

Chapter 6

General Preventative Maintenance

6.1 Introduction

This section covers the preventative maintenance necessary on the KM 47 diver's helmet. A helmet that is kept clean and in good repair will offer far better service to the user. These helmets are designed for easy access to all areas for proper inspection and servicing.

6.2 Required tools, Sealing, Cleaning Agents, Lubrication

All KMDSI helmets and masks are designed with the professional diver in mind. Most maintenance can be performed by the diver using common tools and this manual. There are some repairs however, that must be accomplished only by KMDSI authorized repair facilities. This includes fiberglass and helmet neck ring repairs, face port inserts and sealed pin overhauls. For technical assistance please telephone your nearest authorized dealer or call KMDSI at (805) 928-7772.

Every diver should carry sufficient tools and spare parts to maintain his helmet in top working condition. It is very important to use wrenches of the correct size rather than adjustable wrenches when possible. Adjustable wrenches tend to slip and can round the edges of soft brass parts. The following wrenches and tools are required to maintain the KM 47:

Torque wrench with the following attachments:

- 1 3/8 inch crows foot
- 7/16 inch open end wrench
- 9/16 inch open end wrench
- 5/8 inch open end wrench
- 11/16 inch open end wrench
- 3/4 inch open end wrench
- 13/16 inch open end wrench
- 7/8 inch open end wrench
- 1 inch open end wrench

Torque screwdriver and these attachments:

- 1/8, 1/4, and 3/8 inch flat blade screwdrivers
- #2 Phillips blade screwdriver
- 7/64 inch Allen wrench driver
- 9/64 inch Allen wrench driver
- 5/32 inch Allen wrench driver



Special tools are required to do proper maintenance on the Kirby Morgan 47 helmet.

Open end wrenches in the following sizes:

- 3/8 inch
- 7/16 inch
- 9/16 inch
- 3/4 inch
- 7/8 inch
- 1 inch

- Two adjustable wrenches, 6 & 8 inches in length.
- 3/8 inch flat blade screwdriver with a notch in the center of the tip.
- 1/4 inch flat blade stubby screwdriver
- #1 Screwdriver
- 2 needle nose pliers
- diagonal cutting pliers
- slip joint pliers
- 3/32 inch punch
- putty knife
- O-ring removal tool
- KMDSI regulator repair tools: Part #525-620
- ball peen hammer
- tie wraps: Part # 520-042
- Silicone grease
- Loctite® 222 Thread locker
- #320, 400, 600 wet/dry sandpaper
- rubbing compound
- automotive wax
- clean rags

Other tools may be required for certain specialized operations.

6.2.1 Component and Parts Cleaning

The helmet and components should only be cleaned using a mild solution of dish washing soap such as JOY™ or Dawn™ hand dish washing soap.

Parts that have corrosion should be washed and scrubbed with a nylon bristle brush and then soaked in a solution of 50% white vinegar and water for 30-60 minutes followed by a light brushing and a good fresh water rinse. Helmet liners and rubber components should be cleaned using a mild soapy solution followed by a good rinsing and air-dried.

DO NOT use hair dryers or high heat to dry the rubber or fabric components, high temperatures will severely reduce their serviceability. To clean parts heavily encrusted with salt we recommend a dilute solution of white vinegar and a toothbrush.

6.2.2 Component and Parts Lubrication

All helmets are lubricated at KMDSI with Christo Lube. Helmets used for air diving or with oxygen mixtures containing less than 50 % oxygen can be lubricated with food grade silicone such as Dow Corning® 111 or equivalent.

Do not use aerosol spray or lubricants. Many aerosol propellants will damage plastic. Avoid lubricant contact with plastic parts.


NOTE: All parts on the helmet that require lubrication must be lubricated sparingly with the appropriate lubricant.

Silicone grease is not recommended for helmets used with oxygen. (Avoid mixing lubricants to preclude incompatibility).

⚠ WARNING

All parts on Kirby Morgan helmets and masks must be adjusted to their proper torque specifications. See Appendix 1 for a complete listing of torque specifications for each part. Failure to adjust parts to the recommended specifications could lead to helmet failure and accidents. This could be fatal.

⚠ WARNING



Never use any aerosol propelled sprays near the face port of Kirby Morgan helmets. The propellant used in these aerosols can invisibly damage the polycarbonate face port and cause it to shatter upon impact from any strong blow. If the face port fails underwater the helmet will flood and drowning may result.

6.2.3 Teflon® Tape

All pipe thread fittings used on our helmets, masks and components require sealing with Teflon® tape. **DO NOT USE LIQUID SEALANT.** When installing Teflon® tape on pipe threads, apply the tape starting two threads back from the end of the fitting.

Apply the tape in a clockwise direction under tension. 1½ wraps is all that is needed. Applying more than 1½ wraps of tape is not recommended. The use of more than 1½ wraps could cause excess Teflon® tape to travel into the breathing system.

⚠ WARNING

Do not allow any excess Teflon® tape to cover the end of the pipe thread fittings. Loose pieces of Teflon® tape can interfere with the performance of helmet components and may block the diver's air supply. This could lead to death through suffocation.

⚠ WARNING

Use only thin Teflon® tape to avoid damage to threads.

6.2.4 RTV Sealant

Certain components used in KMDSI helmets and masks use RTV adhesive / sealant to provide bonding and sealing. KMDSI recommends Dow Corning® RTV 732 multi purpose sealant. When sealant is applied the user must use care to insure excess sealant is wiped clean so as not to interfere with other components. Sealant should be allowed to cure for 24 hours before equipment is used.

6.2.5 Thread Locker

KMDSI recommends Loctite® 222 or equivalent as the type of thread locking compound that should be used on components that call for a thread locker. Threads should be clean and dry prior to applying thread locker.

Ensure that all excess thread locker has been removed. Allow thread locker to cure for at least 3 hours prior to using the component.



6.3 General Cleaning & Inspection Procedures

Each diver must establish his own minimum standards for the care of his helmet. We offer recommendations here with the suggestion that the diver establish for himself what is necessary to provide a good working unit. Use of the helmet in fresh water will require a timetable for maintenance procedures different from that when the helmet is used in salt water.

Using the helmet in sea water while jetting in sand will necessitate increased maintenance. Use of the helmet in a heavy oil and/or chemical environment may make it necessary to replace rubber parts to assure proper function. Regardless, all helmets and masks should be disassembled, cleaned and inspected at least once a year. All soft goods should be replaced at least once a year, if needed.

NOTE: Certain fuel oils and/or chemicals will cause premature degradation of soft goods and seals by making them become soft, swell or break down. Upon exiting the contaminant, KMDSI recommends a thorough external decontamination/washing of the helmet/neck dam yoke as soon as feasibly possible, followed by a vigilant inspection of the interior of the helmet to ensure that no contaminant has entered.

Pay particular attention to the following parts prior to re-use; the REX®-3™ assembly, demand regulator diaphragm, demand regulator exhaust valve, communications post(s) or communications connector assembly, and neck dam.


⚠ WARNING

If in doubt about the serviceability of a part, repair or replace it immediately. Use only Genuine Kirby Morgan replacement parts. The use of unauthorized parts may result in injury or death to the user.

⚠ WARNING

Do not use solvents or bleach for cleaning. These agents are toxic and use of them may result in injury or death to personnel and damage to equipment.

WARNING



Wear eye protection to prevent cleaning and germicidal cleansing solutions from contacting eyes. If contact occurs, rinse eyes with copious amounts of water and consult medical help immediately.

WARNING

Cleanliness is imperative in maintaining and handling Kirby Morgan masks and helmets. All tools, parts, and components must be kept free of oil, grease, rust, and other contamination. Foreign substances within an assembly may result in equipment failure and possible injury or death to personnel.

WARNING

Different brands of grease should never be mixed. Ensure all old grease is removed prior to applying new grease.

6.3.1 O-ring Removal/Inspection/Cleaning and Lubrication

Strict cleanliness and proper lubrication are extremely important during O-ring installation. Comply with the following instructions to ensure proper installation:

NOTE: *Ensure all parts are clean throughout the assembly procedure. Dirt or loose particles in the O-ring groove can cause leaks in the seal and damage to the O-ring, reducing its life. During cleaning of equipment, carefully clean O-ring grooves, using a soft bristle brush and mild soap solution.*

6.3.1.1 O-ring Removal

Do not use screwdrivers or hard metal picks to remove O-rings. When possible, only use fingers to remove O-rings. If an O-ring fits too tightly in its groove to be removed using the fingers, use the appropriate tool from an O-ring removal kit (brass pick).

A plastic cable tie makes an effective O-Ring removal tool. Use of an appropriate tool helps prevent scratching the O-ring groove, which can cause leakage or premature failure of the seal.

6.3.1.2 O-ring Inspection:

If during routine corrective maintenance O-rings

are to be reused, only reuse O-rings that pass a visual inspection. Inspect for deformities or compression set, hardening or brittleness, nicks or cuts, pits or blisters, or any other signs of damage. Cut and discard damaged O-rings and replace them with new ones.

6.3.1.3 O-ring Reuse:

All O-rings and soft goods should be replaced whenever scheduled overhauls are being completed. During routine repairs or maintenance in between the overhauls, O-rings and soft goods may be reused after cleaning provided a careful inspection reveals no wear or damage.

Place the O-rings in a cleaning basin, cover with mild soap solution, and brush gently with a soft bristle brush to remove all traces of old lubricant and contamination.

Rinse cleaned O-rings with fresh water and wipe clean with lint-free cloths, then allow to air dry, carefully inspect for cracking, cuts, abrasions and deformities. Replace O-rings if any damage is found or suspected.

6.3.2 General Cleaning Guidelines

Cleaning and sanitizing of the helmet should be accomplished upon completion of use and/or prior to storage. Clean is defined as free of dirt, rust particles, grease and oil and other contaminants as viewed by the unaided eye.


Sanitizing is defined as eliminating germs and microorganisms. Sanitizing should be accomplished post use or prior to use by another user. KMDSI recommends sanitizing be accomplished any time the unit is to be used by another person during the mission or operation.

NOTE: *The Sanitizing Procedure should be accomplished if possible between dives when two or more divers are making consecutive dives with the same helmet*

Both the regulator cover and diaphragm should be removed for cleaning and sanitizing. The inside of the regulator and whisker must also be sanitized. See Chapter 7 for instructions on how to remove and replace these components properly.

See the most up-to-date procedures for cleaning on the Dive Lab website at www.divelab.com.

⚠ WARNING

 Always sanitize the helmet prior to use by another person. Failure to do so could result in the transmission of communicable diseases, some of which may cause long term disability or death.



The regulator cover and diaphragm need to be removed for cleaning and sanitizing. See Chapter 7 for regulator service procedures.

6.3.2.1 Mild Soap Solution for General Cleaning and Leak Detector Use

Maintenance procedures include cleaning with a general-purpose solution of a mild diluted hand dish washing soap such as Joy® or Palmolive®. Cleaning solution is prepared by mixing approximately one teaspoon of soap to 1/2 gallon of warm fresh water. This solution may also be used as a leak detector solution. Place all parts and components in a clean washbasin or sink and immerse in soap solution.

Allow parts/components to soak for at least five minutes, and then scrub using a nylon brush. Carefully brush all surfaces, paying close attention to O-ring grooves and threaded surfaces ensuring all greases are removed. Regardless of the soap used, all components must be thoroughly rinsed post cleaning to remove all traces of soap.

6.3.2.2 Acidic Cleaning Solution and Procedures

Metal parts that have visible corrosion should first be cleaned using the soap solution scrubbed with a nylon bristle brush, then soaked in a solution of 50% white vinegar and water for less than 60 minutes. They may also be placed in a ultrasonic sink followed by a light brushing and thorough rinsing with fresh water and air-dried. If corrosion is such that 50/50 vinegar will not clean components, it will be best to replace the components.

6.3.2.3 Germicidal Cleaning Solutions and Procedure

Sanitizing of the oral-nasal mask/regulator of Kirby Morgan helmets is accomplished using one of four approved germicidal cleansing solutions. There are four examples of solutions shown below, along with the necessary ordering information and mixing instructions.

NOTE: *Ensure helmet liner and cushion are removed prior to sanitizing the oral-nasal mask/regulator.*

1. SaniZide Plus: P/N: 34805 (spray) or 34810 (gallon), Ready to use; do not dilute.
SAFETEC of America, Inc
1055 E. Delavan Ave.
Buffalo, NY 14215 USA
1-800-456-7077

2. Advance TBE: P/N: AD160 (spray) or AD1128 (gallon), Infection Control Technology): Ready to use.
Infection Control Technology

1751 So. Redwood Rd.
Woodscross, UT 84087 USA
1-800-551-0735

3. Bi-Arrest 2: P/N: BP201 (4 ounces) or BP 222 (32 ounces), Infection Control Technology. Mix two pumps of the concentrate with 16 ounces of fresh water.

Infection Control Technology
1751 So. Redwood Rd.
Woodscross, UT 84087 USA
1-800-551-0735

4. Confidence Plus: P/N: 10009971 (32 ounces) Mix one ounce of concentrate with one gallon of fresh water.

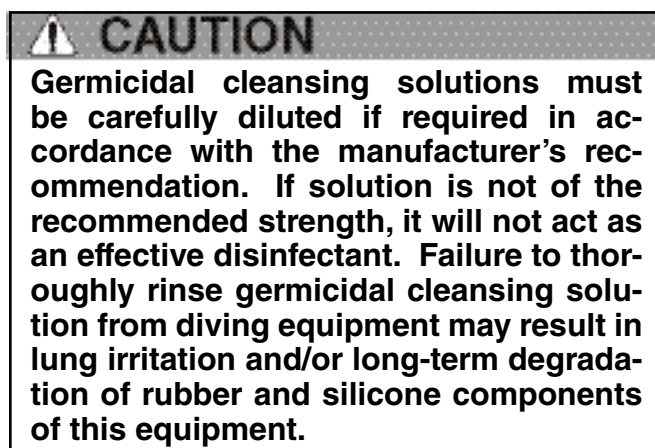
Mine Safety Appliances 1-800-MSA-2222

Sanitizing Procedure:

Unless otherwise directed, use the following procedure to disinfect the oral-nasal mask/regulator:

- 1) Wet or immerse all components to be sanitized. Allow components to stay in contact with the solution for at least 10 minutes.
- 2) If the solution appears to be drying, apply more solution to keep it wet for the full 10 minutes.
- 3) After 10 minutes, thoroughly rinse components under running potable water.

NOTE: *The purpose of this procedure is to sanitize the components exposed to each of the divers. KMDSI recommends sanitizing be accomplished daily in between use by different divers, after each use, or when future use is anticipated within the mission (job) period. KMDSI defines “A mission is defined as use of the helmet over a seven-day period.”*



6.4 Daily Maintenance

The following steps must be performed daily at the completion of diving operations.

1) Disconnect the helmet from the diving hose and EGS cylinder. Make sure the air is off and the breathing system of the helmet is unpressurized. To vent the system, open the defogger valve knob and emergency gas valve knob until all gas flow stops.

2) Place a protective cap over both the air inlet and the emergency valve inlet to prevent foreign matter from entering the valves.



Cover the air inlet and emergency gas valve openings with dust caps when not in use.

⚠ WARNING

Never disconnect any hose from the helmet unless all gas has been vented from the hose first. If the hose is disconnected with pressure in the line the fittings may be damaged. In addition, the hose can whip about causing injury to anyone standing nearby.

3) Remove the neck dam/neck ring assembly, clean with sanitizing solution, rinse thoroughly and allow to dry. Remove the O-ring from the neck dam ring, clean and lubricate.

4) If the head cushion is wet, remove it from the helmet. The head cushion is fastened into the helmet with snap tabs and pulls out easily.

To wash the head cushion, place it in a solution of mild dish soap. Lightly brush the fabric with a soft

nylon brush to remove perspiration and skin oil, then rinse thoroughly. Squeeze out excess water from the head cushion and hang to dry in a safe place.

To ensure that the head cushion is dry for future use you may want to remove the head cushion foam. However, do not remove the foam unless it is absolutely necessary. The head cushion will dry properly without removing the foam.

5) If the head cushion is wet, the chin cushion is probably wet, too. Like the head cushion, the chin cushion is fastened into the helmet with snaps. Follow the same cleaning instructions as for the head cushion.

6) Loosen and remove the nose block knurled knob then loosen the packing nut and remove the nose block device and oral nasal mask. Clean and sanitize the nose block device and oral nasal mask then rinse thoroughly and set them aside to dry.



Removing the head cushion.



Uncover the earphones so they may dry.

7) Remove the communications assembly from the helmet so it can dry completely. Remove the communications cover, P/N 510-630 to allow adequate drying and to avoid corrosion of the communication assembly. Clean the microphone with sanitizing solution, rinse it, and allow it to dry.

8) Wash the exterior of the helmet with a mild soapy water solution and rinse thoroughly with fresh water. Turn the defogger valve knob, emergency valve knob, and regulator adjustment knob while rinsing to prevent salt from accumulating under these valves.

Operate the sealed pull pins as you run water over them.

Wipe the inside of the helmet out with a clean, damp rag. Do not depress the purge button while rinsing the regulator as this action will permit foreign matter back into the inlet valve and seat.

Remove the regulator cover ring, regulator cover, washer and diaphragm, then clean all components and swab out the interior of the regulator with the sanitizing solution as per the sanitizing procedure. Ensure the dewatering valve gets cleaned. Note: avoid depressing the purge button to minimize water entering the inlet valve.

After cleaning and sanitizing, rinse thoroughly. Wipe out the inside of the helmet with cleaning solution, pour solution into the exhaust area and work into the regulator cavity and exhaust area allow to remain in contact for the required time then thoroughly rinse all surfaces.

9) Screw the demand regulator adjustment knob all the way out. This will prolong the life of the inlet valve and keep the internal adjustment correct.

10) If the neck dam is damaged it should be replaced.

11) Reinstall the oral nasal mask, Lubricate the nose block shaft then reassemble and tighten.

12) Reinstall the head and chin cushions when dry.

13) For additional details on daily maintenance, consult the Dive Lab website at www.divelab.com

NOTE: By definition “Monthly” is the minimum recommended maintenance that should be performed at least once a month with the helmet in continuous use, (used for more than 20 diving days a month) or at least every two months with the helmet used less than 10 diving days a month. Maintenance should also be performed any time the serviceability of the helmet is in question.”

⚠ WARNING

The sealed pull pins must operate smoothly with a positive action. If the pins do not release properly the diver may not be able to remove the helmet quickly if necessary. If the pins do not lock with a positive action the locking collar assembly will not lock properly and the helmet may come off the diver’s head. If this happens underwater, drowning could result.

6.5 Monthly Maintenance (or between jobs)

6.5.1 Locking Collar Assembly & Helmet Ring

Check the two sealed pull pins to make sure they operate smoothly and engage the pins on the locking collar properly. If the sealed pull pins stick or do not provide adequate tension it is essential to return your helmet to your dealer or KMDSI for service. **Do not attempt to service these mechanisms by yourself.**

6.5.2 Neck Dam Ring Assembly

Inspect the neck dam carefully. There must be no holes in the neck dam. If you are using a latex neck dam, the latex must be firm, not sticky. If there is any damage to the latex the neck dam must be replaced. Do not patch a latex neck dam. Apply talcum powder to the neck dam prior to storage and to prepare it for the next dive.

⚠ WARNING

Avoid patching a torn or punctured neck dam. If the patch comes off underwater the helmet could flood and/or cause the demand regulator to free flow. Serious injury, drowning or death may result. A damaged neck dam should be replaced.

⚠ WARNING

Avoid patching a torn or punctured neck dam. If the patch comes off underwater the helmet could flood and/or the demand regulator assembly may not function properly. A damaged neck dam should be replaced.



Check the neck dam for holes.



Inspect the O-ring on the neck dam.

Inspect the O-ring on the neck dam ring assembly. It must be in good condition with no nicks, tears, or cracking. Replace the O-ring if it shows signs of wear.

6.5.3 Head Cushion and Chin Cushion

Remove the foam from the head cushion and inspect it for wear. If the foam is worn or crumbling it must be replaced (order Part #510-672).

Inspect the chin cushion. It, too, must be in good

condition. Replace it if the foam is worn or has started to crumble.

6.5.4 Communications Inspection

Visually inspect the earphones, microphone, wires, lugs, and communications posts if installed. Test each component for proper operation. Connect to the deck amplifier and talk back and forth. Replace any weak earphone or microphone. Open the earphone rubber covers and remove the protectors. Allow to dry thoroughly. Replace defective earphones.



The nose block O-rings must be regularly lubricated.

6.5.5 Lubricate Nose Block O-Rings

Tools Required:

7/16 inch Open End wrench

- 1) Unscrew the nose block device packing nut and lubricate the two O-rings and nose block shaft. Retighten the nut just to the point where the nose block device will still slide, but requires a firm push or pull.
- 2) Test the shaft to ensure that it will still slide freely at this time. If it does not, loosen or tighten the packing nut just enough to permit the shaft to slide properly.
- 3) Retighten the nose block knob.

6.6 REX® Demand Regulator & Exhaust System Post Dive Cleaning & Sanitizing

Purpose

This procedure should be completed at completion of diving operations and /or whenever the helmet is to be used by another user.

Tools Required:

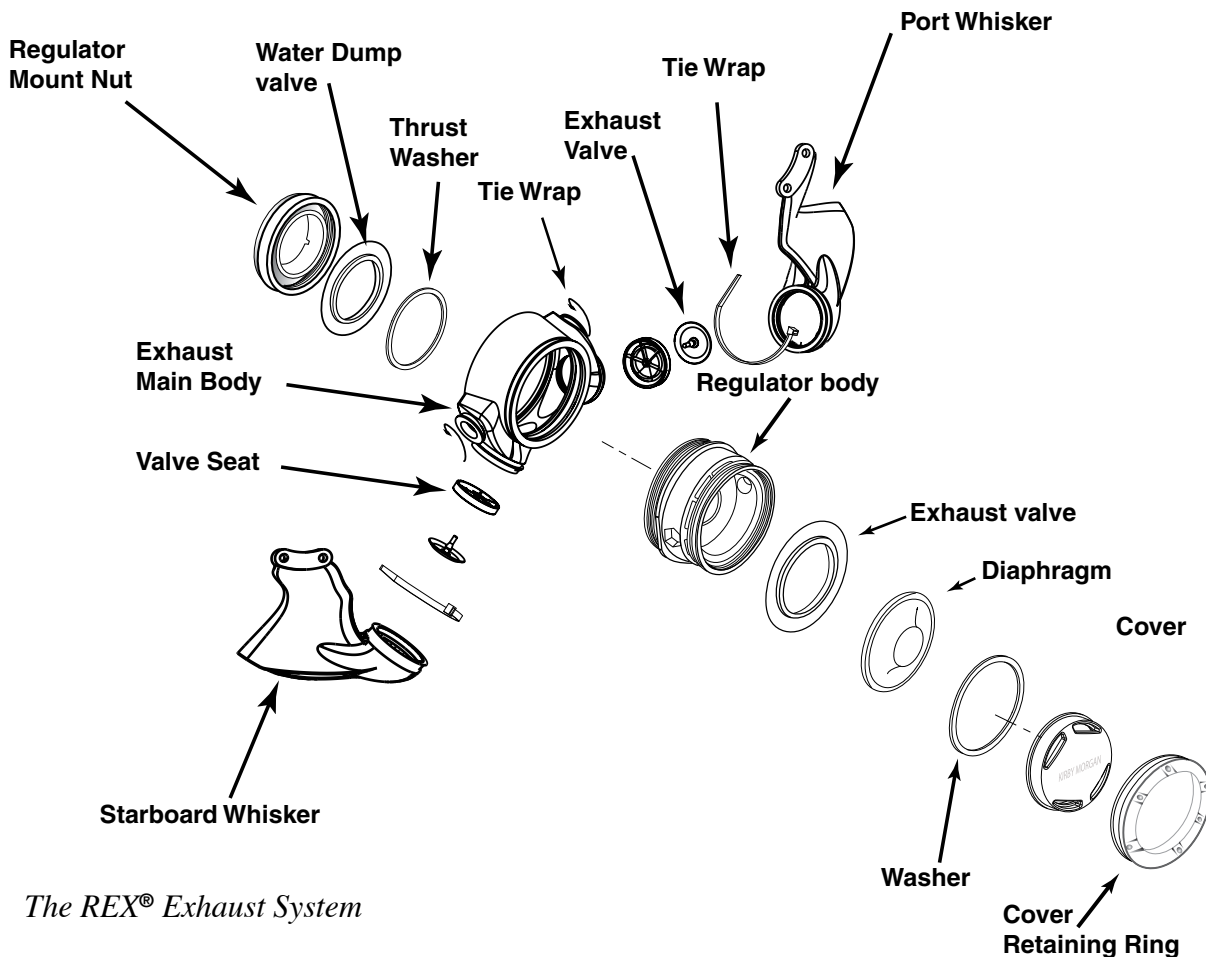
- Small flat blade screwdriver
- Small cutting pliers
- Clean wiping rag
- Nylon tooth brush
- Regulator cover wrench
- Spray bottle with detergent solution
- Spray bottle with antiseptic cleaner

6.6.1 Post Dive Disassembly

1. Remove the regulator cover retainer using the cover removal tool, then pull out the cover, thrust washer, and diaphragm.
2. Remove the nose clearing device by loosening the packing nut removing the knurled knob and sliding the shaft out through the oral nasal.



Remove the regulator cover to inspect the regulator exhaust valve.



The REX® Exhaust System

3. Remove the microphone from the oral nasal mask then remove the oral nasal mask from the helmet.

4. Using small cutting pliers, carefully cut & remove the two tie wraps then pull the whiskers away from the main exhaust body.

5. Using the soap solution, wet the exhaust valves and seats as well as the water dump valve and valve seat surfaces as well as all surfaces exposed to the diver's exhalation. The water dump valve can be difficult to see so take extra care to be sure it is cleaned. Agitate surfaces with the rag and or brush, then rinse with freshwater.

6. After cleaning with soap, wet components and surfaces of the regulator, oral nasal mask, water dump, whisker internals, and microphone with the sanitizing solution. Carefully inspect for any obvious signs of deterioration or damage, replace any components in question.

6.6.2 Sanitizing

Sanitizing is done to minimize the spread of germs. The helmet should be sanitized daily when used by one diver, and between dives when used by multiple users. To maximize germ killing action, all internal surfaces that come in contact with the exhalation gas need to be thoroughly wetted with the sanitizing solution and kept wetted for at least 10 minutes then thoroughly rinsed.

1. Wet the oral nasal mask, microphone, and oral nasal valve assembly, wipe and agitate all components and surfaces with the damp rag and allow to stay wetted for a minimum of 10 minutes to maximize germ killing action then rinse thoroughly.

6.6.3 Post Dive Reassembly

1) Reinstall the oral nasal on the regulator mount nut, then lightly lubricant the nose block shaft with silicone, install, and secure by wrapping the knurled knob with a rag and tightening with pliers while holding the pad end.

⚠ WARNING

It is essential to ensure that the whisker encloses the outer lip of the regulator ring. If this does not happen, the retain-er ring could possibly come unscrewed underwater. This would allow the dia-phragm to fall out and the helmet would flood. This could lead to serious person-al injury or death.



Remove the microphone so you can remove the oral/nasal mask.



Inspect the exhaust valves on a regular basis.

Lightly tighten the packing nut only tight enough so that it cannot be loosened by hand.

2) Install the microphone in the oral nasal mask then check to make sure the oral nasal valve is installed so the valve opens into the mask.

3) Reinstall both whisker valves ensuring the valves open outward away from the regulator body. They must be installed in the correct orientation.

4) Install the left and right whiskers then inspect and install the tie wraps.

Place tie-wraps around the tie wrap grooves in each of the two whiskers. Before doing the final tightening of the tie-wraps, make sure that parting line on bottom of wings is 5/16" behind parting line on the main body, and the heads of the tie wraps are positioned on the back of the body.

Properly re-align the port and starboard wings to the main body.

5) Install the diaphragm, thrust washer, soft cover and cover retainer ring. Start the ring by running it in 1-2 turns, using the regulator cover ring tool, just enough to hold it in place.

6) Be sure the exhaust main body that surrounds the regulator body captures the cover retaining ring. Using a flat blade screwdriver, adjust the rubber seal flap on the main exhaust body. Once this is done, finish tightening the ring using the cover ring tool.

7) For complete details on regulator service procedures see Chapter 7.



Make sure the exhaust main body that surrounds the regulator body captures the cover retaining ring. You can use a blunt screwdriver to snap the edge of the exhaust main body over the ring.

⚠ WARNING
The exhaust valve inserts must be installed in the correct orientation in exhaust main body. If the inserts are installed backwards, the diver will be unable to exhale. This could lead to suffocation and death.

⚠ WARNING
The exhaust valves must be correctly installed in the exhaust valve inserts or they will not seal correctly. This could lead to a backflow of water into the helmet, which could expose the diver to any contaminants that are in the surrounding water. Depending on the contaminants, this could lead to serious personal injury or death.