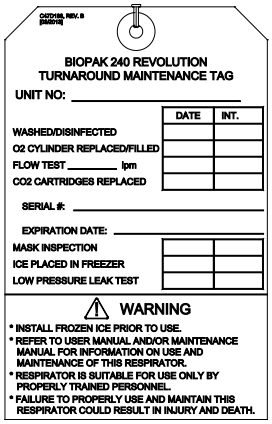
This manual presents the minimum recommended procedures for maintaining the BioPak 240R. End users are free to implement additional procedures and tests above and beyond the scope of this manual as they see fit or as may be required for specific locations or applications, provided these procedures meet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

1.1 Maintenance Tag



Obtain a maintenance tag supplied with replacement carbon dioxide scrubbers.

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

Record the apparatus identification onto the tag.

1.2 Disassembly

Immediately after completion of BioPak, use, remove the used CO_2 scrubber canisters, scrubber moisture pad and disconnect the demand and constant add lines from the center section to prevent migration of moisture into the manifold assembly.

Disassemble the apparatus to prepare for cleaning and disinfection. Identify any apparatus damage and repair as needed. Repairs beyond the scope of the Benchman should be referred to **Biomarine.**

1. Remove the upper housing.
2. Remove the coolant lids and coolant ice.
3. Remove the oxygen cylinder, making sure the seal washer, if utilized, remains in place, and install the regulator wash cover supplied with the service kit.

It is acceptable to leave the oxygen cylinder in place until after washing and disinfecting has been completed to prevent ingress of contaminates into the high pressure plumbing of the BioPak.

4. Remove the facemask from the breathing hoses.
5. Remove the breathing hoses from the breathing chamber.
6. Remove the center section lid.
7. Remove and discard the two carbon dioxide scrubber components and the scrubber moisture pad.
8. Remove the moisture sponges and the PCM.
9. Disconnect the electrical line and both pneumatic connections to the center section. Use care when handling the center section. Avoid sharp objects and rough surfaces that could damage the rubber diaphragm.
10. Remove the four quarter-turn fasteners and remove the center section.

1.3 Cleaning/Disinfection

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

The apparatus must be cleaned and disinfected as soon as possible after each use. If cleaning is not immediately possible after use, at a minimum remove and discard the carbon dioxide scrubber and moisture pad, remove the moisture control foam pads, disconnect both the constant and demand add lines and temporarily store the BioPak with the center section lid open to prevent the growth of mold or mildew.

DO NOT submerge the electronic monitor housing.

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

1. Clean the upper and lower housings, ice canisters and coolant lids and all connected components with a mild soap and water mixture if necessary.
2. Mix the disinfectant with clean water as directed on the package.
3. Submerge the facemask, hoses with facemask connector, center section lid, center section, PCM and moisture sponges into the disinfectant solution. Allow the components to be wetted on all surfaces.

Install a Demand Port Wash Plug, supplied with the service kit, to the demand port of the center section to keep water from migrating into the demand valve.

DO NOT allow the mask to soak in cleaning solutions for extended periods. Extended soaking can cause delamination of the anti-fog film.

4. **Thoroughly** rinse all components in clean water to remove all disinfection solution. **It is extremely important to fully rinse the facemask of all cleaning solution.**
5. Allow all components to dry either by air-drying, heated drying or through the use of a dryer system. Heat-assisted drying temperatures shall not exceed 120°F (50°C).
6. Date and initial the maintenance tag under *Washed/Disinfected.*

1.4 Coolant Canister

The coolant canisters must be frozen before use.

1. Place the cleaned and dried canisters into the freeze form and secure the lid.
2. Place the freeze forms onto a level surface in a freezer for a minimum 8-hour period at a temperature of 10°F (-12°C) or less.
3. Date and initial the maintenance tag under *Ice Placed in Freezer.*

1.5 Oxygen Cylinder

The oxygen cylinder must be fully charged to 3000 psi (207 bar) with oxygen before use.

Oxygen used to supply or charge the breathing apparatus must be medical or aviation grade oxygen with moisture content less than 50 mg/m^3 at 3000 psi (207 bar). The composition of suitable oxygen is given below.

Oxygen: 99.5% minimum mole
Carbon Dioxide: 300 ppm maximum
Carbon Monoxide: 10 ppm maximum

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

National regulations must be observed.

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

1. Obtain the proper cylinder fill adapter need to connect the oxygen cylinder to the booster pump.
2. Connect the cylinder to the booster pump and charge to 3000 psi (207 bar) pressure with medical or aviation grade oxygen, according to pump manufacturer's instructions.

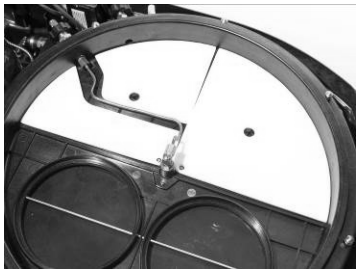
1.6 Facemask

1. Inspect the components of the facemask and replace as required.
2. **Do not** apply anti-fog solutions to the lens of the facemask.
3. Date and initial the maintenance tag under *Mask Inspection.*

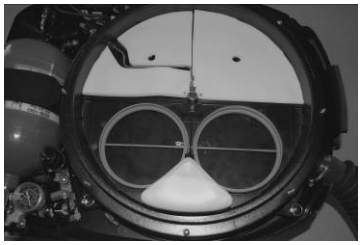
1.7 Assembly

1. Position the BioPak in a level position as depicted above, by propping up the handle end of the lower housing.

2. Install the center section making sure to properly seat the three springs onto the diaphragm.
3. Lock the center section into position using the four quarter-turn fasteners.
4. Connect the electrical and pneumatic lines to the center section. Verify the presence of an o-ring seal on each pneumatic line connection.
5. Position the fully dry moisture sponges into the center section. The sponges must be fully dry to prevent the growth of mold within the apparatus.



6. Install the PCM into the breathing chamber.



7. Install the center section lid and latch to secure. If pre-packing the carbon dioxide scrubbers complete section 1.12 then return to step 8 of this section.
8. Install the breathing hoses to the breathing chamber and secure with clamps making sure mask connector is sitting with an approximate 45° angle and the flow direction arrows are facing up.
9. Install the storage plug into the facemask connector.
10. Install the oxygen cylinder and secure with the hold down strap.

1.8 Constant Flow Test

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

2. Open the oxygen cylinder valve and observe flowmeter while holding it in a vertical and level position. The flowmeter shall indicate a flow as per the table below when reading the center of the flowmeter ball.

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

Cylinder Pressure, psi	**0-5280 ft Flow, lpm**	**+5280 ft Flow, lpm**
1500-2000	1.8-2.4	1.9-2.6
2000-3000	1.9-2.5	2.0-2.8

Cylinder Pressure, bar	**0-1600 m Flow, lpm**	**+1600 m Flow, lpm**
100-150	1.8-2.4	1.9-2.6
150-207	1.9-2.5	2.0-2.8

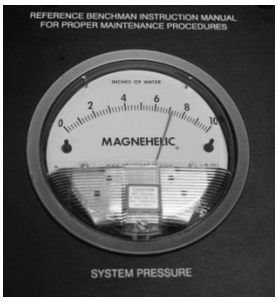
3. Enter the measured flow rate, date and initial the maintenance tag under *Flow Test____ lpm.*
4. Close the oxygen cylinder valve, remove the test flowmeter and reconnect the constant add feed line to the center section.

1.9 Low Pressure Leak Test

1. Attach the open end of the rubber tubing to the input port of the service kit and close the bleed valve on the service kit.
2. Remove the storage plug from the breathing hoses and install the leak test adapter to the hose adapter.

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

4. Open the oxygen cylinder valve and depress the bypass valve until the test kit displays a pressure of 3.0” water column, then immediately close the oxygen cylinder valve.



5. Activate the emergency bypass valve to empty all gas into the breathing chamber and raise the pressure reading to between 6 and 8” water column. **DO NOT** over pressurize, vent as needed.
6. After the test gauge stabilizes, note the exact pressure reading of the service kit and allow the apparatus to sit undisturbed for 60-seconds. The apparatus pressure shall not drop more than 0.2” water column in the 60-second period, restart the timed test if the pressure on the service kit increases.

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

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

7. Open the service kit bleed valve.
8. Remove the leak test adapter from the hose adapter to vent the apparatus.
9. Replace the storage plug.
10. **Remove the two test keys from the rear of the lower housing.**
11. Date and initial the maintenance tag under *Low Pressure Leak Test.*

1.10 Alarm Test

1. While observing the pressure gauge, open the oxygen cylinder valve. The cylinder must be filled with a minimum of 1500 psi (100 bar) pressure for this test.
2. When the oxygen cylinder is opened the LED shall cycle **RED**, **GREEN**, **BLUE** with the horn sounding. The LED will then flash **GREEN** and the horn will be silent.
3. The pressure gauge will reach full reading in approximately 60-seconds.
4. Close the oxygen cylinder and allow the BioPak to slowly reduce pressure while observing the pressure gauge and LED indications. The LED should turn to a flashing red with a horn sounding when the pressure gauge reads between 650-1000 psi (45-69 bar). The LED will cease when the pressure gauge reads less than 25 psi (1.7 bar).
5. Verify that the oxygen cylinder is fully charged to 3000 psi (207 bar) and top off if necessary.
6. Date and initial the maintenance tag under *O2 Cylinder Replaced/Filled.*

1.11 Upper Housing

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

See section 1.12 concerning procedures for pre-packing the carbon dioxide scrubber into the apparatus during turn around maintenance.

3. Tie the completed maintenance tag to the BioPak in a conspicuous and consistent location.

1.12 Carbon Dioxide Scrubber Pre-Packing Procedure

The carbon dioxide scrubbers can be pre-packed into the apparatus during turn around maintenance if so desired.

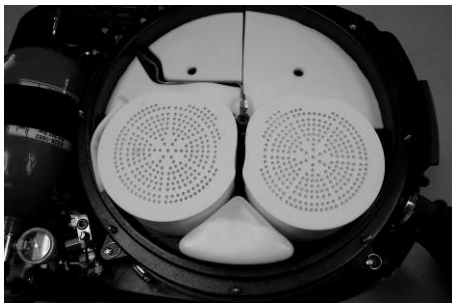
Pre-packed carbon dioxide scrubbers may only be stored in the apparatus for a maximum period of 1-year.

Moisture sponges must be installed dry when pre-packing the BioPak.

DO NOT pre-pack any BioPak that will be stored at temperatures at or below freezing (32ºF/0ºC).

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

1. Inspect the “use by date” of the carbon dioxide scrubber to ensure that it is current. Record the carbon dioxide scrubber serial number and “use by date” date onto the maintenance tag or affix the scrubber label to the back of the tag.
2. Open the sealed bag and inspect each canister to verify the presence of an o-ring properly seated into the lower groove.
3. Install two carbon dioxide scrubber canisters into the breathing chamber making sure that they are proper aligned and fully seated into position.



4. Remove the moisture pad from the sealed pouch and install it into the breathing chamber as shown.

Proper moisture pad installation.

WARNING: Failure to install the moisture pad can lead to scrubber flooding that will result in elevated carbon dioxide levels in the breathing gas that may 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.

5. Install and secure the breathing chamber lid.
6. Date and initial the maintenance tag under *CO2 Cartridges Replaced. Record the expiration date of the scrubber onto the maintenance tag.*

The “use by date” of pre-packed carbon dioxide scrubbers will be the shorter time period between the following two factors:

1-year from date of scrubber installation into BioPak, or,

“use by date” provided on packaging of carbon dioxide scrubber.

2 Long Term Maintenance Procedure

In addition to normal turn around maintenance, the apparatus shall be visually inspected and pressure tested on a periodic basis as outlined below:

Used 1 time or more/month: monthly
Used <1 time/month: quarterly
In Long Term Storage: every 6 months

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

2.1 Visual Inspection

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

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

2.2 Demand Valve Functional Test

1. Vent the BioPak of all internal pressure.
2. Open the oxygen cylinder and listen for the sound of gas escaping into the breathing chamber. The sound will last approximately 1-3 seconds. This signals that the demand has properly opened.
3. After 1-3 seconds the sound of gas escaping into the breathing chamber must cease. This signals that the demand valve has properly closed.

2.3 Constant Flow Test

1. Perform the test as described in Section 1.8.

2.4 Vent Valve Functional Test

1. Replace the seal plug from the facepiece adapter with the leak test adapter from the test kit and connect the barb of the adapter to the barb of the service kit using rubbing tubing.
2. Depress the emergency bypass valve in several short bursts. Observe the pressure reading on the service kit. The apparatus pressure should remain at or below 2” water column pressure after releasing the emergency bypass valve.

2.5 Low Pressure Leak Test

1. Perform the test as described in Section 1.9.

2.6 High Pressure Leak Test

1. Place the apparatus on a flat surface. Ensure that the test keys of the Low Pressure Leak Test have been removed. **The oxygen cylinder must be fully charged to above 1500 psi (103 bar).**
2. Open the oxygen cylinder valve and wait until the apparatus pressure gauge has reached its final reading.

3. Apply an oxygen-safe leak detection fluid to each plumbing connection. Wait 60-seconds then inspect each connection for the sign of bubble formation.
4. Repair any leaking joint or replace the leaking components. **Repairs must be performed with the BioPak fully vented of all internal pressure.**
5. Close the oxygen cylinder valve and depress the emergency bypass valve to depressurize the apparatus.

Note: A digital high-pressure test apparatus is available from Biomarine that will eliminate the need for the use of leak detection fluid during testing.

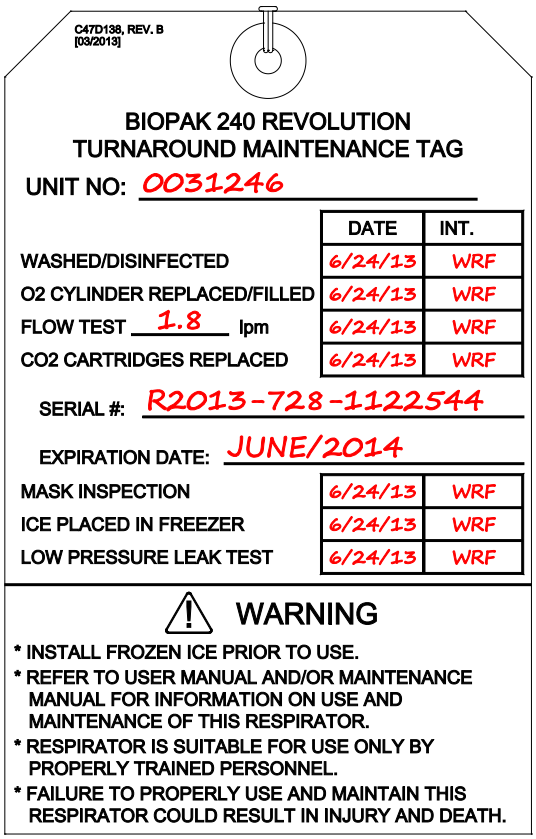
2.7 Emergency Bypass Valve Functional Test

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

2.8 Alarm Test

1. Perform the test as described in Section 1.10.

2.9 Maintenance Tag Validation



C47D138, REV. B
[03/2013]

BIOPAK 240 REVOLUTION
TURNAROUND MAINTENANCE TAG

UNIT NO: 0031246

	DATE	INT.
WASHED/DISINFECTED	6/24/13	WRF
O2 CYLINDER REPLACED/FILLED	6/24/13	WRF
FLOW TEST 1.8 lpm	6/24/13	WRF
CO2 CARTRIDGES REPLACED	6/24/13	WRF

SERIAL #: R2013-728-1122544

EXPIRATION DATE: JUNE/2014

MASK INSPECTION	6/24/13	WRF
ICE PLACED IN FREEZER	6/24/13	WRF
LOW PRESSURE LEAK TEST	6/24/13	WRF

WARNING

* 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.

1. Inspect the maintenance tag that should be attached to the apparatus in a conspicuous and consistent location. Verify that all portions of the tag are properly completed.
2. Verify that the apparatus oxygen cylinder is fully charged to 3000 psi (207 bar) and top off if necessary.
3. Replace the upper housing.

3. General Service Procedures

3.1 Scheduled Component Inspection

Breathing Diaphragm:

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

Diaphragm Alignment: Proper diaphragm alignment is depicted below. Note the positioning of the three large holes in the diaphragm plate in relation to the breathing chamber mounting feet and the breathing hoses. Reference diagram in Section 5.6.

Facemask: Inspect all rubber components for signs of wear, tears, rips, cracking or rot. Inspect the lens for signs of cracking, breakage, crazing or other damage.

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

O-ring Seals: If the apparatus has passed the high and low pressure leak tests the o-ring integrity is acceptable. Reference Appendix A for a schedule of o-ring seal inspection and lubrication.

3.2 System Lubrication

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

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

3.3 Oxygen Cylinder

The cylinder should be inspected regularly for signs of damage to the outer wrapping. Cylinders that are cracked, flaking or show exposed fibres should be immediately retired from service. Inspect cylinders per publication CGA 6.2.

Cylinders require periodic hydro-static testing per national requirements. Intervals are every 5-years from the date of manufacture. Cylinder testing should be conducted by an authorized testing facility, with experience testing oxygen cylinders.

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

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

3.4. RMS Battery Replacement Procedure

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

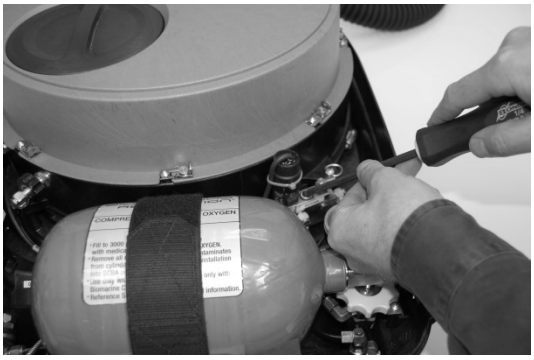
1. Remove the upper cover.
2. Disconnect the electrical line to the center section.
3. Use two 7/16” wrenches from the service kit to remove the light guide from the alarm monitor housing. **DO NOT** allow the fitting anchored to the alarm housing to rotate.
4. Inspect the housing for cracks or damage. Dust-tight and water-tight integrity are required for use in potentially explosive atmospheres. **The alarm module will require replacement if any damage to the housing is discovered.**
5. Remove the battery cover. Inspect the cover and gasket for cracks or damage. **The battery cover door will need to be replaced if any damage is found.**
6. Remove the battery from the alarm housing and replace with a fresh battery. Inspect the interior of the battery compartment for the presence of corrosion, liquid or dust. Clean if necessary or replace the alarm module.
7. Install the replacement battery into the battery compartment making sure to proper align the battery poles.

Use only battery types as specified for replacement.

8. Replace the battery cover making sure that the gasket is properly positioned and that the gasket is not damaged in any way. The battery door will only fit in one orientation on the module.
9. Install the alarm housing into the apparatus.
10. Use two 7/16” wrenches from the service kit to install the light guide from the alarm monitor housing. **DO NOT** allow the fitting anchored to the alarm housing to rotate. The light guide shall be positioned so that it is directed straight down towards the lower housing.
11. Connect the electrical line from the center section to the alarm housing.
12. Conduct the Alarm Test as described in section 1.10.
13. Install the upper housing.

3.5 Flow Restrictor Replacement Procedure

1. Remove the upper housing and vent the BioPak of all internal pressure.



2. Use the ¼” hex driver from the service kit to the remove the flow restrictor. **Be sure to remove and discard the head gasket and o-ring of the existing flow restrictor.**
3. Use the ¼” hex driver from the service kit to the install a replacement flow restrictor.

Use caution when installing the flow restrictor to insure that o-ring does not roll out of its gland.

4. Perform the high-pressure leak test as directed in long term maintenance.
5. Perform the constant add test as directed in turn around maintenance.
6. Replace the upper housing.

3.6 Factory Service and Training

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

Biomarine, Inc.
ATTN: Service Department
456 Creamery Way
Exton, PA 19341-2532
USA

Tel: (610) 524-8800
Extensions 146 or 163

Fax: (610) 524-8807

Web: www.BioPak240r.com

- Customers can also contact their local authorized Biomarine Distributor for training, product support, emergency support or maintenance.
- The BioPak 240R-NIOSH User and Benchman manuals can be provided in electronic format upon request.
- Reference documentation supplied with sales order for standard terms of warranty**.**
- Training posters, manuals, MSDS data and other training materials are available for download from the Biomarine website.
- Contact **Biomarine** prior to returning any equipment.

To better serve your needs, please provide the following information when contacting **Biomarine**.

- Apparatus Serial Number (Located internal to the BioPak, beneath the oxygen cylinder)
- Date of purchase
- Approximate number of uses
- Description of problem
- Actions taken to correct problem
- Contact name, address and phone number with area or country code and email address
- **Please** provide your current email address with all service correspondence.

4. STORAGE GUIDELINES

Follow the guidelines below for proper storage of the apparatus.

- Storage plug **shall** be installed.
- **Never** store a wet apparatus. The apparatus **must** be fully dry before storage to prevent the growth of mold, germs and bacteria.
- **Never** store an apparatus that has not been fully cleaned and disinfected.
- Store in a location free from impact that could cause damage to the apparatus.
- Store in the stated conditions of ambient temperature and relative humidity.
- Store in a location that will not submerge the apparatus.
- **Long Term Storage (storage of BioPak for periods exceeding 6-months without use):** Follow all of the above guidelines. The BioPak should not be placed back into service until all the procedures associated with Turn Around and Long Term maintenance have been performed and passed.

5. PARTS LIST

5.1 Top Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
1	1	---	AV3500 Facemask Assembly-*See Section 5.2*
2	1	----	PRO PP Facemask Assembly-*See Section 5.3*
3	1	B6-02-5002-18-0	Upper Housing Assembly
4	2	B2-02-4000-39-0	Coolant Lid
5	2	B6-02-5002-37-0	Ice Canister
6	2	B2-02-7001-09-0	Breathing Hose-See *Section 5.4*
7	1	B6-02-5002-04-3	Center Section Lid Assembly-*See Section 5.5*
8	1	B6-02-5003-69-0	CO_2 Scrubber Canister[2]
9	1	B6-02-5003-34-0	Scrubber Moisture Pad[2]
10	1	B6-02-5002-07-5	Center Section Assembly-*See Section 5.6*
11	1	---	Pneumatic Assembly-*See Section 5.8*
12	1	B6-01-5000-05-0	Alarm Monitor-*See Section 5.10*
13a	1	B6-02-5001-98-0	Green O_2 Cylinder, Empty[3]-*See Section 5.11*
13b	1	B6-02-5001-98-1	Green O_2 Cylinder, Full[3]-*See Section 5.11*
13c	1	B6-02-5002-06-0	Black/White O_2 Cylinder[3], Empty-*See Section 5.11*
13d	1	B6-02-5002-06-1	Black/White O_2 Cylinder[3], Full-*See Section 5.11*
14a	1	B6-02-5003-73-0	Green O_2 Cylinder, Empty[4]-*See Section 5.12*
14b	1	B6-02-5003-73-1	Green O_2 Cylinder, Full[4]-*See Section 5.12*
14c	1	B6-02-5003-74-0	Black/White O_2 Cylinder[4], Empty-*See Section 5.12*
14d	1	B6-02-5003-74-1	Black/White O_2 Cylinder[4], Full-*See Section 5.12*
15	1	B6-02-5002-28-0	Lower Housing Assembly-*See Section 5.13*
16a	1	B2-02-7001-24-0	Harness Assembly-Flame Rated[5]
16b	1	B2-02-7001-87-0	OTS Harness Assembly-Flame Rated[5]
17	2	B6-02-5002-40-0	Ice Canister Freeze Form-*See Section 5.15*
18	1	B5-06-6000-14-0	User Manual-ENGLISH[6]
19	1	B5-06-6000-15-0	Benchman Manual-ENGLISH[6]
20	opt.	B2-06-6000-17-0	Hard Transit Case (not depicted)
21	opt.	B2-02-7000-39-0	Soft Transit Case (not depicted)
22	1	B2-02-4001-50-0	AV3500/PRO PP Storage Plug
23	1	B6-02-5002-54-0	Cylinder Fill Adapter, CGA 540 Male[7]
24	1	B6-02-5002-55-0	Cylinder Fill Adapter, CGA 540 Female[7]
25	1	B6-02-5002-53-0	Cylinder Fill Adapter, G ¾-A Male[7]
26	1	B6-02-5002-66-0	Cylinder Fill Adapter, W21.8[7]
27	1	B6-02-5002-41-0	Phase Change Heat Exchanger (PCM)
28	1	B2-02-7001-07-0	Moisture Absorbent Pad Set

Note:

1. The BioPak 240R respirator is supplied with a cardboard/foam shipping box. Hard or soft transit cases are to be ordered separately.
2. CO_2 Scrubber Canister, part number B6-02-5003-69-0, will supply four sets of canisters, four sets of moisture pads, and maintenance tags for four separate single uses.
3. Indicated oxygen cylinders utilize a flat sealing washer between the cylinder outlet and the pressure regulator.
4. Indicated oxygen cylinders utilize a captured o-ring to seal between the cylinder outlet and the pressure regulator.
5. There are two harness styles available. The OTS harness will route the remote gauge over the shoulder of the user and provides form mounting of tools, battery cap lamp battery and a self-rescue device.
6. Alternate language manuals are available. Contact Biomarine Representative for details.

5.1 Top Assembly (continued)

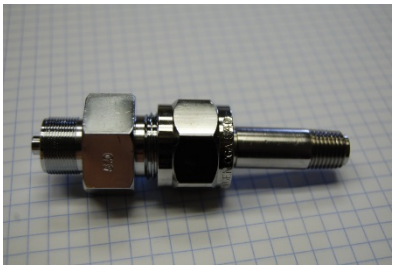
7. The following will detail use of the Cylinder Fill Adapters, items 22, 23, 24 and 25.

Item 22, Cylinder Fill Adapter, CGA-540 Male
B6-02-5002-54-0

This connector will adapt a CGA-540 female connection to the BioPak 240R cylinder.

Item 23, Cylinder Fill Adapter, CGA-540 Female
B6-02-5002-55-0

This connector will adapt a ¼ NPT female port to a CGA-540 female connection.



The above picture shows the CGA-540 Male and Female adapters connected together. This arrangement will provide adaptation from a ¼ NPT female port to the BioPak 240R cylinder.

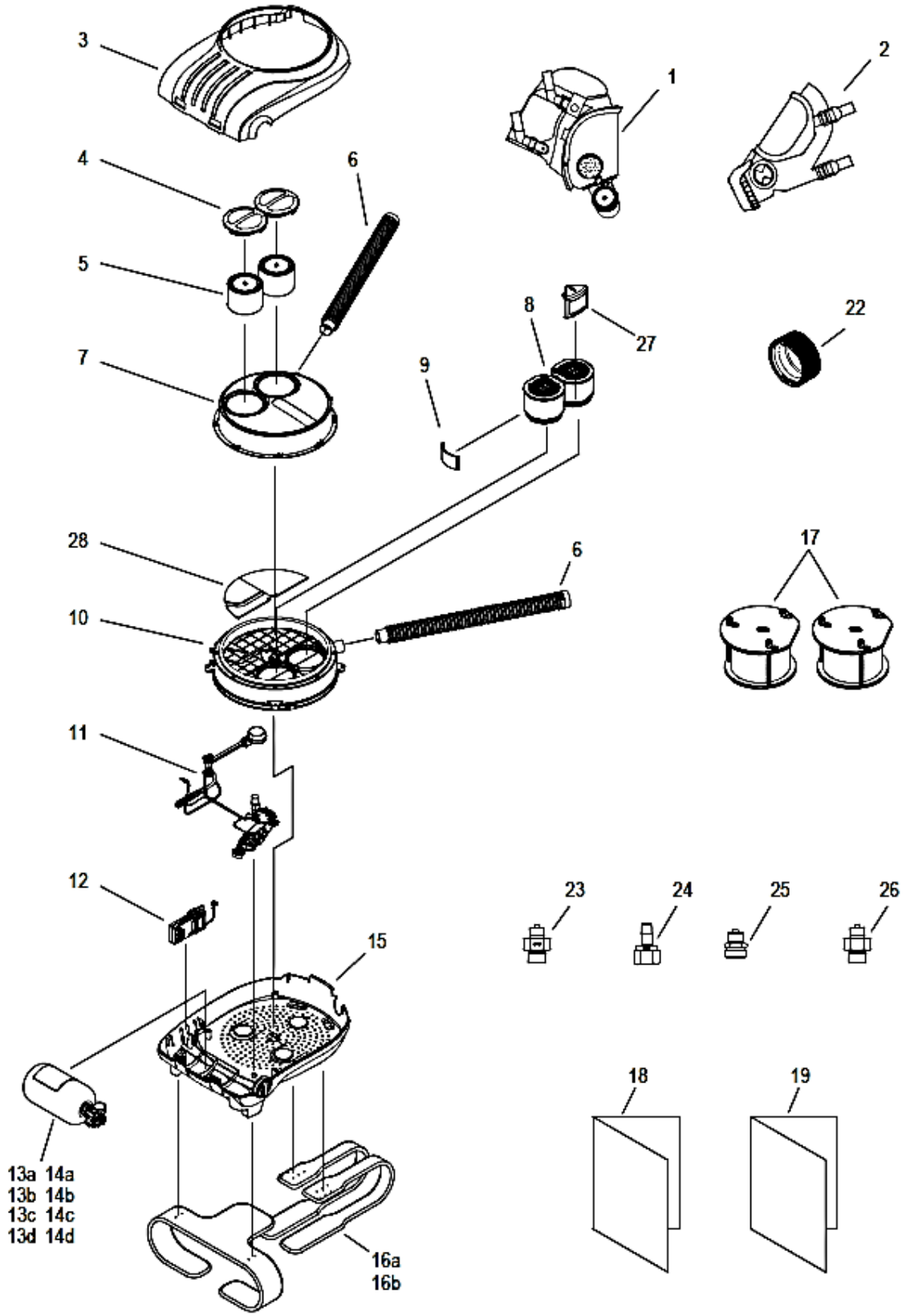
Item 24, Cylinder Fill Adapter, G ¾-A Male
B6-02-5002-53-0

This adapter will provide direct adaptation from a female G ¾-A connection (commonly found on European booster pumps) to the BioPak 240R cylinder.

Item 25, Cylinder Fill Adapter, W21.8
B6-02-5002-66-0

This adapter will provide direct adaptation from a female W21.8 connection (commonly found on Drager booster pumps) to the BioPak 240R cylinder.

5.1 Top Assembly (continued)

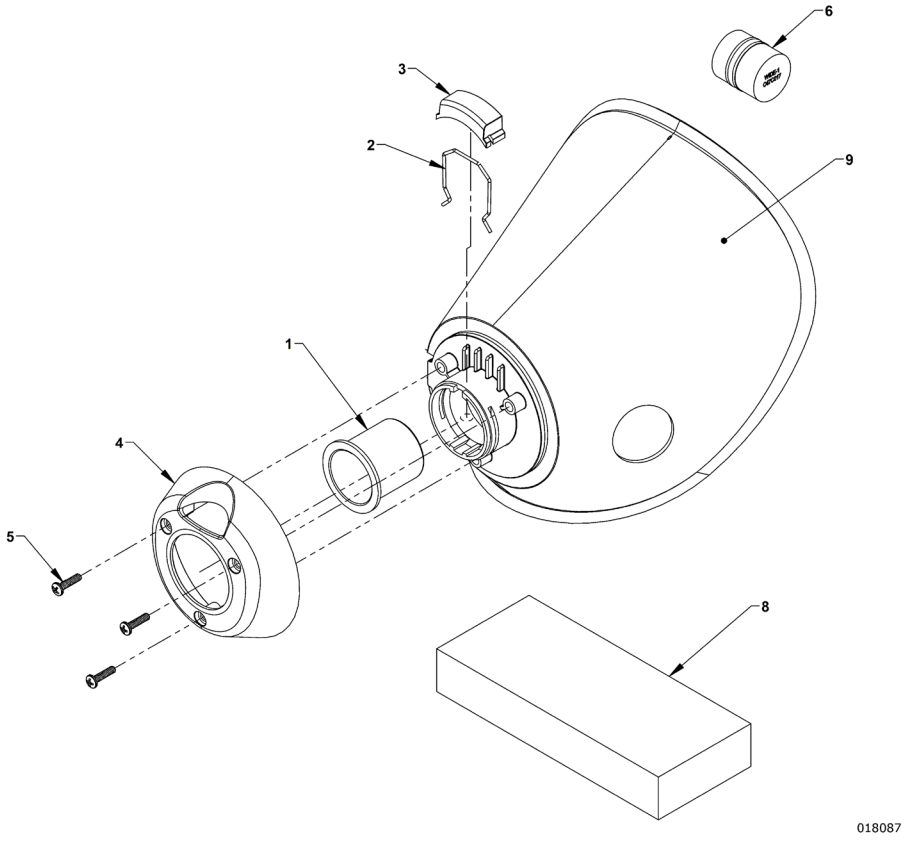


5.2 AV3500 Facemask Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	-	B6-02-5002-98-0	AV3500 Small Facemask-Complete
REF	-	B6-02-5002-98-1	AV3500 Medium Facemask-Complete
REF	-	B6-02-5002-98-2	AV3500 large Facemask-Complete
1	1	B2-02-4001-26-0	Interface Tube[1]
2	1	B2-02-3300-68-0	Spring Clip
3	1	B2-02-4001-54-0	Button
4	1	B2-02-4001-60-0	Cowling
5	3	B3-01-1061-07-1	Locking Pan Head Screw
6	1	B2-06-6002-31-0	Facemask Magnetic Wiper
7	1	B2-06-6001-70-0	Storage Bag (not depicted)
8	opt.	B2-02-7001-49-0	Chin Condensation Pad[2]
9	opt.	B6-02-5003-41-0	Replacement AV3500 Lens with Anti-Fog Film[3]
10	opt.	B2-06-6001-64-0	Kevlar Neck Strap (not depicted)
11	opt.	B6-02-5002-42-0	Spectacle Kit (not depicted)
12	opt.	B6-02-5003-43-0	AV3500 Field Test Kit (not depicted)

Note:

1. Interface Tube, item 1, fits into the central through hole of the mask nose cup.
2. Chin Condensation Pad, item 10, will fit internal to the facemask underneath the nose cup in the lens chin area. The pad will absorb and retain moisture generated by the user in the facemask during use.
3. Contact factory for details concerning mask lens, item 11, replacement.

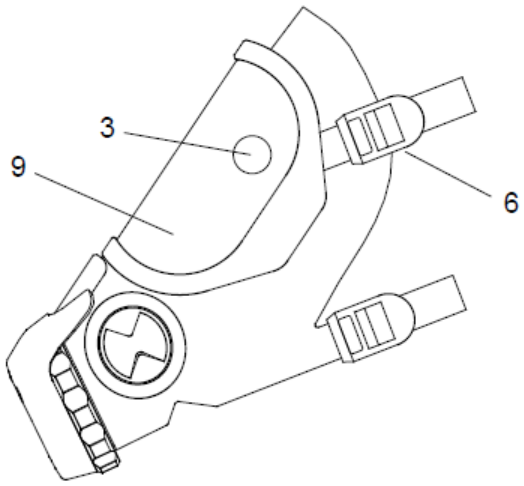


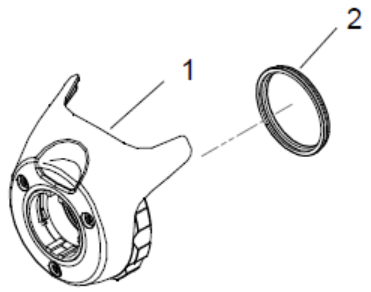
5.3 PRO PP Facemask

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	-	B6-02-5003-09-1	PRO Facemask, Small[1, 2]
REF	-	B6-02-5003-21-1	PRO Facemask, Small with Drink Tube[1, 2]
REF	-	B6-02-5003-09-0	PRO Facemask, Medium[1, 2]
REF	-	B6-02-5003-21-1	PRO Facemask, Medium with Drink Tube[1, 2]
1	1	B6-02-5002-99-0	Interface Adapter-Complete
2	1	B2-02-7100-22-0	Seal Ring
3	1	B2-06-6002-31-0	Magnetic Lens Wiper
4	1	B2-06-6001-70-0	Tote Bag (not depicted)
5	1	B2-06-6002-46-0	Replacement Drink Tube (not depicted)
6	1	B2-06-6002-50-0	Buckle/Roller Kit, Package of 5
7	1	B2-06-6002-51-0	Head Harness
8	1	B2-06-6002-52-0	Neck Strap (not depicted)
9	1	B6-02-5003-47-0	Replacement Lens with Anti-Fog Film[2]
10	-	B2-06-6002-37-0	Optional Spectacle Kit (not depicted)
11	-	B6-02-5003-43-0	Optional Field Test Kit (not depicted)
12	-	B5-06-6900-13-0	Optional Field Service Manual (not depicted)

Note:

1. The complete Facemask Assembly includes the facemask itself plus the complete Adapter.
2. The mask is supplied from the factory with a permanent anti-fog film applied to the internal surface of the lens. This film **cannot** be applied to the mask in the field due to required conditions for installation.



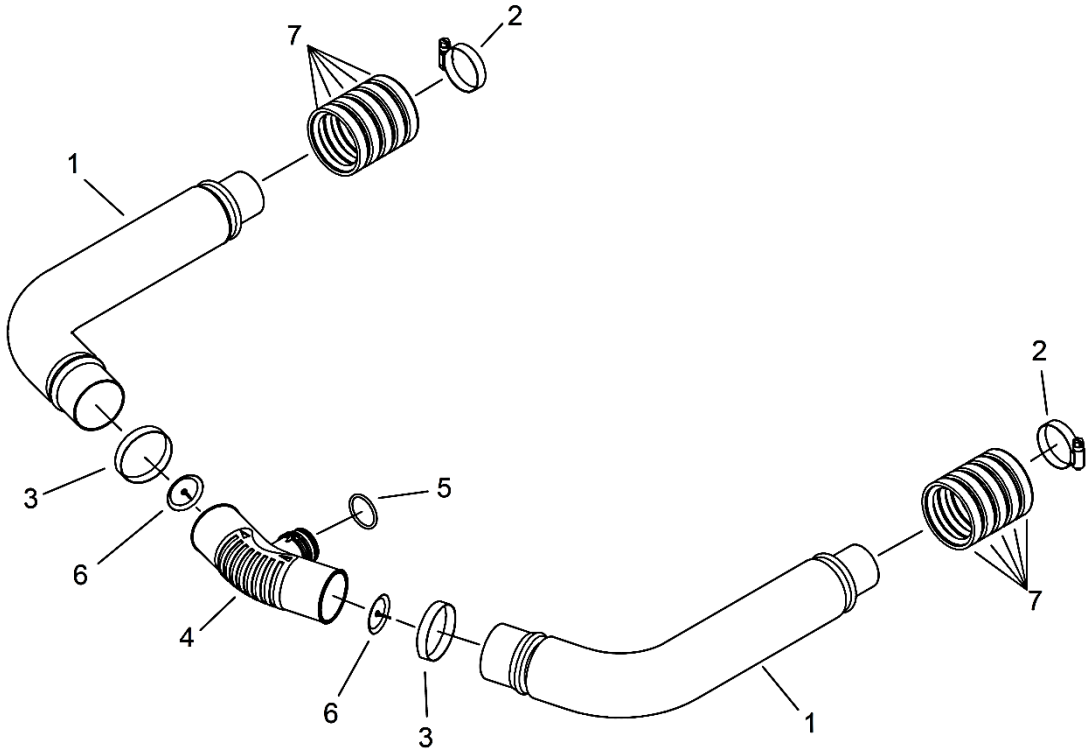


5.4 Mask Breathing Hose

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5003-03-0	Breathing Hose Set[1]
1	2	B2-02-7001-09-0	Breathing Hose
2	2	B2-06-6000-01-0	Worm Gear Clamp (requires tool to operate)
3	2	B2-06-6001-60-0	Stepless Ear Clamp (requires tool to install)
4	1	B6-02-5003-01-0	Mask Adapter Assembly[2]
5	1	B4-04-7060-25-0	Mask Adapter O-Ring
6	2	B2-02-7001-11-0	Check Valves[3]
7	10	B2-02-4101-22-0	Anti-Crush Ring

Note:

1. The Complete Breathing Hose Set includes all depicted items.
2. The Mask Adapter Assembly includes the check valves, item 6, and o-ring, item 5.
3. DO NOT lubricate the check valves.

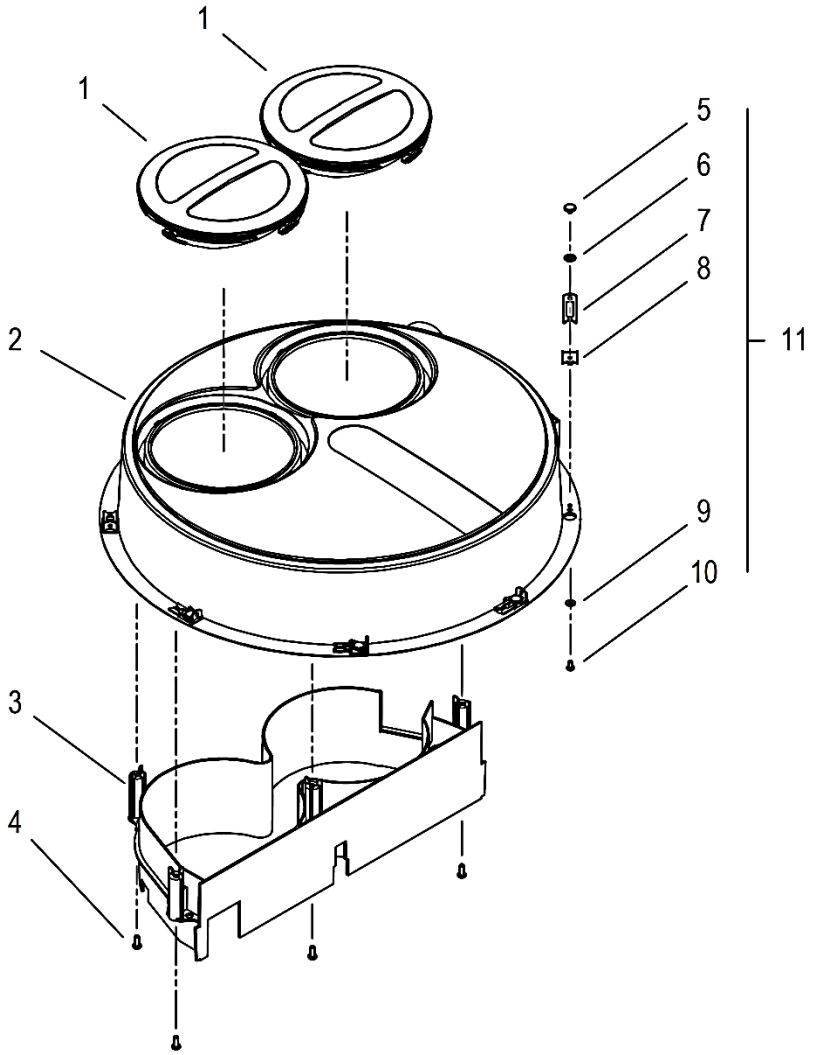


5.5 Center Section Lid Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5002-04-6	Center Section Lid Assembly-Complete
1	2	B2-02-4000-39-0	Coolant Lid
2	1	B6-02-5002-04-4	Center Section Lid[1]
3	1	B2-02-4000-72-1	Flow Baffle
4	4	B3-01-3064-00-1	Flow Baffle Mounting Screw
5	8	B2-02-3100-17-0	Slide Fastener
6	8	B2-06-6000-06-0	Slide Top Washer
7	8	B2-06-6000-04-0	Slide Mechanism
8	8	B2-06-6000-05-0	Slide Guide Plate
9	8	B3-03-1023-01-0	Slide Bottom Washer
10	8	B3-01-1022-01-0	Slide Fastening Screw
11	8	B6-02-5002-92-0	Slide Kit[2]

Note:

1. Center Section Lid, item 2, is supplied with slide mechanisms and coolant shells installed. The baffle and coolant lids are not supplied.
2. Slide Kit, item 11, will supply one each of items 5 through 10.



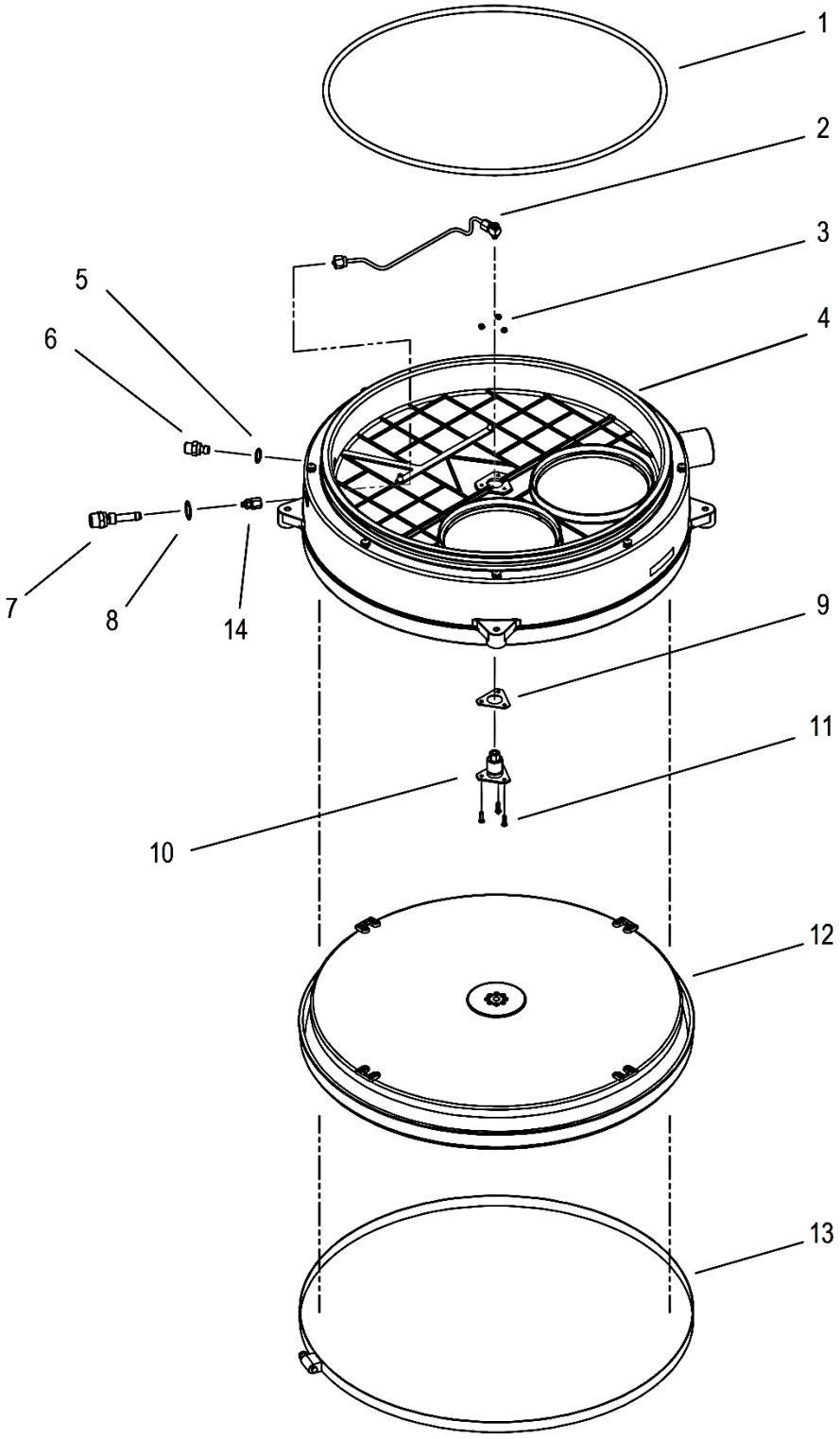
5.6 Center Section Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5002-07-5	Center Section Assembly-Complete
1	1	B4-04-7060-20-0	Lid O-Ring
2	1	B6-02-5002-24-0	Demand Feed Tube
3	3	B3-02-0040-00-0	Demand Valve Mounting Hex Nut
4	1	B6-02-5002-07-6	Center Section Body Assembly[3]
5	1	B4-04-7070-03-1	Constant Add Fitting O-Ring
6	1	B2-02-3300-06-0	Constant Add Fitting[1]
7	1	B2-02-3300-48-0	Demand Add Fitting[1]
8	1	B4-04-7060-01-1	Demand Add Fitting O-Ring
9	1	B2-02-7001-10-0	Demand Valve Gasket[2]
10	1	B6-02-5002-23-0	Demand Valve Assembly
11	3	B3-01-0043-00-0	Demand Valve Mounting Screw
12	1	B6-02-5002-05-0	Diaphragm Assembly, *See Section 5.7*
13	1	B2-06-6001-47-0	Diaphragm Clamp
14	1	B4-03-5204-08-0	Male Tube Fitting

Note:

1. Install indicated components to a torque of 25-30 in-lbs.
2. Indicated components shall be installed with no lubricant.
3. Center Section Body Assembly, item 4, includes all depicted components with the exception of diaphragm, item 12, and diaphragm clamp, item 13.

5.6 Center Section Assembly (continued)

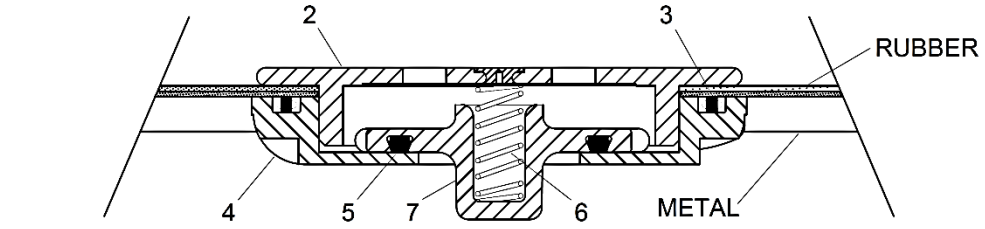


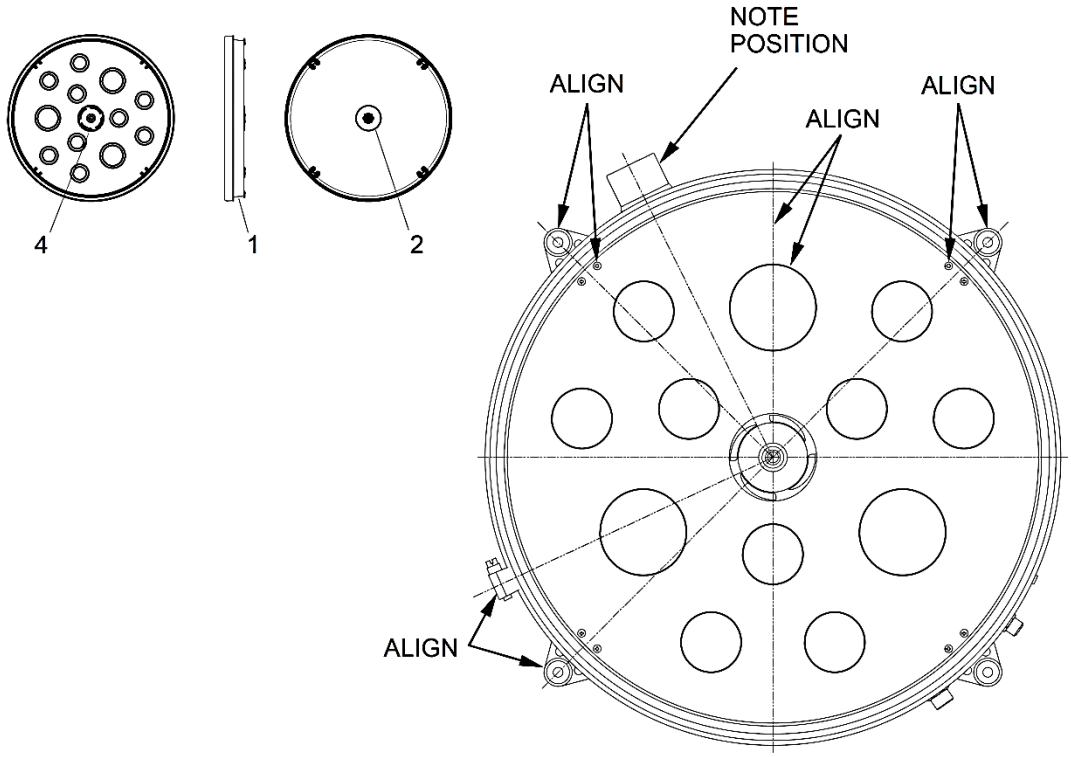
5.7 Diaphragm Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF1	1	B6-02-5002-05-0	Diaphragm Assembly-Complete
REF2	1	B6-02-5003-31-0	Vent Valve Assembly[2]
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[1]
4	1	B2-02-4100-03-0	Vent Body[1]
5	1	B4-04-7060-04-1	Vent Seat O-Ring
6	1	B2-06-6001-53-0	Vent Valve Spring
7	1	B2-02-4000-89-1	Vent Valve Seat

Note:

1. Install Vent Body, item 4, hand tight.
2. Vent Valve Assembly includes items 2 through 7.





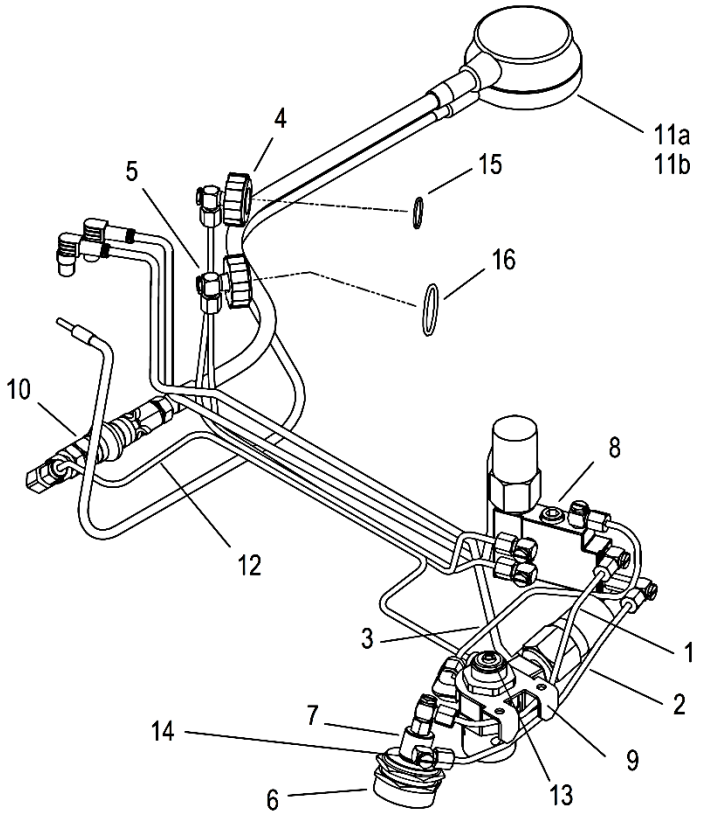
5.8 Pneumatic Assembly

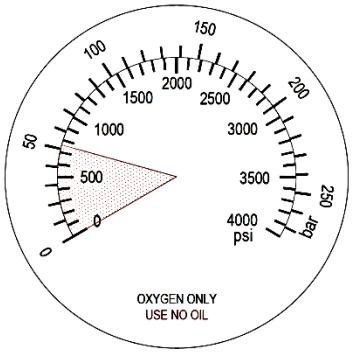
ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF1	1	---	Pneumatic Assembly
REF2	1	B6-02-5003-28-0	Bypass Valve Assembly[3]
1	1	B6-02-5002-31-0	Bypass Feed Tube
2	1	B6-02-5002-32-0	Bypass Return Tube
3	1	B6-02-5002-30-0	Oxygen Feed Tube
4	1	B6-02-5002-03-1	Constant Add Center Section Feed Tube
5	1	B6-02-5002-02-1	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
8	1	B6-02-5002-00-0	Manifold Assembly, *See Section 5.9*
9	1	B6-02-5002-26-0	Oxygen Regulator Assembly[1]
10	1	B6-02-5002-43-0	Remote Gauge Shut Off Valve Assembly
11a	1	B6-02-5002-45-0	Remote Gauge Assembly-psi/bar
11b	1	B6-02-5003-50-0	OTS Remote Gauge Assembly-psi/bar[4]
12	1	B6-02-5002-44-0	Remote Gauge Feed Tube Assembly
13	1	B4-04-0030-00-0	Cylinder Seal Washer[5]
14	1	B2-02-3300-14-0	Bypass Valve Spring[2]
15	1	B4-04-7070-02-1	Constant Add Tube O-Ring
16	1	B4-04-7070-00-1	Demand Add Tube O-Ring

Note:

1. Oxygen Regulator, Item 9, is supplied as a complete assembly only. Regulator will mount to BioPak lower housing with two #8 x 3/8" Self-Tapping Screws, B3-01-4071-00-0
2. Bypass valve spring, item 14, is to install between the bypass valve and the bypass valve push button. Spring shall seat around the actuator stem of the bypass valve.
3. Bypass Valve Assembly, item REF2, includes factory assembled items 6, 7 and 14.
4. The OTS Remote Gauge, item 11b, is to be utilized with the OTS Harness and will route over the shoulder of the user.
5. The Cylinder Seal Washer, item 13, is to be utilized only with the oxygen cylinders of section 5.10. **Do not apply lubricants of any kind to the Cylinder Seal Washer.**

5.7 Pneumatic Assembly (continued)





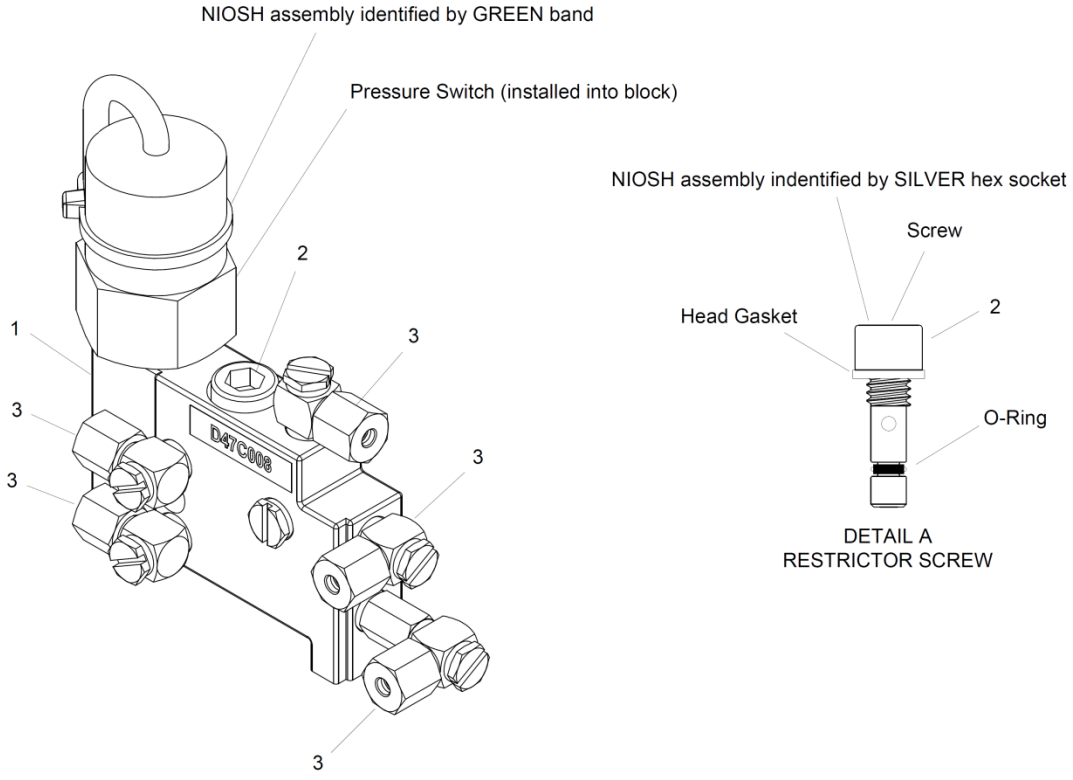
psi/bar Gauge Dial Face
Item 11a & 11b

5.9 Manifold Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-02-5002-00-0	Manifold Assembly-Complete[2]
1	1	B6-02-5002-21-0	Manifold Block w/ Pressure Switch & Fittings
2	1	B6-02-5002-50-0	Flow Restrictor Assembly-Complete
3	5	B4-03-5203-01-0	Swivel Elbow Fitting[1]

Note:

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



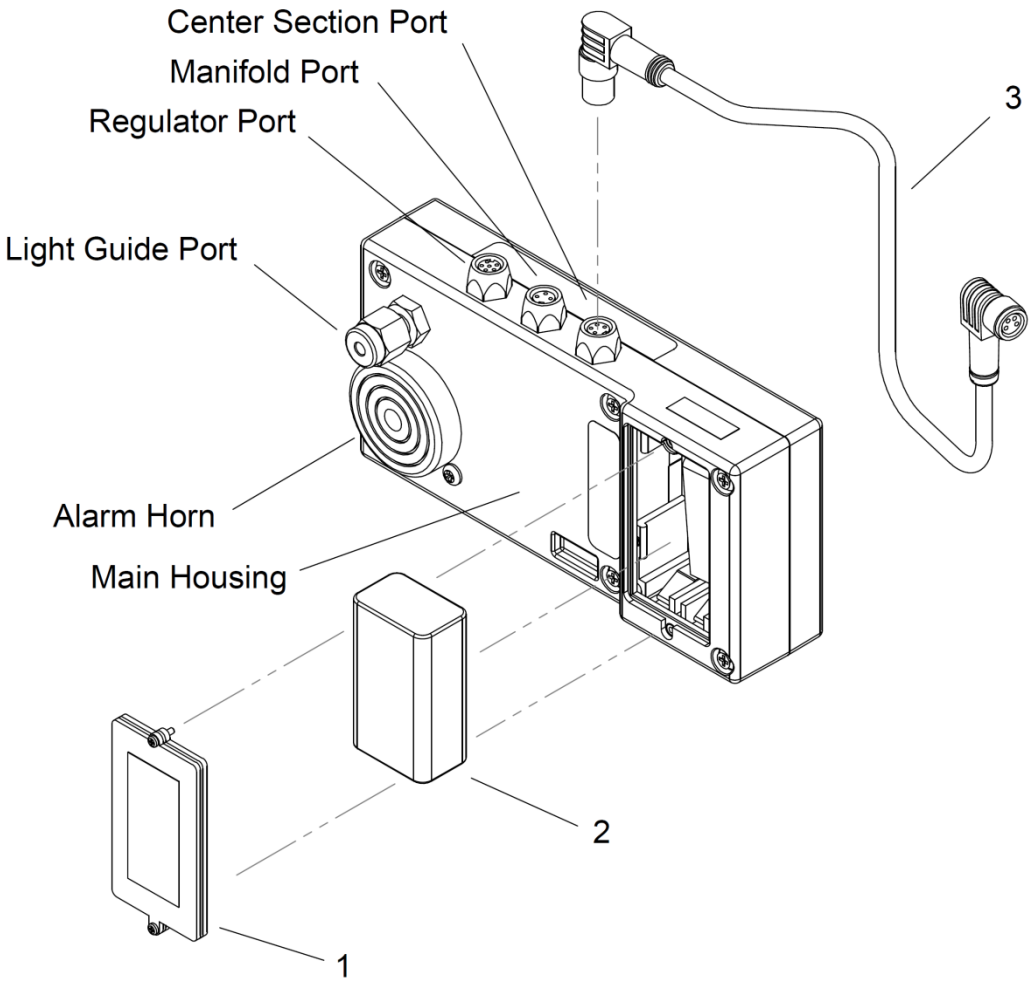
5.10 RMS Alarm Monitor

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	1	B6-01-5000-05-0	Monitoring System Complete
1	1	B6-02-5002-51-0	Battery Door-Complete
2	1	B1-14-2000-00-0	9Vdc Battery[1]
3	1	B1-10-3000-03-0	Temperature Sensor Cable

Note:

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

   Energizer #522
   Panasonic #6AM6
   Rayovac #A1604
   Duracell #MN1604

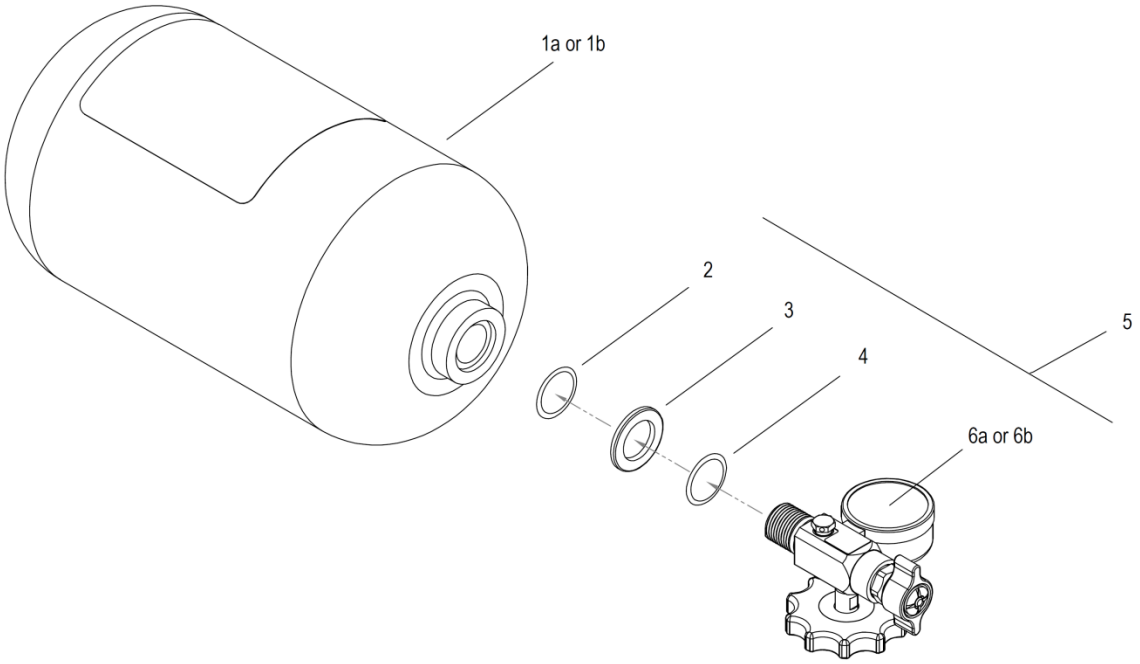


5.11 Oxygen Cylinder Assembly (utilizes flat sealing washer on outlet)

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	-	B6-02-5001-98-0	Green Cylinder Assembly-Empty
REF	-	B6-02-5001-98-1	Green Cylinder Assembly-Filled[2]
REF	-	B6-02-5002-06-0	Black/White Cylinder Assembly-Empty
REF	-	B6-02-5002-06-1	Black/White Cylinder Assembly-Filled[2]
1a	1	B2-01-2000-06-0	Green Cylinder
1b	1	B2-01-2000-06-1	Black/White Cylinder
2	1	B4-04-7060-00-0	Exterior O-Ring
3	1	B2-02-3300-52-1	Valve Collar
4	1	B4-04-7060-07-2	Interior O-Ring
5	1	B6-02-5001-97-0	Valve Assembly[1]
6a	1	B2-06-6001-38-0	Pressure Gauge Lens Cover-WIKA
6b	1	B2-06-6001-40-0	Pressure Gauge Lens Cover-Ametek

Note:

1. Valve Assembly, Item 5, includes valve plus components numbered Item 2 through Item 4. The Valve Assembly shall be installed into the cylinder at a torque of 60 +/- 1 foot-pound.
2. Filled cylinder assemblies can not be shipped from Biomarine to locations outside continental borders of the United States of America.

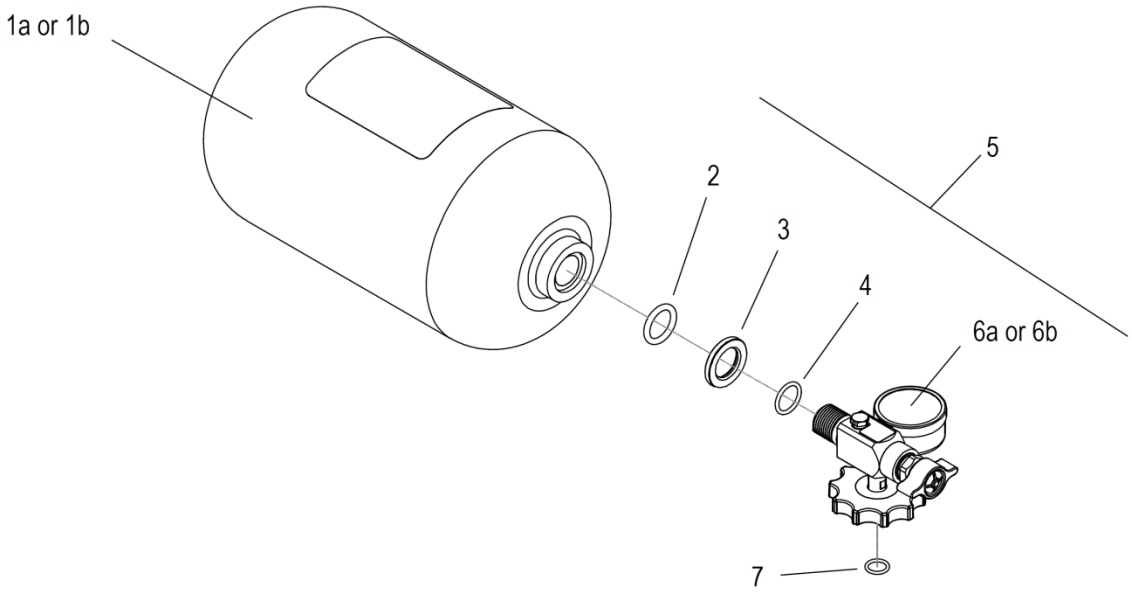


5.12 Oxygen Cylinder Assembly (utilizes o-ring on outlet)

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	-	B6-02-5003-73-0	Green Cylinder Assembly-Empty
REF	-	B6-02-5003-73-1	Green Cylinder Assembly-Filled[2]
REF	-	B6-02-5003-74-0	Black/White Cylinder Assembly-Empty
REF	-	B6-02-5003-74-1	Black/White Cylinder Assembly-Filled[2]
1a	1	B2-01-2000-06-0	Green Cylinder
1b	1	B2-01-2000-06-1	Black/White Cylinder
2	1	B4-04-7060-00-0	Exterior O-Ring
3	1	B2-02-3300-52-1	Valve Collar
4	1	B4-04-7060-07-2	Interior O-Ring
5	1	B6-02-5003-72-0	Valve Assembly[1]
6a	1	B2-06-6001-38-0	Pressure Gauge Lens Cover-WIKA
6b	1	B2-06-6001-40-0	Pressure Gauge Lens Cover-Ametek
7	1	B4-04-7070-19-0	Outlet O-Ring[3]

Note:

1. Valve Assembly, Item 5, includes valve plus components numbered Item 2 through Item 4 plus item 7. The Valve Assembly shall be installed into the cylinder at a torque of 60 +/- 1 foot-pound.
2. Filled cylinder assemblies can not be shipped from Biomarine to locations outside the continental borders of the United States of America.
3. **DO NOT** apply lubricants of any kind to Outlet O-Ring, item 7.



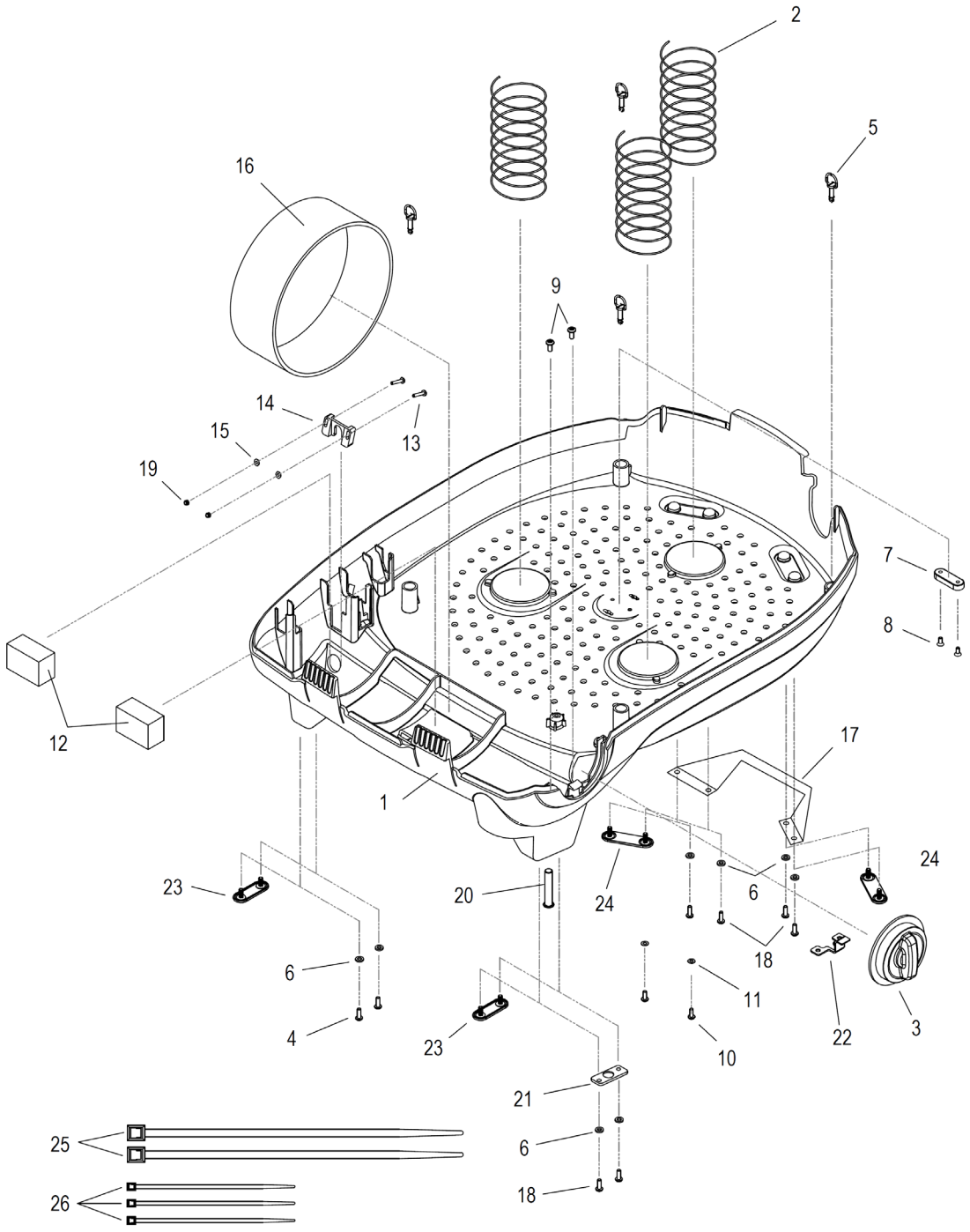
5.13 Lower Housing Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
1	1	B6-02-5002-28-0	Lower Housing Shell
2	3	B2-02-3300-46-0	Diaphragm Springs[1]
3	1	B2-02-4000-68-0	External Oxygen Knob[2]
4	2	B3-01-1071-03-0	Harness Waist Belt Fastening Screws[3]
5	4	B3-01-0008-00-0	¼-Turn Center Section Hold Down Pins
6	8	B3-03-1073-00-0	Harness Mounting Washers[3]
7	1	B2-02-1300-27-0	Vent Spacer
8	2	B3-01-1063-00-0	Vent Spacer Mounting Screw[3]
9	2	B3-01-4071-00-0	Oxygen Regulator Mounting Screw
10	2	B3-01-1061-01-1	Manifold Mounting Screw[3]
11	2	B3-03-3063-00-0	Manifold Mounting Washer[3]
12	2	B2-02-7001-30-0	Latch Foam Pad
13	2	B3-01-1042-00-0	Remote Gauge Mounting Screw[3]
14	1	B2-02-1100-10-0	Remote Gauge Mounting Bracket
15	2	B3-03-3043-00-0	Remote Gauge Tooth Washer
16	1	B2-02-7001-21-0	Oxygen Cylinder Hold-Down Strap[4]
17	1	B2-02-4001-29-1	Kevlar Carrying Handle[3]
18	6	B3-01-1071-01-0	Handle/Harness Shoulder Strap Mounting Screw[3]
19	2	B3-02-4040-00-0	Remote Gauge Hex Nut
20	1	B2-02-1300-29-0	Regulator Support Tube
21	1	B2-02-1300-05-0	Regulator Support Plate
22	1	B2-02-1100-11-0	Oxygen Knob Retaining Bracket
23	2	B6-02-5003-76-0	OTS Harness Waist Mounting Plate[3, 5]
24	2	B6-02-5003-75-0	OTS Harness Shoulder Mounting Plate[3, 5]
25	2	B3-04-0300-10-0	8” Cable Tie[5]
26	3	B3-04-0300-00-1	4” Cable Tie[6]

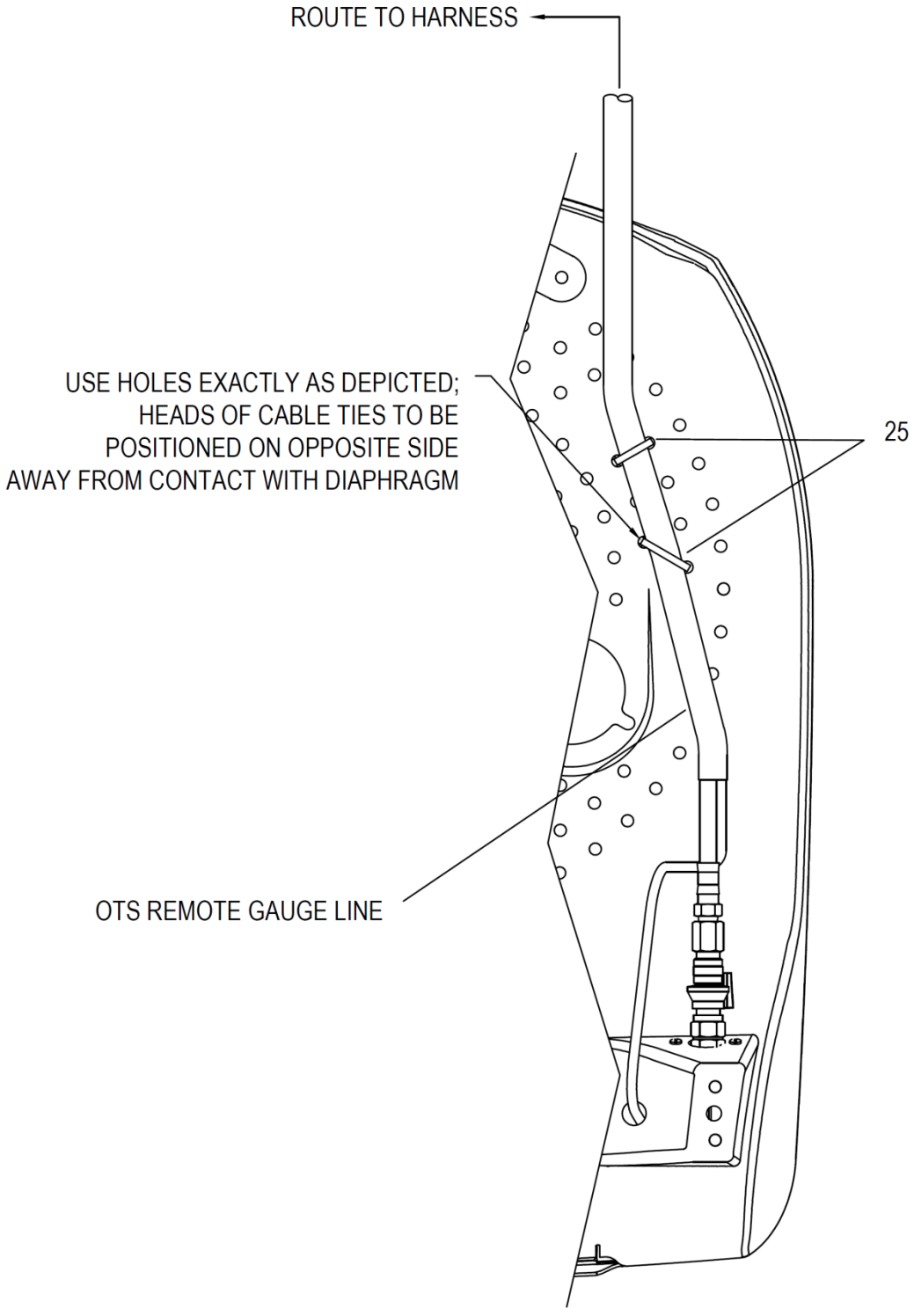
Note:

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.
5. Indicated components are for mounting of the OTS harness only.
6. 4” Cable Ties, item 26, are utilized to anchor pneumatic and electrical lines crossing the lower housing.

5.13 Lower Housing Assembly (continued)



5.13 Lower Housing Assembly (continued)



EXTERNAL REAR VIEW (OTS Harness & Gauge only)

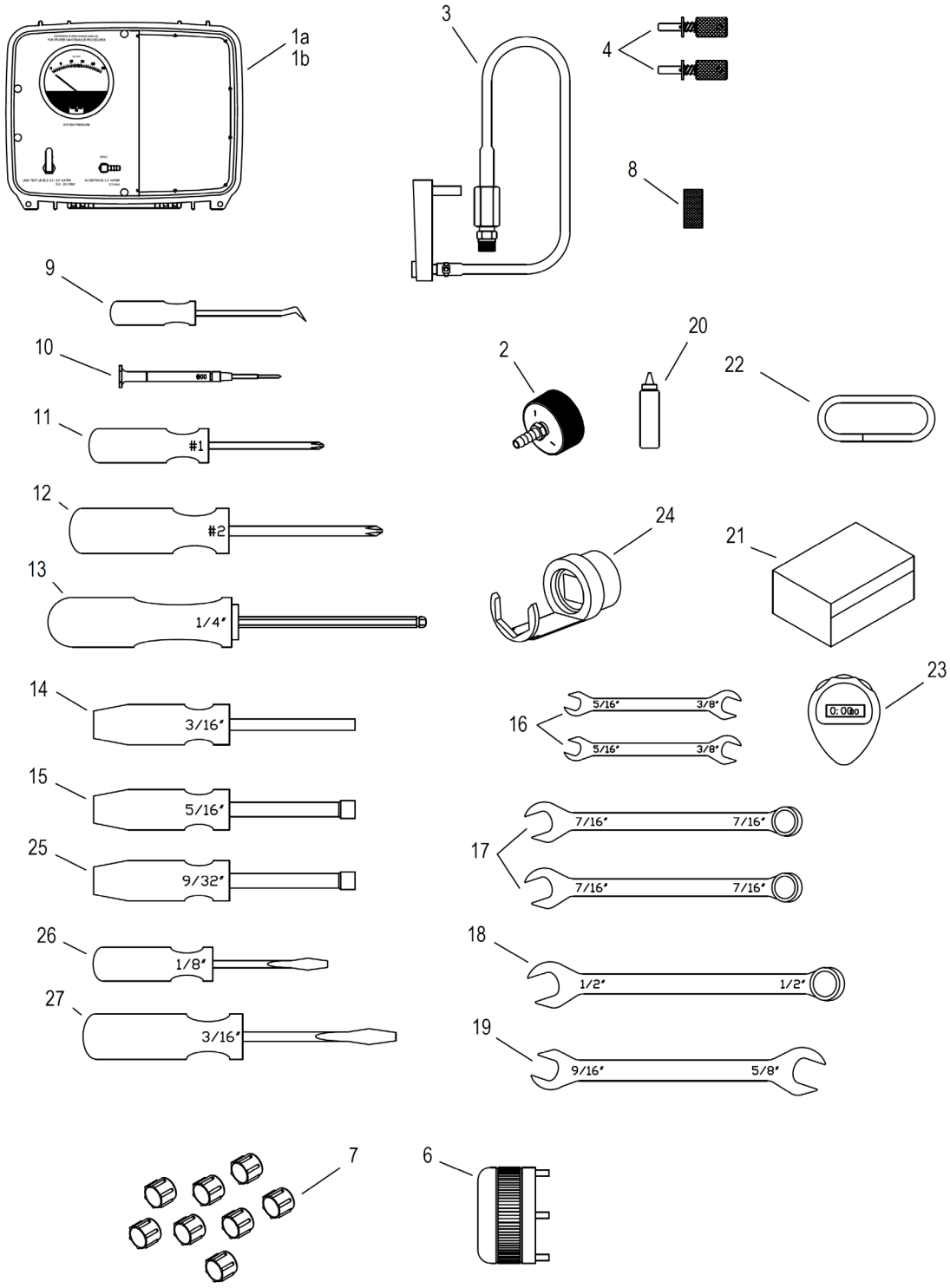
5.14 Service Kit Assembly

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	---	B6-02-5002-16-0	SK240R Service Kit, "WC-Complete
REF	---	B6-02-5002-16-3	SK240R Service Kit, mbar-Complete
1a	1	B6-02-5002-57-0	Replacement Case Assembly, "WC[1]
1b	1	B6-02-5002-57-1	Replacement Case Assembly, mbar[1]
2	1	B6-02-5003-00-0	AV3500 Leak Check Adapter Fitting
3	1	B6-02-5002-15-0	Flow Test Fixture
4	2	B6-02-5000-17-2	Test Key Tool
6	1	B2-03-3000-01-0	Vent Valve Hand Wrench
A			
8	1	B2-02-5400-04-0	Regulator Wash Plug
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	Oxygen Safe Leak-Tec Leak Detection Fluid, 8 ounces
21	1	B2-02-7001-28-0	Tool Pouch
22	1	B4-02-6037-00-0	3/8" OD Rubber Tubing[2]
23	1	B2-03-1000-20-0	Stop Watch
24	opt.	B2-03-3000-08-0	Bypass Valve Tool[3]
25	1	B2-03-1000-21-0	9/32" Nut Driver
26	1	B2-03-1000-22-0	1/8" Slotted Screwdriver
27	1	B2-03-1000-01-0	3/16" Slotted Screwdriver

Note:

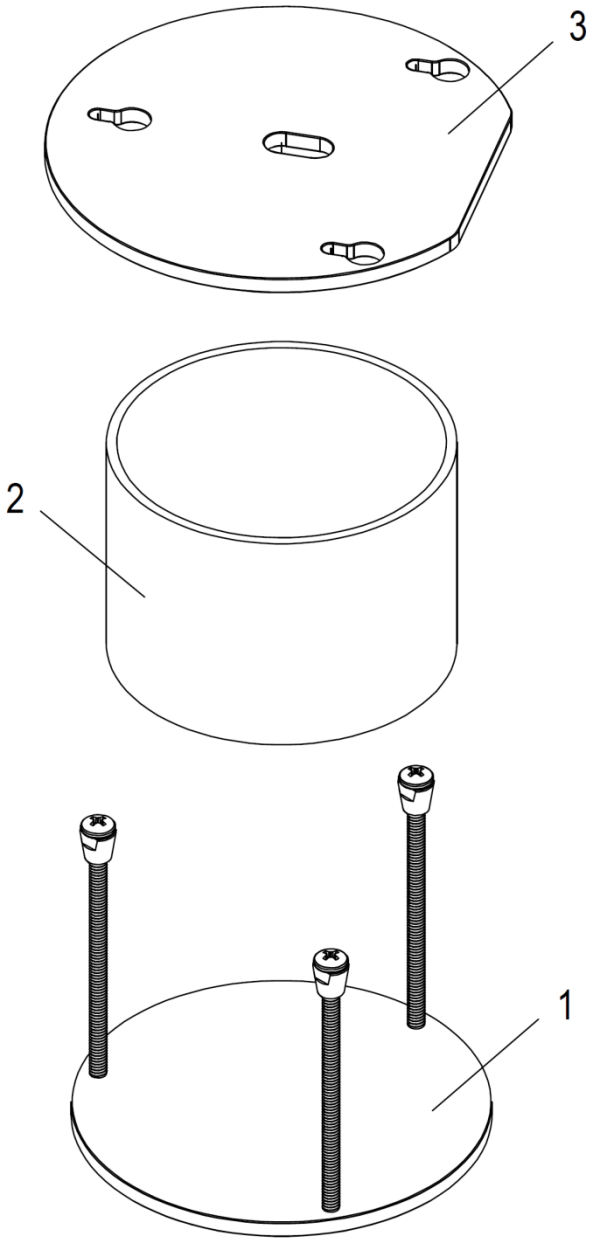
1. Replacement Case Assembly, item 1, includes the service kit case complete with internal pressure gauge and associated plumbing plus external shipping box.
2. Order a minimum length of 6-feet of tubing. Longer lengths are available upon request.
3. The Bypass Valve Tool, item 24, is not supplied with the Service Kit. The tool is utilized for installation and removal of the entire bypass valve assembly.

5.14 Service Kit Assembly (continued)



5.15 Coolant Canister Freeze Form

ITEM #	QTY.	PART NUMBER	DESCRIPTION
REF	---	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



5.16 Miscellaneous Supplies

DESCRIPTION	PART NUMBER
Seal and Lubrication Kit	B6-02-5002-14-0
Seal Kit (includes all replacement seals without lubricants)	B6-02-5002-14-1
Christo-Lube O-Ring Lubricant (2-ounce tube)	B5-01-3000-01-0
MolyKote-111 O-Ring Lubricant (5.3-ounce tube)	B5-01-3000-11-0
Oxygen Safe Leak-Tec Leak Detection Fluid (8-ounce bottle)	B5-01-3000-03-0
Disinfectant Maintenance Tag	B5-06-6000-17-0

5.17 Optional Attachments

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

Hard Transit Case, B2-06-6000-17-0: An injection molded-style carrying/storage case that provides exceptional BioPak 240R storage capabilities.

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

AV3500 Hydration System, B6-02-5002-52-0**:** The Hydration System provides a 1.5-liter reservoir and an interface to the AV3000 or AV3500 facemask that will enable the user to drink liquid without breaking the breathing loop seal to the external ambient atmosphere.

PRO PP Hydration System, B6-02-5003-17-0: The Hydration System provides a 1.5-liter reservoir and an interface to the PRO PP facemask that will enable the user to drink liquid without breaking the breathing loop seal to the external ambient atmosphere. Note that the PRO PP facemask requires a factory modification for use with the hydration system. The PRO PP mask cannot be field modified.

Harness Shoulder Pad, B2-02-7001-48-0: Constructed of flame-rated materials, will provide additional padding on the shoulder of the main harness.

High Pressure Digital Leak Tester, B6-02-5003-39-0: Provides a method to test the high-pressure sections of the BioPak (from cylinder valve to remote gauge and to demand housing and all connection in between) utilizing pressure decay and eliminating the use of leak detection fluid. Leak detection will be required if a leak is detected in order to locate the leak but leak detection fluid is not required for initial testing.

AVIWT Communication Interface, B6-02-5003-57-0: Provides an interface connection to an Innovative Wireless Technologies (IWT) communication system. Includes a mask-mounted microphone (mounts through AV3000 or AV3500 voice emitter port), lapel mounted speaker and interface cable for connection into a IWT radio.

6. 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: -5ºF to 104ºF (-20ºC to 40ºC) Relative Humidity: 0 to 100%
Storage Conditions:	Temperature: 40º to 90ºF (4ºC to 32ºC) 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 300 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

Note:

1. Operating temperature range provided above is the standard 4-hour duration with PCM installed. For extreme temperature ranges utilize as directed below:

Ambient Temperature	**Recommended Safe Duration of Use**
105 to 140ºF (41 to 60ºC)	1-hour
141 to 194ºF (61 to 90ºC)	15-minutes
+194ºF (+90ºC)	6-minutes

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

7. MAINTENANCE LOG SHEET

BioPak Model: BioPak 240R

BioPak Serial Number:

Date	Turnaround Maintenance	Long Term Maintenance									Comments, Benchman Signature
		Visual Inspection	Demand Valve Test	Constant Flow Test	Vent Valve Test	Low Pressure Leak Test	High Pressure Leak Test	Bypass Valve Test	Alarm Test	Maintenance Tag Validation	

APPENDIX A: O-RING & SEAL INSPECTION/LUBRICATION GUIDE

Description	Parts List Reference		Inspection/Lube Frequecy			Lubrication Type			Note
	Section	Item No.	After 25 Uses	After 50 Uses	Annually	Moly-Kote	Christo-Lube	NONE	
Mask Adapter O-Ring	5.3	5			X	X			
Center Section Lid O-Ring	5.5	1	X		X	X			
Constant Add Fitting O-Ring	5.5	5					X		Do not remove without consulting Biomarine
Demand Add Fitting O-Ring	5.5	8					X		Do not remove without consulting Biomarine
Demand Valve Gasket	5.5	9						X	
Vent Body O-Ring	5.6	3		X	X	X			Do not remove seal, lube in-place.
Vent Seal O-Ring	5.6	5		X	X	X			Inspect after each use, **apply no lubricants**
Cylinder Seal Washer	5.7	13						X	
Constant Add Tube O-Ring	5.7	15			X		X		
Demand Add Tube O-Ring	5.7	16			X		X		
Flow Restrictor O-Ring	5.8	2			X		X		Do not remove seal, lube in-place.
Exterior Cylinder O-Ring	5.10	2					X		Inspect & lubricate after each hydrotest
Interior Cylinder O-Ring	5.10	4					X		Inspect & lubricate after each hydrotest
Cylinder Outlet O-Ring	5.11	7						X	Inspect after each use, **apply no lubricants**

REVISION RECORD

Revision	Description	AAR No.	TN- No.
A	Initial release, replaced A47D135, Rev. M	BIO1601	20695
B	Facepiece Cracking issue revisions	BIO1602	20729
C	Added AVIWT Microphone to Draft Label	BIO1704	22034
D	Added PRO PP Facemask	BIO1801	22435

(This page left intentionally blank).