Kirby Morgan® 77 Diver's Helmet Operations and Maintenance Manual

KMDSI Part #100-085

Patented, patents pending, foreign patents apply

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Manual prepared by Marine Marketing and Consulting, Dive Lab, Inc., and KMDSI.

NOTE: This manual is the most current for the Kirby Morgan 77 Helmet. It is page dated March 2013. Future changes will be shown on page III and the changed pages will carry the date of change. Previous manuals may not reflect these updates.

⚠ WARNING

Diving with compressed breathing gas is a hazardous activity. Even if you do everything right there is always the danger that you may be killed or injured. No piece of diving equipment can prevent the possibility that you may be killed or injured any time you enter the water.

The Kirby Morgan 77 diving helmet meets or exceeds all performance and testing requirements of all government and non-government testing agencies throughout the world. It is CE approved.

Document Number 130318003

Warranty Information

Kirby Morgan Dive Systems, Inc. warrants every new mask, helmet, or KMAC Air Control System to be free from defects in workmanship for a period of three hundred sixty five (365) days from date of purchase. This warranty covers all metal, fiberglass, and plastic parts. This warranty does NOT cover rubber parts, communications components, or head cushions. In addition, due to the electrolytic nature of underwater cutting and welding, chrome plating cannot be warranted when the diver engages in these activities.

Should any part become defective, contact the nearest authorized KMDSI dealer. If there is no dealer in your area, contact KMDSI directly at (805) 928-7772. You must have a return authorization from KMDSI prior to the return of any item, Upon approval from KMDSI, return the defective part, freight prepaid, to the KMDSI plant. The part will be repaired or replaced at no charge as deemed necessary by KMDSI.

This warranty becomes null and void if:

1) The product is not registered with KMDSI within ten (10) days of purchase.

2) The product has not been properly serviced and/or maintained according to the appropriate KMDSI manual. In addition, the user is responsible to ensure that all product updates as recommended by KMDSI have been performed.

3) Unauthorized modifications have been made to the product.

4) The product has been abused or subjected to conditions which are unusual or exceed the product's intended service.

NOTE: Be sure to complete the enclosed warranty card and return it to KMDSI immediately. No warranty claims will be honored without a satisfactorily completed warranty card on file at KMDSI.

Record Of Changes

It is the responsibility of the owner of this product to register their ownership with Kirby Morgan Dive Systems, Inc., by sending the warranty card provided. This card is to establish registration for any necessary warranty work and provides a means of communication that allows KMDSI to contact the user regarding this product. The user must notify KMDSI of any change of address by the user or sale of the product.

All changes or revisions to this manual must be recorded in this document to ensure that the manual is up to date. Quantities marked in parenthesis.

Change Number	Date	Description of Change
1	06/15/2012	Updated copyright format
2	10/02/2012	Updated torque specifications locations
3	03/08/2013	Update chapter 3 with new head cushion “See section 3.4.1 Head Cushion Section” to section 3.4.2 Trimming the Neck Dam”

⚠ WARNING

Diving with compressed breathing gas is a hazardous activity. Even if you do everything right there is always the potential for serious injury or death. No one piece of diving equipment can prevent the possibility that you may be injured or killed any time you enter the water. The information in this manual is intended for users of Kirby Morgan helmets and persons that maintain or service Kirby Morgan helmets.

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Definition of Signal Words Used in this Manual

For your protection, pay particular attention to items identified by signal words in this manual. These terms are identified as, CAUTION, WARNING AND DANGER. It is especially important for you to read and understand these sections.

⚠ DANGER

This word indicates an imminently hazardous situation, which if not avoided, could result in death or serious injury.

⚠ WARNING

This word indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

⚠ CAUTION

This word indicates a potentially hazardous situation, which if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

If English is not your native language and you have any difficulty understanding the language of any warnings as they appear in the manual, please have them translated.

⚠ WARNING

Este é um aviso importante. Queira mandá-lo traduzir.

⚠ WARNING

Este es un aviso importante. Sirvase mandario traducir.

⚠ WARNING

Quest è un avviso importante. Tradurlo.

⚠ WARNING

Ceci est important. Veuillez traduire.

⚠ WARNING

Diese Mitteilung ist wichtig. Bitte übersetzen lassen.

If you have any questions concerning this manual or the operation of your helmet, contact KMDSI (805) 928-7772 or by Email at kmdsi@kirbymorgan.com or Dive Lab Inc. (850) 235-2715 or at divelab@divelab.com

IMPORTANT: A word about this manual. We have tried to make this manual as comprehensive and factual as possible. We reserve the right, however, to make changes at any time, without notice, in prices, colors, materials, equipment, specifications, models and availability. Since some information may have been updated since the time of printing, please contact your local KMDSI dealer if you have any questions. Periodically KMDSI Operations and Maintenance Manuals are reviewed. Any updates/changes will be posted on the KMDSI website and may be downloaded for insertion/correction.

Important Safety Information: This Kirby Morgan 77 diving helmet is intended for use by trained divers who have successfully completed a recognized training course in surface supplied diving

⚠ WARNING

Follow all the instructions in this manual carefully and heed all safety precautions. Improper use of this diving helmet could result in serious injury or death.

⚠ WARNING

Kirby Morgan Dive Systems, Inc. (KMDSI) warns all divers who use Kirby Morgan diving helmets or masks to be sure to use only KMDSI original parts from a KMDSI authorized dealer. Although other parts, O-rings and fittings may appear to fit your Kirby Morgan diving helmet or mask, they may not be manufactured to the same standards maintained by KMDSI. The use of any parts other than KMDSI original parts may lead to equipment failure and accidents.

⚠ WARNING

Diving in waters that are chemically, biologically, or radiologically contaminated is extremely hazardous. Although Kirby Morgan diving helmets may be adapted for use in some contaminated environments, special training, equipment, and procedures are necessary. Do not dive in a contaminated environment unless you have been thoroughly trained and equipped for this type of diving.

Read this manual before using or maintaining the helmet, even if you have experience with other diving helmets. **If you have purchased the helmet new from a dealer, be sure to send in the warranty registration card so we may keep you informed of any safety notices that affect this product**. If you resell or loan this helmet to another diver, be sure this manual accompanies the helmet and that the person reads and understands the manual. In addition to the manual a log book should be used to log all repairs, maintenance and use.

⚠ WARNING

This helmet was completely checked and should be ready to dive as it was shipped from the factory. However, it is always the diver's responsibility to check all the components of the helmet prior to diving. Use Dive Lab checklist A2.3 found on the web at www.divelab.com.

⚠ WARNING

Diving is a life threatening occupation. Even if you do everything right you can still be killed or injured. None of the models of Kirby Morgan helmets or masks can prevent accidents, injuries or death due to improper training, poor-health, improper supervision, improper job requirements, improper maintenance or acts of God.

This manual is supplied to the original purchaser of this helmet. If you have any questions about the use of the helmet or you need another copy of this manual, contact KMDSI or your nearest KMDSI dealer. It may also be downloaded free from the KMDSI website at www.KirbyMorgan.com.

If you have any questions regarding the use, maintenance, or operation of this helmet, contact KMDSI at (805) 928-7772, fax: (805) 928-0342, or e-mail: info@kirbymorgan.com.

⚠ WARNING

KMDSI helmets and masks are intended for underwater use only and should only be used by qualified divers that have received proper training in the use of this type of equipment. KMDSI helmets and masks should not be used or worn without the appropriate life support systems, such as air or gas supplies and support personnel as described in this manual.

⚠ WARNING

KMDSI helmets and masks should never be used for motor sport racing, aviation / space craft use, or for chemical warfare use. The helmet must never be used by persons in poor physical condition, by persons with previous head, neck, or back injuries which could be aggravated by its use. The helmet should not be used by persons under the influence of drugs or alcohol. Furthermore, infants, children, or persons under the age of 18 should never wear KMDSI helmets and masks. Failure to pay heed to the above could result in serious injury or death.

⚠ WARNING

Do not use KMDSI masks or helmets in currents exceeding 3.0 knots Use in currents greater than 3 knots may allow water to enter the exhaust valve, possibly causing regulator flooding. This could lead to drowning.

⚠ WARNING

Surface-supplied diving can be a strenuous activity. The Kirby Morgan 77 weighs approximately 30 lbs. KMDSI recommends that persons with a previous neck or back injury seek professional medical approval prior to engaging in surface supplied diving operations using the Kirby Morgan 77. Use of the Kirby Morgan 77 with a pre-existing physical/ medical condition may result in death or serious injury.

Components requiring lubrication, should only be lubricated with oxygen compatible lubricants such as Christo-Lube®, Fluorolube®, or Krytox®. Lubricants must be used sparingly and should not be mixed with other lubricants.

The information contained in this manual is intended to aid the user in optimizing the performance of this helmet. The application of some of this information will depend on the diving situation and the use of associated equipment. Many countries have specific laws and rules regarding commercial diving. It is important for the user to understand the rules, regulations, and philosophy imposed by the governing, regulating bodies whenever using commercial diving equipment.

Whenever KMDSI helmets or masks are used in European Countries, which have adopted the C.E. certification programs, they must only be used with C.E. certified components. Diving operations should only be conducted within

⚠ WARNING

Never use the helmet without first completing all pre-dive maintenance and set up procedures. Failure to complete all pre-dive checks could result in helmet failure due to problems with the incorrect set-up of the equipment. This could lead to serious personal injury or death.

⚠ WARNING

Always read the Material Safety Data Sheet (MSDS) for any chemical - adhesive, cleaning agent, or lubricant - used on your Kirby Morgan helmet. Some of these chemicals may cause serious bodily injury or death if used improperly or without the proper personal protective equipment.

the limits of the operational specifications, and in accordance with the rules and regulations established by the governing authority in the specific country or geographical location where the diving operations are being conducted. If you have any questions concerning this manual or the operation of your helmet, contact KMDSI (805) 928-7772 or at KMDSI@KirbyMorgan.com or Dive Lab Inc. (850) 235-2715 or at Divelab@aol.com

⚠ WARNING

Some of the procedures shown in this manual are for illustration purposes only. When using chemicals or materials that require the use of hand or eye protection, always wear the appropriate personnel protective equipment. Failure to use personnel protective gear may result in serious personal injury.

STOP!
BEFORE GOING FURTHER-

This manual will refer to location numbers in specific drawings, or in the exploded view, which is in the back of this manual. These numbers are called "location" numbers. They are used to find the referred to parts in the drawings in this manual only. They are not the part number. Next to the exploded drawing is a list of the "location" numbers that match the Kirby Morgan part numbers along with the name of the part. Always check the part number when ordering to make sure it is correct. When ordering, always specify the helmet model number and serial number as well.

Chapter 1
General Information KMDSI Products

1.1 Introduction

The Kirby Morgan Corporation was started in 1965. The copper and brass "Heavy Gear" or "Standard Dress" helmets were the first helmets manufactured by the company. Over the years Kirby Morgan designed, manufactured and sold many different helmets and masks for commercial divers.

Staying active in commercial diving has contributed to the successful design innovations of KMDSI products. This may be the primary reason for the acceptance of our designs by professional divers.

Bev Morgan has designed more than fifty-seven diving helmets and over 40 diving masks. All employees of KMDSI participate as part of the Kirby Morgan design team. It would not be possible for us to supply the commercial, military, scientific, and public service diving industries with our equipment, without the team of people that make up Kirby Morgan Dive Systems, Inc. (KMDSI)

We feel it is important for the reader to understand that we at KMDSI consider ourselves as only part of the process along the path in diving equipment design. We welcome all input from our customers. The thinking of many good divers, diving equipment engineers, diving medical specialists, diving organization administrators and their supporting personnel has contributed to the current state of the art of diving.

Each piece of gear we manufacture has in it some of the thinking of those who have gone before us. To all those people who gave something of themselves to the men and women who work underwater, we express a thank you.

We have a strong commitment to providing the best diving equipment and service possible. This thinking has been the policy of Kirby Morgan Dive Systems, Inc. and we will continue to take this approach to our work.

Bev Morgan, Chairman of the Board
Kirby Morgan Dive Systems, Inc.

Our extensive dealer network makes it easy to obtain genuine Kirby Morgan replacement parts, as well as technical assistance worldwide.

KMDSI has always concentrated on designing and manufacturing diving equipment that allows most repairs, inspections, and all routine maintenance to be performed by the user. Most routine preventative and corrective maintenance can be accomplished by the user utilizing this manual, the KMDSI Tool Kit (P/N 525-620) and common hand tools. Technician training is available through Dive Lab Inc. Information can be obtained on line at **www.divelab.com** or by telephone at 850-235-2715.

1.2 Full-Face Masks and Manifolds

KMB® 18 A/B

CE *approved and* CR™ *marked*

The **KMB 18B BandMask®** frame is constructed of hand laid fiberglass. The head harness is a molded, strong tear resistant neoprene rubber.

The hood, which attaches to the mask frame with welded stainless steel bands, provides warmth for the divers head as well as pockets for the earphones. The communications connections can be either a male waterproof plug in type or bare wire posts. Both this mask and the KMB 28B feature the new Tri-Valve™ Exhaust System.

The **KMB 28B BandMask®** (not shown) is very similar to the KMB 18, with many parts on the KMB 18B being interchangeable with the KMB 28B. The major difference between the 18 and 28 is the material of the mask frame itself. The KMB 18 has a fiberglass frame (yellow) while the KMB 28B frame is an extremely durable injection molded plastic (black).

Other differences include:
1) The main exhaust body of the KMB 28 is part of the frame itself and uses a #545-041 main exhaust cover
2) no comfort insert is required on the 28
3) the face ports for the 18 and the 28 differ slightly in size.

Both the KMB 18 and KMB 28 are CE approved.

The **EXO Full Face Mask** is designed for both surface supplied and scuba diving. By enclosing the divers eyes, nose and mouth, the EXO permits nearly normal speech when used in conjunction with most wireless, and all hard wire underwater communication systems.

The **EXO BR (BALANCED REGULATOR)** shown here is designed to meet or exceed recommended performance goals in both scuba and surface supplied modes and is CE approved. It meets and surpasses European standards for regulator performance.

EXO® BR

CE *approved and* CR™ *marked*

The Balanced Regulator helps reduce the work of breathing for the diver by balancing the intermediate air pressure against the valve sealing pressure inside the regulator. This enables the regulator to instantly adjust to changes in line pressure. The balanced regulator is adjustable for a wide range of intermediate pressures between 90 PSIG – 250 over ambient pressure (6.2 – 17 bar).

Both models have a modular communications design that permits rapid and simple maintenance. The optional Hard Shell provides surfaces for mounting lights, cameras etc.

SuperMask M-48
w/ Scuba Pod

CE *approved and* CR *marked*

The **SuperMask M-48** is an innovative new design in a full-face mask. It provides the diver with all the comfort of a full-face mask with the convenience of changeable second stage regulators as well as the ability to use a snorkel without having to remove the mask.

The mask is comprised of two major components, the mask frame and the interchangeable lower pod. The removable lower pod is a feature unique to the SuperMask full-face mask. When diving, the pod is easily removed and replaced on the mask, providing the diver the capability to buddy-breathe, snorkel, use an octopus or perform an "in water" gas switch.

With the pod sealed to the mask, the flexible, silicone pod cover allows the diver to quickly place the regulator mouthpiece into the mouth or dive with it free of the mouth for communications. With the mouthpiece in, the regulator may be used without the pod being sealed to the mask.

The mask may also be used surface supplied when used with the proper accessories. We are currently developing several different pod configurations for both open circuit and rebreather use. For further information, see the Frequently Asked Questions (FAQ) area on our web site at **www.KirbyMorgan.com/FullFaceMasks/M48.html.**

SuperMask M-48
w/ Rebreather pod

CR *marked*

KMACS-5
w/ No Communications

KMACS-5
w/ Communications

The **Kirby Morgan Air Control System-5 (KMACS)** is a lightweight, portable control box for use in surface supplied air diving operations. The KMACS-5 controls the diver's air supply, communications and monitors the diver's depth. It allows two divers clear push-to-talk (two wire) or round robin (four wire) communications. The KMACS-5 is also available without communications.

The air supply can be either from a low-pressure compressor or high-pressure cylinders. The adjustable first stage regulator reduces the high-pressure air and supplies low pressure through the umbilical to the diver's breathing system.

High pressure yokes permit U.S. standard scuba cylinders or DIN equipped cylinders to be used. Low-pressure air supply fittings allow for a compressor to be used as the primary air source.

A complete pneumo system with dual reading gauges (both US Standard and Metric) is provided for each diver's air, as well as a shut-off/bleed system that uses two high-pressure feed lines which allows changing of used cylinders without interruption of the diving operation. Optional shut off valves allow the isolation of each diver's air supply.

The Communication Set is a multipurpose intercommunication system that provides reliable and clear communications between a topside operator (tender) and one or more surface-supported divers, recompression chambers, or other submersible systems.

1.3 Kirby Morgan Diving Helmets

All Kirby Morgan diving helmets and masks are manufactured by Kirby Morgan Dive Systems, Inc. (KMDSI). Each step of the manufacturing process is carefully controlled to assure the customer of a high quality, durable helmet that will function properly for many years.

There are eight models of Kirby Morgan diving helmets currently in production. They are the SuperLite®-17B, (MK-21- U.S. Navy version), SuperLite® 17C the SuperLite® 27, and Kirby Morgan models 37, 37SS, 47, 57, and 77. All are CR™ marked.

The **SuperLite®-17 A/B** was first developed in 1975 and quickly set a new standard for diving helmet design. Many large and small commercial diving companies, military organizations, scientific divers, and public safety divers are successfully using this design around the world. This helmet is CE marked.

The SL-17 A/B helmet system consists primarily of two major components: the neck dam/yoke assembly, and the helmet. To don the helmet, the diver first slips the angled neck dam with the attached yoke over their head. The helmet is lowered onto the diver's head with the help of a tender, then the yoke hinge tab is hooked onto the alignment screw on the rear weight. The neck clamp is then slipped onto the helmet and locked. The locking system not only seals the neck dam to the helmet but also secures the front of the yoke, fastening the helmet to the diver's head.

The SuperLite®-17A/B shares many common breathing system parts with all Kirby Morgan helmets and masks. The breathing system was man-tested to 1600 FSW by the University of Pennsylvania and approved by the U.S. Navy for surface-supplied diving to 190 FSW with air and 300 FSW with mixed gas. It surpasses all requirements of all governing agencies and it is approved for commercial diving through out the world.

SuperLite® 17A/B

CE approved and CR™ marked

Kirby Morgan® 37

CE approved and CR™ marked

Yoke and Latch Catch Assembly

Neck Pad and Sealed Pull Pins.

Other features that are common to all Kirby Morgan helmets include:

* Face port and retainer ring
* Communications components
* Oral/nasal mask
* Nose block device
* Air train defogger

The **Kirby Morgan® 37** Commercial Diver's Helmet represents what we at Kirby Morgan consider to be a turning point in modern diving helmet design. The helmet consists of two major assemblies: the helmet shell/helmet ring assembly and the neck dam/neck ring assembly.

The helmet comes with the large tube SuperFlow 350 adjustable demand regulator which provides an easier breathing gas flow during peak work output. A quick change communications module is available with either bare wire posts or a waterproof connector.

The helmet ring houses the sealed pull pins and provides protection for the bottom end of the helmet. The diver is also provided with an internally adjustable chin support. This custom fit and balance seats the helmet comfortably for long periods of time even when working in the face down position.

The **SuperLite® 27®** Commercial Diver's Helmet has all the same features of the KM37 on a smaller, low volume shell design. This helmet is often preferred by persons with smaller heads.

The chrome plated machined brass helmet neck ring houses the sealed pull pins and provides protection for the bottom end of the helmet. Like the SL-17K, 37 and 17C, the diver is provided with an internally adjustable chin support. This support, along with the adjustable neck pad on the locking collar, gives the diver a comfortable, secure, custom fit.

The quick-change communications module, available with either bare wire posts or a waterproof connector, allows for easy, efficient maintenance of the helmets communications.

The helmet also features the SuperFlow 350 large tube adjustable demand regulator. The helmet is available in the umbilical over the shoulder, "B" configuration only.

SuperLite® 27®

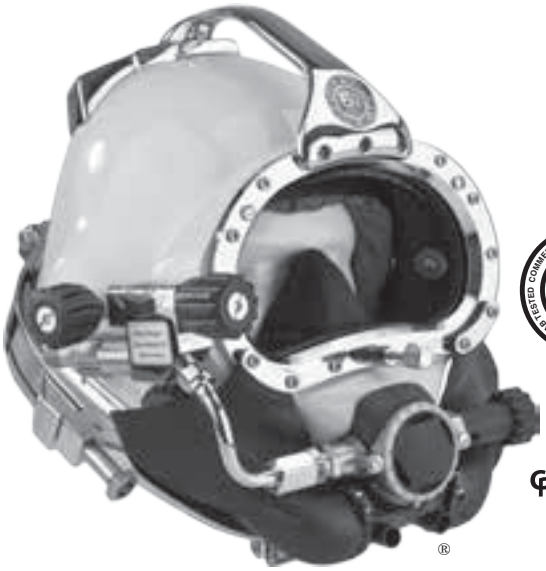
CE *approved and* CR™ *marked*

Kirby Morgan® 47

CE *approved and* CR™ *marked*

The **Kirby Morgan® 47** offers the ultimate in a high performance breathing regulator. This helmet has an entirely new breathing system, oral nasal mask, and water ejection system. The REX® Demand Valve, with it's fully adjustable balanced piston is a breakthrough design that exceeds the requirements of all government or other testing agencies.

It has the best work-of-breathing performance when compared to ANY other commercial diving helmet. The Kirby Morgan 47 Dive Helmet has been tested and meets or exceeds European CE requirements and is fully commercially rated. In all other respects, this helmet is nearly identical to the Kirby Morgan 37.



marked

The **Kirby Morgan® 57** helmet features our revolutionary new SuperFlow 450 Stainless Balanced Regulator. It's machined from a stainless steel casting for the ultimate in performance and reliability.

Like all KMDSI regulators on our helmets and Band Masks®, we use only regulators that are specifically designed for surface-supplied diving, that will perform over the wide range of pressures delivered by low pressure compressors. An ordinary SCUBA regulator mounted on a diving helmet is not capable of delivering the gas you need at heavy work loads. This commercially rated fully diver adjustable regulator delivers all the breathing gas you might require for the most demanding work underwater.

The **Kirby Morgan® 57** also includes our Quad-Valve™ Exhaust System. It's recommended for diving in biologically contaminated water, when you're properly trained and equipped, using recommended procedures. This new exhaust has exceptionally low exhalation resistance that you must experience to appreciate.

⚠ WARNING

Before attempting any diving in any type of contaminated water, a complete diving and topside course in hazardous materials emergencies should be completed. The divers and the topside team must be properly trained and have the proper safety equipment. All helmets and suits can leak water under certain conditions. Divers should use extreme caution when diving in contaminated waters.

approved and marked

The **Kirby Morgan® 77** represents the first in a new generation of stainless steel diving helmets that provide an alternative for the diver who prefers a metal helmet. The helmet features our new stainless steel REX® regulator, which offers the best performance of any other Kirby Morgan system.

It has the best work-of-breathing performance when compared to ANY other commercial diving helmet. The Kirby Morgan 77 Dive Helmet has been tested and meets or exceeds European CE requirements and is fully commercially rated.

The advantages of this all stainless steel helmet include the following:

• No refinishing required if the surface is scratched or gouged.

• Faster production of helmets for customer delivery.

• Elimination of threaded inserts for securing the port retainer to the helmet shell.

• No need to remove the handle to remove the port retainer.

• One piece sideblock includes both the free-flow valve and the Emergency Gas System valve.

• The helmet ring is an integral part of the helmet.

CE *approved and* CR™ *marked*

The **Kirby Morgan® 37SS** features an all stainless steel shell, as well as a stainless sideblock, helmet ring, bent tube, handle, and other key components. The SuperFlow 350 is standard on this helmet.

The Kirby Morgan 37SS features a quick change communications module, available with either bare wire posts or a waterproof connector, and allows for easy, efficient maintenance of the helmet's communications.

The advantages of this stainless steel helmet include the following:

• Rugged helmet shell and other components

• No refinishing required if the surface is scratched or gouged

• Elimination of threaded inserts for securing port retainer to helmet shell

Chapter 2
Description & Operational Specifications
Kirby Morgan 77

⚠ WARNING

This manual is our effort to explain the operation, maintenance and use of the Kirby Morgan helmet. We do not herein make any effort to teach the principles of diving. It is our assumption the reader is a qualified diver. We highly recommend that all divers should train, under controlled conditions, in the use of any model of commercial diving helmet that they have not previously used or trained in, prior to use on the job, until they have mastered the skills required to use their helmet correctly. Kirby Morgan helmets are intended for professional use only and are not intended for recreation use by persons not trained in surface supplied procedures and practices.

This section includes detailed descriptions of the Kirby Morgan 77, as well as important operational specifications. This helmet shares some, but not all, parts with the Kirby Morgan 47.

2.1 CR Marking

The helmet meets or exceeds all standards established by Dive Lab of Panama City, Florida, and is CR (Commercially Rated) marked.

2.2 CE Certification

The helmet has been tested and conforms to the performance requirements as set forth in Annex II of Directive 89/686/EEC and, as far as applicable, the EN 250:2000, EN 250/A1:2006 and EN 15333-1:2008 (class B). It is fully CE marked with demand valve REX®.

Category of PPE: III

⚠ WARNING

The helmet has been tested with air and CE certificates for use with air up to 50 meters. Compressed air must be compliant with the EN 12021.
All the tables reporting the technical data and the pressure of use are relative to compressed air.

2.2.1. CE Marking

On the frame of the helmet the CE mark is affixed.

EN250:2000
EN250/A1:2006
EN15333-1:2008
CLASS B

KIRBY MORGAN®

KIRBY MORGAN DIVE SYSTEMS, INC.
1430 Jason Way,
Santa Maria, CA 93455

HELMET MODEL: _____

YEAR OF PRODUCTION: _____ CE 0477

CE Mark

In the mark the data reported are the following:

1. the name and the address of the manufacturer;
2. harmonized reference standard: EN 250:2000, EN 250/A1:2006 and EN 15333-1;
3. Helmet model;
4. the serial number;
5. the year of production;
6. CE marking: CE;
7. number of notified body.

⚠ CAUTION

The user cannot:
• remove the mark from the frame of the helmet;
• modify or counterfeit the data reported on the mark.

⚠ CAUTION

The mark must be visible and legible throughout the life of the PPE. If the mark deteriorates or is not legible the user should contact the manufacturer.

2.2.2. Notified Body

The Notifying Body is	Eurofins-Modulo Uno S.p.A.
Address:	Via Cuorgne, 21-10156 Torino, ITALY
Identification number:	0477.

2.3 Other Marking

The helmet Kirby Morgan 77 meets or exceeds all requirements of NPD, Health and Safety (U.K.), United States Navy and ADCI United States.

2.4 Product Specifications

Weight: KM 77 - 32.43 pounds
Helmet Shell: Stainless steel
Regulator Body - Stainless steel
Control Knobs: Polyurethane
Lens: Clear polycarbonate
Neck Dam: Neoprene. Optional latex neck dam available.
O-Rings: Buna-N
Head Cushion: Nylon bag filled with #4 Polyester foam
Recommended Lubricants: Dow-Corning® MS4 Silicone Lubricant. Christo-Lube®, Krytox®, and Halocarbon® are also acceptable.

⚠ WARNING

Never use aerosol-propelled sprays near the face port of any Kirby Morgan diving helmet. The propellant used in these aerosols can invisibly damage the face port and cause it to shatter on impact from any strong blow. If the face port fails underwater, injury or death may result.

If you have any questions regarding proper set-up, operation, or maintenance of your Kirby Morgan helmet contact KMDSI (805) 928-7772 or at kmdsi@KirbyMorgan.com or Dive Lab Inc. (850) 235-2715 or at Divelab@aol.com. There are also detailed checklists for the set-up and maintenance of your helmet on the Dive Lab web site at www.divelab.com.

2.5 Regulator Performance

2.5.1 REX® Regulator

The REX® regulator on the Kirby Morgan 77 offers high performance. The regulator has been tested at Dive Lab at Panama City, Florida. It meets or exceeds all current U.S. Navy and European diving standards.

2.5.2 Minimum Operating Temperature

The KM-77 can be used in waters at water temperatures as low as 34 degrees Fahrenheit (1 degree Celsius) without the use of a hot water shroud and hot water to prevent freezing. However it is strongly recommended that the hot water shroud be used for the comfort of the diver. At the time of this writing a specific part number hot water shroud is not available for the KM-77 however work is underway to produce one. The the standard shroud PN# 525-100 can be modified to work. for more information contact Dive Lab Inc. www.divelab.com

Without a hot water shroud, the diver may be subject to hypothermia due to cold gas inspiration temperatures. Kirby Morgan makes no physiological recommendations regarding minimum safe operating temperatures for divers using this helmet.

⚠ WARNING

Diving in cold water, i.e., at temperatures below 50 degrees F, may subject the diver to severe respiratory heat loss. This may lead to a decrease in body core temperature also known as "hypothermia." Hypothermia is extremely dangerous and can lead to a loss of reasoning ability, decreased manual dexterity, uncontrollable shivering, unconsciousness, and death.

2.6 Cage Code

The cage code for identifying KMDSI products for U.S. government purposes is 58366.

2.7 Operational Specifications & Limitations

-Umbilical minimum I.D. 3/8" (9.5 mm) of not more than two sections, total length not to exceed 600 feet (183m).

⚠ WARNING

When the helmet is used for air diving in countries that conform to C.E. regulations it must be used to a maximum depth of 164fsw (50msw). I.A.W. EN 15333-1.

2.7.1 Using the REX® Regulator with a Low Pressure Compressor Supply

The REX® Regulator Low Pressure Compressor Supply Requirements table were developed to allow the

⚠ WARNING

The REX® Regulator® Low-Pressure Compressor Supply Pressure Requirements tables presented in this manual are intended for use with properly adjusted and maintained KMDSI® 47 and 77 helmets only. None of the KMDSI® supply tables have been evaluated on other makes of hats and should not be used with other manufacturers' helmets or masks.

⚠ WARNING

To properly supply the diver with breathing air, the helmet as well as the umbilical and associated supply system must be properly configured, maintained, and adjusted.

maximum performance based on the compressors output. The table allows the user to maximize depth capability based on respiratory work load and supply system capability. In physiological terms the work rate is the amount of gas breathed in a one minute. For highly fit diver's, the main performance limiting factor is the inhalation and exhalation effort of the breathing system. For divers not so fit, the limiting factor may be their own physical ability. Regardless, all divers should never push themselves beyond their capability and the capability of the equipment being used.

For practical purposes, the U.S. Navy defines breathing work rates in terms of "RMV" which stands for Respiratory Minute Volume." RMV is defined as the amount of breathing gas that flows in and out of your lungs in one minute. See Appendix Table 1.

Users should ensure that the compressor or supply system meets both the supply pressure and output volume required for the deepest anticipated depth and ventilation rate. Below is the formula used for computing the volume of air being used at a given ventilation rate at depth.

Note: This is the bare minimum. As a safety margin, it is best to plan on an additional 10%-20% of breathing gas to ensure the supply system can keep up.

{(Depth + 33) ÷ 33} x RMV} x .10 or .20 safety margin.

Best Practice:

• When using a LP compressor always base the output pressure on the lowest pressure during compressor cycling.
• Complete a flow test of the compressor / air system and all umbilicals at least once a year and/or whenever in doubt as to the capability.
• Always take the standby diver into consideration when planning air usage.
• Always allow for at least 10-20% greater volume than what is needed for the maximum ventilation anticipated.
• Never use less than 40 RMV for planning purposes.
• Refrain from heavy use of the helmet steady flow valve. Short 2-3 second bursts will not significantly affect inhalation performance.
• Always dive with a fully functional man worn emergency gas supply system (EGS) of sufficient capacity based on the hazards of the task, have the cylinder valve open and the emergency valve shut.
• When using HP supply systems (Control Consoles) use the recommended pressures for depth as listed in the table for High Pressure Regulators Settings found in this chapter. For best overall performance avoid using pressures excessively higher than what is required for depth especially if diving shallow.

⚠ DANGER

Decompression diving always involves the risk of decompression sickness. Omitted decompression due to a loss of the breathing gas supply or other accidents can cause serious injury or death. Use of a Kirby Morgan helmet or mask cannot prevent this type of injury.

2.7.2 Using the REX® Regulator Low-Pressure Compressor Supply Pressure Requirements Table

The REX® LP table is for use when using LP compressors only. If you are using an HP reducer console, use the High Pressure table on page 28 of this manual. The REX® low pressure table in this manual is intended for the **REX® regulator only** and should not be used for the other KMDSI regulators or with other manufactures helmets or masks. To use the REX® Regulator Low Pressure table, you must know your compressors output pressure and volume, the divers maximum planned depth, and the anticipated work rate.

SCFM stands for "standard cubic feet per minute" and is the standard measurement of compressor delivery at sea level. SLPM stands for standard liters per minute (SLPM). SLPM is normally used in Europe and other places in the world and is normally the unit used when talking about RMV. To convert SLPM to SCFM divide the SLPM by 28.31. To convert SCFM to SLPM multiply SCFM by 28.31.

To compute the air required at depth, take the depth plus 33 to get depth absolute then divide by 33 to get atmospheres absolute. Next multiply the atmospheres absolute by the RMV then and 10 to 20% as a safety factor. You can convert the LPM to CFM by dividing the answer by 28.31.

Example: You are using a Quincy 325 compressor that has an out put of 19.0 CFM at 150 psig. You know you will be doing moderate to heavy work placing sand bags at a depth of 150 FSW so how much air will be needed if the diver is working at work rate of 50 RMV.

{(150 FSW + 33) ÷ 33) x 50 RMV}
[(183 ÷ 33) x 50]
(5.55 x 50)
277 SLPM

The diver will need a bare minimum of 277 liters per minute. Best practice would be to add a minimum 20% more volume as a safety factor. 277 x .20 = 55.5 ending up with 332 liters per minute. Now there are 28.31 liters in one cubic foot so to find out how many cubic feet a minute this would be you simply divide 332 by 28.31. Answer: 11.74 SCFM. This means the diver at 160 FSW working at 50 RMV will need to plan on a supply source that meets the press for depth in accordance with the table, and can deliver at least 11.74 SCFM. The out put pressure of 150 PSIG at 150 FSW would allow 50 RMV to a maximum depth of 149 FSW according Appendix Table 2 of 150 PSIG at 150 FSW would allow 50 RMV to a maximum depth of 149 FSW according to Appendix Table 2.

⚠ WARNING

It is important for the user/diver to take excessive currents into consideration. The exhaust system on the REX® Regulator will help prevent water intrusion when diving in heavy currents. The REX® exhaust system does not limit the diving depth.

The umbilical assembly should be composed of good quality diving hose that meets industry standards. Generally, gas hose will be married to the communications wire, pneumofathometer hose, and strength member in a manner that will allow the strength member to receive all the strain.

There are also good quality umbilicals available that are assembled at the factory using a twisted method which does not require marrying. Regardless of the system used, the umbilical is the diver's life line and should always be of excellent quality and maintained carefully.

If you have any questions regarding proper set-up, operation, or maintenance of your Kirby Morgan helmet contact KMDSI (805) 928-7772 or at kmdsi@KirbyMorgan.com or Dive Lab Inc. (850) 235-2715 or at Divelab@aol.com.2.6.3 Using a High-Pressure Breathing Gas Supply
High pressure (HP) control consoles are capable of suppling air or mix gas at pressures and volumes much greater than low pressure air compressors, and are often preferred by military and and scientific divers. HP air systems are often used as back up supply for LP compressor diving.

When using HP air or mix gas systems, The regulator is normally loaded to 100-150 psig on the surface and increased to the bottom setting as the diver descends or when the diver reaches the bottom. During ascend the pressure is reduced to between 100-150 p.s.i.g. once the diver is shallower than 100 feet. A high-pressure gas supply is typically used under the following conditions:

- When the work load exceeds the capabilities of the compressor to supply a sufficient volume and pressure of breathing gas, regardless of the depth.
- When the diver is using pre-mixed gas.
- As a back-up for a low-pressure compressor
- Any time a high-pressure supply is available

The regulator is loaded as the diver increasingly descends and unloaded as the diver returns to the surface. If the diver experiences a free-flow with his regulator, when the bias adjustment knob is properly set and the regulator has been maintained correctly, the pressure setting on the high-pressure regulator setting may be too high and may need to be decreased.

For recommended pressures when using a high-pressure breathing gas supply and dome loaded regulator see Appendix Table 3. Generally speaking, the topside regulator should be set at 140 p.s.i.g. over bottom pressure for optimum regulator performance.

⚠ WARNING

The demand regulator and side block assemblies have a maximum design pressure of 225 p.s.i.g. (15.5 bar) over-bottom. Higher pressures could lead to component failure and serious personal injury.

⚠ WARNING

Gas systems used to supply Kirby Morgan helmets and masks must be capable of supplying gas to the diver at the required pressure and flow rates as stated in the operational specifications. The use of unregulated gas sources is extremely dangerous.

The use of standard SCUBA type regulators is unacceptable, as there are no provisions for adjusting the intermediate pressure to the diver. Only proven systems that allow for varying the gas supply pressure to the diver should be used for umbilical diving.

2.8 Helmet Features

All Kirby Morgan diving helmets are manufactured by hand. Each step of the manufacturing process is carefully controlled to assure the customer a high quality, durable helmet that will function properly.

Development of the KM77 was started in 2005. The goal was to bring together all of the top design elements of the various Kirby Morgan helmets and then refine the mix into what we at KMDSI consider to be among the best in current diving helmet design. The KM 77 takes some of the proven design features of our world famous SuperLite® 17 A/B and blends in many of the advanced design features of the SuperLite® 27. Add in some balance refinements, a stainless shell, sideblock, and our REX® regulator, and you have a superb diving helmet. Exemplifying our adherence to the highest quality and proven superior work performance, the KM 77 is another outstanding helmet from Kirby Morgan.

The KM 77 incorporates the innovative locking system and communications system of the SuperLite® 27 onto a larger KM47 size stainless steel shell. The 77 features the REX® adjustable demand regulator which provides superb breathing gas flow during peak work output. This is the same regulator used on the KM47.

The helmet consists of two pieces: the helmet shell/helmet ring and the neck dam/neck ring assembly. The machined helmet ring houses the sealed pull pins and locking collar, and provides protection for the bottom end of the helmet. The adjustable neck pad on the locking collar, in combination with the internal chin strap and adjustable head cushion, gives the diver a secure, custom tailored fit in the helmet. The superior fit and balance makes the helmet sit comfortably for long periods of time even when working in the face down position.

A quick change communications module, available in either bare wire posts or a waterproof connector, allows for easy, efficient maintenance of the communications in the helmet.

The KM 77 has the REX® exhaust system, which is recommended for diving in contaminated water.

⚠ WARNING

Before attempting any diving in any type of contaminated water, a complete diving and topside course in hazardous materials emergencies should be completed. The divers and the topside team must be properly trained and have the proper safety equipment. All helmets and suits can leak water under certain conditions. Divers should use extreme caution when diving in contaminated waters.

Other helmet features which are common to the KM77 and other KMDSI helmets include:

- the face port
- communications components
- the oral/nasal mask (KM47 only)
- the nose block device
- the head cushion (SL27, 37, 47 & 57)
- neck dam (SL27, 37, 47 & 57)

Many of the breathing system components on these helmets are also compatible with the KMB 18B and 28B full-face masks and the EXO-26. This helps reduce the inventory of spare parts that must be carried by commercial diving companies.

Each step of the manufacturing process is carefully controlled to assure the customer of a high quality, durable helmet that will function properly. The following is a general description of the features of the KM 77.

1) The face port (or view port) area remains unchanged from the SuperLite®-17B.

2) The helmet is cast as a single piece and finished using computer controlled machinery. The bottom helmet ring receives the neck dam ring which seals to the helmet with an O-ring. The seal is very air/water tight. The metal bottom of the KM 77 is quite durable in normal use, but care should be taken not to drag the helmet bottom on the deck.

3) The neck dam on the KM 77 is sandwiched between the neck dam rings, securely holding it in place. Replacement neck dams install easily. Latex or foam neoprene neck dams are available.

4) When the neck dam/neck ring is locked into place on the helmet, it is located up inside the protective helmet ring (that the neck ring O-ring seals to) which protects the neck ring and neck dam from side impact damage during the dive.

5) The neck dam design (latex or neoprene foam) helps position the helmet correctly. Replacement neck dams should only be genuine KMDSI/Kirby Morgan neck dams to assure proper operation and comfort. An internal adjustable chin strap helps to secure the diver's head in the helmet.

6) The locking collar design holds the neck ring in the sealed position. The O-ring seal is continuous once the neck ring enters the helmet ring.

7) Attached to the locking collar is an adjustable neck pad that should be adjusted to the diver prior to diving. This will improve the fit and performance of the KM 77.

8) A system of two sealed pull pin locks is on the KM 77. One lock is located on each side of the helmet. The spring and sliding shaft of these locks are inside an O-ring sealed main body. The interior of the main body is filled with silicone fluid. No fine sand or other debris can reach the interior of these locks to interfere with their operation.

9) The head cushion attaches just inside the bottom of the helmet, keeping it in place when the diver dons the hat. The standard head cushion consists of a brushed nylon bag with an open cell polyester foam inside. The 17B head cushion should not be used in the KM 77 because the design of the head cushions is different. Only genuine Kirby Morgan KM 77 head cushions should be used to assure proper operation and comfort.

10) The handle that is fitted to the top of the helmet and the port weight are areas that can be used as mounting brackets for lights, TV cameras, etc. Removal of the handle is quick and easy and does not require sealing it to the helmet shell.

11) The communications system is a modular, quick change design.

12) The exhaust system is a three valve design, the REX®, that helps to keep the helmet exceptionally dry.

2.9 General Description

2.9.1 Helmet Shell

The helmet shell and neck ring is fabricated of stainless steel as a one piece assembly. This shell is the central structure for mounting all the components that make up the complete helmet. It is designed to allow easy replacement of parts when necessary. Any repair to the helmet shell must be done at an approved KMDSI repair center.

2.9.2 Gas Flow Systems

The main gas supply flow from the umbilical enters the system at the adapter and flows through the one way valve to the interior of the side block. The one way valve or "non-return" is a very important component.

The one way valve prevents the flow of gas out of the helmet to the umbilical in the event of a sudden lowering of pressure in the umbilical. This can happen due to an accidental break in the hose or a fitting near the surface. Not only would the emergency gas be lost if the one way valve failed (concurrent with a hose or fitting break on deck), but the diver could suffer from a serious "squeeze" that could cause injury or death.

Although we have selected the valve for its reliability and quality, inspection and maintenance of this valve must be done regularly. It is very easy to disassemble and inspect. (A rebuild kit for this valve is available).

⚠ CAUTION

The bent tube assembly for the KM77 is a unique design and is not interchangeable with the bent tube assembly used on other Kirby Morgan masks and helmets.

⚠ WARNING

The one way valve must be tested daily, prior to the commencement of diving operations. Failure of one way valve could cause serious injury or death. Follow the procedures for testing the valve in this manual.

The emergency gas comes from a tank of compressed gas worn by the diver. It enters the system through the Emergency Gas valve when the diver turns the control knob on. The flow then enters the side block.

⚠ DANGER

Never connect the main gas supply hose from the diving station/umbilical to the auxiliary valve. There is no one way valve in the emergency gas valve. If this mistake is made, any break in the supply hose could possibly result in a "squeeze". This could result in serious injury or death.

Both sources of gas flow through the same passage in the side block body to three exits. One exit is always open to supply gas to the demand regulator assembly. The second exit is to the defogger valve (also known as the free-flow or steady-flow valve) assembly. The third is to the port on the side block to connect a dry suit inflator hose.

A second port is located on the top of the sideblock. This port is controlled by the defogger control knob and only supplies air when the defogger knob is the open position. This port is not for dry suit or buoyancy compensator use.

The diver controls the flow of gas through the defogger system with the control knob. The gas enters the helmet and flows through the air train which directs the gas onto the face port to help eliminate or clear fogging that forms on the port from the diver's warm breath.

The gas flow continues out through the regulator exhaust system, or into the oral nasal mask by means of the oral/nasal valve. The diver can breathe from this flow of gas if the demand regulator malfunctions. The gas then flows into the regulator and out through the regulator exhaust. From there it can exit through either of the exhaust valves and out through the whiskers.

Returning to the side block assembly: the other passage for gas is to the demand regulator. It goes to a bent tube assembly that connects to the inlet nipple of the demand regulator. The flow of gas in the demand regulator assembly is controlled by the inlet valve that supplies gas to the diver on inhalation "demand" only, and shuts off during the exhalation cycle.

⚠ WARNING

The side block inflator port is intended for dry suits and buoyancy compensators only - no air tools. When using the side block low-pressure inflator port, only good quality hoses and fittings should be used and must incorporate an in-line flow restrictor to reduce gas flow in the event of hose failure. Any hose or fitting failure in this arrangement will subject the diver to a decreased air supply.

The side block on the helmet is drilled and tapped to accept low-pressure inflator hoses. This allows the diver the capability to inflate variable volume dry suits and buoyancy compensators. It is tapped with a 3/8-24 thread orifice, standard for American first stage scuba regulator's low-pressure auxiliary fittings. As an added precaution, the orifice for dry suit/buoyancy compensator inflation is restricted to supply only enough air for suit or BC inflation. Unlike other Kirby Morgan helmets, no external restrictor is required. The low pressure inflator port is shipped plugged at delivery. This inflation capability does not significantly interfere in any way with the breathing characteristics of the regulator during normal use providing a limiting hose is used. The low-pressure inflation hose should be one that is restricted to flow less than 100 LPM.

⚠ WARNING

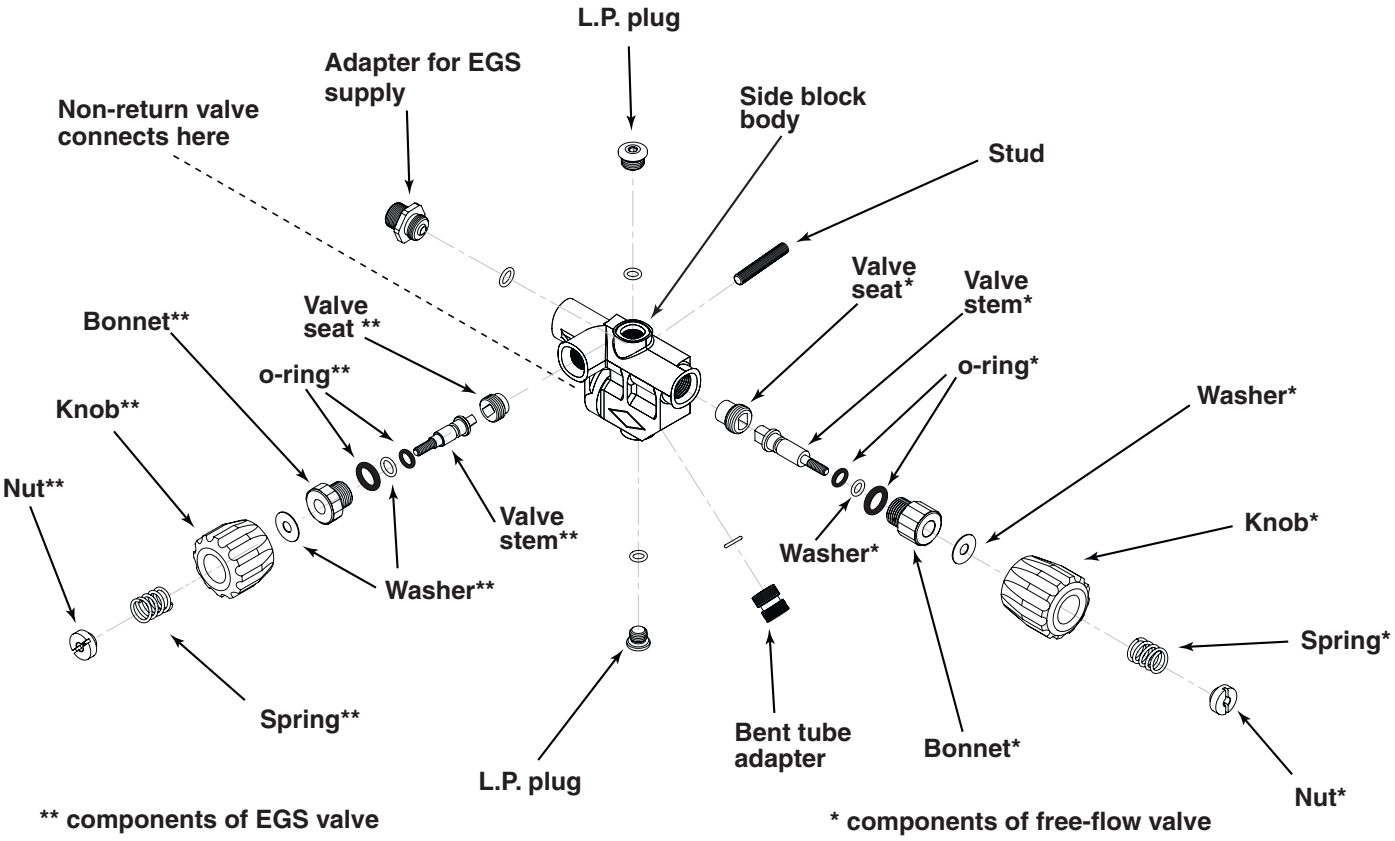
When using the side block low pressure inflator port, the diver should only use high quality hoses with an integrated flow restrictor.

The REX® demand regulator senses the start of the divers inhalation and opens the inlet valve, matching the diver's need. The regulator continues to match

the diver's inhalation as the rate increases, peaks, then ebbs and stops. When the diver exhales, the supply gas stays off as the exhalation gas flows through the regulator body, out the regulator exhaust valve, through the whisker, and out into the water. The whiskers deflect the exhaust bubbles away from the face port to keep the diver's view clear.

Low pressure hoses may be connected to the side block.

All KMDSI Helmets and Band Masks are equipped with a multi-turn demand regulator adjustment knob.



Components of the EGS valve and free-flow valve. (Rebuild with kit #525-313)

KEY FEATURES OF THE KM 77

Steady Flow Valve provides an additional flow of air into the helmet for ventilation and defogging. The air/gas flow is through the air train, across the faceplate into the oral nasal mask.

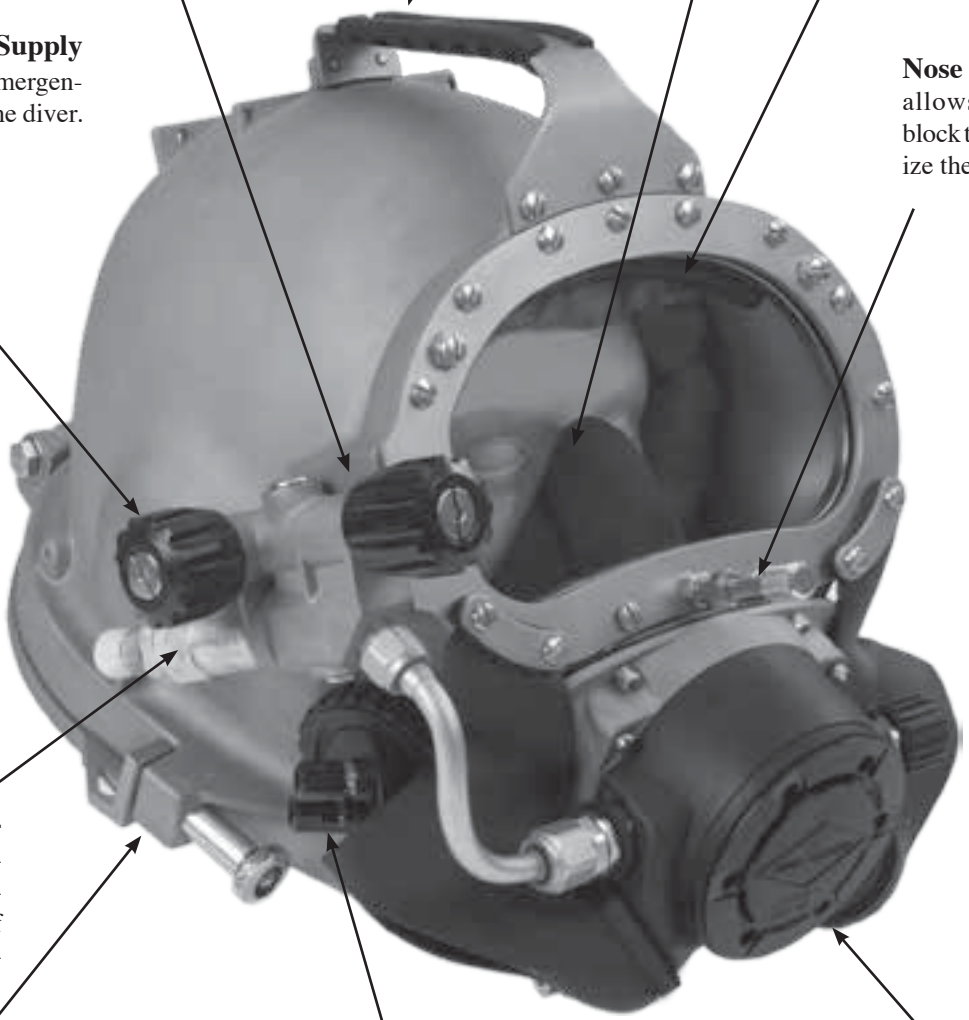
Handle
Carrying point and provides attachment of accessories.

Silicone Oral Nasal Mask is made of a superior silicone material which is hypoallergenic and has a longer work life than latex.

Air Train diffuses the incoming breathing air/gas onto the face plate to defog the lens.

Emergency Gas Supply Valve provides the emergency breathing gas to the diver.

Nose Block Device allows the diver to block the nose to equalize the ears.

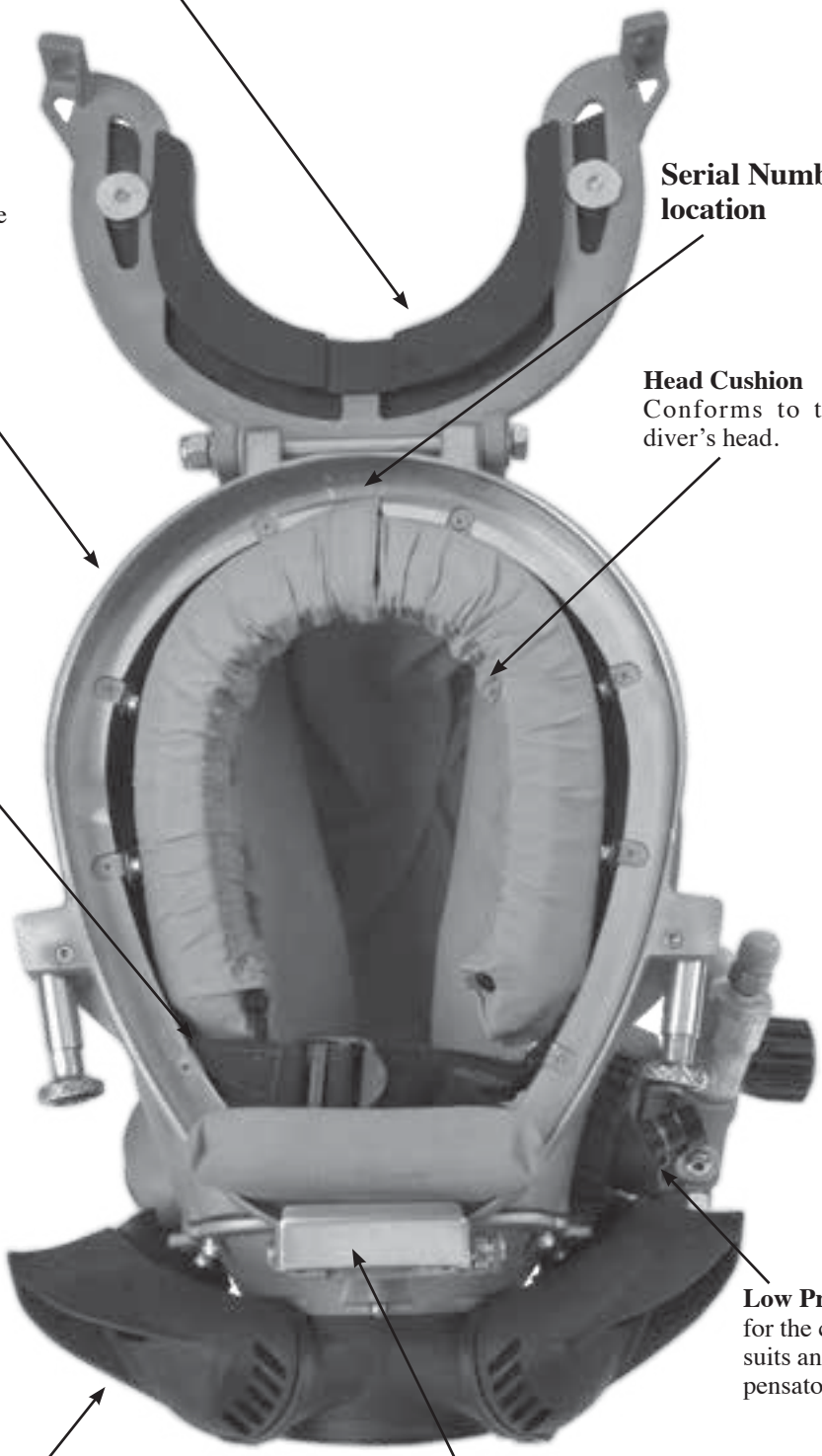


Gas Supply Non-Return Valve prevents loss of gas pressure in the event of umbilical damage, preventing a "squeeze".

Positive-Lock® Latch System
The latch catches consist of two spring loaded sealed pull pins which are pulled forward to release the locking collar and neck dam system. Even when the latches are released, the neck dam maintains a positive seal and will not allow the seal to be broken until the locking collar actually clears the diver's shoulders.

Modular Communications System can be either bare wire posts as shown or a waterproof connector. The waterproof type is recommended when a "round robin" or diver/tender both mics "on" communications system is used.

REX® Regulator has exceptional breathing characteristics and an extremely low work-of-breathing.



Adjustable Neck Pad
Helps provide for a customized fit

Neck Dam Sealing Surface
Helps to provide a positive seal.

Serial Number location

Head Cushion
Conforms to the diver's head.

Chin Strap
Helps to adjust the fit of the helmet

Sealed Pull Pin
Part of the latching system.

Low Pressure Port
for the connection of dry suits and buoyancy compensators.

Wings Exhaust System
Ultra low-resistance exhalation system. Very dry.

Neck Dam Swing Catch
The Swing Catch rotates out of the way to allow the neck dam assembly to be unsealed from the helmet. This simplifies getting out of the helmet.

This adjustment knob allows the diver to make corrections to compensate for a wide range of incoming gas supply pressures.

The adjustment knob operates by simply increasing or decreasing the amount of spring bias tension on the demand regulator inlet valve. The adjustment knob has a range of approximately 13 turns from full in to full out. The intent of this bias adjustment device is strictly to allow the diver to make adjustments for variations in umbilical supply pressure.

This adjustment device is not intended as a minimum-maximum device. Minimum and maximum applies to supply pressure only. The adjustment knob should be adjusted by the diver to be at the easiest breathing setting at all times. The exact number of turns required is dependent on the supply pressure.

⚠ CAUTION

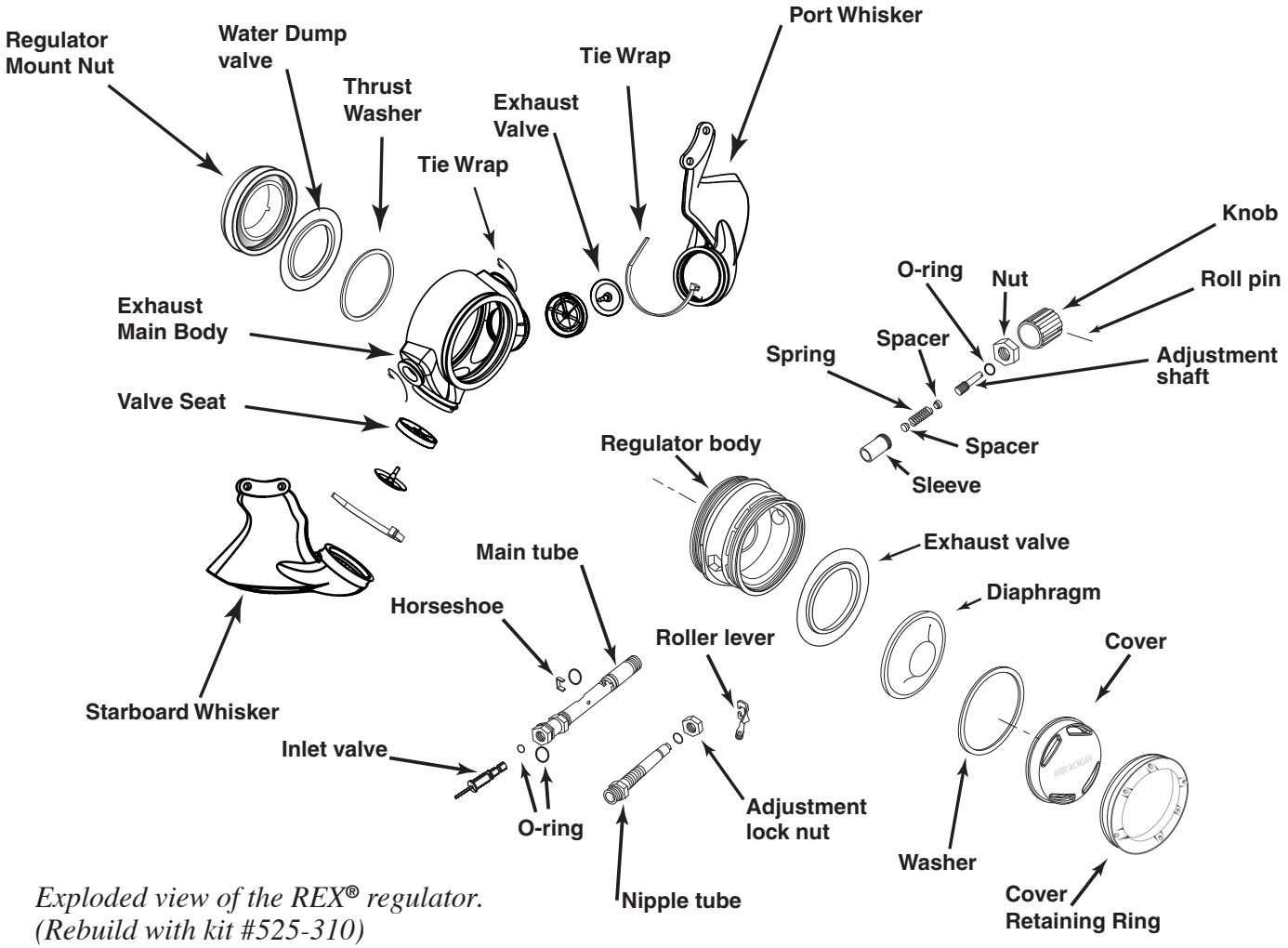
Diving a KMDSI helmet or band mask with a bias setting greater than that just necessary to keep the demand valve from free flowing increases the work of breathing and reduces the diver's ability to perform heavy work.

⚠ CAUTION

The regulator adjustment knob should be adjusted to the easiest breathing setting at all times. Adjusting the regulator further in than necessary to keep from free-flowing increases breathing resistance.

2.9.3 Emergency Gas Supply System (EGS)

KMDSI strongly recommends that the working diver carry an independent supply of compressed gas (or air) fitted with a first stage regulator and hose that is connected to the inlet of the Emergency Gas Supply Valve (EGS).



Exploded view of the REX® regulator. (Rebuild with kit #525-310)

The KMDSI Overpressure Relief Valve, (part number 200-017) is fully adjustable and serviceable and has been designed to relieve any over-pressurization of the first stage regulator greater than the desired setting.

Every bailout (Emergency Gas System or EGS) first stage regulator must be fitted with an overpressure relief valve to prevent over pressurization of EGS L.P hose in the event the first stage develops a "creep" (i.e., leaks pressure).

⚠ WARNING

Be sure the Emergency air/gas first stage regulator is fitted with a relief valve for over-pressurization of the emergency gas supply hose. A leaky first stage can overpressure the hose resulting in hose rupture. This would cause a loss of the entire emergency gas supply, with possible serious injury or death.

The over-pressure relief valve should be installed on every first stage used for bailout.

KMDSI Part #200-017

NOTE: This valve can be adjusted for various relief pressures.

The diver should always be equipped with an emergency gas system.

⚠ CAUTION

Your emergency air/gas supply on a deep mixed-gas dive is extremely limited. All divers must be aware of exactly how long their bailout bottle will last at depth. For example, a diver breathing one cubic foot of air a minute at the surface will use a 50 cubic foot bailout bottle in approximately 7 minutes at 198 FSW while at rest.

2.9.4 Helmet Attachment to the Diver

On the KM 77, the ring on the base of the helmet shell has a machined O-ring sealing surface. The O-ring that seals against this surface sits inside the neck dam ring assembly. The neck dam ring is actually a two part ring, consisting of the upper split ring and the lower stepped ring. The neck dam is captured (sandwiched) between these parts.

The locking collar and neck pad assembly has a smaller opening than a diver's head so the helmet is almost impossible to accidentally dislodge. The neck pad pushes against the neck dam and lower portion of the head cushion firmly securing the helmet to the diver's head. The neck pad also helps prevent neck dam ballooning. Each diver must personally adjust the fit on his helmet by adjusting the neck pad, as

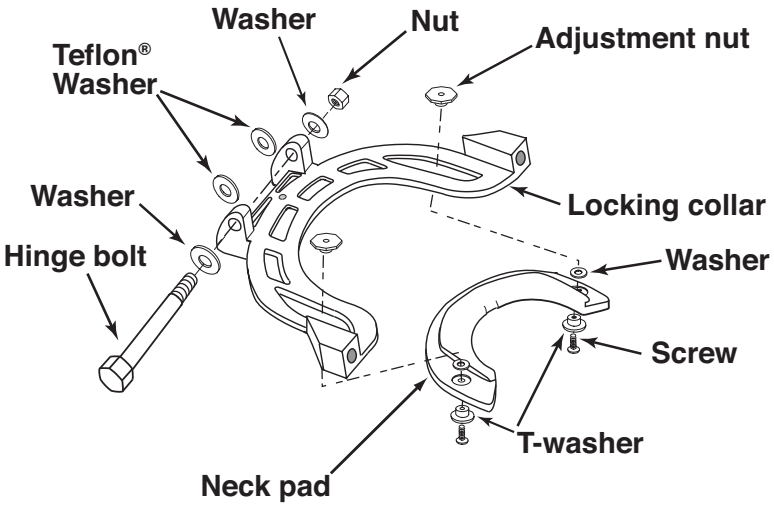
well as the head cushion. All of these parts together help provide a good fit.

On the KM 77, both sides of the helmet locking collar have a latch catch block to receive the locking sealed pull pins. If the sealed pull pins are turned to the locking position while the locking collar is open, the locking collar will snap into the locked position when it is pushed up into the helmet neck ring. The sealed pull pin on each side must be pulled to release the locking collar to remove the helmet. This system provides an extremely secure method of attaching the helmet to the diver.

A special locking sealed pull pin filled with silicone fluid helps to prevent fine sand or mud from entering the mechanism and helps to avoid jamming.

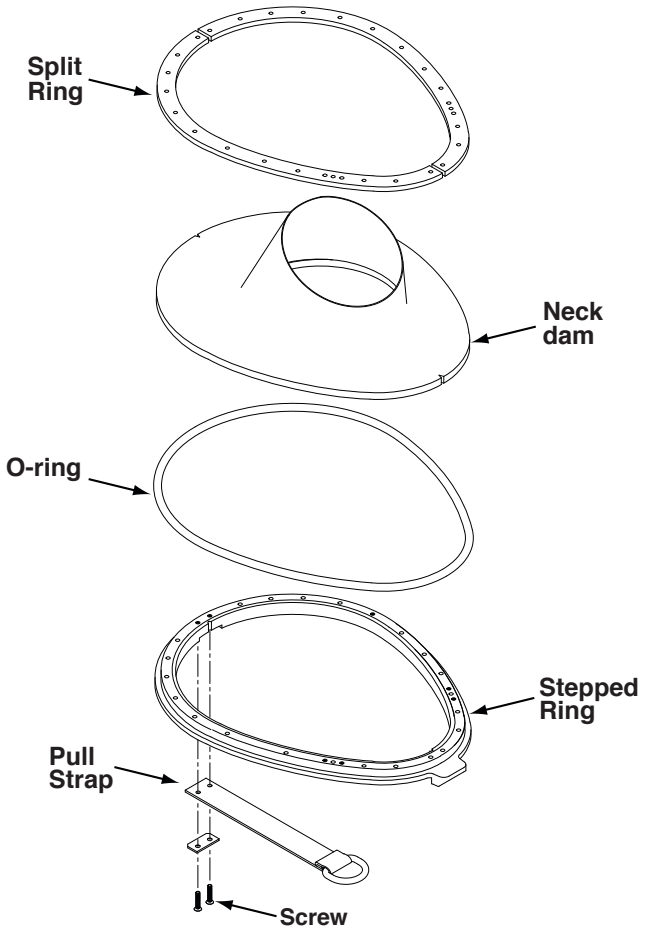
The head cushion is made from layers of open cell foam inserted in a head shaped nylon bag. Adding or subtracting foam layers from the bag can adjust the fit of the head cushion. The head cushion must be adjusted correctly for the helmet to fit properly.

The relationship between the locking collar assembly, head cushion, chin cushion, and helmet shell all affect the fit of the KM 77.



The Locking Collar assembly.

The locking sealed pull pins can only be serviced by KMDSI or an authorized dealer.



The Neck Dam Assembly

⚠ WARNING

This locking sealed pull pins must be repaired or overhauled by an authorized KMDSI technician or returned directly to KMDSI. Failure to properly service these pins could result in a failure of the locking collar latch system, which could cause the helmet to come off the diver's head. This could lead to drowning.

⚠ CAUTION

The fit of the Kirby Morgan helmets is partially determined by the adjustment of the neck pad. If the neck pad is not properly adjusted it may be very uncomfortable on the diver's neck. Take the time to adjust the neck pad properly and check the fit prior to each dive to ensure the adjustment has not changed.

2.9.5 Sealing Arrangement

The neck dam is available in several sizes and is fabricated in a cone shape. The standard neck dam on Kirby Morgan helmets is made of foam neoprene. Optional latex neck dams are available.

The neck dam seals against the diver's neck. The fit of the neoprene neck dam may be made larger by trimming 1/4" off the circumference. Only trim a maximum of 1/4" at a time; trimming too much will result in a loose fit.

⚠ WARNING

Pulling the neck dam over the diver's head can be difficult. Stretching (expanding) the seal and placing it part way over the head can help reduce the force needed to install the seal. Proper training is necessary to install the neck seal over the diver's head and onto his neck. Although the possibility is very remote, injury may result if this procedure is not done properly. If a diver does not know how to don the neck dam, he must seek proper instruction before proceeding.

NOTE: If you must trim the neck dam, be careful not to trim off too much material. The neck dam must fit snugly. While it may be a slight bit uncomfortable out of the water, and may feel snug, once in the water the neck dam will loosen slightly.

2.9.6 Reducing Carbon Dioxide

It is important to reduce the volume of air/gas space that the diver is breathing through. Carbon dioxide (CO_2) can build up if proper flushing does not occur. A rubber oral nasal mask is located inside the helmet to fit over the diver's nose and mouth. The oral nasal attaches to the regulator mount nut. This separates the breathing gas flow from the larger gas space on the interior of the helmet, and this in turn reduces carbon dioxide buildup.

⚠ WARNING

Always be sure the oral nasal valve is properly mounted in the oral nasal mask. If the valve is mounted improperly or is absent this can lead to a higher CO_2 level inside the helmet. A higher CO_2 level can cause dizziness, nausea, headaches, shortness of breath, or blackout.

2.9.7 Communications

In Kirby Morgan helmets, both earphones and microphone are wired in parallel to the communications module. This module allows for rapid replacement of the entire communications system. The module can be equipped with either a waterproof connector, or binding posts for bare wire connection.

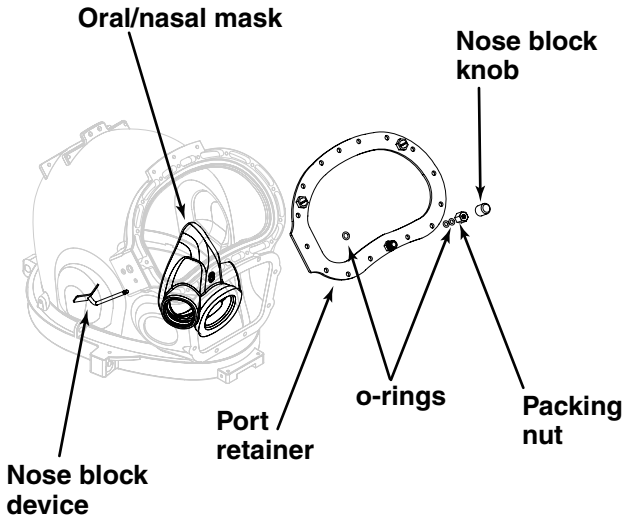
Kirby Morgan uses only high quality speakers and microphones in its communication system, to help ensure the clearest possible communications.

2.9.8 Equalizing the Middle Ear

A nose block device allows the diver to block his nose to provide an overpressure in his middle ear for equalization. The blocking pad on the inside of the oral nasal mask is attached to a shaft which passes through a packing gland to the outside of the helmet. A knob attached to the end of the shaft can be pushed in to slide the pad under the diver's nose.

When not needed, the knob is pulled out so the pad does not rub under the diver's nose. The pad may also be turned upside down (to provide more clearance under the diver's nose) by rotating the shaft.

2.9.9 Face Port or Viewing Lens



The face port or viewing lens is extremely strong clear polycarbonate plastic which is easily removable for replacement of the lens. An O-ring, located under the lens, seals the lens to the stainless steel helmet shell.

⚠ DANGER

The port retainer screws must be tightened to proper torque specifications per the instructions in this manual. See Appendix 1 for proper torque specifications. Do not over tighten. This could lead to port failure and helmet flooding. Drowning could result.

2.10 Accessories

2.10.1 Eye Protection for Welding

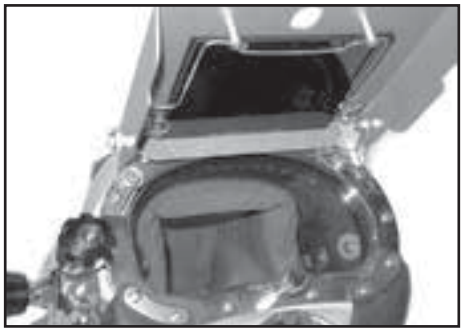
The Welding Lens assembly (Part #525-403) or the new Weld Shield Assembly (Part #525-400) may be installed on the port retainer using the pre-drilled and tapped holes that are provided. These holes are plugged with blanking screws when a new helmet is shipped from our plant.

The weld lenses are standard 2 x 4 1/2 inches or 4 1/2 x 5 1/2, identical to the lenses used in topside welding hoods. They may be replaced quickly without tools.

The KMDSI Welding Lens for Kirby Morgan helmets (KMDSI Part #525-403)

⚠ CAUTION

Be sure to use only the mount screws provided with the weld lens assembly. Longer screws can damage the port retainer mounting inserts and cause the face port O-ring to leak.



The KMDSI Weld Shield Assembly (KMDSI Part #525-400)

2.10.3 Special Regulator Tools for REX® Regulator

A special tool kit, Part #525-768 is available that will assist you in removing and adjusting the REX® regulator on the Kirby Morgan 77 helmet.

Use a brush with a soft handle, made from brass or plastic, to avoid damage to the critical internal bore of the main tube when cleaning it.

2.11 Helmet Transport And Storage

- the kind of package is a cardboard box with air filled pillows with styrofoam inserts to stabilize the helmet;
- the weight of the box is usually 40 pounds (18 Kg);
- the package dimension is 18 × 18 × 15 inches (460 × 460 × 380 mm);
- one helmet is packed per box;
- the helmets are sent to dealers by plane and truck. Depending on how the dealer wants it sent.

Packaging Step 1

Packaging Step 2

Packaging Step 3

Packaging Step 4

Packaging Step 5

Packaging Step 6

2.11.1 Helmet Carrying Bag

To help protect your KM 77, the helmet carrying bag should be used to transport and store your helmet between jobs.

The KMDSI Helmet Bag, Part #500-901.

The KMDSI bag is made from extra heavy duty, black, ripstop nylon. The bottom of the bag is padded for additional protection. Grommeted drain holes allow the bag to breathe. The bag is also equipped with large carrying straps and side pockets. The bag is not intended for shipping your helmet as air cargo.

2.12 Use of Kirby Morgan Original Replacement Parts

Users of Kirby Morgan life support equipment are cautioned to always use Kirby Morgan original replacement parts. Parts manufactured by third party companies can cause accidents.

Look for the Kirby Morgan logo on Kirby Morgan products. This is your assurance that you are getting genuine Kirby Morgan replacement parts.

Chapter 3.0
Operating Instructions

⚠ WARNING

This manual is our effort to explain the operation, maintenance and use of the Kirby Morgan helmet. We do not herein make any effort to teach the principles of diving. It is our assumption the reader is a qualified diver. We highly recommend that all divers should train, under controlled conditions, in the use of any model of commercial diving helmet that they have not previously used or trained in, prior to use on the job.

3.1 Introduction

This section provides advice on how to use your Kirby Morgan helmet. The use of these diving helmets will vary with the type of work and environmental conditions. The basic procedures of donning and removing these helmets will be similar for every job.

A proper training program in a calm, clear body of water should be undertaken. If the diver has not used a particular Kirby Morgan helmet before, he must not dive with the helmet without proper training.

However, divers that are familiar and trained in the use of previous Kirby Morgan masks; i.e., KMB 8, 9, 10, 18, 28, the Navy MK. 1 Mask, Navy MK. 21 helmet, or the Navy MK. 22 mask or the SuperLite® helmets, will find that all Kirby Morgan diving helmets and masks have the breathing system controls located in the same position. The operation of this helmet will also be similar. The diver must be tended at the surface at all times by a trained, qualified commercial diving tender.

3.2 Design Purpose

All Kirby Morgan diving helmets are designed for use with an umbilical.

The umbilical is usually composed of at least a gas or air supply hose and communication wire, assembled with waterproof tape (and in some umbilicals wound similar to strands in a rope) to form a single unit. Some umbilicals also include a hose for hot water, a pneumofathometer hose, and a strength member, such as a cable or strong line.

It is strongly recommended that the air/gas umbilical be married to a strength member in a manner that allows the strength member to receive the strain. This will help reduce the possibility of umbilical and umbilical fitting fatigue and possible failure.

The umbilical is the diver's lifeline to the diving control station.

⚠ WARNING

Kirby Morgan diving helmets are not intended for use with a self contained gas supply (scuba). There is no provision for surface swimming once the scuba air supply is depleted. This could lead to suffocation or drowning, which could be fatal.

The diver must be tended at the surface at all times by a trained, qualified commercial diving tender.

The diver must be tended at the surface at all times by a trained, qualified commercial diving tender. Never dive without a qualified tender holding your diving hose.

The diving control station can be at the surface, in a diving bell, or in a submerged habitat. The diving control station is the center of the air/gas supply, communications with the diver, and diving procedures. The station can be as simple as a tender with a set of "phones" (communication amplifier), or as complex as a control van in the midst of a saturation system.

⚠ WARNING

All diving always involves the risk of decompression sickness. Omitted decompression due to loss of gas supply or other accidents can cause serious injury or death. The use of the Kirby Morgan helmets or masks cannot prevent this type of injury.

KMDSI manufactures a complete Air Control System, the KMACS 5™ with integrated communications and pneumofathometer. This portable system can be operated on either a high pressure air supply or on a low pressure compressor. The Air Control System has a specially designed high pressure regulator that reduces high pressure air and provides an adequate flow to support divers to a depth of 130 fsw (40 msw)

The helmet demand regulator and side block assemblies have been designed to operate with a supply pressure from 130 p.s.i.g. (8.8 bar) to 225 p.s.i.g. (16 bar) over ambient pressure. This wide operating range allows flexibility when using various gas supply systems.

⚠ WARNING

High pressure supply regulators and associated piping systems for surface supplied diving with Kirby Morgan helmets and masks must be capable of delivering a minimum of 3.2 acfm to the diver at depth. Only systems that can deliver the required gas flow should be used.

For maximum breathing performance it is desirable to maintain an over bottom supply pressure in accordance with the low-pressure and high-pressure supply tables found in Chapter 2 of this manual. With the many different gas supply console configurations in use, it is important to ensure that the gas supply system used, is capable of supplying the helmet with the necessary pressure and flow of gas to allow the diver to work safely and efficiently.

There are also detailed checklists for the set-up and maintenance of your helmet on the Dive Lab web site at www.divelab.com.

3.3 First Use of Your Kirby Morgan Diving Helmet

When you first receive your Kirby Morgan diving helmet, carefully unpack it and examine it for any damage that may have occurred during shipment. Use the inspection sheet provided to ensure that no damage has occurred. The purchaser must contact the freight carrier and/or the KMDSI dealer if the helmet has been damaged in shipment.

Early production of the REX® 77 helmet had a much different surface finish than what is found on current production runs.

Earlier helmets shells and components were finished using a combination of glass and Stainless Steel beads; this gave a dull or flat looking surface finish. Later shipments have a surface finish with a much smoother and almost shiny appearance. Although the parts are not shiny, the surface finish is very smooth. A Scotch-Brite®, (or similar non metallic), scouring pad will remove buildup of unwanted surface deposits on both older, and newer REX® 77 helmets. It can also be used to give the main helmet components on newer helmets, a satin (brushed) finish.

Be sure to complete the enclosed warranty card and return it to KMDSI immediately. No warranty claims will be honored without a correctly completed warranty card on file at KMDSI.

3.4 Initial Adjustments to Your Helmet

Before using the helmet for the first time, it must be checked and adjusted for proper fit. There are several adjustments that must be made to provide a more comfortable fit when wearing the helmet.

3.4.1 Head Cushion

The fit of the head cushion is critical to both comfort and safety. In general the head cushion should be snug fitting and help hold the helmet to your head. The head cushion should also be adjusted so that it assist in the proper fit of the oral nasal mask to the face.

⚠ WARNING

Never dive with a Kirby Morgan helmet without a properly functioning oral/nasal mask. Without an oral/nasal, dangerous levels of carbon dioxide may accumulate in the helmet. This can lead to unconsciousness and death.

The head cushion is part of a helmet cushion system that includes the head cushion, the head cushion foam spacer and the chin cushion.

3.4.1.1 Head Cushion Removal

1) Remove head cushion from helmet.

2) Open zipper on head cushion and remove old foam. You may want to keep the old foam for sizing reference later. Clean out any old foam particles.

3.4.1.2 Clean and Inspect

1) Clean head cushion bag using mild soap and water. Rinse thoroughly and hang dry.

2) Inspect head cushion bag to ensure that there are no rips or tears in the materials and that the sewing and zipper are still in good working condition. Replace if needed; order head cushion bag.

3.4.1.3 Stuffing

1) Read "3.4.1.4 Head Cushion Adjustment" on page 29 of these instructions first.

2) Compare to old foam and trim for adjustment.

3) Stuff head cushion.

3.4.1.4 Head Cushion Adjustment

Fit test (follow these instructions if refitting or resizing the head cushion.

Note: *The head cushion system consists of three separate components. The head cushion, the head cushion foam spacer and the chin cushion.*

1) Snap the chin cushion in place on the helmet.

2) Start with a new head cushion. Snap the head cushion into the helmet and try the helmet on.

Note: For divers with smaller sized heads, install the head cushion foam spacer before installing the head cushion into the helmet.

Note: Make sure the neck pad on the locking collar is adjusted correctly and also check the fit of the head cushion with the locking collar in the closed position.

3.4.1.5 Foam Trimming tips

Note: The side foams do not have ear holes. This is intentional. Ear holes may be cut in if preferred. Trim Foam for adjustment.

The tips of the “egg shell” side can be trimmed off if the side foams are too tight.

The chin cushion can also be trimmed for comfort if needed.

3.4.1.6 Foam Stuffing Tips

There is no one way of stuffing the head cushion. Different combinations of foam can be set up and foam can be trimmed depending on desired fit.

1) The neck pad block can go on either side of the top foams, against the neck or against the helmet shell or, the neck pad block can be removed.

1 or 2 pieces of top foam may be used

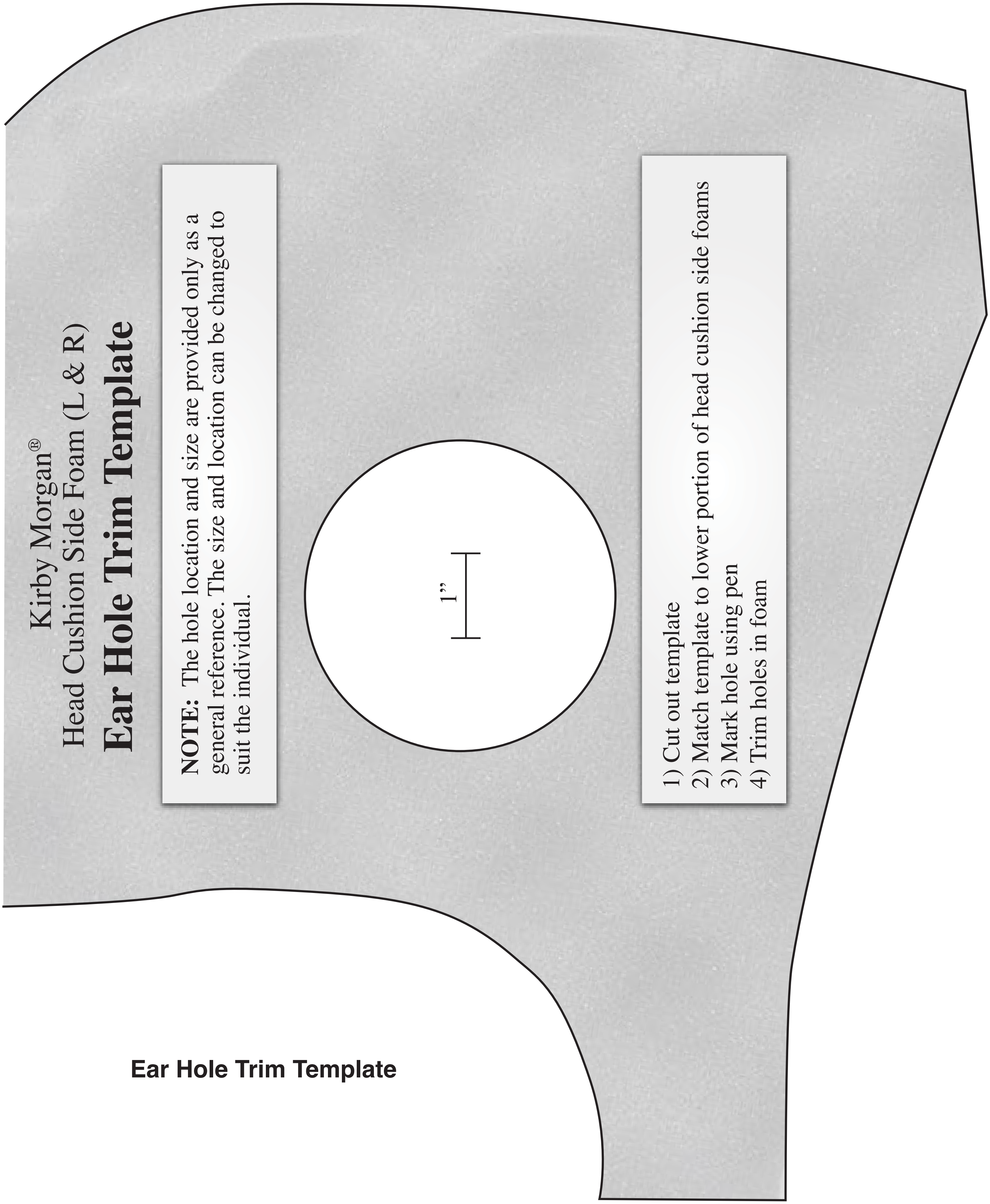
The “egg shell” side of the Left & Right Side Foams usually faces outward against the Helmet Shell.

Earphone holes may be cut into the side foams if desired (see drawing "Ear Hole Trim Template" on page 31 for general size and location)

3.4.1.7 Adding Earphone Holes to the Head Cushion

No earphone holes are included on the side foams. These may be trimmed in if desired. Using the template for general size and location, mark the desired area for cut out.

Trim the ear hole into the foam using the guide line made from the Ear Hole Template



Ear Hole Trim Template

3.4.2 Head Cushion Foam Spacer (HCFS)

The head cushion foam spacer (HCFS) is a simple length of foam that is nested into the head cushion. The spacer helps properly position the top and back of the head in the helmet by using a larger foam piece in the lower neck area which helps push the head forward, and the nose and mouth into the oral nasal mask.

3.4.2.1 Installation of Head Cushion Foam Spacer (HCFS)

Note: In September of 2012 the head cushion foam spacer (HCFS) was upgraded with an elastic/Velcro strap at the top front part of the HCFS bag. This new feature is intended for use with head cushions P/N 510-754, or the 510-521 which will soon have the mating Velcro patches.

Note: If using the HCFS with P/N 510-682 or a P/N 510-521 without a Velcro patch, the elastic/Velcro strap can simply be folded over the top front portion between the head cushion and the helmet shell, or it may be trimmed off if desired.

1. Install the HCFS into the top inside portion of the head cushion. Wrap the elastic/Velcro strap around the front top edge and attach onto the mating Velcro patch in front of the hanging loop.

Proper installation and alignment of the HCFS in the helmet.

3.4.2.2 Donning the Head Cushion Foam Spacer (HCFS)

Hold the HCFS towards the back of the helmet when donning.

⚠ CAUTION

Ensure that the HCFS is properly positioned against the back of the head/neck and does not get caught between the helmet ring and the neck dam rings when closing the helmet. Failure to do so could result in an improper seal.

3.4.2.3 Maintenance of the Head Cushion Foam Spacer (HCFS)

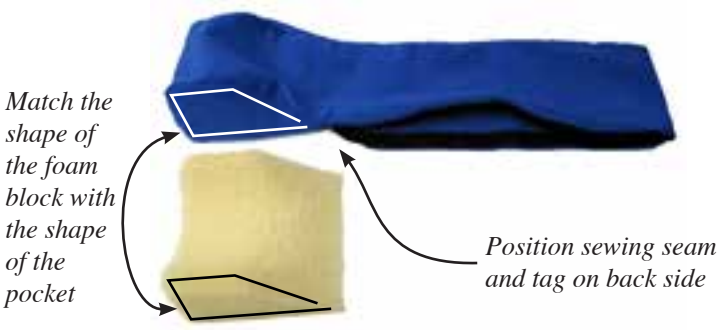
Daily: Post dive rinse with fresh water, air dry.

Periodic: Remove foam and fresh water rinse. Hand wash the HCFS bag using a mild soap, rinse with fresh water and air dry.

3.4.2.4 Stuffing the Head Cushion Foam Spacer (HCFS)

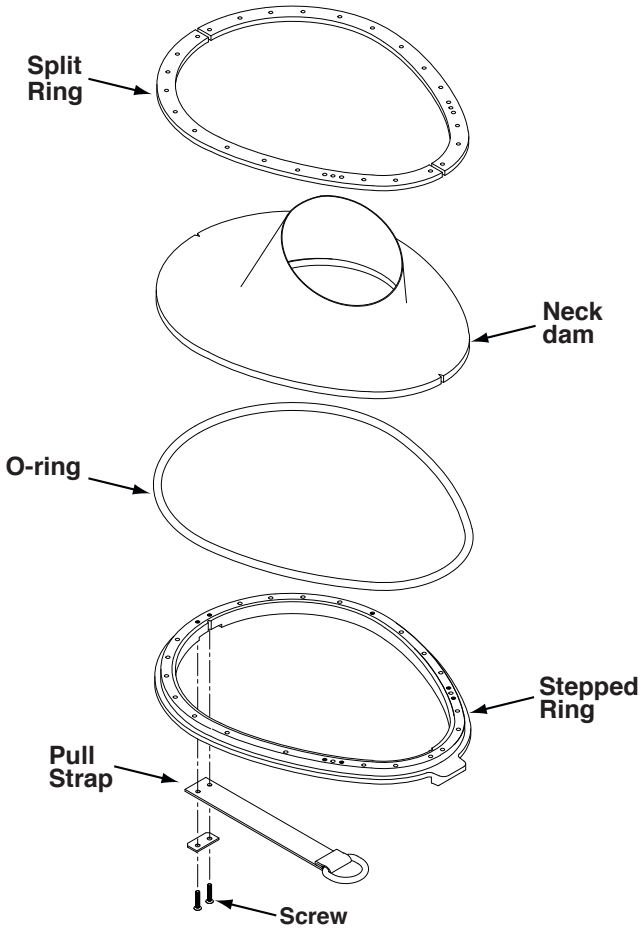
1. Stuff the neck foam block and top foam into the HCFS bag. Close the Velcro.

Note: Match the shape of the neck foam block with the shape of the HCFS bag.



3.4.3 Trimming the Neck Dam

If your helmet is new, or any time you replace the neck dam, it must be adjusted to fit you. New neck dams are cone shaped and will probably be too tight if not properly trimmed.



Neck Dam components.

The neck dam must be trimmed to fit your neck. To trim the neck dam, have your tender hold the neck dam opening so that the two "edges" of the neck dam are parallel. The neck dam must be under slight tension but must not be stretched beyond its normal length. Trim the neck dam with the largest, sharpest scissors available, in order to make as few cuts as possible. There must be no jagged edges on the neck dam or it may tear.

⚠ WARNING

Never dive with a neck dam that is too tight. A neck dam that is too tight could cause the diver to pass out due to pressure on the carotid artery in the neck. This could lead to severe personal injury or death.

⚠ CAUTION

Avoid trimming neoprene neck dams too much. Neoprene neck dams will loosen over time as they are used and the cells of the foam neoprene break down. If you trim the neck dam too much it will be too loose and will leak. Trim the neck dam until it is snug, then stretch it before use.

Trimming the neck dam.

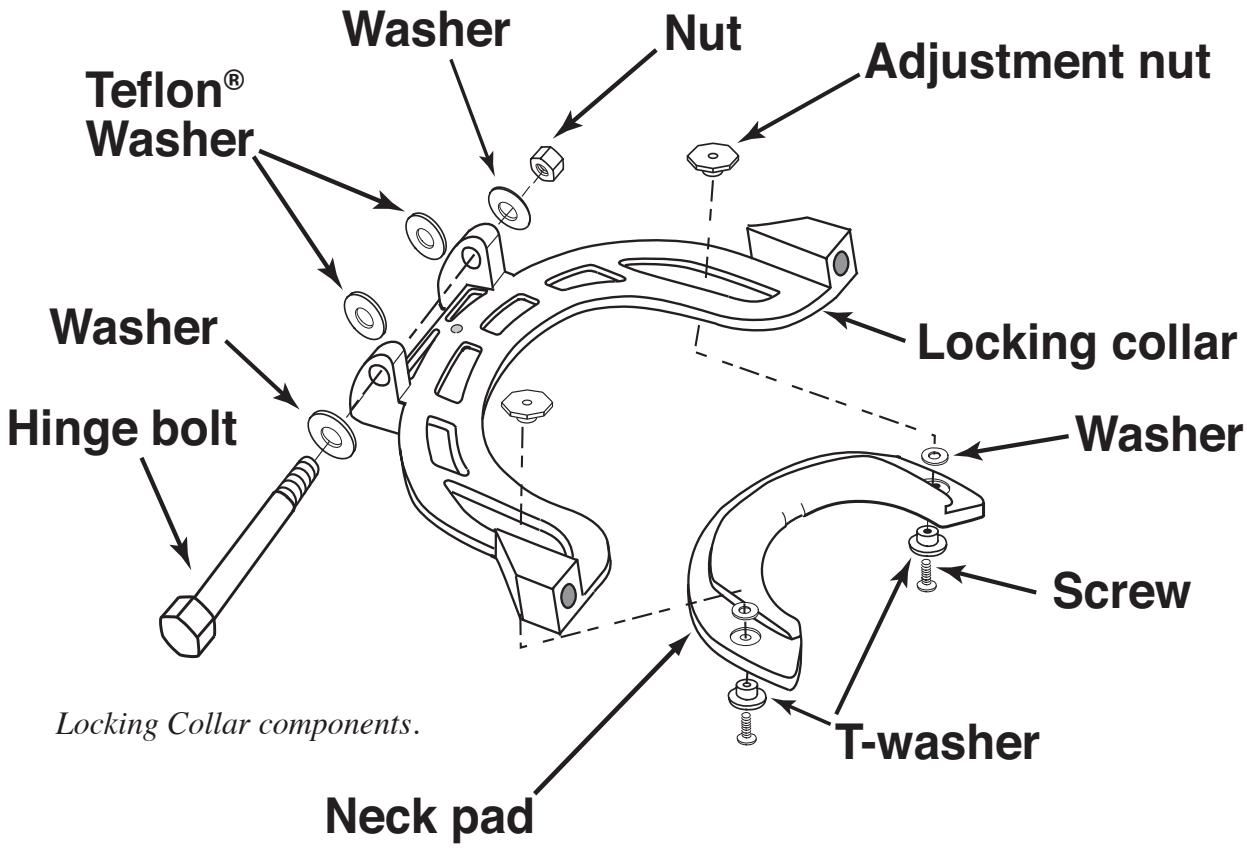
Trim only 1/4 inch off the neck dam at a time. When you are done, the neck dam must be just tight enough so that it does not leak. This may feel a bit snug out of the water, but should be comfortable underwater.

If you have a neoprene neck dam, it may also need to be stretched for it to fit properly. Trim the neck dam until it is still snug, then stretch it by sliding it over a scuba tank and allowing it to sit overnight. If you still cannot get the proper fit by stretching the neck dam, it must be trimmed further. Do not trim more than 1/4 inch at a time.

As the neoprene neck dam ages, it will become looser, due to a natural breakdown of the cells. This is particularly true if the helmet is locked in and out of a bell or saturation system. As the neck dam becomes worn it will need replacement to ensure that it seals properly.

3.4.4 Adjusting the Neck Pad

Another component that controls the fit of the Kirby Morgan helmet is the adjustable neck pad. The neck pad, which is mounted on the locking collar, slides back and forth along the locking collar body for adjustment to fit different divers. Two screws and adjustment nuts lock the neck pad plate to the locking collar. Loosening these screws from the mount nuts allows the neck pad to be adjusted.



Locking Collar components.

The following procedure requires a diver and tender. You do not need to have the air on to the helmet if you do not use the neck dam ring assembly. If the neck dam assembly is used, the diver **must** have air to the helmet to breathe.

With the helmet face down on a suitable surface, pull and turn each of the sealed pull pins until they are locked open. Swing the locking collar/neck pad assembly out away from the base of the helmet. Slightly loosen the screws until the neck pad can slide back and forth. Be sure each of the head cushion snaps are attached to their corresponding fitting inside the helmet.

Pick up the helmet and pull the nose block device knob out fully. Position the helmet on your head so the oral nasal is in the proper position on your face, covering your nose and mouth. Turn the sealed pull pins to the locking position with the ridge on the pins engaging the notch in the sleeve and the pins fully retracted.

Tilt your head forward so the locking collar/neck pad assembly may be swung forward and locked up into its closed position. The sealed pull pins must snap into place on the locking collar.

Lift your head back up and slide the neck pad forward until it is snug but comfortable. Mark the position of the neck pad on the locking collar using an indelible marker. Pull the sealed pull pins out to their unlocked position and let the locking collar open.

Remove the helmet. Position the neck pad plate on the locking collar at the marked position and tighten the screws on each side. After the adjustment screws are tightened, don the helmet again, tilt your head forward and lock the locking collar/neck pad assembly. Move your head in various positions to make sure the pad is adjusted for comfort.

The helmet is now adjusted for your head. It should need no further adjustment unless another diver uses the helmet.

3.5 Pre Dress-In Procedure

Before dressing in for a dive, inspection of the helmet systems must be made to be sure it is in proper working order. This must be done well in advance of the dive so any problems can be fixed without delaying the dive. The following steps are part of the recommended daily maintenance.

⚠ WARNING

There must be no holes in the neck dam. If there are any holes in the neck dam the helmet could leak or flood. In addition, the demand regulator will not operate properly. Drowning could result.

3.5.1 Pre-Dive Visual Inspection

Visually inspect the exterior and interior of the helmet.

1) Inspect the regulator cover for any damage. The purge button must work.

⚠ WARNING

The O-ring on the neck dam ring assembly on the Kirby Morgan helmet must be in place and in good condition. It must be properly lubricated for smooth operation. Without a proper functioning O-ring the helmet will leak and possibly flood. Drowning could result.

2) The neck dam must not be torn or punctured, and properly trimmed to fit.

3) Inspect the O-ring on the neck dam ring assembly. The O-ring must be in place, undamaged, and lubricated.

4) Inspect the bent tube that supplies breathing gas to the regulator. There must be no dents or kinks in the assembly.

5) Inspect the face port. It must be in good condition.

6) Be sure the communications wires are hooked up and tested.

7) Inspect the oral/nasal mask. Make sure it is on the regulator mount nut properly and the valve is installed properly.

8) Inspect the sealed pull pin on each side of the helmet. They must engage and disengage properly.

9) Make sure the head cushion and chin cushion are properly fastened inside the helmet. The chin strap should be open as wide as possible.

⚠ WARNING

All parts on Kirby Morgan diving helmets 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.

10) Check the screws on the port retainer. They must be adjusted to the proper torque setting specifications noted in Appendix 1 of this manual. Binder head screws are used in this application for their self locking characteristics.

3.6 Preparing the Helmet for Diving

3.6.1 Clean Face Port

Thoroughly clean the face port with a soft cloth and a mild liquid soap solution. DO NOT USE ANY AEROSOL SPRAYS ON THE POLYCARBONATE PORT!

3.6.2 Check Moving Parts

Check all moving parts, such as the regulator adjustment knob, the defogger control knob, emergency (EGS) knob, and the nose block device knob and all locking collar parts to ensure smooth and proper operation.

3.6.3 Check Communications

Check the communications system for proper operation. Put the helmet on and talk to an assistant on the amplifier. If you are by yourself, with the helmet off take the helmet near the amplifier and tap on each earphone and the microphone, listening to the taps on the amplifier/speaker. Talk into the amplifier/speaker feeling the vibration on each earphone and the microphone with your fingertips. Check the fit and tightness of the comm module mount nut.

3.6.4 One Way Valve Check

The one way valve must be tested daily, prior to commencement of diving operations.

1) Prior to attaching (or pressuring up) the umbilical, close the emergency valve knob, attach and pressure up the emergency hose. Shut off the defogger control knob and screw in the adjustment knob on the regulator all the way.

You can test the one way valve by connecting the bailout bottle to the emergency valve and pressurizing the sideblock. There must be no gas leakage through the one way valve.

⚠ WARNING

The one way valve must be tested daily, prior to commencement of diving operations. Failure of the one way valve could cause serious injury or death.

You can also test the one way valve by attempting to suck air through the valve. The emergency valve must be open for this test to work properly. If you are able to suck any air through the valve it is not working properly.

⚠ WARNING

Never dive if the one way valve is not operating properly. If the hose or breathing gas/air fitting breaks near the surface a serious injury could result to the diver's lungs and/or eyes. In extreme cases this could be fatal. The one way valve must be tested daily prior to the commencement of diving operations.

2) With the emergency hose pressurized, turn on the emergency valve knob. If any gas escapes out the end of the adapter, the one way valve is faulty and must be rebuilt or replaced. A one way valve repair kit is available to rebuild these valves (Part # 525-330).

3.7 Emergency Gas System (EGS)

If the diver's main gas supply fails, the diver must have another source of gas that will enable him to return to the dive station or to a point where a normal gas supply can be reestablished. For this reason, an emergency gas supply (bailout) cylinder must be used on all dives. The bailout cylinder is normally worn on the back using a combination backpack and lifting harness.

⚠ WARNING

Do not dive without a diver worn Emergency Gas System. If the main gas supply is lost, you will have nothing to breathe and may drown.

Diver donning a complete bail-out system.

Most commercial divers wear a harness (separate from the weight belt) that is used for several purposes. The harness is fitted with large metal rings (usually brass or stainless steel). The umbilical is hooked into one of these rings to keep any strain off the helmet. In addition, the rings on the harness are used to hang

⚠ WARNING

Never dive without attaching the umbilical to some type of harness or clip on the diver's body. Never allow the umbilical to pull on the helmet directly or the diver could suffer a neck injury.

tools and other equipment. Usually the harness is also designed to provide a means of lifting an unconscious diver from the water. This harness is the best method of securing the emergency breathing gas to the diver.

A small tank can be mounted horizontally on the lower rear or front, while larger tanks are usually mounted vertically in the center back similar to a Scuba diver's tank. Some harness designs incorporate

The diving harness must have a provision for attaching the emergency gas supply and a place to attach the diver's umbilical.

a cloth enclosure into which the tank fits. The entire tank, valve, and regulator are enclosed in fabric. This helps to prevent snagging.

When determining the size of the emergency gas cylinder to use, several factors must be considered. The divers depth, the length of time the diver may be without the main gas supply, and the gas consumption rate. Regardless of the cylinder used, it should be of sufficient volume to allow the diver to ascend at a normal rate or transit to a point where a normal gas supply can be reestablished.

European C.E. ONLY

In European countries that have adopted C.E. certification, only C.E. certified cylinders are allowed to be used and must have a minimum charged capacity available to the diver of 1400 N/l (50 scf). The emergency gas supply must only be fitted with a KMDSI first stage regulator and have a KMDSI over pressure relief valve installed (Part # 200-017). The relief must be adjusted to start lifting at approximately 180-200 p.s.i.g. (12.4-13.8 bar) above the regulator

⚠ WARNING

A standard Scuba submersible pressure gauge must be connected to the high pressure port on the first stage so that the diver can monitor his emergency supply.

Use a good quality first stage for your emergency gas supply.

intermediate setting. The purpose of the relief valve is to allow pressure to vent off in the event the first stage regulator develops a leak or creeps. Without a pressure relief valve, the hose could rupture and the emergency gas supply would be lost.

The emergency air/gas tank must be fitted with a good quality first stage regulator to reduce the pressure to less than 225 p.s.i.g. (16 bar) ambient diver pressure. Connect the first stage hose with a set of quick disconnecting locking sleeves to the emergency valve assembly located on the side block.

The first stage regulator must have at least two low pressure ports. One port is used for the connector hose to the emergency valve and the second is used to install an overpressure relief valve (Part #200-017). If the first stage develops a leak, the full pressure of the tank could be placed on the low pressure hose. This could cause the hose to burst. The overpressure relief valve will bleed off any leak.

Make sure the emergency valve knob is turned off, otherwise the emergency gas supply will be used up without the diver's knowledge. Once the emergency supply hose is connected, the tank valve is turned on

An over-pressure relief valve must be installed on the first stage used for the Emergency Gas Supply.

⚠ WARNING

Never dive without an over pressure relief valve installed on the EGS regulator (1st stage). Without the relief valve if the EGS regulator develops an internal leak, or carries-away, the full pressure of the EGS cylinder would be placed on the low-pressure EGS hose and the Emergency Valve. This could cause the low-pressure hose to burst resulting in the complete loss of the EGS system.

⚠ WARNING

Never connect the main gas supply hose from the diving control station to the Emergency Gas valve assembly (EGS). If this is done there is no one way valve protection for the diver in the event of damage to the umbilical or related equipment. The diver could be exposed to a serious "squeeze". This can result in serious personal injury or death.

There are risks with each method of configuring your bail-out system. There is a risk that if you have the bail-out bottle on and the emergency valve on the helmet closed, that the emergency gas could be lost if the hose or the first stage itself develops a leak. However, KMDSI believes that this method poses the least amount of risk for the diver.

Probably the most serious problem with any of the other possible configurations is that the first stage will almost certainly flood if it is not pressurized while you are underwater.

If the regulator floods and is not promptly serviced, it will not perform properly when you need it in an emergency. As a diver, you always must decide how much risk and what types of risk you are willing to expose yourself to when you dive. It's up to each individual to make an informed choice regarding how to configure your bail-out system. We cannot make this choice for you.

Always be sure to check the pressure in your bail-out bottle before you dive.

KMDSI strongly recommends the use of a submersible pressure gauge with every bail-out system. Not only does this make it very easy to check your emergency gas pressure prior to diving, it also allows you, in most cases, to periodically check the pressure in your system while you dive. In this way, if you have a leak, you will probably figure it out and will be able to take appropriate action.

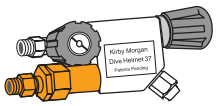
There are several possible ways to configure your emergency gas system, although at KMDSI we only recommend one method. The configuration we recommend is as follows:

Cylinder Valve Open - EGS Valve on Helmet Closed

This is the only method that we recommend. The advantages of this method are as follows:

- You only need to open one valve to activate your emergency supply.
- There is little danger of flooding your first stage regulator and ruining it.

Possible Emergency Gas Supply Cylinder & EGS Valve Configurations

Configuration	Cylinder Valve	EGS Valve	Advantages/Disadvantages
			
Configuration 1 (Regulator pressurized)	**On**	**Off**	**Advantages** **• One valve to open** **• First stage won't flood** **Disadvantages** **• If hose or first stage leaks some or all EGS gas will be lost**
Configuration 2* (No pressure in regulator)	**Off**	**On**	**Advantages** **• One valve to open** **• No loss of gas from cylinder if hose leaks or regulator leaks** **Disadvantages** **• First stage will flood and must be serviced after each day of diving**
Configuration 3* (Regulator pressurized then cylinder valve closed)	**On momentarily then Off**	**Off**	**Advantages** **• No loss of cylinder gas if hose or regulator leaks** **Disadvantages** **• Two valves to open in emergency** **• Slow leak on long dive may result in flooded 1st stage** **• If dive depth exceeds pressure in first stage, first stage will flood**
Configuration 4*	**Off**	**Off**	**Advantages** **• No use of cylinder gas unless emergency occurs** **Disadvantages** **• Regulator will flood and need service daily** **• Two valves to open in emergency**

*** Requires ability to reach cylinder valve without difficulty**

⚠ WARNING

Some divers, keep the EGS gas cylinder valve shut during the dive. Their rationale being; in the event of an emergency, they will simply open the EGS cylinder valve thus eliminating any EGS air/gas unknowingly being lost due to either a 1st stage failure or EGS hose failure.

KMDSI strongly recommends never diving with the EGS cylinder valve shut. The reasoning behind this is twofold. First, with the EGS cylinder valve open, gas is immediately available in the event of topside gas interruption via the EGS valve on the side block simply by opening it. Secondly, and most importantly, if the EGS regulator (1st stage) is not pressurized, during descent it is possible that sea water will leak through the first stage intermediate circuit and regulator, causing failure of the EGS regulator if not frequently serviced and resulting in possible injury or death.

You can use a quick-disconnect whip to connect the EGS valve to the bail-out bottle. This makes dressing the diver much easier.

to pressurize the hose. In the event of an emergency due to a loss of the main gas supply, the emergency valve knob located on the side block is turned on supplying gas to the side block assembly and the regulator.

3.8 Setting Up to Dive

3.8.1 Flushing Out the Umbilical

Before connecting the umbilical to the helmet, the umbilical must be flushed out to remove any dirt, moisture, or other debris. Connect the topside umbilical end to the topside diver control console. Ensure there is no pressure in the divers umbilical.

⚠ WARNING

If the one way valve or the adapter is loosened this will allow breathing gas to leak out of the breathing system. This could also result in a loss of all pressure to the helmet, leaving the diver with nothing to breathe.

Carefully uncap the helmet end of the umbilical and hold securely while pointing in a safe direction, then slowly bring up gas pressure to approximately 25-40 p.s.i.g. (1.7-2.7 bar). Allow the gas to flow for at least 15 seconds. If it is not going to be used immediately, the umbilical should be recapped.

3.8.2 Connecting the Umbilical to the Helmet

When you connect the hose to the helmet be sure to use a wrench to hold the adapter, or inlet fitting, and a second wrench to turn the swivel fitting on the hose. If this is not done, the adapter will turn inside the one way valve. If this happens repeatedly the threads will wear and the valve will need to be replaced.

The connection between the hose and the helmet must only be made up “snug”. Excessive force will deform and ruin the adapter. A second wrench must be used when the helmet is disconnected as well, otherwise the adapter and/or the one way valve assembly may become loose and fail to make a seal.

If you are using waterproof connectors for your communications, take extra care in handling these pieces. To connect the male and female parts, align the large pin on the male connector with the yellow mark on the female connector. Press the two connectors together until you hear a distinct “pop”. Do not twist the connectors. Tape the two connectors with a bit of electrical tape to prevent them from pulling apart.

Connecting the umbilical to the helmet.

Connecting the waterproof connectors.

To separate the connectors remove the tape, grasp them at the thickest part, place your thumbs against each other, and push apart until the connectors are disconnected.

Do not twist the connectors. Do not pull them apart by pulling on the thin part of the wires.

3.8.3 Opening the Breathing Gas Supply to the Helmet

Prior to turning on the air supply for the helmet, check to see that the free flow valve is closed and the regulator adjustment knob is all the way in.

Slowly bring up the gas pressure to the helmet to 150 p.s.i.g. (10.2 bar). Slowly back out on the regulator adjustment knob until a slight free flow develops, then turn the adjustment knob in (clockwise) until the free flow just stops.

To properly check the breathing system you must completely don the helmet.

3.8.4 Fogging Prevention

A thin film of anti-fogging solution may be applied to the interior of the polycarbonate face port prior to the dive to help prevent fogging during the dive. A mild liquid dish washing detergent, or other commercially available anti-fogging solutions, may be applied with a soft rag or paper towel to the interior of the port.

A thin film of dish soap or other anti-fogging solution should be applied to the lens prior to the diver donning the helmet.

⚠ WARNING

Never use any aerosol propelled sprays near the face port of the any Kirby Morgan helmet or band mask. 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.

The diver should use a solution which has been found satisfactory in the past. However, ***do not use an aerosol spray*** on the polycarbonate lens. The propellants in some aerosol dispensers cause damage to the lens.

3.8.5 Donning The Kirby Morgan Helmet

All donning procedures must be done by the diver until he is thoroughly at home with the helmet. This will train for familiarity. However, the tender must be present to assist the diver and check to ensure that the diver has properly donned his equipment. It is impossible for the diver to see whether he is properly dressed in once the helmet is on his head.

To dress in, the neck dam ring assembly must first be pulled down over the diver's head.

Be sure to loosen the chin strap inside the helmet prior to donning the neck dam. To loosen the strap, place your thumb on top of the rounded end of the plastic buckle and pull down, away from the helmet.

To don the neck dam, hold the neck dam/ring assembly vertically, in front of your chest, so that the large end of the assembly where the pull strap is mounted is on top. The pull strap should both be facing your chest. Lift the neck ring assembly over your head, grasping the front and rear of the neck ring assembly. Pull the neck dam down over your head. The neck dam should be as low as possible on your neck.

⚠ WARNING

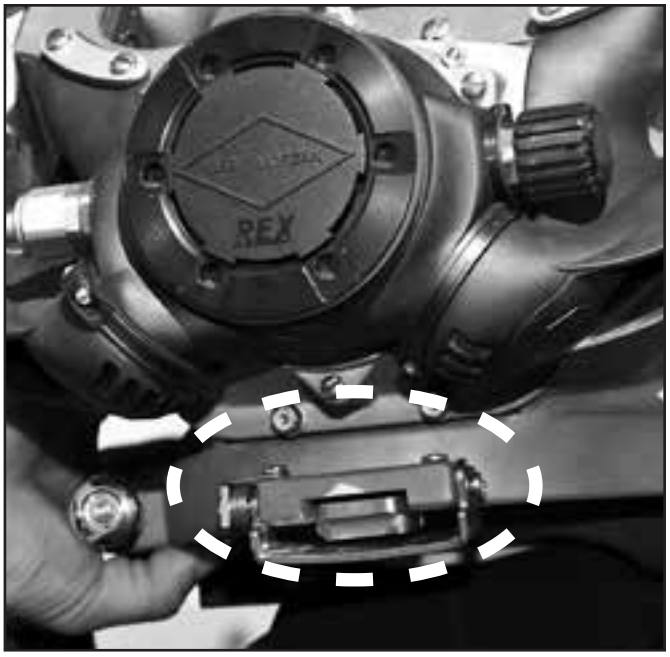
The tender must always be present to assist the diver while dressing and whenever the diver has his helmet on his head while he is out of the water. It is difficult for the diver to walk while he is dressed in and he can stumble and fall, resulting in serious personal injury.

The neck dam is always turned up against the diver's neck. This is very important!
With the neck dam turned down, the helmet will vent air from the neck dam causing the regulator to free flow. This will make the helmet very uncomfortable.

The neck dam ring assembly must be oriented so the "tongue" on the front of the neck dam ring assembly is pointed to the front of your body, in front of and below your chin. You should be able to look down and see the tongue sticking out from underneath the neck dam ring assembly when you are wearing the assembly and it is oriented properly.

The tender must be available to assist the diver while he is dressing into his helmet.

Open the locking collar/neck pad assembly fully.



The diver inserts the tongue on the neck dam/ring assembly into the swing tongue catch. The tender must check to see that this is properly engaged.

The locking collar must be completely open for the diver to don the helmet.

Push the neck dam/ring up into the neck ring on the base of the helmet .

With the diver holding the helmet, the tender should now connect the quick disconnect fittings for the bailout supply. Open the regulator adjustment knob and the defogger control knob for a steady flow from both just prior to the diver dressing into the helmet.

With the helmet face down, pull the sealed pull pins and open the locking collar/neck pad assembly fully. Be sure the head cushion is attached to the bottom of the helmet. Pull the nose block device knob out all the way.

Loosen the chin strap all the way. The helmet is worn most comfortably when the chin cushion against the diver's chin with the chin strap outside of the chin cushion.

With the locking collar/neck pad assembly fully open, lift the helmet and place it over your head. Lower the helmet onto the back of your head first, then pivot it forward until your face is in position against the oral nasal mask.

Although the diver must be capable of donning and removing the helmet himself, the tender must ensure that the helmet is properly secured on the diver.

Rotate the sealed pull pins into the locking position.

⚠ WARNING

Both sealed pull pins must properly click into position on the base of the helmet. If the pins are not engaged correctly the neck dam/ring assembly may not seal and the helmet could flood. The diver could drown as a result.

The locking collar/neck pad assembly must be open and hanging down behind your shoulders. Tighten the chin strap so that it is comfortable under your jaw.

Now, the neck dam/ring assembly is resting directly under the hat on the diver's shoulders. The diver inserts the tongue on the neck dam/ring assembly into the swing tongue catch on the bottom front of the helmet.

Grasp the base of the helmet with your fingers and push the neck dam/ring up into the neck ring on the base of the helmet. The neck dam ring fits very snugly in the neck ring.

The diver then tilts his head and the helmet forward and swings the locking collar up over his shoulders. Push the locking collar/neck pad assembly up into position until it locks with the sealed pull pins.

If you have not positioned the sealed pull pins into the locking position, do it now with the locking collar/neck pad assembly in place.

3.8.6 Testing the Breathing System

Test the defogger system by turning on and off the defogger control knob. There should be no leakage when the valve is closed. The regulator should be adjusted by turning the adjustment knob out until a slight steady flow starts, then back in until the flow just stops.

Test the breathing system to make sure that it is operating correctly.

Next, the demand regulator system is checked for proper function: breathe in and out. Inhalation and exhalation effort should be nearly unnoticeable. Press in on the regulator cover. This should produce a strong burst of breathing gas.

3.8.7 Sealing Integrity Check

If there is any doubt that the helmet is sealing properly, perform the following test prior to diving.

Turn the supply gas off at the dive control system and bleed the umbilical.

To perform this test, the diver must have an assistant standing by. The assistant should be in control of the gas supply console in the event the diver needs air or he must be ready to lend a hand. The diver must be next to the dive control manifold so that the air may be turned on instantly, or the diver must be ready to run a hand between his neck and the sealing neck dam in order to pull the neck dam away from the neck to allow breathing.

With the neck dam ring on the diver's head, the helmet is installed and the locking collar closed. When the diver attempts to inhale, a suction on the neck dam is formed, indicating he is achieving a good seal. The diver must then turn the air on immediately so that he can breathe. If the diver does not turn the air on he will not be able to breathe, unless the neck dam is pulled away from his neck.

⚠ WARNING

Do not perform this test unless the diver and his tender are stationed immediately adjacent to the diver's air manifold and you are certain the air is on to the manifold. If the diver is unable to flow air to the helmet, either through the umbilical or the bailout, he may not be able to remove the helmet easily.

To break the seal in this situation, the diver must put his hand between the neck dam and the neck, and pull the neck dam away from the neck. A tender must be standing by to assist the diver in removing the helmet if needed. Suffocation could result.

3.8.8 Adjust Regulator for Low Work Rates

At very low work rates, such as when the diver is resting, or during in-water decompression, the diver's respiratory rate may be quite slow (10-15 breaths per minute). When this occurs, the diver's exhalations

⚠ WARNING

Excess carbon dioxide (CO_2) is dangerous. Too much carbon dioxide in the diver's breathing system can cause the diver to feel that he cannot breathe for comfort. It can also cause headache, confusion and rapid breathing. In extreme circumstances, carbon dioxide can cause unconsciousness. This could lead to suffocation and death.

may not be sufficient to move enough breathing gas through the mask exhaust to adequately wash out carbon dioxide (CO_2), if the oral/nasal does not have a good fit on the diver's face.

In order to ensure that carbon dioxide does not accumulate in the mask, divers who are at rest underwater should screw the regulator adjustment knob "out," i.e., away from the regulator, until a slight steady flow occurs and the regulator can be heard to hiss. This will help to eliminate any excess carbon dioxide from the mask. You can also open the steady flow valve (defogger) until a slight hiss is heard.

3.9 Removing the Helmet

To remove the Kirby Morgan helmet, start by pulling out (forward) on each sealed pull pin and turning so each remains in the open position. Tilt your head, and the helmet, forward and swing the locking collar assembly back behind your shoulders.

With the locking collar open, you can use the pull strap to break the seal between the neck dam ring and the helmet ring.

Tilt your head upright again and push the swinging tongue catch forward with one hand and hold it in this position. Grasp the pull strap and pull down on it, towards your back. This will break the seal between the neck dam/neck ring and the helmet neck ring on the base of the helmet. Once the seal is broken the neck ring assembly will come loose from the helmet.

Pull the nose block device knob away from your face, loosen the chin strap, and lift the helmet off of your head. A good tender will be prepared to help the diver with the removal of the helmet as required.

Grab the neck ring at the front and use your fingers to gather the neck dam away from your neck in the front. Lift the neck dam over your head.

3.10 Diving Procedures

3.10.1 Standing By to Dive

The diver may wear the neck dam ring assembly without discomfort if he is standing by to make a dive. However, the helmet itself must always be the last thing put on before the diver enters the water. Everything else must be ready to go before the diver puts the helmet on so he won't have to support the weight of the helmet while out of the water.

3.10.2 Attaching the Umbilical to the Harness

The umbilical must now be hooked to the diver's harness by means of a suitable clip that is bound to the umbilical. Some divers and companies prefer a quick release clip and others prefer a clip that is screwed together so the diver cannot easily remove it from his harness. The securing of the umbilical keeps the pull of the hose at the diver's harness and not on the helmet.

⚠ WARNING

Never dive without attaching the umbilical to some type of harness or clip on the diver's body. Never allow the umbilical to pull on the helmet directly or the diver could suffer a neck injury.

3.10.3 Diver Dons Helmet

The diver dons the helmet as per Section 3.8.5.

3.10.4 Diver Check Gas Flow Systems

The diver must check out the breathing system himself as the tender finishes dressing him. Operate the defogger valve, the demand regulator, and the purge button to assure yourself of proper operation before entering the water.

3.10.5 Communications Check

The communications system, sending and receiving, should be checked at this point.

3.10.6 Diver Ready

The diver is now ready to enter the water. He should be assisted to the water if needed. If a welding lens is being used, make sure it is hinged up all the way if the diver is making a jump entry. We do not recommend jump entries. A quick overall inspection by the

It is essential for the diver to ensure that the breathing system is working properly before he enters the water. Note the correct attachment of the diver's umbilical to his harness and the use of a submersible pressure gauge for the bailout system.

tender is done and the diver is given the OK.

3.10.7 Water Entry and Descent

The tender must make sure there is a sufficient length of umbilical clear if the diver is using a jump entry. There must be no chance of the umbilical hanging up when the diver jumps. Also, the defogger valve should be turned on maintain sufficient pressure in the helmet to prevent the possibility of water pressure from inverting the helmet exhaust valve when hitting the water.

The diver must report to the surface immediately after the entry. It is a good policy to descend 10 or 20 FSW (3-6 MSW), pause and check the regulator adjustment knob to ensure adjustment for the least breathing resistance.

The purpose of this adjustment knob is to allow the diver the ability to compensate for variations in umbilical supply pressure. This adjustment device operates by simply increasing or decreasing the amount of spring bias tension on the demand regulator inlet valve.

This adjustment device is not intended as a minimum-maximum device. Minimum and maximum applies to supply pressure only. The adjustment knob should be adjusted by the diver to be at the easiest breathing setting at all times.

Diving a KMDSI helmet or band mask with a bias setting greater than that just necessary to keep the demand valve from free flowing increases the work of breathing and reduces the diver's ability to perform heavy work.

Then the diver checks in with the surface before descending to the job. If a closed bell is being used, the diver enters the water from the bell and pauses for a short time outside the trunk until he is sure all systems are operating properly.

During the decent the communications must be checked again and the diver supply pressure should be adjusted as necessary to maintain the required over-bottom pressure. It may be necessary for the diver to readjust the demand regulator by means of the adjustment knob once at the work site to compensate for the variation in umbilical supply pressure.

3.11 Emergency Procedures

3.11.1 Flooding

In the event of partial or complete flooding, the diver may clear the helmet quickly by tilting the helmet forward and slightly down and activating the defogger control knob. Pressing in on the manual purge button in the center of the regulator cover will dewater the regulator.

After clearing, cautiously check for additional flooding. If the helmet continues to take on water, return to the diving station, swimming with the water dump valve positioned at the lowest part of the hat: that is with the diver's face forward and slightly tilted down. Keep the free flow knob on. This increases the air/gas pressure slightly inside the hat and keeps the water out. Any incoming water is automatically purged.

3.11.2 Inhalation Resistance

If breathing becomes difficult, adjust the demand regulator adjustment knob, for easier breathing by rotating the adjustment knob counter clockwise. If the breathing does not get noticeably better, press the purge button in the regulator cover. If a surge of gas does not flow with this action, open the emergency valve.

If the flow is noticeably better, immediately notify topside that you are on emergency gas. Insure your umbilical is clear and return to the stage or decent line. The diver should stay in communication with topside personnel and make preparations to abort the dive. The console operator should check to ensure the supply pressure to the diver is at the proper pressure.

3.11.3 Gas Flow Stops

A stop of flow in the demand regulator usually indicates the main gas supply has stopped. The diver should first open the emergency valve by turning the knob. If there is still no flow from the demand regulator, the defogger valve knob should be opened. Keep in mind that if the defogger valve is left open, the bailout bottle will drain very quickly, particularly if the diver is deep.

Immediately notify topside, check to insure your umbilical is clear and return to the diving station using the emergency breathing supply. Avoid making a rapid ascent if at all possible.

Once at the surface, or inside the bell, the diver may remove the helmet if needed. Never ditch the helmet underwater unless conditions absolutely require that.

3.11.4 Demand Regulator Free Flow

If the demand regulator free flows, turn the adjustment knob in (clockwise) until it stops. If the free flow cannot be stopped, the dive should be aborted. Even if there is no serious problem to the diver, the dive should be aborted and the problem with the regulator corrected.

Sometimes it may be necessary to tilt your head so the regulator is face up to help stop the regulator in a free-flow situation.

⚠ DANGER

Rapid ascent is dangerous. It can lead to air embolism or decompression sickness. Air/gas embolism can cause immediate loss of consciousness and/or death. Even on a no decompression dive, a rapid ascent may cause decompression sickness. A diver must only make a rapid ascent when he is in immediate danger of death by drowning or asphyxiation.

⚠ DANGER

Ditching the helmet underwater must be avoided. If the diver ditches the helmet underwater he will not be able to see. In many instances, even if the air supply is interrupted, topside will be able to get it back on line quickly. Do not ditch the helmet underwater unless you are completely out of breathing gas and it is impossible to return to the surface due to entanglement of your equipment or similar circumstances.

⚠ WARNING

Never remove the diving helmet while you are in the stage. If you fall out of the stage with the helmet off but still attached to your harness it may be very difficult to swim. Drowning may result.

3.12 Post Dive Procedures

3.12.1 Removing the Equipment

After the diver is well clear of the water he may remove the helmet. If the diver is working out of a stage he must not remove the helmet until the stage is on deck.

3.12.2 Removing the Helmet

Remove the helmet by pulling the sealed pull pins out (forward) and turning them until they are locked open in the extended position. Tilt your head and the helmet forward and swing the locking collar back behind your shoulders. You will need to pull down on the pull strap to break the seal between the neck dam ring and the helmet ring and to disengage the neck ring from the swing tongue catch.

Once the neck ring is disengaged from helmet ring, you can loosen the chin strap and then lift the helmet off of your head. A good tender will be prepared to help the diver with the removal of the helmet as required.

The emergency gas supply hose may be disconnected while the diver leaves the helmet on or while he holds the hat after removal. The quick disconnect makes this procedure very easy.

The tender should then unfasten the umbilical from the harness and take the helmet from the diver and set it aside. (Closing the locking collar/neck pad assembly onto the helmet before setting the hat down on a rough deck will help protect the helmet neck ring from damage). The harness and bailout bottle is then removed.

3.12.3 Storage of the Helmet Between Dives

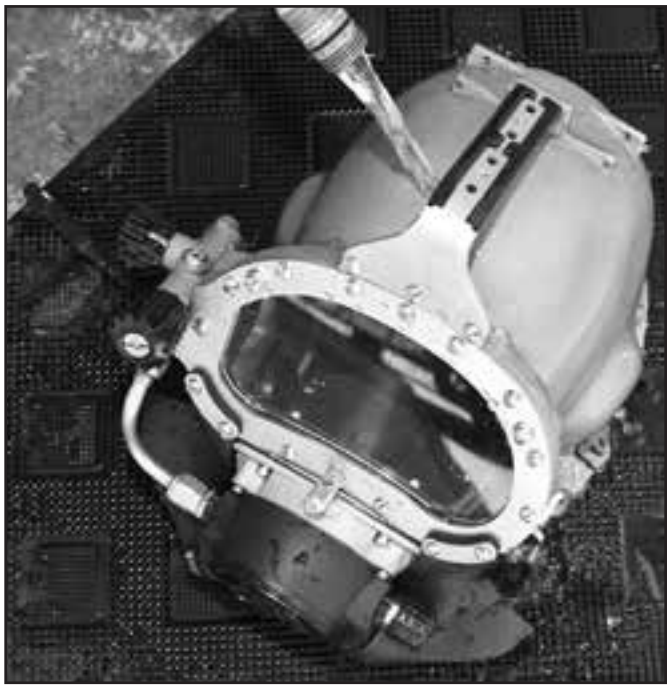
The helmet should be maintained per the daily maintenance section in Chapter 6.

If the helmet is not going to be used for a period of time, the head cushion, should be removed. The head cushion should be dried and replaced in the hat before storage. The regulator adjustment knob should be unscrewed all the way out (counterclockwise) until the next dive. Be sure to check the communications components and allow them to fully dry.

When the helmet is completely dry, or the diver is ready to leave the job, the helmet should be stored in the carrying bag to protect it.

If the head cushion becomes wet it may be dried out by removing it from the helmet, squeezing excess water out, and letting the head cushion hang dry or putting it in a clothes drier on air dry only.

The Pull Strap assembly has a 1" Stainless Steel “D” ring sewn on the end to hang the neck ring assembly to allow proper drying.



The helmet should be rinsed with clean fresh water following each use, then thoroughly cleaned.

⚠ WARNING

Use only the air dry setting when drying head cushion foam in a drier. Use of a higher setting could cause the foam to melt or start a fire.

Chapter 4
Troubleshooting

4.1 General

Kirby Morgan diving helmets are highly reliable life support equipment which should not malfunction if proper preventative maintenance procedures are followed. Most problems encountered in using the helmet can be easily remedied. The following information covers most potential operating difficulties.

4.2 Communication Malfunction

Symptoms	Probable Cause	Remedy
No sound at either com box or helmet.	**Communications box not on.**	**Activate switch and adjust volume.**
	Communications incorrectly hooked up.	Switch terminal wires.
	Communications not hooked up.	Plug into terminals.
	Communicator not functional.	Replace communicator.
	Broken/damaged comm wire	Check continuity replace wire or umbilical.
	Battery Dead	Recharge / use alternate D.C. source.
Communications weak or broken up.	Terminals in communication module corroded.	Clean terminals with wire brush. Terminals should be bright, shiny metal.
	Battery weak.	Recharge / use alternate D.C. source.
	Loose wire.	Clean and repair.
Communications only work when wire is wiggled back and forth.	Break in diver's communication wire.	Splice wire if damage is minor. Replace wire if damage is major.
Communications only work when connector is wiggled back and forth.	Break in waterproof connector.	If connector is suspect, remove from line and test line for integrity prior to replacing connector.
Diver speech weak or can't be heard.	Microphone in helmet dead or damaged.	Replace microphone as per manual.

4.3 One Way Valve Malfunction

Symptoms	Probable Cause	Remedy
One way valve allows back-flow.	Foreign matter in valve.	Disassemble valve, clean and rebuild. Replace if needed.
One way valve doesn't flow any gas.	Foreign matter in valve.	Disassemble valve, clean and rebuild. Replace if needed.

4.4 Side Valve Malfunction		
Symptoms	**Probable Cause**	**Remedy**
Defogger can't be shut off. Helmet free flows through defogger.	Seat assembly damaged or debris under seat.	Clean and/or replace seat assembly.
	Sideblock damaged by debris	Replace sideblock.
Defogger valve will not flow gas.	No air in umbilical.	Turn air on to diver's supply topside.
	Foreign matter in side block or one way valve.	Disassemble side block one way valve and clean.
Defogger valve knob hard to turn.	Valve stem bent.	Replace valve stem.

4.5 Water Leakage Into Helmet		
Symptoms	**Probable Cause**	**Remedy**
Water leakage into helmet.	Exhaust valve damaged or stuck open.	Seat or replace valve.
	Communications module O-ring extruded or damaged.	Replace o-ring.
	Communications module not properly tightened.	Tighten module mount nut.
	Comm module Damaged.	Replace.
	Binding posts or connector seal damaged.	Remove posts, clean and reseal with RTV sealant.
	Diaphragm damaged or not seated properly.	Seat or replace diaphragm.
	O-ring in neck dam ring damaged or missing.	Replace o-ring.
	Port retainer screws loose.	Tighten screws.
	Neck dam torn or damaged.	Replace neck dam.
	Hair caught between o-ring and base of helmet.	Remove hair from this space.
	Head cushion or chin strap caught under o-ring at neck dam.	Clear cushion or dam
	Regulator assembled improperly.	Check for proper assembly.
	Damaged or loose reg pod.	Tighten/ repair pod
	Damaged gasket	Replace gasket

4.6 Demand Regulator Malfunction

Symptoms	Probable Cause	Remedy
Regulator continuously free flows.	Adjustment knob not screwed in.	Screw in adjustment knob.
	Bent tube damaged causing mis-alignment of adjustment nipple.	Check the inlet nipple and soft seat. Replace as necessary.
	Supply pressure too high.	Adjust supply pressure lower than 225 p.s.i. over ambient.
	Regulator out of adjustment.	Adjust regulator
Regulator continuously free flows when underwater only.	Neck dam turned down, or too large for divers neck.	Neck dam must be turned up. Replace neck dam with proper size.
	Hair caught between o-ring and base of helmet.	Clean hair out.
	Neck dam torn.	Repair or replace neck dam.
	Poor seal in neck dam ring Assembly	Replace O-rings
Regulator is hard breathing.	Adjustment knob screwed too far in.	Screw adjustment knob out.
	Supply pressure too low.	Increase supply pressure.
	Regulator improperly set up.	
Regulator does not supply gas.	Gas supply pressure too low.	Increase supply pressure to minimum required for depth.
	Regulator is out of adjustment.	Adjust regulator
	No gas in umbilical	Turn diver's gas supply on topside.
	Blockage in breathing system.	Disassemble regulator, clean, and adjust.

4.7 Emergency Gas Supply Valve

Symptoms	Probable Cause	Remedy
Bail-out bottle drained without diver opening EGS valve	Stem fails to seat in valve body.	Replace EGS valve body.
	Debris under sea causing leakage.	Service valve.
	Leaking over-pressure relief valve on bail-out regulator.	Service valve.
	Leaking bail-out regulator on bottle.	Service regulator.
	Leak in supply line 1st stage	Service regulator.
Knob difficult to turn.	Stem bent.	Replace stem.
Valve will not flow gas.	Foreign matter in valve.	Disassemble, clean, and reassemble.
	Stripped control knob.	Replace knob.

Chapter 5
Inspection and Maintenance

5.1 Routine Maintenance

Routine and preventative maintenance is critical and must be done on a regular basis. All parts and components of the helmet have a useful service life and eventually will require replacement. Some items, when properly maintained, can go many years before replacement becomes necessary. Each helmet or mask should have a logbook that tracks the usage, maintenance and repairs.

It is essential to safety of the user that a routine and periodic schedule of maintenance, inspection, and testing be carried out. Helmets should be inspected pre-dive on a daily basis. Helmets in continuous use around the clock should be rotated out every 24 hours and have a daily pre-dive inspection performed. Post dive cleaning and inspections should be completed each time helmet or mask use is finished for the day. To minimize the spread of germs, sanitizing should be performed after use, and in between use by different divers. Sanitizing procedures and recommended solutions are described and explained in the General preventative section of each KMDSI helmet and mask manual. If the user is in doubt about the serviceability or has questions in general, please contact your local KMDSI authorized repair facility or KMDSI at Tel. 805-928-7772. Check the Dive Lab website at www.divelab.com for the most up-to-date maintenance procedures.

KMDSI Maintenance Checklist are located on the KMDSI and Dive Lab websites. The checklists are intended for all helmet and mask models. There are also checklists for the KMB-18/28 band masks which are done up the same as the helmet checklists.

A2.1. All SL and KM helmets (all models) Recommended Annual Maintenance Inspection and Overhaul
A2.2. Monthly Maintenance
A2.3. Daily Set-Up and Functional Checklist
A2.4. Supervisor's Equipment Checks Prior to Entry
A2.5. Supervisor's Equipment Checks In-Water
A2.6. Post Dive Cleaning

5.1.1 Daily Pre-Dive Maintenance A2.3

The helmets and masks should be set up in accordance with the Daily Set-Up and Function Checklist A2.3. The checklist can be laminated placed on a clipboard and checked off with a grease pencil. Completion should be logged in both the supervisors log and the helmet or mask log book. The daily pre-dive is minimum daily checks KMDSI recommends. The daily pre dive may be modified to suit the needs of the user providing the basic intent of the checklist is being completed in a manner with the original intent.

5.1.2 Daily Post Dive Maintenance A2.6

The helmets and masks should be cleaned in accordance with the A2.4 checklist The checklist can be laminated placed on a clipboard and checked off with a grease pencil. Completion should be logged in both the supervisor's log, and the helmet or mask log book. The daily pre-dive is minimum daily checks KMDSI recommends. The daily post-dive may be modified to suit the needs of the user providing the basic intent of the checklist is being completed in a manner consistent with the original intent.

5.1.3 Supervisors Equipment Checks A2.4 and A2.5

These checks should be conducted by the diving supervisor or by persons designated by the supervisor in accordance with company policy.

5.2 Monthly Maintenance

A monthly inspection should be performed IAW the A2.2 checklist on a monthly or as directed by the A2.2 and / or anytime serviceability of the helmet or mask is in doubt. Helmets or masks used in contaminated waters or for welding, burning, and jetting operations will require service and inspection more frequently. If a situation arises that casts any doubt as to the serviceability of a part or component it should be replaced.

Use the appropriate manual for the model helmet or mask being serviced.

5.3 Yearly Maintenance

5.3.1 Overhaul/Inspection Checklist A2.1

The A2.1 checklist procedure fulfills all requirements for complete inspection. The checklist should be performed at least annually and or more often if daily and monthly inspections reveal signs of excessive corrosion, contamination, improper operation or signs of damage or if the helmet log shows the unit had previously been used in a questionable environment. The daily and monthly inspections will determine the necessity for overhaul with greater accuracy than

simply placing a number of hours on the overhaul schedule. All O-ring's, exhaust valves, and soft goods should be replaced at least once a year. In between overhauls the soft goods can be cleaned inspect and reused providing a careful inspection reveals no damage or deterioration. Again, logged questionable previous diving environments will be determining factor as well. The A2.1 checklist should be filled out and retained in the maintenance files and provides an excellent record of maintenance. All maintenance should be annotated in the helmet log.

The Overhaul Checklist Procedure A2.1 is intended to aid persons performing routine overhauls of KMDSI SuperLite® Helmets and Band Masks. The checklist should be used in conjunction with the applicable Operations and Maintenance Manual for the model helmet being serviced and is primarily intended to guide and document the maintenance as it is completed. Specific detailed procedures for each section of this checklist can be found in the Operations and Maintenance Manuals. This checklist when completed should be retained in the equipment maintenance files and the helmet or mask log book should be updated. The checklist's are intended to be used for all models of KMDSI SuperLite® and KM Helmets and band masks. All KMDSI helmet and band mask manuals can be downloaded free at www.kirbymorgan.com.

Chapter 6.0
General Preventative Maintenance

6.1 Introduction

This section covers the preventative maintenance necessary on the KM 77 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 helmet neck ring repairs 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 when possible. The following wrenches and tools are required to maintain the KM 77:

Torque wrench with the following attachments:
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

Open end wrenches in the following sizes:
3/8 inch
7/16 inch
9/16 inch
3/4 inch
7/8 inch
1 inch

The KM77 Regulator adjustment kit.

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
KM77 Regulator tool kit Part # 525-768
ball peen hammer
tie wraps: Part # 520-042
Silicone grease
Loctite® 222 Thread locker
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 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.

⚠ 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 propellent 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.

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).

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. $1^1/_2$ wraps is all that is needed. Applying more than $1^1/_2$ wraps of tape is not recommended. The use of more than $1^1/_2$ 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 most 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. Also, be sure not to use excessive thread locker in the port retainer screws as it is possible to damage the face port if contact is made between thread locker and the port. Allow thread locker to cure for at least 3 hours prior to using the component.

⚠ WARNING

Avoid any contact between Loctite® and the face port. This can cause the port to fail unexpectedly and drowning could result.

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.

Early production of the REX® 77 helmet had a much different surface finish than what is found on current production runs.

Earlier helmets shells and components were finished using a combination of glass and Stainless Steel beads; this gave a dull or flat looking surface finish. Later shipments have a surface finish with a much smoother and almost shiny appearance. Although the parts are not shiny, the surface finish is very smooth. A Scotch-Brite®, (or similar non metallic), scouring pad will remove buildup of unwanted surface deposits on both older, and newer REX® 77 helmets. It can also be used to give the main helmet components on newer helmets, a satin (brushed) finish.

Kirby Morgan highly recommends rinsing your helmet thoroughly after every dive. Regular polishing and cleaning of the surface can be helpful. REX® 77 owners can also put a thin layer of car wax such as Turtlewax® on the helmet shell. Do not wax the rubber components. A hand cleaner with pumice such as GOJO® Natural Orange™ Pumice Hand Cleaner—which contains tiny abrasive particles—may also be used.

⚠ WARNING

DO NOT use car wax on rubber components as the ingredients may cause premature degradation to the rubber resulting in failure of equipment and possible injury or death to personnel.

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® regulator assembly, demand regulator diaphragm, demand regulator exhaust valve, water dump 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

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.

⚠ 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.

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 or plastic 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, prior to storage, and before use by another person. 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.

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

Start removal of the cover by unscrewing the retainer ring.

Remove the retaining ring and regulator cover.

Remove the diaphragm and washer.

To sanitize the breathing system properly, the regulator cover and diaphragm must be removed so that the interior of the regulator can be cleaned and sanitizing solution can be flushed through the exhaust valve and whiskers.

1) Start removal of the regulator cover by using the regulator cover removal tool to begin removal of the retaining ring.

2) If necessary, peel the regulator cover back from the retaining ring. Remove the ring.

3) Remove the diaphragm and washer.

4) Sanitize the regulator interior and flush sanitizing fluid through the whiskers. Rinse with fresh water.

5) Reinstall the diaphragm, washer, cover, and retaining ring.

6) Tighten the retaining ring until snug. The lip of the cover should completely cover the retaining ring, holding it in place.

⚠ WARNING

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

When the retaining ring is properly installed, the cover should be oriented so that the Kirby Morgan name is level on the cover. If an imaginary line is drawn through the Kirby Morgan name, it will bisect the holes on opposite sides of the retaining ring. Note the alignment of the other holes on the ring relative to the slots in the regulator cover. This will help ensure proper water flow over the diaphragm and avoid trapping debris under the cover when working in water where there is suspended matter.

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.

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.

Use a dilute solution of hand dish washing soap to clean your helmet after each diving day. The oral/nasal mask and regulator must also be sanitized between use by different divers.

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 proce-

dure 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."

⚠ CAUTION

Germicidal cleansing solutions must be carefully diluted if required in accordance with the manufacturer's recommendation. If solution is not of the recommended strength, it will not act as an effective disinfectant. Failure to thoroughly rinse germicidal cleansing solution from diving equipment may result in lung irritation and/or long-term degradation of rubber and silicone components of this equipment.

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

Removing the head cushion.

Uncover the earphones so they may dry.

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.
7) Remove the communications assembly from the helmet so it can dry completely. Remove the communication 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

⚠ 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.

6.5 Monthly Maintenance (or between jobs) (See DiveLab Checklist A2.2)

6.5.1 Locking Collar Assembly & Helmet Ring

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."

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.***

⚠ 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.

6.5.2 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.

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.

Check to see if the neck dam has pulled away from the neck ring. This requires a close visual inspection.

Check the screws on the ring to ensure they are properly tightened.

6.5.3 Head Cushion and Chin Cushion

Remove the foam from the head cushion and inspect

⚠ 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.

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.

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. Re-tighten 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.

Good communications are vital to your safety. Regularly inspect the components of the communications system and replace when necessary.

The nose block O-rings must be regularly lubricated.

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.

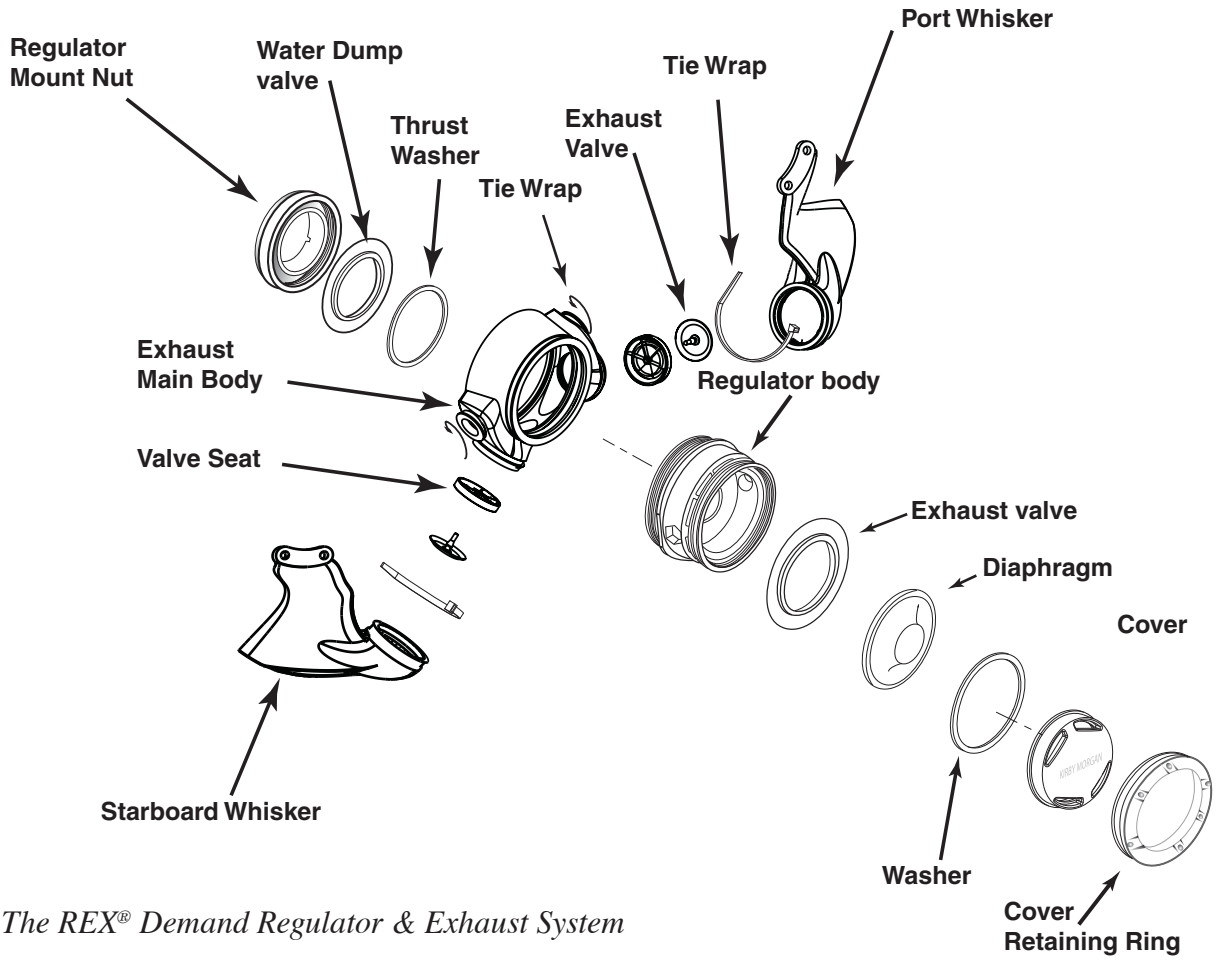
Tools Required:
Small flat blade screwdriver
Small cutting pliers
Clean wiping rag
Nylon tooth brush
Regulator cover wrench
Spray bottle with detergent solution
Spray bottle with antiseptic cleaner

Remove the regulator cover to inspect the diaphragm.

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 REX® Demand Regulator & Exhaust System

the shaft out through the oral nasal.

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.

Make sure the solution flows through the rear of the regulator where the oral/nasal attaches to the mount nut. This will help to ensure the exhaust valve in the regulator gets cleaned.

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.

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

Inspect the exhaust valves on a regular basis.

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.

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. If needed, you can use a blunt screwdriver to snap the edge of the exhaust main body into the groove on 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.

⚠ WARNING

It is essential to ensure that the whisker encloses the outer lip of the regulator ring. If this does not happen, the retainer ring could possibly come unscrewed underwater. This would allow the diaphragm to fall out and the helmet would flood. This could lead to serious personal injury or death.

Chapter 7.0
Breathing System Maintenance and Repairs

7.1 Introduction

This chapter covers the maintenance and repair of all components of the breathing system. The breathing system includes the one way valve, the emergency valve, the side block, the bent tube assembly, the demand regulator, and the oral/nasal mask.

Overhauls and Inspections IAW the DiveLab Overhaul and Inspection Checklist A2.1 can be accomplished using the detailed instructions in this chapter. The A2.1 checklist should be used and filled out as a means of tracking maintenance and repairs. Repairs and replacement parts and components can be documented on the A2.1 checklist.

The breathing system on all Kirby Morgan helmets and masks is simple and highly reliable. The fact that they can continue to operate when the components are not in a well-maintained condition can cause divers to become complacent about maintenance.
Your life depends on the correct function of this equipment!

While Kirby Morgan helmets and masks are simple to maintain, like any type of life support equipment, they do require regular periodic maintenance to function properly.

All parts disassembled should be thoroughly cleaned using the methods described in Chapter 6. Components that require the use of lubricants, sealing and thread locking compounds should also be serviced.

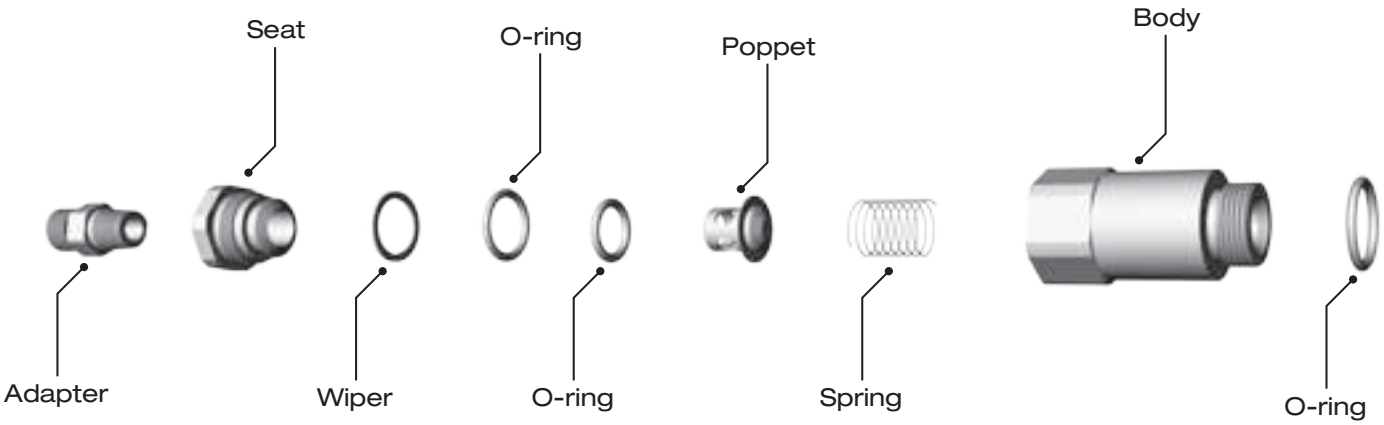
Most fasteners have a torque value. It is imperative that all fasteners which have a torque value be tightened to the torque specifications as outlined by the procedure, or as listed in the table in the rear of this manual. If in doubt as to the proper torque setting, contact your local authorized repair facility or KMDSI.

⚠ WARNING

Overtightening a part may lead to part failure and improper operation of Kirby Morgan life support apparatus. Undertightening a part may cause the part to come loose and may also lead to improper operation of the equipment. Either situation may lead to personal injury or death.

7.2 Torque Values

All fittings must be tightened to their correct torque values. See Appendix 1 in the rear of this manual for the correct torque specifications.



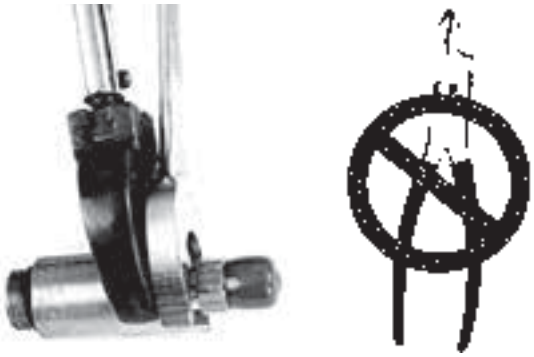
Correct assembly order of the one way valve.

7.3 One Way Valve

NOTE: The one-way valve assembly should be disassembled, cleaned and the three o-rings should be replaced at least annually. Damaged and/or corroded parts should be replaced. A repair kit is available for replacement parts, KMDSI Part #525-330.

⚠ CAUTION

Do not use pliers on the main body of the one way valve. You may damage the valve if pliers are used.



7.3.1 Disassembly Of The One Way Valve

Tools Required:
Soft Jaw Vise
1 inch Open End Wrench Attachment on Torque Wrench
(If no vise is available use a backup 1 inch open end wrench)

To disassemble and inspect the one way valve assembly:

1) The one way valve assembly must be removed from the side block. Use the open end wrench to remove it.

⚠ CAUTION

Use two wrenches or hold the hex part of the body in a vise while removing or turning the seat with a wrench. Do not use pliers on the main body of the one-way valve. You may damage the valve if pliers are used.

⚠ WARNING

Do not attempt to move or remove the cage that sits inside the non-return (one-way) valve. Any attempt to remove this part can cause the non-return valve to fail, which can lead to serious personal injury or death.

2) After the one way valve has been removed, use two wrenches or hold the hex part of the body in a soft jaw vise while removing the seat with a wrench.

As the seat is removed, the wiper and the o-ring slide out in place in a groove on the seat. The poppet and the poppet o-ring usually come out in the seat being followed by the spring.

The only functional part remaining in the valve body is a non-moving, pressed-in cage. The function of the cage is to contain the poppet during high gas flows.

3) Inspect the body interior for foreign matter of any type and clean, if necessary. Clean in accordance with the KMDSI cleaning instructions. If corrosion is present, clean using the acidic solution as outlined in the KMDSI cleaning procedures.

4) Inspect the seat, wiper, o-ring, poppet o-ring and poppet for wear, replace if necessary. Be sure each part is clean and all components are lightly lubricated with the appropriate lubricant.

A repair kit is available for replacement parts, (Part #525-330). The one-way valve overhaul kit is also included in(the standard helmet overhaul soft goods kit.) All o-rings should be replaced during normal/ annual overhauls.

5) Be careful to wipe the poppet and poppet o-ring thoroughly, removing nearly all silicone to prevent foreign materials from sticking to these components.

6) Replace the spring.

7.3.2 Reassembly of the One Way Valve

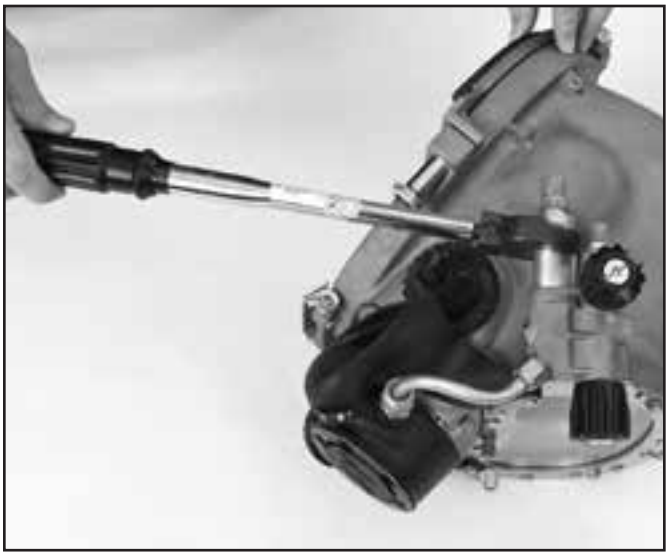
1) Slide the new o-ring over the poppet.

2) Insert the new spring into the valve body, followed by the poppet.

3) Next, install the new o-ring and new wiper on the seat. Thread the seat into the valve body.

4) Tighten the seat to 150 inch lbs. (17 newton meters) with a torque wrench while holding the body in a soft jaw vise or wrench.

5) If the adapter has been removed, it must be cleaned and wrapped with Teflon® tape.



Tighten the non-return (one-way valve) in the sideblock to 150 inch lbs. (17 Newton Meters) with a torque wrench.

⚠ WARNING

Do not allow any Teflon® tape to cover the end of the adapter, or to enter the one-way valve. Loose pieces of Teflon® tape can interfere with the performance of the one-way valve or the regulator and may block the diver's air supply. This could lead to death through suffocation.

7.4 Side Block Assembly

7.4.1 General

The side block should be overhauled at least annually, or whenever components show signs of wear, damage or do not function smoothly or properly. Minimum replacement components during overhaul includes all o-rings. A repair kit is available for replacement parts, KMDSI Part #525-311, which includes o-rings.

The side block does not require removal from the helmet each time an overhaul is being conducted providing inspection of the internal passages does not reveal contamination or excessive corrosion. However, the side block should be completely removed at least every three years of active use to ensure fasteners are not corroded or frozen.

The side block assembly is held in place on the helmet frame by a stud, flat washer, lock washer, nut, and a machine screw. The screw does some securing but its main function is to prevent rotation of the side block. The stud also extends into the interior of the helmet frame far enough to secure the air train by means of a washer and nut.

The air train in the KM77 is different from most other Kirby Morgan helmets. The train itself consists solely of a brass tube that snaps into a rubber block which sits in a recess inside the helmet.

A spares kit is available for rebuilding the side block. Order KMDSI Part #525-313.

7.4.2 Removal of the Bent Tube

Tools Required:
3/16 inch Open End Wrench

The bent tube assembly can be entirely removed before removal of the side block assembly is started. It can also be removed from the block and left attached to the regulator.

1) Completely unscrew the bent tube assembly nut from the side block.

2) Loosen the lower bent tube nut by turning the wrench up.

3) Unscrew the bent tube nut until it comes free, then pull the bent tube assembly straight out of the regulator inlet nipple.

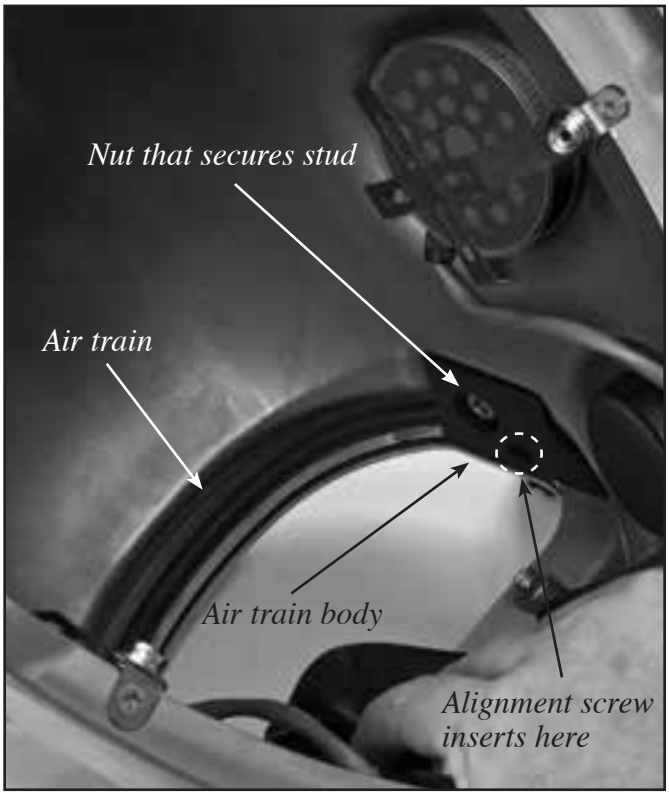
4) The side block assembly is ready to start removal.

Loosening the bent tube from the side block.

Swing the bent tube down and out of the way.

7.4.3 Separating the Side Block Assembly from the Helmet Shell

Tools Required:
Putty Knife,
7/16 inch socket with driver
5/32 hex key (hex key screwdriver is helpful)



The nut seen here secures both the air train and the sideblock.

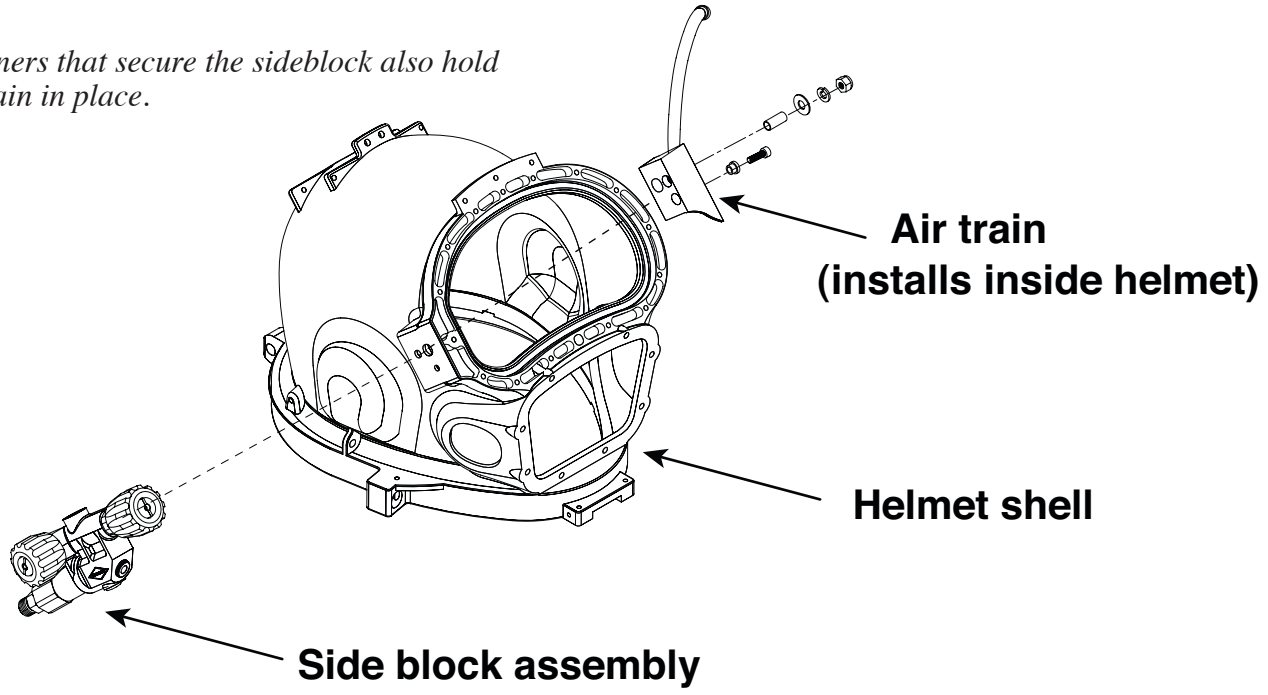
Remove the alignment stud from within the air train body.

1) Removal of the side block assembly requires removing the air train.

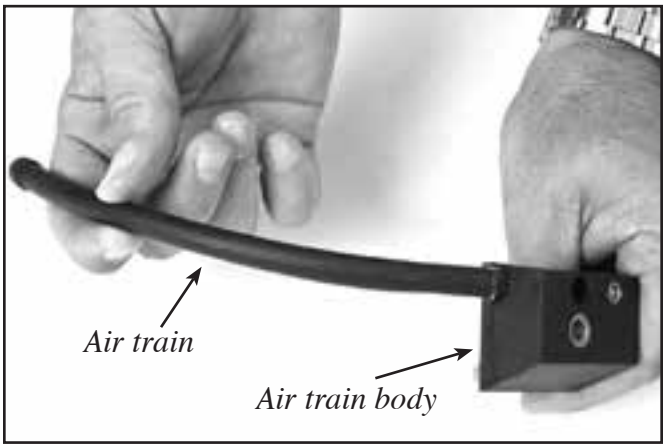
2) Remove the nut and washer that help to secure the air train using the 7/16 inch socket.

3) Next, the alignment screw that also helps to secure the side block is removed from the recess in the air train body.

The fasteners that secure the sideblock also hold the air train in place.



Remove the air train with the air train body.



The air train and the air train body. The air train snaps into the body and is held in place by a small barb on the tube that fits into a matching groove in the rubber air train body. The outer curve of the air train tube must be positioned to sit in the area behind the port retainer with the holes in the tube positioned so that breathing gas from the tube will defog the port.

NOTE: The alignment screw is located in a recess below the stud.

A thin putty knife can be pushed between the side block and the helmet shell to help remove the side block.

4) The side block assembly is now unfastened, but held in place by the rubber sealing compound (silicone sealant) that acts as a glue. It may be necessary to rock just slightly, or pry the side block from the helmet shell. A thin putty knife can be pushed between the side block and the helmet shell to help free it.

Do not use a screwdriver or chisel to remove the sideblock as scratches or gouges to the shell could result. Be sure to peel or scrape the old silicone sealant away from both sealing surfaces before reassembling. Acetone helps remove this, but must be used sparingly.

5) If you plan to rebuild the side block assembly, it should be done at this time, while the side block is off the helmet. Overhaul the defogger valve and emergency valve in accordance with the section in this chapter. Overhaul the one-way valve in accordance with the section in this chapter.

6) Be sure to remove all traces of old silicone sealant from the side block and helmet shell.

7.4.4 Side Block Assembly Replacement

If a new side block is being installed, make sure it aligns correctly in the holes of the helmet shell before applying RTV silicone sealant.

1) Silicone sealant must be applied to the side block prior to installation on the helmet shell. Use only Dow-Corning® RTV 732 Multi Purpose sealant.

A small amount of silicone sealant must be evenly applied to the side block prior to installation on the helmet shell. Use only Dow-Corning® RTV 732 Multi Purpose sealant or equivalent.

⚠ WARNING

Use silicone sealant in a well ventilated area. Do not breathe the fumes from uncured silicone sealant. These fumes are dangerous and can cause unconsciousness. They can also cause long term damage to body tissue. Read and follow all precautions listed on the silicone sealant tube and Material Safety Data Sheet.

⚠ WARNING

If silicone sealant is blocking the air flow into the mask it must be cleaned out. If it is not cleaned out, the diver may not be able to properly defog the mask or clear a flooded mask quickly. In addition, if the demand regulator is not delivering air properly, the diver cannot use the free flow system as a source of breathing air. This could lead to suffocation.

Install the sideblock on the helmet shell.

⚠ WARNING

Do not dive the helmet until the sealant has had time to cure. Check the directions on the tube of sealant for curing time. If the mask goes into the water before the sealant has cured it could leak through the side block mounting stud hole, screw hole, or air flow hole. This could lead to drowning.

Install the air train and air train body inside the helmet.

Care must be taken to avoid sealant entering the air opening in the side block. Be sure to remove all excess silicone sealant before it sets up. Acetone can be used to dissolve uncured sealant.

2) Before installing the air train into the helmet, make sure the screw spacer is properly and fully inserted. It is sometimes easier to install the large sleeve over the stud after the air train body is installed.

3) Install the air train body into its proper position inside the helmet shell. The stud on the side block penetrates the larger hole in the air train body.

4) Thread the screw through the spacer and through the air train body and helmet shell and lightly tighten into the side block body.

5) Install the large sleeve onto the stud. Slide the flat washer and the lock washer onto the stud. Run the stud nut down the stud and tighten. Tighten to 35 inch pounds (4 Newton meters). **DO NOT OVER-TIGHTEN**.

6) Tighten the screw to the correct torque, 20 inch pounds (2.25 Newton meters).

7) Clean off all excess silicone sealant.

8) Test the side block prior to diving to ensure that no silicone sealant is blocking the air flow to the mask. If it is, it must be cleaned out prior to diving.

7.5 Defogger Valve

7.5.1 Disassembly of the Defogger Valve

Tools Required:
Soft Jaw Vise
1/4 inch Slotted Flat Blade Screwdriver
Torque Wrench with 13/16 inch Open End Attachment

The defogger valve (also referred to as free-flow or steady-flow) components are disassembled as follows:

1) Back out the control knob all the way (valve in the fully open position).

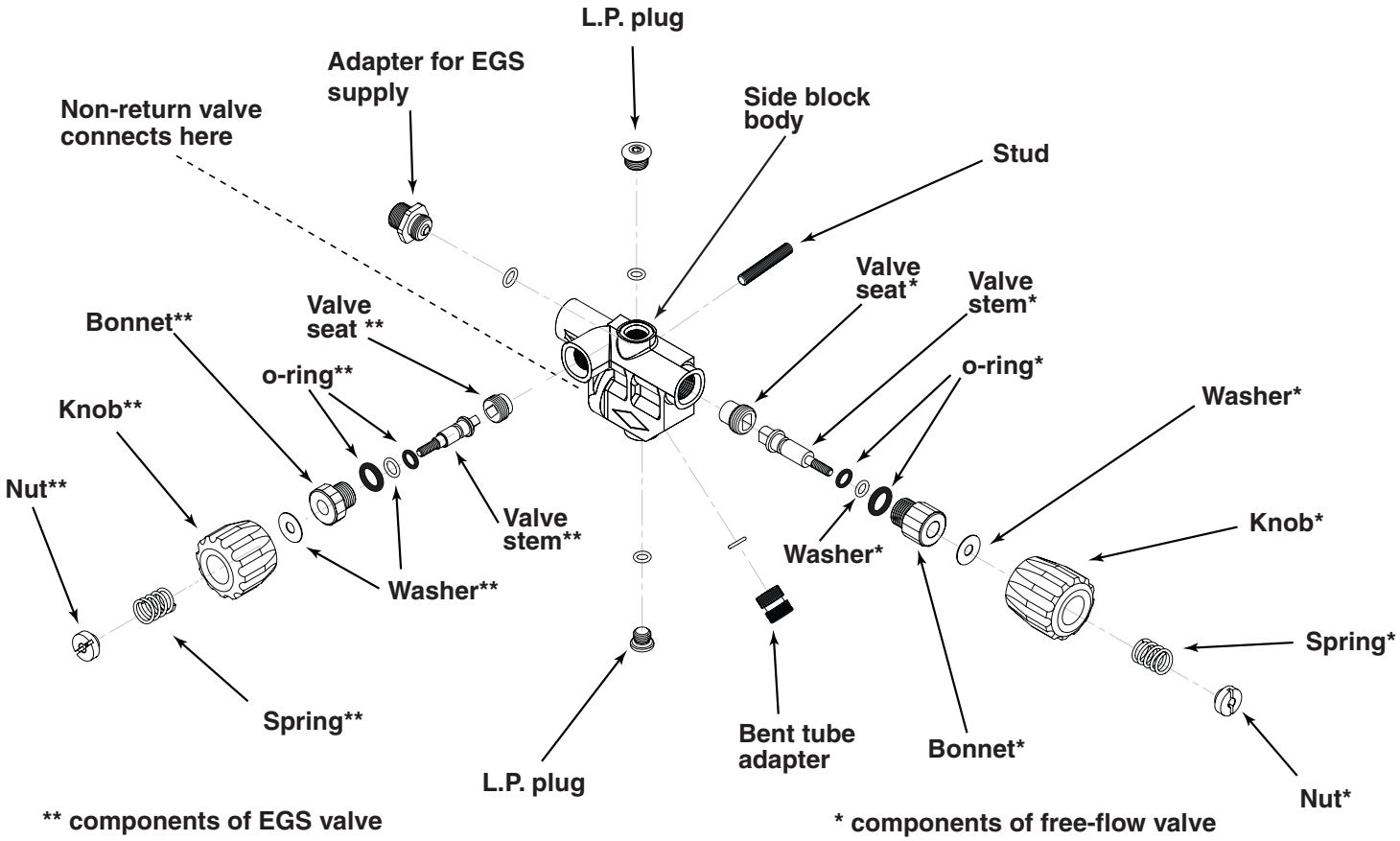
2) Remove the lock nut and the spring, control knob, and washer.

3) Unscrew the bonnet. Its o-ring will come off with it. The valve stem, o-ring, and washer usually come out with the bonnet and can be pushed out of the bonnet once removed from the side block.

4) If the stem remains in the side block body it can be lifted out after the bonnet is removed.

5) The seat assembly can be unscrewed from the side block body with the stem or a screwdriver.

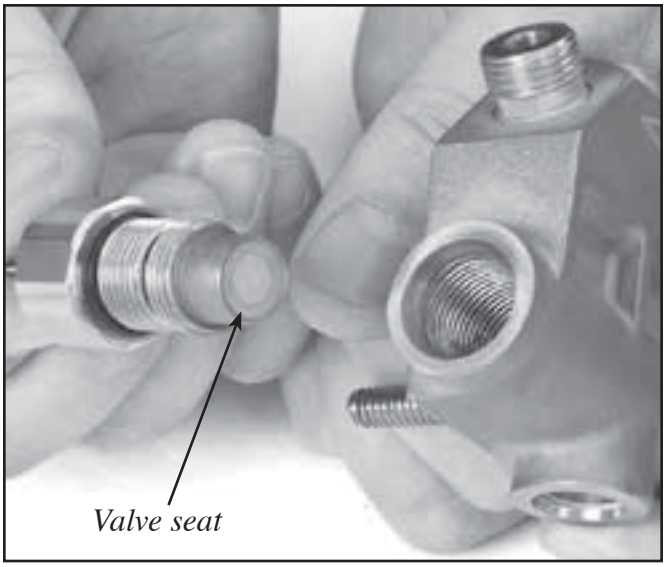
Remove the nut from the defogger valve knob.



Components of the sideblock, including the EGS valve and the defogger or "free-flow" valve.

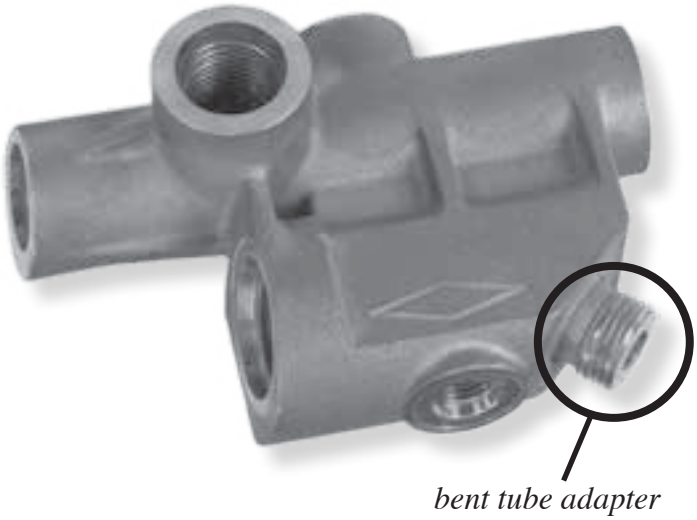
Don't lose the washer that sits between the defogger valve knob and the bonnet.

Loosen the bonnet to remove the valve stem.



As you unscrew the bonnet, the valve stem and seat will usually come out of the side block together. Note the condition of the seat as shown here. The seat in the defogger valve is a different size than the EGS valve seat. Since the parts have a similar appearance, it's a good idea to keep the parts for the defogger and EGS valve separate.

Use a toothpick, credit card, or other non-metal objects to remove the o-rings for cleaning and replacement. Note that the bonnet on the defogger valve is longer than the bonnet on the EGS valve.



The bare sideblock is shown here. It is machined from a single block of stainless steel. Note that the bent tube adapter can be replaced if damaged, but this requires a special tool. Check with your authorized repair center for tool availability.

7.5.2 Cleaning and Lubricating

1) Clean all the metal first in the soapy water solution and then in a 50/50 dilute solution of white vinegar/water. Rinse in fresh water.

2) Check the Teflon® seat for wear and/or contamination, and replace if necessary. Damage such as a rough face or cuts to the seat indicate it must be replaced.

3) The Teflon® washer and o-ring must be replaced if worn.

4) Be sure to place a light coating of lubricant on all internal moving parts, o-rings, and washers. However, do not lubricate the Teflon® seat, as this will attract dust and debris.

Be sure to lubricate all parts, with the exception of the valve seat, prior to reassembly.

Install the o-ring on the defogger bonnet.

7.5.3 Reassembly of the Defogger Valve

Tools Required:
3/8 inch Slotted Flat Blade Screwdriver
13/16" Open End Attachment on Torque Wrench
Minimum mandatory replacement parts during overhaul:
Washers, o-rings

1) Screw in the new seat assembly until it is even with the front of the side block body.

2) Next, install the new Teflon® washer and new o-ring onto the stem.

3) Insert the proper end of the stem into the seat assembly and turn clockwise until the seat lightly bottoms out. Leave the stem in place.

4) Lubricate the new o-ring and install on the bonnet.

5) Slide the bonnet over the stem and thread the bonnet into the side block.

6) Tighten the bonnet with a torque wrench to 100 inch lbs.

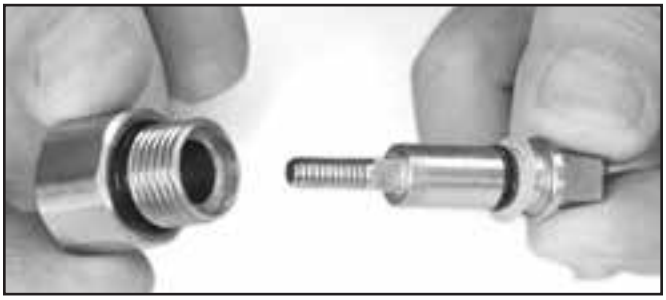
7) Place the new Teflon® washer and the control knob on the stem and rotate the stem counterclockwise until the seat assembly tops out fully open. The control knob must turn smoothly without any binding.

Binding (or "hard spots") in the rotation could be an

Install the washer on the defogger valve stem.

indication of a bent stem that must be replaced. Replace the knob and or stem if the fit allows the valve to rotate loosely more than 1/8th of a turn.

8) Install the spring and locknut. Tighten the locknut until it is flush with the knob.

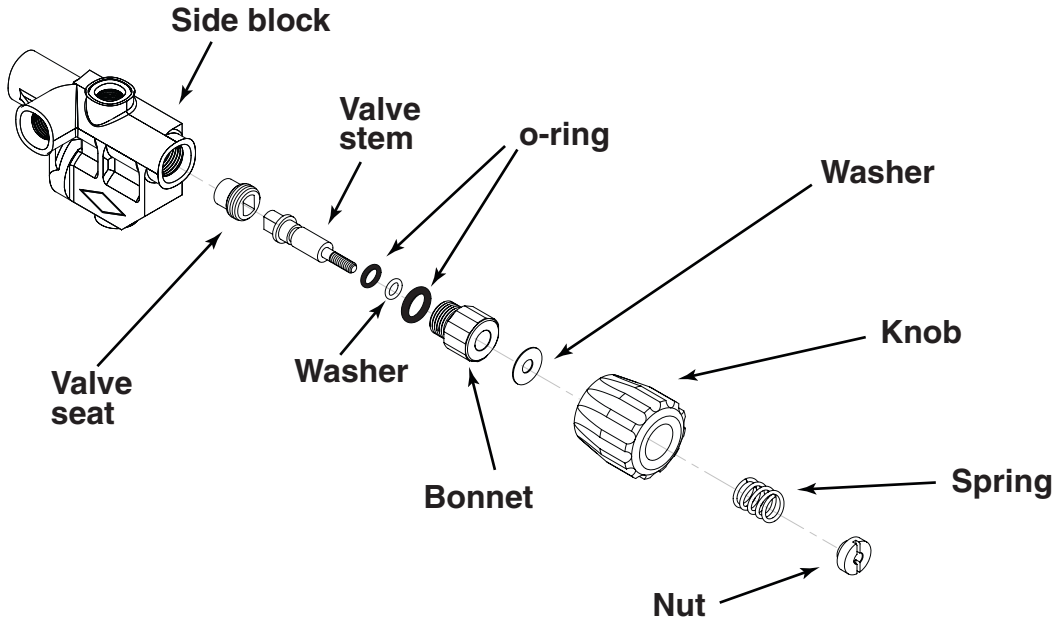


Install the stem into the bonnet. Make sure the o-ring and washer are in place.

Be sure to install the washer that rests underneath the valve control knob.

Install the defogger knob mechanism in the side block.

Install the spring in the defogger valve control knob.



Components of the defogger valve.

7.6 Emergency Gas System Valve Assembly

Unlike previous models of Kirby Morgan helmets and band masks, the emergency valve body is built into the side block. The design of the valve is very similar to the defogger valve in appearance and function, but the parts are **not** interchangeable.

7.6.1 Disassembly of the Emergency Valve

Tools Required:
13/16 inch Open End Wrench
Torque Wrench Attachments & Torque Wrench
3/8 inch Slotted Flat Blade Screwdriver
Soft Jaw Vise
Lubricant
Teflon® Tape

1) First, unscrew the lock nut and remove the spring, control knob, and washer.

2) Next, unscrew the bonnet. Its o-ring will come off with it. The valve stem, o-ring, and washer usually come out with the bonnet and can be pushed out of the bonnet once removed from the side block.

3) If the stem remains in the side block body it can be lifted out after the bonnet is removed.

4) The seat assembly can be unscrewed from the side block body with the stem or a screwdriver.

5) The adapter that provides the breathing gas to the

Remove the lock nut and spring

Remove the knob from the valve.

Loosen the bonnet on the EGS valve.

Removal of the bonnet, valve stem, and seat.

EGS valve should be periodically removed so the o-ring can be inspected and lubricated, or replaced if needed.

The adapter for the EGS valve should be removed periodically to inspect the o-ring and to make cleaning of the side block interior easier. Note the stud which is used to mount the side block is fastened with Loctite® 222. This is a dealer serviceable item only.

7.6.2 Cleaning and Lubricating

1) Clean all the metal first in the soapy water solution and then in a 50/50 dilute solution of white vinegar/water. Rinse in fresh water.

2) Check the Teflon® seat for wear and/or contamination, and replace if necessary. Damage such as a rough face or cuts to the seat indicate it must be replaced.

3) The Teflon® washer and o-ring must be replaced if worn.

4) Be sure to place a light coating of lubricant on all internal moving parts, o-rings, and washers. However, do not lubricate the Teflon® seat, as this will attract dust and debris.

All internal moving parts (with the exception of the valve seat) and o-rings should be regularly lubricated.

7.6.3 Reassembly of Emergency Valve

Required Tools: open end wrench
flat blade screwdriver

1) Screw in the new seat assembly until it is even with the front of the side block body.

2) Next, install the new Teflon® washer and new o-ring onto the stem.

3) Insert the proper end of the stem into the seat assembly and turn clockwise until the seat lightly bottoms out. Leave the stem in place.

4) Lubricate the new o-ring and install on the bonnet.

5) Slide the bonnet over the stem and thread the bonnet into the side block.

6) Tighten the bonnet with a torque wrench to 100 inch lbs.

7) Place the new Teflon® washer and the control knob on the stem and rotate the stem counterclockwise until the seat assembly tops out fully open. The control knob must turn smoothly without any binding.

Binding (or "hard spots") in the rotation could be an indication of a bent stem that must be replaced. Replace the knob and or stem if the fit allows the valve to rotate loosely more than 1/8th of a turn.

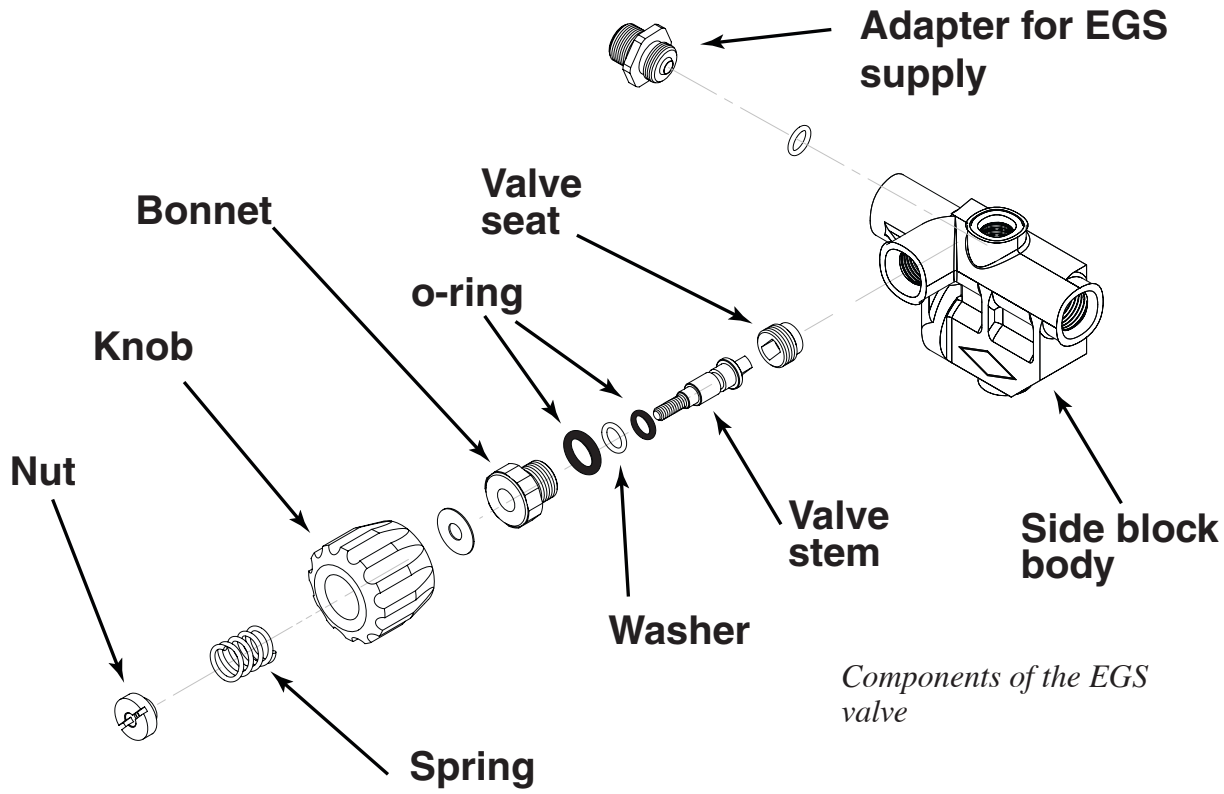
Replace the washer on the valve stem and make sure the o-ring is in its groove on the stem.

8) Install the spring and locknut. Tighten on the locknut until it is flush with the knob.

9) To test the valve, attach the supply whip from the EGS first stage to EGS mask valve.

10) Ensure the defogger valve knob is open and the EGS Valve is shut.

11) Pressurize EGS Valve to a minimum of 135 p.s.i.g. (9.3 bar) using the EGS cylinder as supply. Allow system pressure to stabilize , and then shut the EGS supply cylinder valve. Note time and final stabilized system pressure.



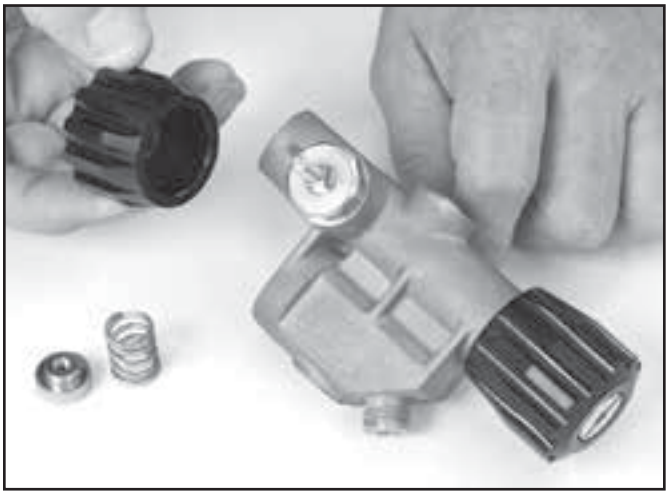
Components of the EGS valve

The valve stem must engage the seat properly.

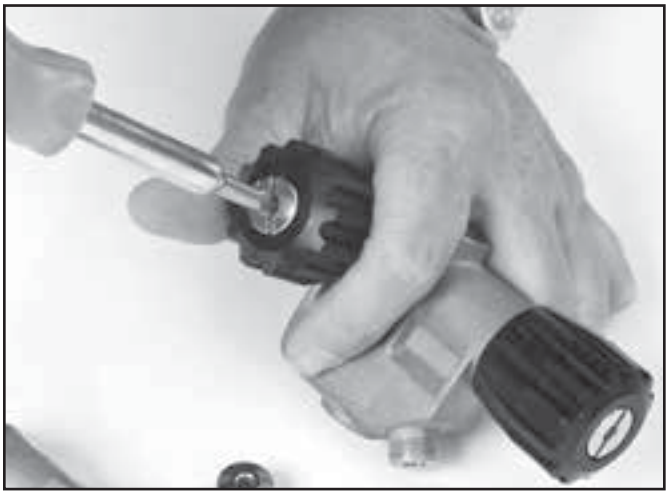
⚠ WARNING

A leaking Emergency Gas Valve assembly can cause the diver to exhaust his entire EGS (bailout) without his knowledge. This may lead the diver to mistakenly assume his EGS supply is available when it is not. This could lead to panic or drowning in an emergency. Any worn or damaged components must be replaced.

12) Perform the leak check for minimum of five minutes, using a mild soap solution. Ensure there is no gas flowing or pressure drop in the system. There should be no visible signs of external leakage if the valve is operating properly.



Remember to install the washer before you replace the valve handle.



Tighten the nut that holds the handle in place.

The properly assembled side block with the non-return valve and EGS adapter in position.

7.7 Bent Tube Assembly

7.7.1 General

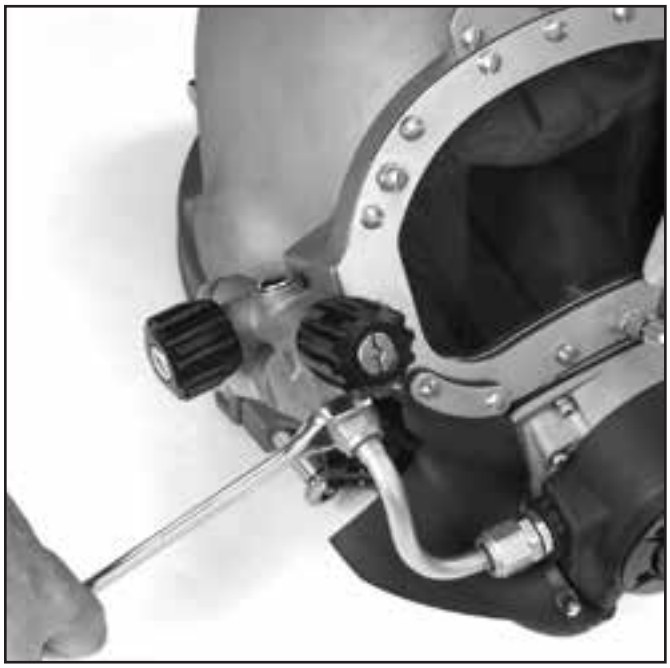
The bent tube assembly provides breathing gas flow from the side block assembly to the regulator assembly. Both ends of the bent tube assembly disconnect for complete removal. The o-ring and the Teflon® o-ring should be replaced during normal overhauls or any time these components are deemed unserviceable.

These components do not require replacement during field repairs providing a careful visual inspection does not reveal wear or damage. All soft goods should be carefully cleaned in accordance with KMDSI procedures prior to inspection for reuse.

7.7.2 Removal of the Bent Tube Assembly

Tools Required:
11/16 open end wrench
2 ea. 13/16 wrenches from tool kit

1) Always start removal at the side block end. Loosen the tube with the 11/16 inch wrench. The free swiveling mount nut on this end of the bent tube can be



Always start removal at the side block end.

unthreaded completely and can slide down the tube.

2) Loosen the lower bent tube nut by using the two 13/16 inch wrenches from the regulator tool kit. Place one wrench on the bent tube nut and the second on the nipple tube nut. Only turn the outer nut on the bent tube to loosen the bent tube.

The mount nut can then be rotated until free of the

Removing the bent tube.

regulator nipple tube threads. It can be pushed up the bent tube.

3) With the two mount nuts free; the bent tube assembly can be pulled straight out of the regulator inlet nipple. The bent tube assembly can be rotated back and forth to aid removal.

7.7.3 Inspection of Bent Tube Assembly

Clean the bent tube in accordance with the cleaning procedures in Chapter 6. The o-ring at the regulator end should be cleaned and inspected whenever the bent tube is removed.

Replace the bent tube if it is excessively scratched dented or compressed deeper than 1/8 inch. If the helmet has been used for burning jobs, carefully check for erosion of the metal or severe corrosion. Replace

Replace the o-ring on the bent tube if it is worn or damaged.

if any erosion is present or integrity is in question. Keep in mind the bent tube is a critical component that routes breathing gas to the regulator system.

7.7.4 Reinstallation of the Bent Tube Assembly

Tools Required:
11/16 inch Open-end Torque Wrench Attachment
Torque wrench
2 ea. 13/16 inch regulator adjustment wrenches

Normal minimum replacement parts during overhaul: o-ring, Teflon® ring

If a new bent tube is being installed or the side block has been removed, refer to the section on sideblock replacement for installation instructions.

1) Lightly lubricate the bent tube o-ring and install in the o-ring groove at the regulator end of the bent tube, then install new Teflon® o-ring at the side block end with the new ones supplied.

2) Push the o-ring end of the bent tube assembly into the regulator nipple tube. Slide it in until the side block end is aligned with the threads for the mount nut.

3) Be sure the new Teflon® o-ring is in place on the side block end of the bent tube then engage the threads to the side block and hand tighten.

4) Start the "regulator to bent tube" mount nut onto the nipple tube of the demand regulator and run it up by hand as far as it will go. Use a wrench on the nipple tube hex, if necessary, to prevent the nipple tube from threading inward. If the nipple tube threads inward

Tighten the bent tube to the proper torque value.

this can damage the sealing surface of the inlet valve.

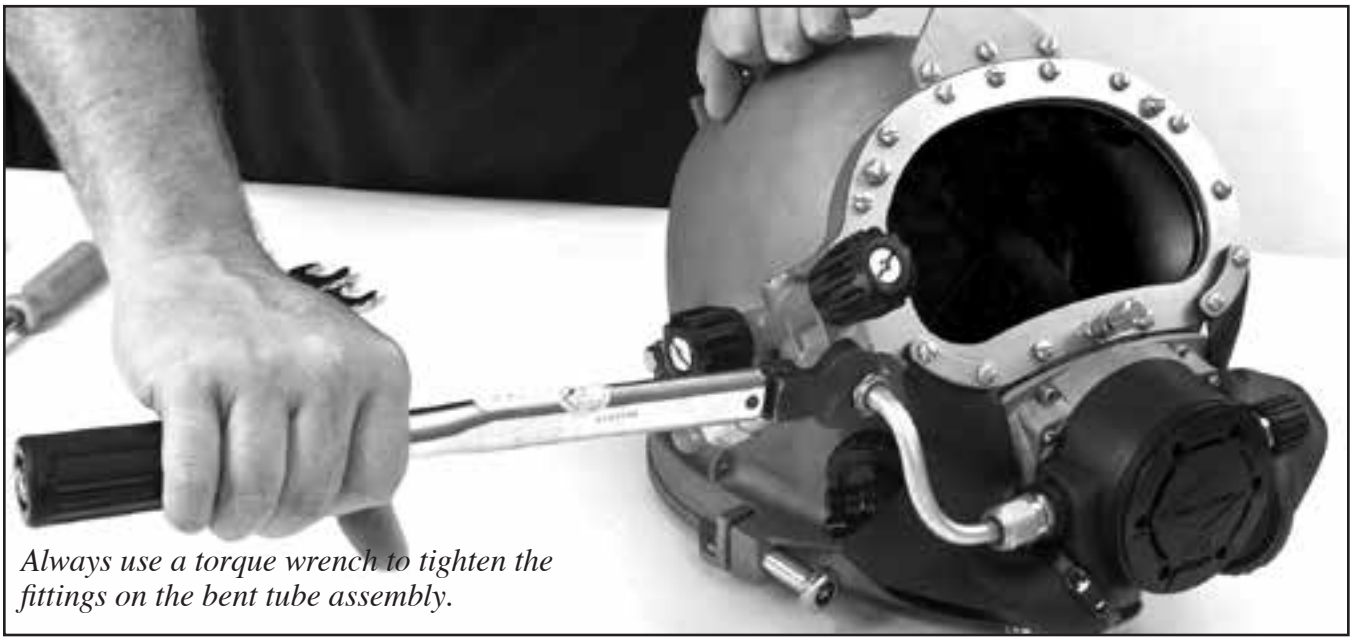
NOTE: Run the mount nut up on the inlet nipple hand tight only.

5) Using a torque wrench, tighten the bent tube assembly nut onto the side block to (100 inch lbs).

6) Hold the hex on the nipple tube with a wrench and tighten the jam nut against it with a torque wrench to 40 inch pounds.

⚠ CAUTION

The bent tube assembly for the KM77 is a unique design and is not interchangeable with the bent tube assembly used on other Kirby Morgan masks and helmets.



Always use a torque wrench to tighten the fittings on the bent tube assembly.

7.8 Demand Regulator & Exhaust System Overhaul

The Kirby Morgan 77 helmet uses a unique pod system. The pod is designed to serve as the mounting point for the regulator. Under normal conditions, it is not necessary to remove the pod to service the regulator.

Note that there are two different length pod mounting screws; six short screws and two longer screws. Also, some of the screw heads are positioned on the outside of the helmet shell, while others are on the inside.

The exhaust and dewatering valves are made of high grade silicone. The exhaust and dewatering valves are very durable and resilient however they should be replaced at least once a year or whenever inspection reveals any signs of damage or deterioration.

All o-rings should be replaced at least once a year or whenever damage/deterioration is present or suspected. In order to replace the main exhaust valve, the demand regulator must be removed from the helmet. Removing the regulator is not difficult if these instructions are followed.

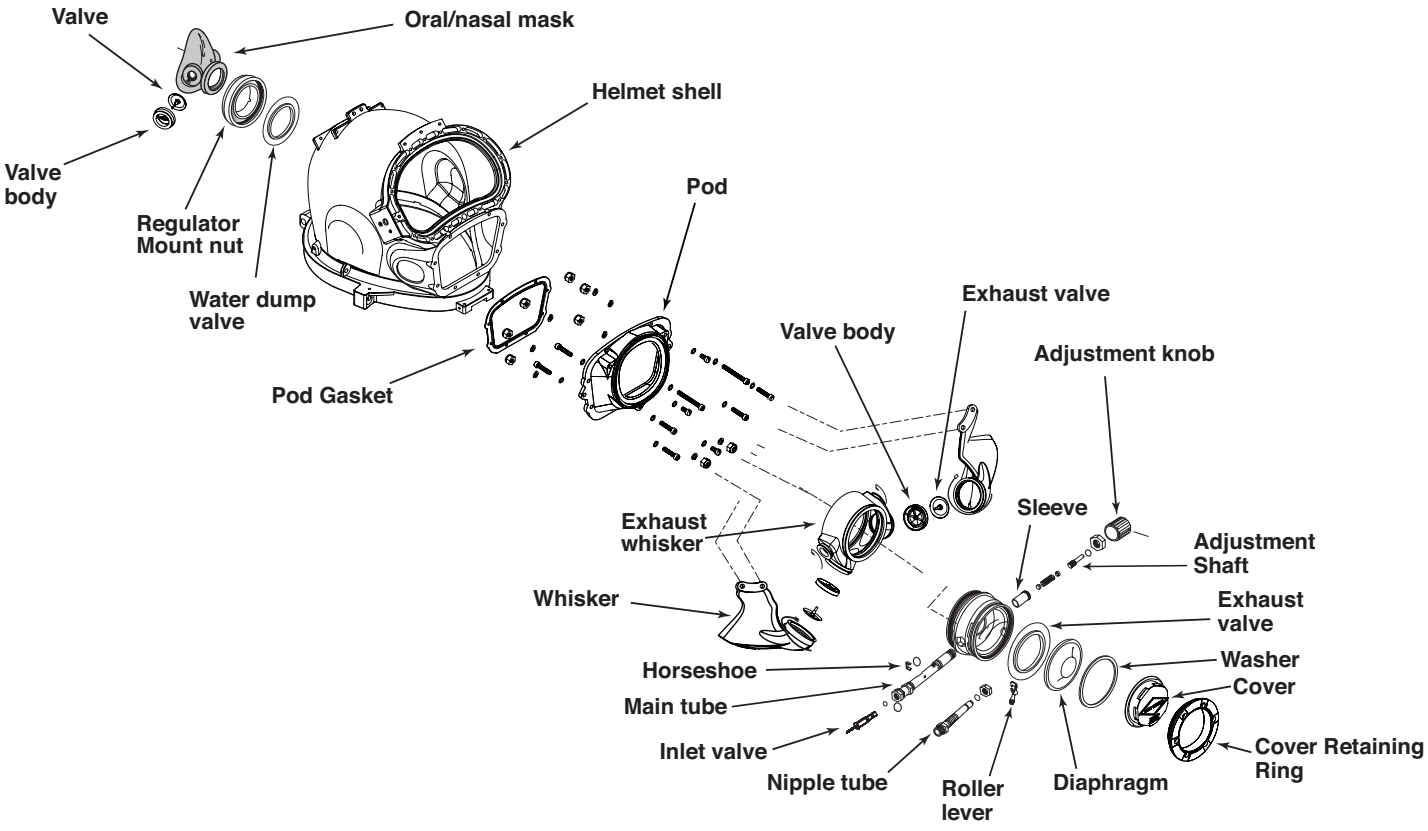
The regulator can be removed without removing the pod. However, during overhauls the pod should be removed for inspection and gasket replacement.

7.8.1 Pod System and Regulator Removal

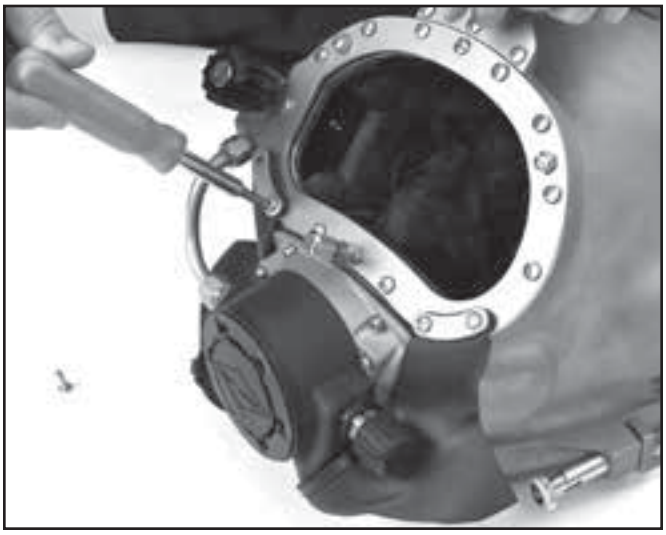
Tools required:
3/8” socket with driver
torque screwdriver with flat blade attachment
5/32 inch hex key

1) Remove the chin strap by removing the screws that secure it.

To remove the pod, start by removing the chin strap.



Blowapart of KM77 regulator with pod and oral/nasal mask.



Remove the screws that secure the kidney plates and whiskers.

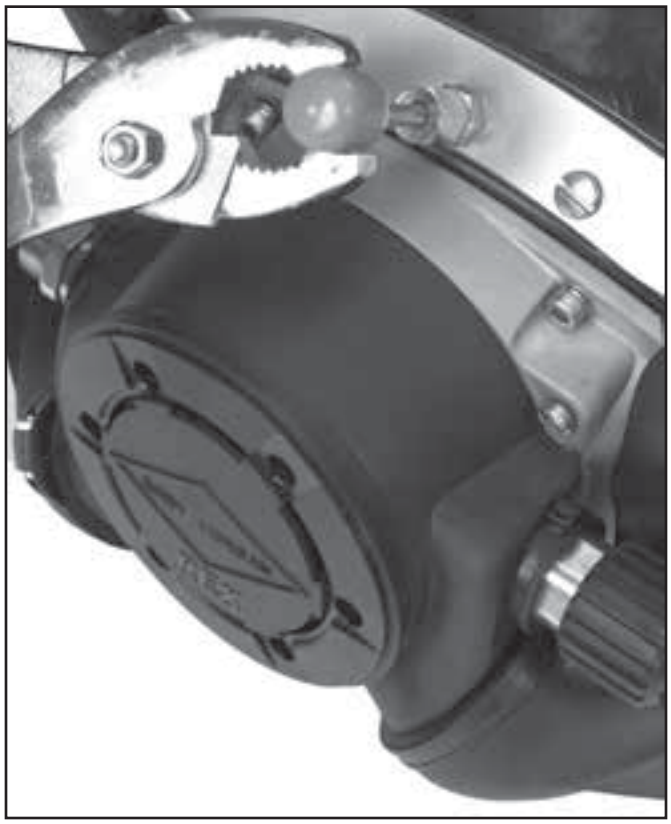
2) Remove the two snap tabs adjacent to the swing tongue catch assembly.

3) Remove the screws that secure the whisker to the port retainer. Take care not to lose the whisker spacers or kidney plates.

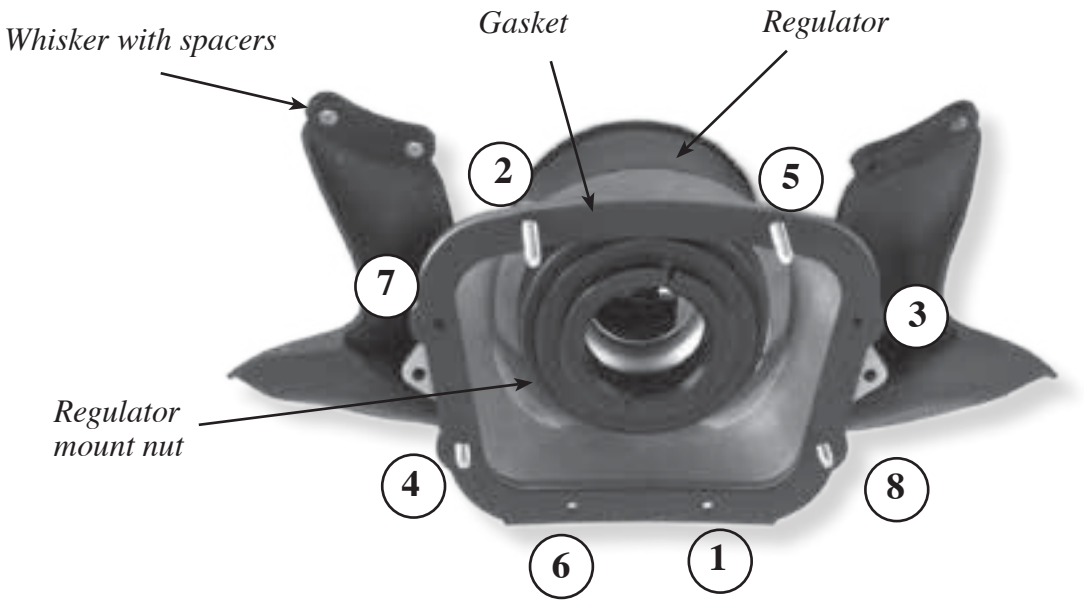
4) Remove the bent tube assembly as per this chapter.

5) Remove the nose block device as per Chapter 8.

6)Remove the microphone from the oral/nasal mask per Chapter 8.



Protect the nose block device knob with a plastic cap or rag when you remove it.



This photo shows the pod with the regulator attached as it appears from the inside of the helmet. The numbers indicate the order in which the bolts and nuts that retain the pod are loosened to disconnect the pod from the helmet. Loosen the bolts gradually, moving from one to another.

Remove the nose block device, microphone, and oral/nasal mask.

7) Remove the oral nasal mask by pulling it off the regulator mount nut.

8) Loosen the bolts gradually in a staggered pattern as shown on the previous page. This is much easier to do if you loosen the regulator mount nut so that the regulator is free to turn.

9) Note that the two longest bolts secure the nuts (and pod) just below the face port.

10) Note that the bottom two nuts attach on the exterior of the pod, while the remaining nuts attach on the interior of the pod.

11) Separate the pod/regulator assembly from the helmet assembly.

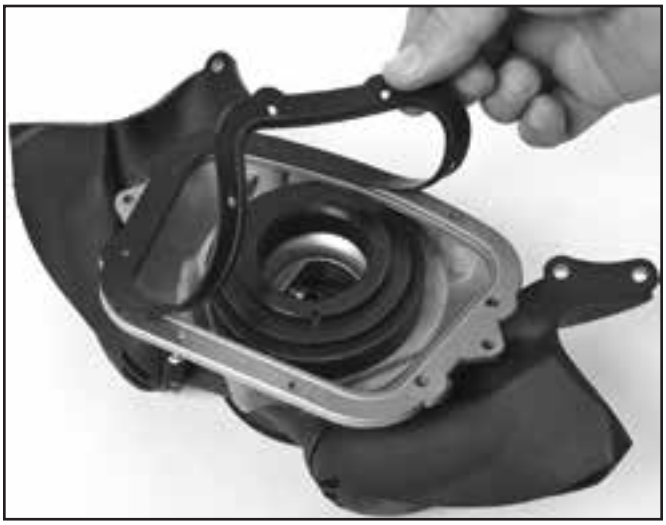
12) Remove the gasket for cleaning or replacement.

13) The locknuts may be reused, once. Be sure to replace them upon the next pod gasket inspection. Failure to replace with the second maintenance could result in an improper seal of the pod, or loosening of the fasteners.

Loosen the regulator mount nut to make it easier to remove the pod.

Remove lock nut number 2.

Separate the pod./regulator assembly from the helmet shell.



Remove the gasket for cleaning or replacement. Note the ridge on the gasket. This ridge is designed to help maintain the proper position of the gasket in the groove in the pod.

Removal of the regulator mount nut.

7.8.2 Removal of Regulator Alone

In most circumstances, it is not essential to remove the pod if you need to service the regulator. To remove the regulator by itself, use the following procedure.

1) Remove the bent tube assembly. See the section in this chapter for the proper procedure.

2) Remove the screws that secure the whisker to the port. Take care not to lose the kidney plate, screws, or whisker spacers.

Take care not to lose the whisker spacers.

3) Remove the oral nasal mask following the procedure in this chapter.

4) Loosen the regulator mount nut. *Note: The nut cannot be removed with any of the regulator mounting threads engaged. The regulator should be pulled from the pod as the mount nut is being loosened.*

5) Pull the regulator body away from the helmet.

7.8.3 Regulator Disassembly

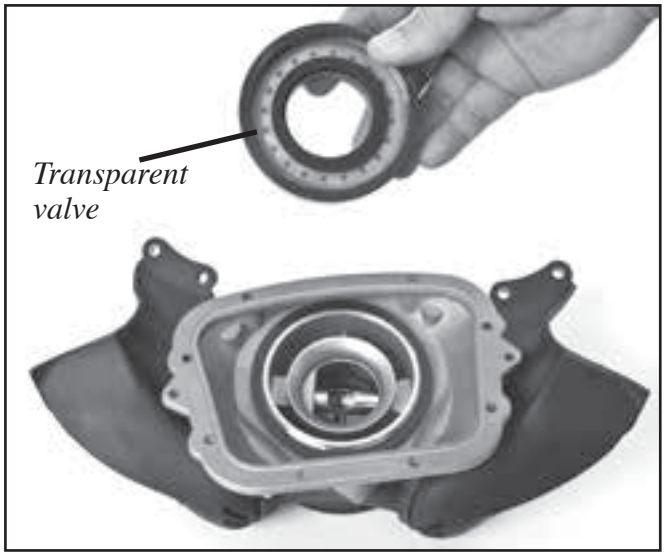
Required Tools:
Tweezers
Small Phillips head screwdriver
Kirby Morgan REX® cover removal tool
Open end wrench

1) Using tweezers if necessary, remove the dewatering valve from the regulator retainer nut. If performing an overhaul replace the valve, if performing a cleaning, carefully clean and inspect for tears cuts or deterioration, replace if any damage is found or suspected. Clean the retaining nut then rinse and inspect.

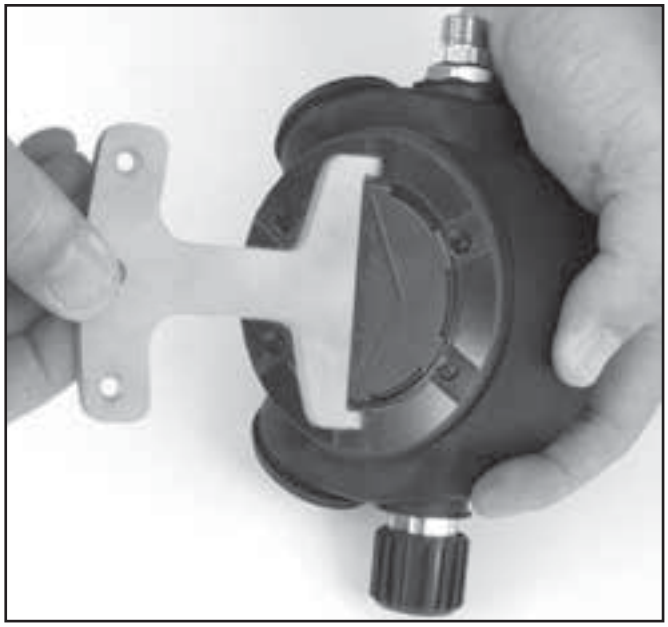
2) Be sure to note position of the whiskers relative to the exhaust main body for proper reassembly. (You can mark these with a permanent marker.) Using small cutting pliers, carefully cut & remove the two tie wraps then pull the whiskers away from the main exhaust body

3) Remove the whisker valve assemblies from each of the exhaust whiskers.

4) Using side cutters, cut the two small tie wraps - the one on the adjustment side and one on the inlet nipple side.



Removal of the regulator mount nut exposes the water dump valve. Note that this valve is made from a clear silicone, which can be difficult to see.



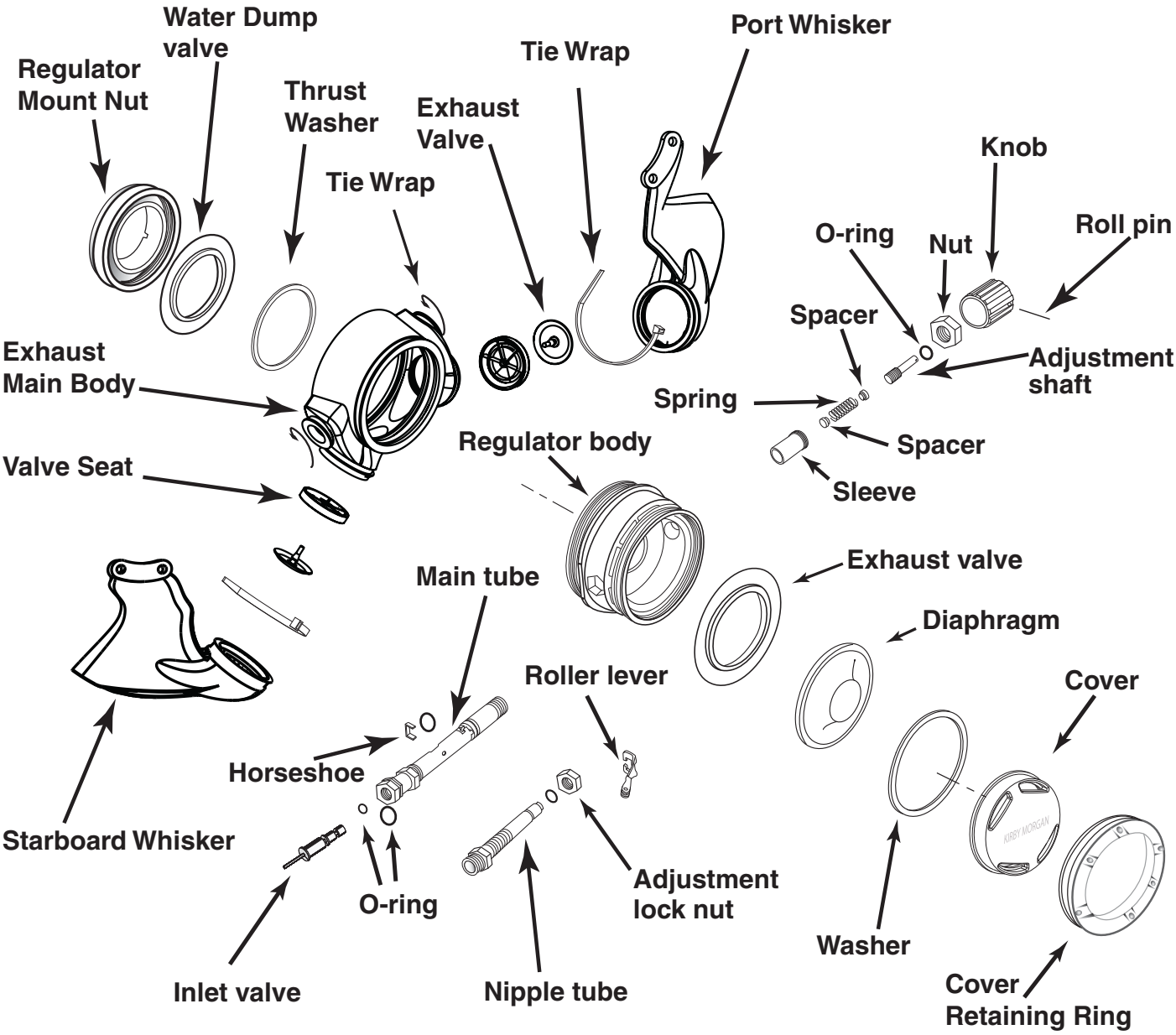
Use the special tool to loosen the cover retaining ring.

Remove the cover retaining ring.

5) Using the regulator cover ring tool, loosen and remove the cover ring. Peel the cover back and remove the cover, washer, and diaphragm.

6) Loosen the adjustment shaft packing nut then remove the adjustment knob and shaft assembly then tilt the regulator and shake out the spring and two spring spacers.

7) Loosen the nipple tube lock nut, then unscrew and remove the nipple tube. Note: Take care not to damage the knife edge of the nipple tube.



Blowapart drawing of the REX® regulator.

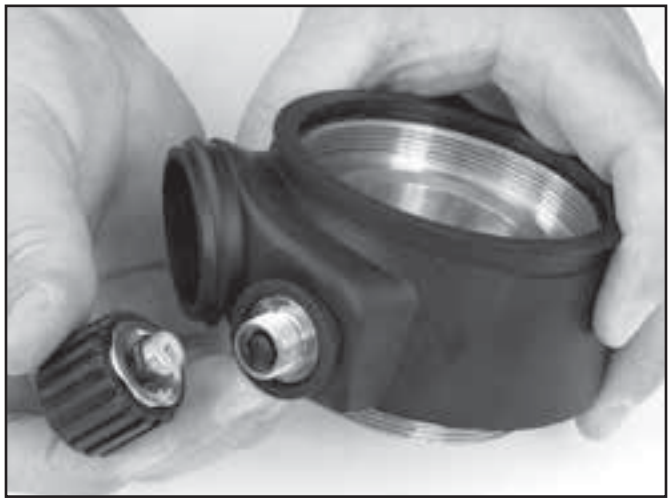
Remove the thrust washer and diaphragm.

Remove the port and starboard exhausts. Be sure to take note of the correct orientation of the valves. They must exhaust when you exhale into the regulator.

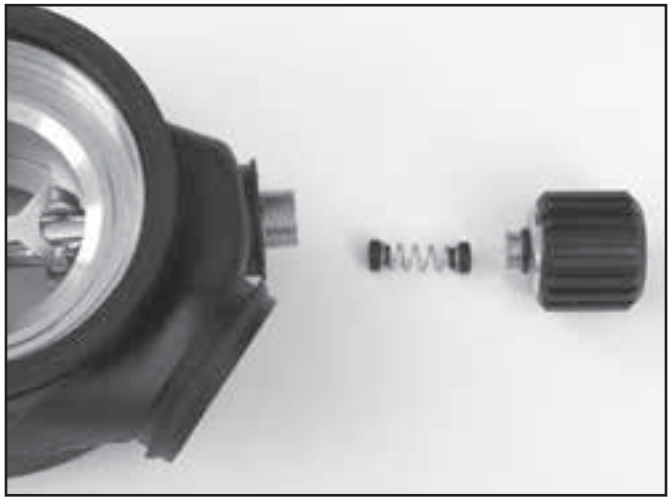
8) Press in on the adjustment side of the main tube until the horseshoe is in the center of the regulator body then remove the horseshoe by pulling it off the main tube.

9) After removal of the horseshoe, the roller lever can be removed. Tilt the regulator towards the bent tube side and remove the balance poppet.

Loosen the regulator adjustment knob and remove.



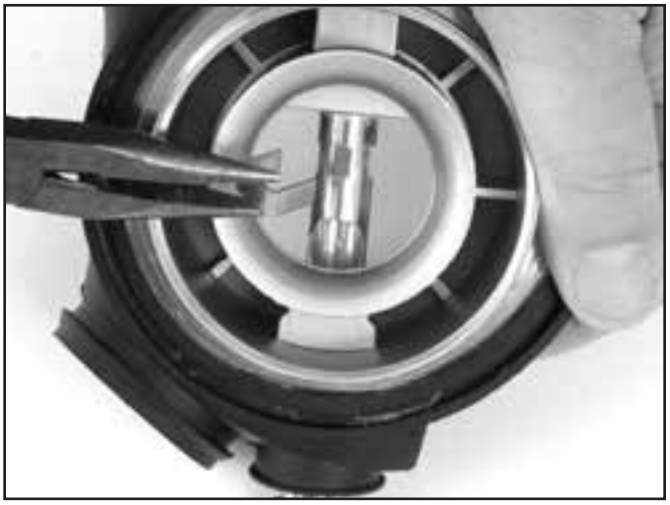
Remove the adjustment knob from the regulator body.



The adjustment assembly including the sprint and spacers.

Loosen the nipple tube jam nut to remove the tube.

Carefully remove the nipple tube.



Remove the horseshoe prior to attempting to remove the roller lever.

Removing the inlet valve.

You can remove the main tube if it needs attention.

10) Shake out the inlet valve, it will drop through the inlet nipple side of the tube.

Note: During regular cleaning and inspection, the whisker valves do not need to be removed from the plastic exhaust valve seats. If a routine overhaul is being performed, the valves should be replaced. As long as the plastic valve bodies show no signs of damage and deterioration they can be reused.

11) Carefully remove each plastic valve cage with the silicone valve still installed.

12) Clean and inspect both valve assemblies and carefully inspect. The silicone valves should be smooth and flat, and when lifted away from the seat should snap firmly into place. The seats should be smooth and straight.

If the exhaust whisker cover is cracked or damaged it should be removed and replaced.

Remove the sleeve from the exhaust whisker cover if it needs cleaning or you are replacing the exhaust whisker body.

Replace any items that show signs of damage or deterioration. Always replace the valves during scheduled overhauls. ***Note: If you need to replace just the silicone seat on the inlet valve, this part must be glued to the inlet valve and allowed to dry for 12 hours prior to reassembly.***

13) Pull the main tube from the body and set aside.

14) Push the regulator body through the whisker cover and set aside.

15) Using tweezers, grab the exhaust valve and pull over and off the regulator body.

16) You will need to remove the sleeve if you are replacing the exhaust whisker body.

7.9 Cleaning REX® Regulator Parts

7.9.1 Precautions for Cleaning

The inlet valve of the REX® requires frequent cleaning and lubrication due to the exacting tolerances of the inlet valve mechanism. Once familiar with this procedure the task can be accomplished in about 10-15 minutes. The following procedure is intended as a routine maintenance of the inlet valve mechanism. If an annual overhaul is being done, replacement of all O-rings is required.

⚠ CAUTION

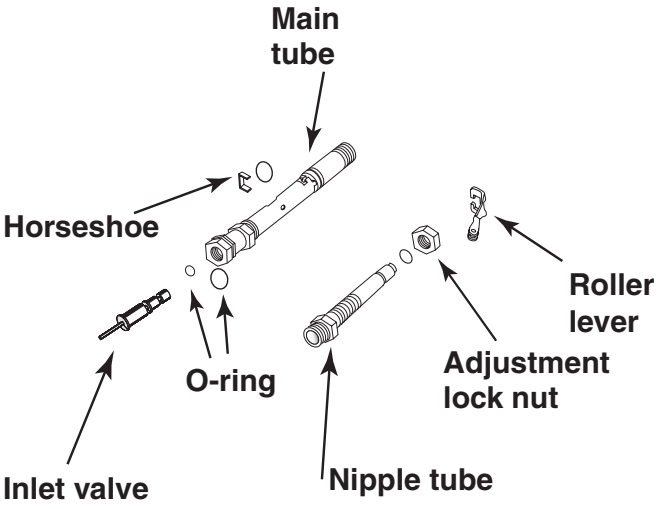
Use only mild soap such as hand dish washing soap. Use only a tube brush that does not have an exposed metal tip, or use an all plastic brush. A tube brush with hard metal components could scratch the plated surface of the balance chamber.

7.9.2 Cleaning Instructions

1) Remove the O-rings from the main tube, inlet valve, adjustment shaft, inlet nipple.

2) Using a wooden tooth pick, carefully remove the inlet valve soft seat from the inlet valve. Inspect the inlet valve for excess wear or damage. Follow replacement procedures if necessary. If the seat looks acceptable, simply clean and re-lubricate prior to reassembly.

3) Carefully clean all regulator components using a solution of dish soap and water, remove corrosion by soaking for 15-30 minutes in a 50/50 solution of vinegar and water. A tube brush should be used to clean the inside of the main tube.



Use extreme care when cleaning the nipple tube and main tube to avoid damage.

Use care not to scratch the metal surfaces with the end of the tube brush. Use a soft nylon brush on all other surfaces. After cleaning rinse thoroughly with warm fresh water and blow or air dry.

4) Lay out all components and carefully inspect using a bright white light for signs of damage, replace any components in question, re-clean any components that show signs of contamination.

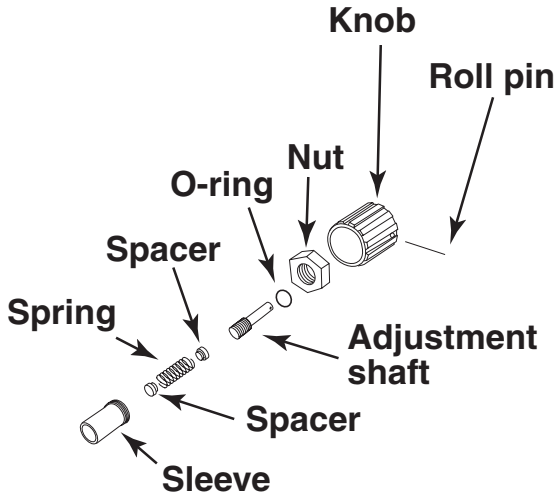
When completing a scheduled overhaul, always replace the diaphragm, exhaust valves, o-rings. Replace any and all components that show signs of wear or damage.

5) Inspect the inlet valve to ensure the area where the soft seat lays is clean and free of old silicone sealant. If damage to the inlet valve seat is discovered, the seat can be replaced to return the assembly to good working order. Use a wooden toothpick to clean out the small vent hole of old silicone sealant.

Note: If you are replacing the inlet valve seat, be sure to perform this step at least 12 hours prior to rebuilding the regulator, so the silicone sealant will have time to dry.

⚠ CAUTION

Use extreme caution when cleaning the balance chamber. A brush with hard metal components could damage the balance chamber.



The adjustment system must be clean and properly lubricated to turn freely.

7.10 REX® Regulator Re-Assembly

1) Note: If you are replacing the inlet valve seat, this must be done at least 12 hours before installing it in the regulator. Place a very thin film of silicone sealant on one side of the inlet soft seat then install it sealant side down onto the inlet valve and press firmly and evenly to fully seat. The sealant must be allowed to dry completely (at least 12 hours) before re-installing and adjusting.

2) Install the o-ring onto the inlet valve, then lightly lubricate.

3) Install the exhaust valve onto the regulator body. Ensure that the valve is not wrinkled and lays flat against the seat area. Make certain this valve is not installed upside down. Check proper positioning and seating by blowing clean air up through the valve. Be certain the valve does not stick open after doing so.

4) Insert the sleeve into the left side of the exhaust whisker body. Make certain the groove in the sleeve aligns with the mating rubber area of the whisker main body to allow proper sealing. When properly installed, the end of the sleeve will be just inboard of the main body end.

5) Hold the exhaust whisker body so the two valve ports are facing down and the large opening on the back side is facing you. Install the regulator body into the main exhaust body with the round inlet tube hole

⚠ CAUTION

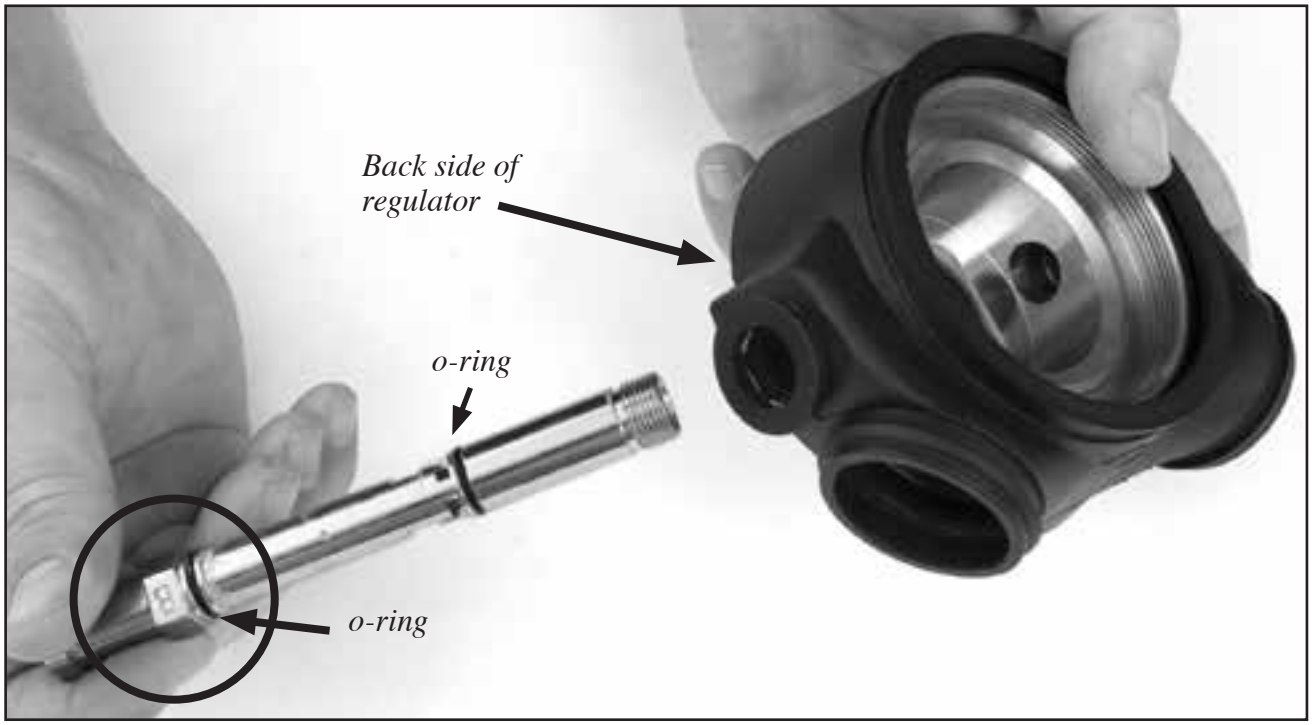
Use good ventilation when using RTV sealant. Fumes from this material may irritate your lungs. Read and follow the directions in the MSDS before using this material.

⚠ CAUTION

Wear hand protection when using RTV sealant. This material may irritate your skin. Read and follow the directions in the MSDS before using this material

⚠ CAUTION

Wear eye protection when using RTV sealant. This material may irritate your eyes. Read and follow the directions in the MSDS before using this material.



Note the engraved letter "B" on the main tube. It must face outwards, away from the helmet to be installed properly.

If you install a new seat on the inlet valve, you must allow the silicone sealant time to dry. Be sure the o-ring is properly installed on the valve body.

The lever is installed after the horseshoe is installed.

Installing the nipple tube.

on the left as you are looking into the body.

6) Lightly lubricate the two main tube o-rings and install on the main tube.

7) Install the main tube into the regulator body by installing the male threaded end into the side opposite of the spacer tube installed previously. Push the tube in far enough to allow installation of the horseshoe. Rotate the main tube so the small vent hole at the middle of the tube will be facing up towards the diaphragm.

8) Install the inlet valve into the inlet side of the main tube with the soft seat facing out. Ensure the valve is fully seated. Tilt the regulator up and shake as needed to position the inlet valve properly into the tube to accept the lever arm.

9) Install the lever into the main tube insuring to engage the slot in the inlet valve.

10) Press the main tube all the way into the body until the lever legs are up against the inside wall of the regulator body. To check for proper engagement, try shaking the inlet valve loose by tilting the regulator up and shaking it. If the inlet valve falls out, it was

not properly engaged.

11) Lightly lubricate and install a new o-ring onto the nipple rube, then install the nipple tube and rotate inwards for about 1/4 inch.

12) Lightly lubricate the two spring pads (spacers), and install them on both ends of the regulator adjustment spring. Insert this assembly into the adjustment side of the main tube. This is best accomplished if you hold the regulator so that the tube is vertical and the spacers and spring are pushed up into the tube.

13) Carefully inspect the threads on the adjustment shaft for damage then lubricate and install a new o-ring over the threads onto the shaft.

14) Place a small amount of lubricant on the threads of the adjustment side of the main tube, then engage and install the adjustment shaft to the main tube as well as the packing nut onto the main tube. Run the adjustment shaft all the way in while at the same time rotating the packing nut all the way onto the main tube. Make sure the adjustment knob is turned in far enough, so only enough of the packing nut is exposed to accept a wrench to fit it.

15) Tighten the regulator packing nut to 40 inch lbs.

16) Make sure the rubber on the whisker body properly fits the matching groove on the main tube at the inlet side of the regulator. Install new tie wraps on both the adjustment and inlet sides of the exhaust whisker where it joins the main tube, securely tighten then using side cutters cut the excess tie wrap material.

17) Inspect the regulator mount nut for contamination and damage. Use a tooth brush to clean threads as needed, then install a new de-watering valve. Take your time and make sure it is properly seated.

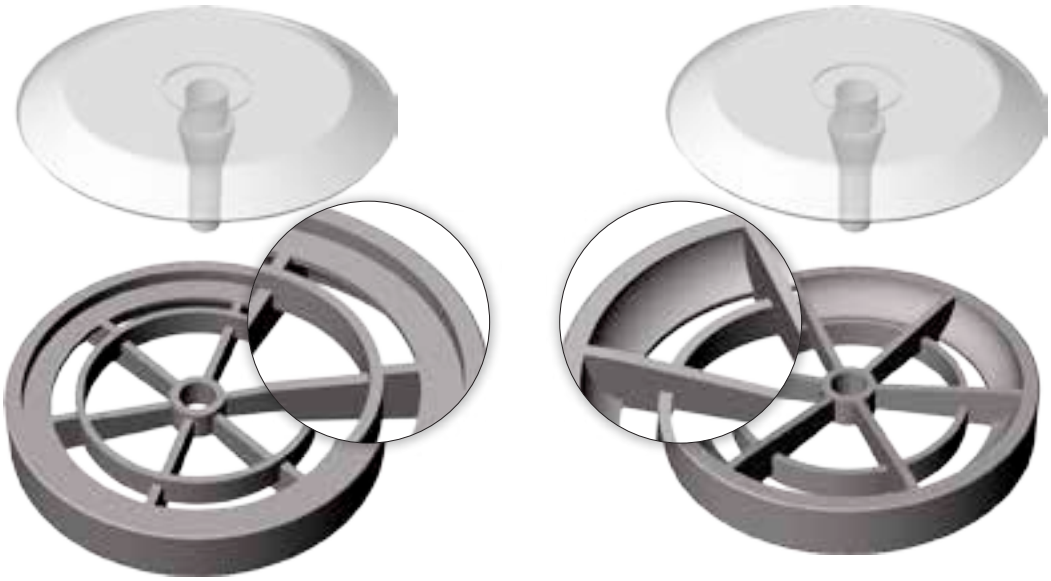
18) Carefully inspect the bent tube for damage and contamination. The bent tube must be free of dents and compressions deeper than 1/8” and should have deep scratches or sever corrosion.

Replace the bent tube if questionable. Lightly lubricate a new o-ring and install on the regulator end of the bent tube. Install a new Teflon® washer on the side block end.

19) Inspect the whisker valve plastic bodies for damage and contamination. Install new valves ensuring

The spring and spacers must be properly engaged.

Tighten the packing nut on the adjustment knob.



Correct **WRONG**

The exhaust valve inserts are recessed on one side to accept the exhaust valves so they sit flush in the inserts. The exhaust valves must be installed properly in the inserts or they will not seal or perform properly.

they are installed onto the correct side of the plastic body.

20) Install the whisker valve assemblies into the whisker main body. Refer to the notation or marks made when the parts were disassembled.

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

Place tie-wraps around the tie wrap grooves in each of

⚠ 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.

The port and starboard whiskers should align with the whisker covering the regulator body so that the mold lines are in alignment. You can also make marks on the whiskers with a felt tip pen.

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.

22) Screw the regulator adjustment knob in clockwise all the way, then rotate it out counter clockwise three turns.

23) Position the regulator so the lever arm is pointing upwards. Slowly rotate the inlet nipple in clockwise until a very slight movement is noticed at the roller lever then stop. Lightly tighten the jam nut to prevent movement of the nipple tube.

Note: Be certain the regulator cover, washer, diaphragm, and exhaust valve are not in place before installing the regulator assembly, otherwise there may be problems aligning the whisker main body.

24) Install the washer and regulator assembly into the helmet pod, and thread the regulator mount nut, as you feed the regulator assembly into the pod, but just hand tight.

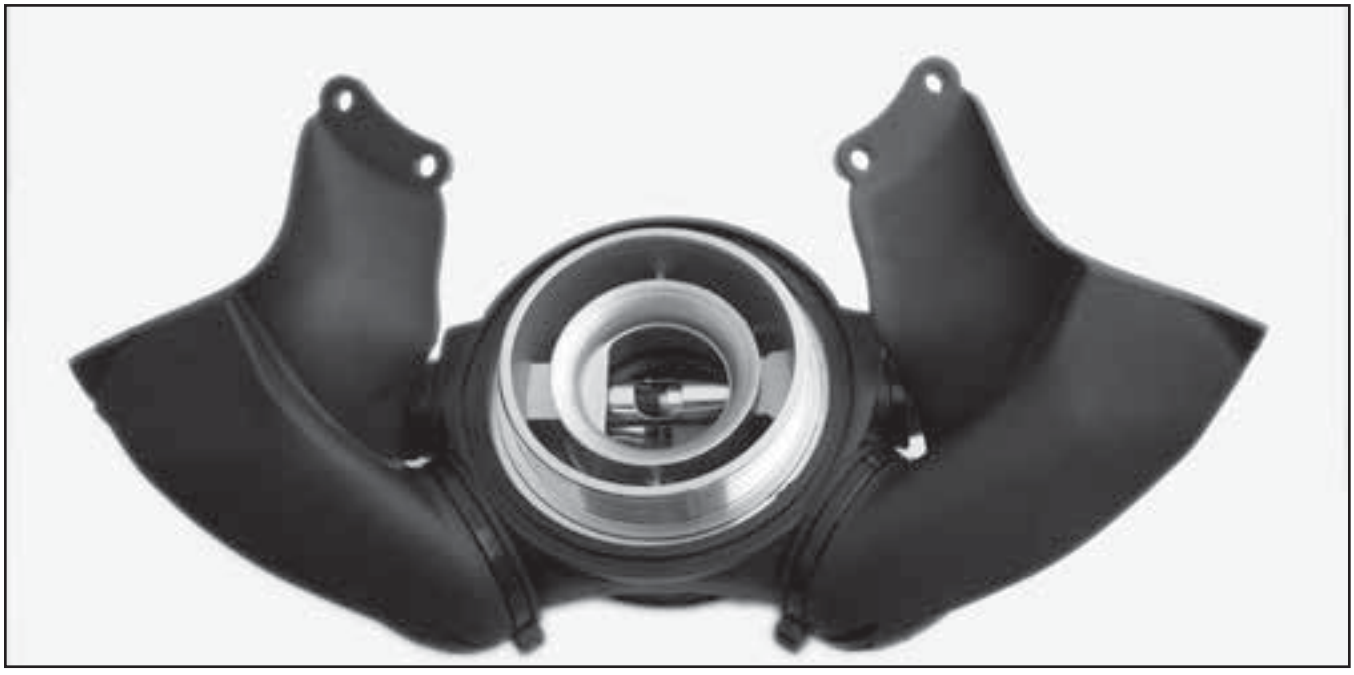
25) Work around the edge of the whisker where it meets the helmet shell to align the rubber grooves at the back of the whisker, to the grooves on the pod. The whisker should have a straight angled surface from the pod towards the outer edge of the regulator. Loosen the mount nut as needed if re-alignment is necessary. Once the regulator is correctly positioned, finish tightening the mount nut to 80 inch pounds.

26) Reinstall the pod on the helmet if it is not already in position. See the section in this chapter on pod installation

27) Install the bent tube into the inlet nipple, 3 or 4 turns. If needed, turn the regulator assembly on the helmet to allow alignment of the bent tube to the side block.

28) Lightly lubricate the male threads on the side block and swing the bent tube up into place and torque the bent tube to the side block. Using the two 13/16 inch wrenches from the regulator tool kit, hold the nipple tube to prevent it from rotating and tighten the bent tube nut against the nipple tube.

29) Install the diaphragm, thrust washer, flexible cover and cover ring to the regulator assy using the special spanner wrench, as shown.



This is how the whiskers should look when they are properly installed on the regulator.

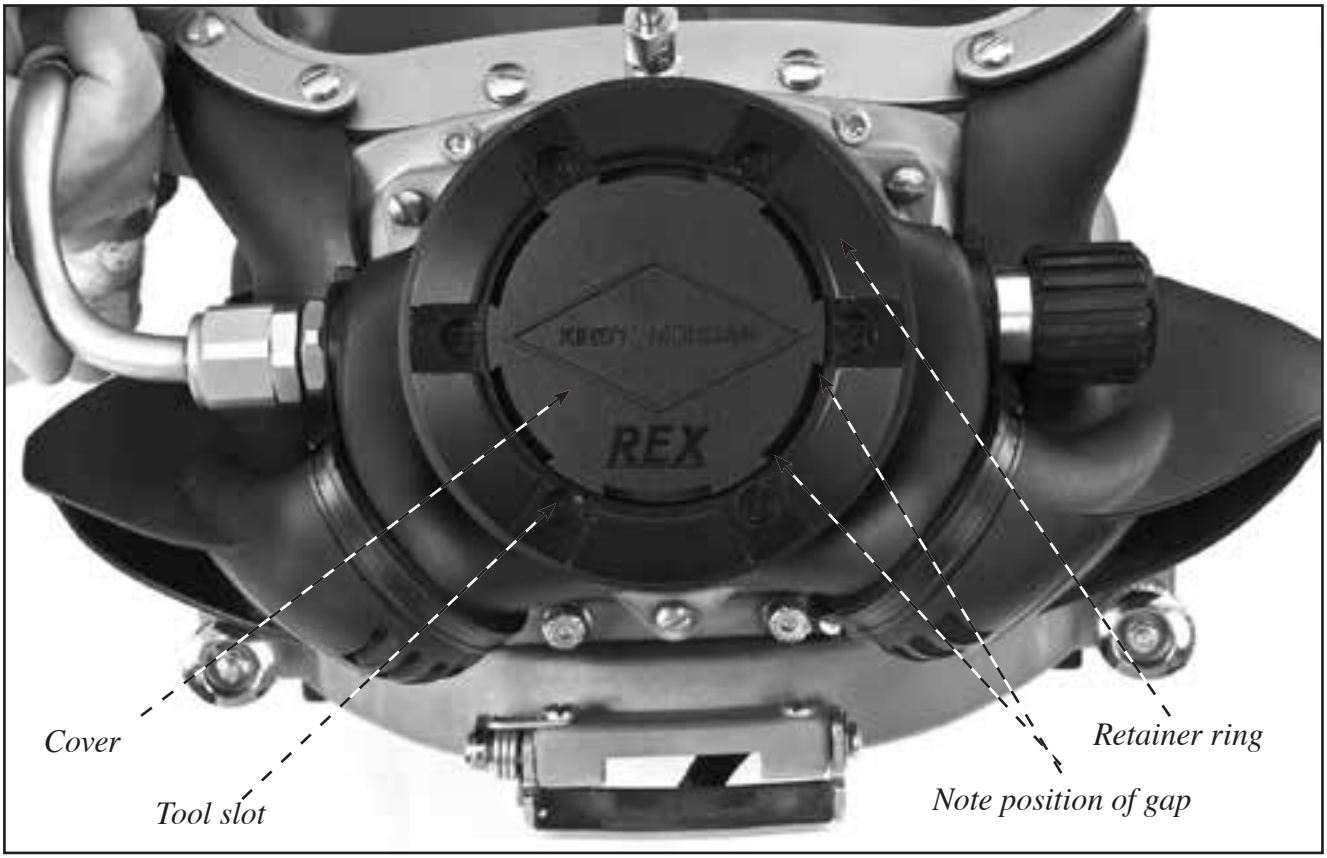
Make sure the whisker that surrounds the regulator body captures the cover retaining ring.

The closed sections of the cover should align with the indentations in the retaining ring. See the photo on the next page for a more detailed illustration of the proper relationship between the cover and the retaining ring.

⚠ WARNING

It is essential to ensure that the whisker encloses the outer lip of the regulator ring. If this does not happen, the retainer ring could possibly come unscrewed underwater. This would allow the diaphragm to fall out and the helmet would flood. This could lead to serious personal injury or death.

Be sure to tighten the regulator mount nut to the proper torque specification when the installation is complete.



The REX® regulator must be properly assembled and installed for it to function correctly. Note the position of the regulator cover relative to the outer retaining ring. The gaps on the edge of regulator cover must be centered between the holes on the regulator retainer ring.

7.11 Testing the REX® Demand Regulator for Proper Adjustment

Tools Required:
KM47 Regulator adjustment tools
Low pressure air source

Adjustment of the demand regulator should be done using a supply pressure of between 135-140 p.s.i.g. Use only breathing quality air with a regulated source.

1) Ensure that the steady flow defogger valve is fully shut.

2) With the regulator cover and diaphragm off. Run the bias adjustment knob all the way in, then back it out three turns.

3) Turn the inlet nipple adjustment, OUT, "Counter Clockwise" just enough to remove any play in the lever arm, Then to get the proper lever arm setting, turn the nipple tube adjustment IN, "Clockwise" slowly until the lever just starts to move then stop and hand tighten the jam nut against the regulator body to stop the inlet valve from turning.

4) Slowly bring up the air pressure supply to between 135-150 p.s.i.g.

5) Back out on the bias adjustment knob, counter-clockwise until a slight free flow starts then turn in clockwise until the flow stops and check the lever play. The lever should have between 1/16"-1/8" of free play (1.5-3mm).

6) To increase lever play, turn the inlet nipple in, to decrease play rotate the inlet nipple out. Once adjustment is achieved, securely tighten the inlet nipple jam nut against the regulator body.

The low pressure air source must be adjustable over a range from 135-150 p.s.i.

The regulator can be adjusted when it is on the helmet.

Check the adjustment of the regulator using the regulator adjustment knob.

Repeat step 5 and 6 as necessary.

7) Make certain the bent tube fitting is snug against the hex on the nipple tube by again using two 13/16" wrenches. Re-check the purge adjustment and re-adjust if needed.

8) Check for proper free flow. Turning the adjustment knob out till free flow then back in until it stops.

7.11.1 REX® Adjustment Troubleshooting

Problem:
Regulator hisses and will not shut off.

Remedy: Check to ensure the lever has between 1/6 inch and 1/8 inch play. To increase lever play rotate the inlet nipple in clockwise.

Remedy: After checking for lever play, secure the air source. Remove the inlet nipple and check for nicks or flaws on the tip. Replace if needed and re-test. If leak persists, check the inlet seat for damage, check for damaged piston o-ring.

Problem: Bent tube damaged causing the nipple tube to be improperly aligned.

Remedy: Replace bent tube.

Problem:
Depressing the regulator cover results in little or no flow.

Remedy: Slowly back out counterclockwise on the inlet nipple 1/8 turn, re-check, readjust as necessary.

7.12 Oral/Nasal Mask

7.12.1 Oral/Nasal Removal

Tools Required:
7/16 inch Open-end Wrench

The oral/nasal mask is easily replaced.

1) Remove the nose block device first. See Chapter 8 for this procedure.

⚠ CAUTION

The nose block device MUST be removed and reinstalled when installing a new oral nasal mask. Simply stretching the oral nasal mask over the nose block device can cause the oral nasal mask to tear.

2) Remove the microphone.

3) The oral/nasal mask can then be pulled off the regulator mount nut. It is held on by a snap fit.

7.12.2 Inspection of Oral/Nasal

1) Inspect the oral/nasal mask. If it is torn, damaged or aged it must be replaced.

2) Inspect the oral/nasal valve. If the valve is in good condition, it may be reused.

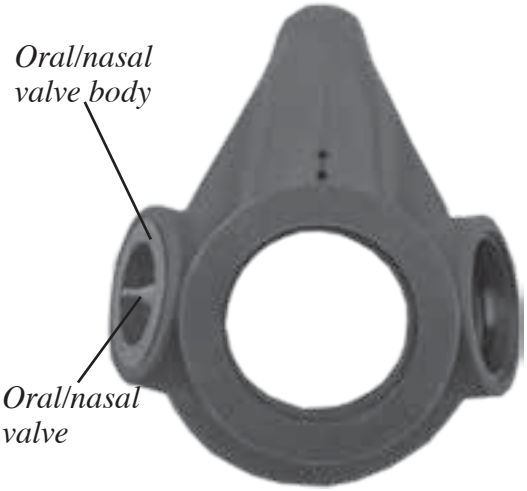
7.12.3 Oral/Nasal Replacement

1) Install the oral/nasal valve body and valve in the oral/nasal mask. This valve helps to reduce carbon dioxide in the helmet and must be in place. Make sure it is installed so the flow is in the proper direction. See the drawing and photo on this page.

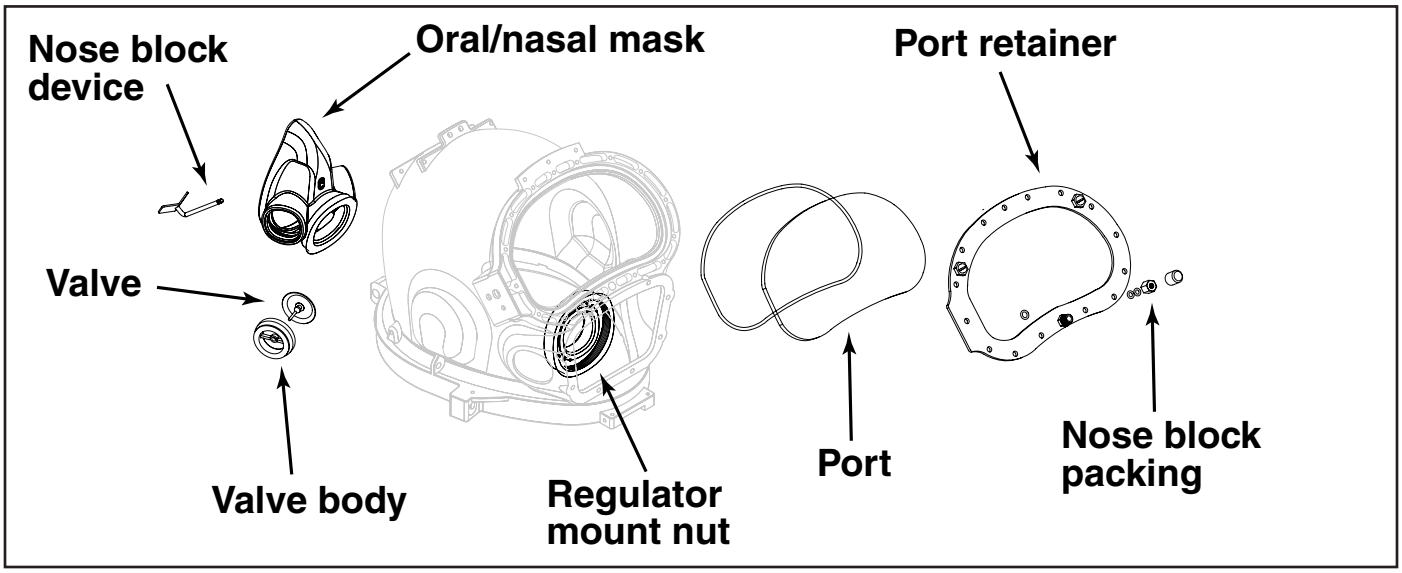
2) Snap the oral/nasal over the regulator mount nut. There is a tight fit between the mask and the pod at the top of the pod. Take extra care to make sure the mask has snapped in position all the way around the mount nut.

3) Reinstall the microphone.

4) Reinstall the nose block device. See Chapter 8 for complete instructions on reinstalling the nose block device.



The exhaust valve must be in place in the oral/nasal valve body and the assembly properly installed in the oral/nasal mask.



The oral nasal mask and the parts associated with it are easy to access.

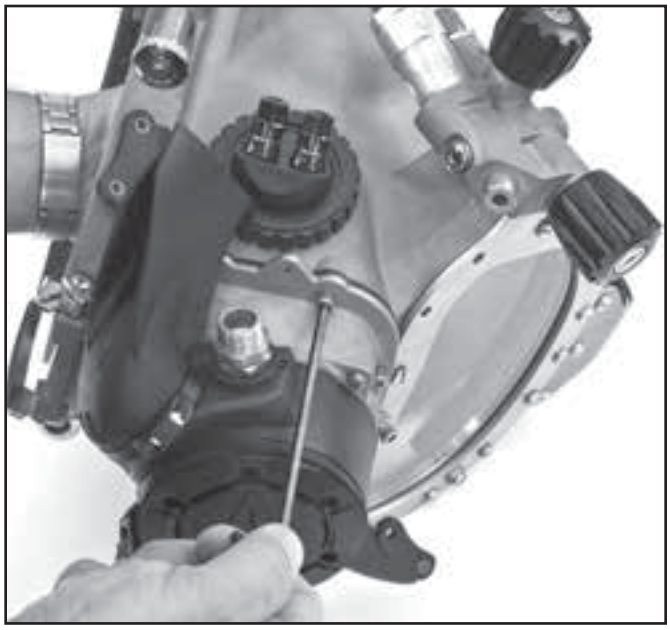
7.13 Reinstalling the Pod on the Helmet

Required Tools:
3/8" socket with driver
torque screwdriver with flat blade attachment
5/32 inch hex key
3/8 inch open end wrench

1) Install the gasket on the pod. Make sure that the ridge on the gasket is properly seated in the groove in the pod.

2) Install all of the Allen screws and washers through the pod and gasket, with the exception of the bottom two. The screws will help to align the pod and gasket to the helmet.

Note that there are eight screws that secure the pod to the helmet. Six screws are "short" while two are "long." The two longer screws are installed in the top two holes in the pod.



Tighten the nuts in a staggered pattern.

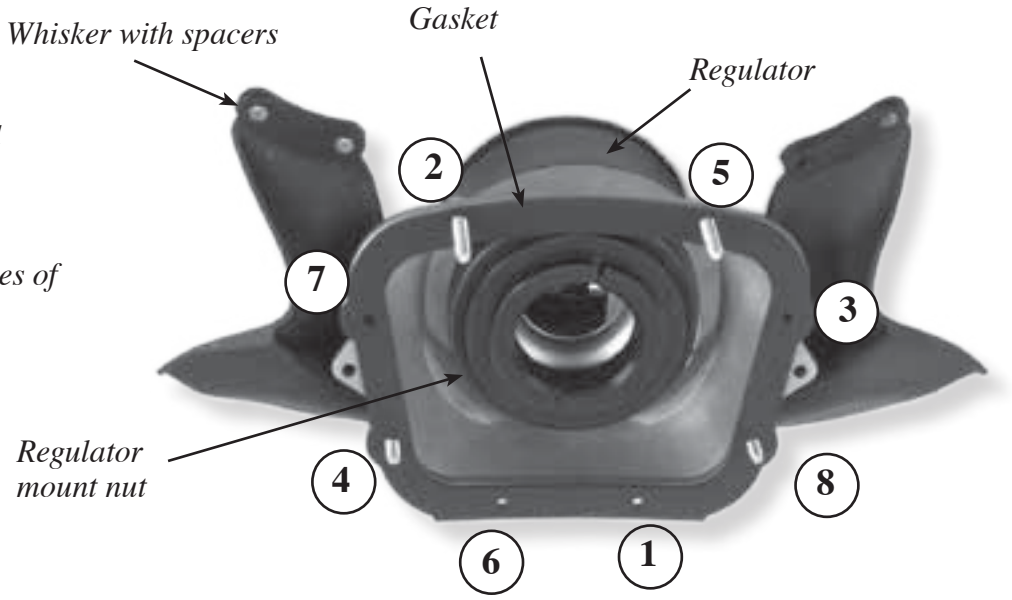
Remember that the two long bolts are installed in the top two holes of the pod, between the top of the regulator cover and the port retainer.

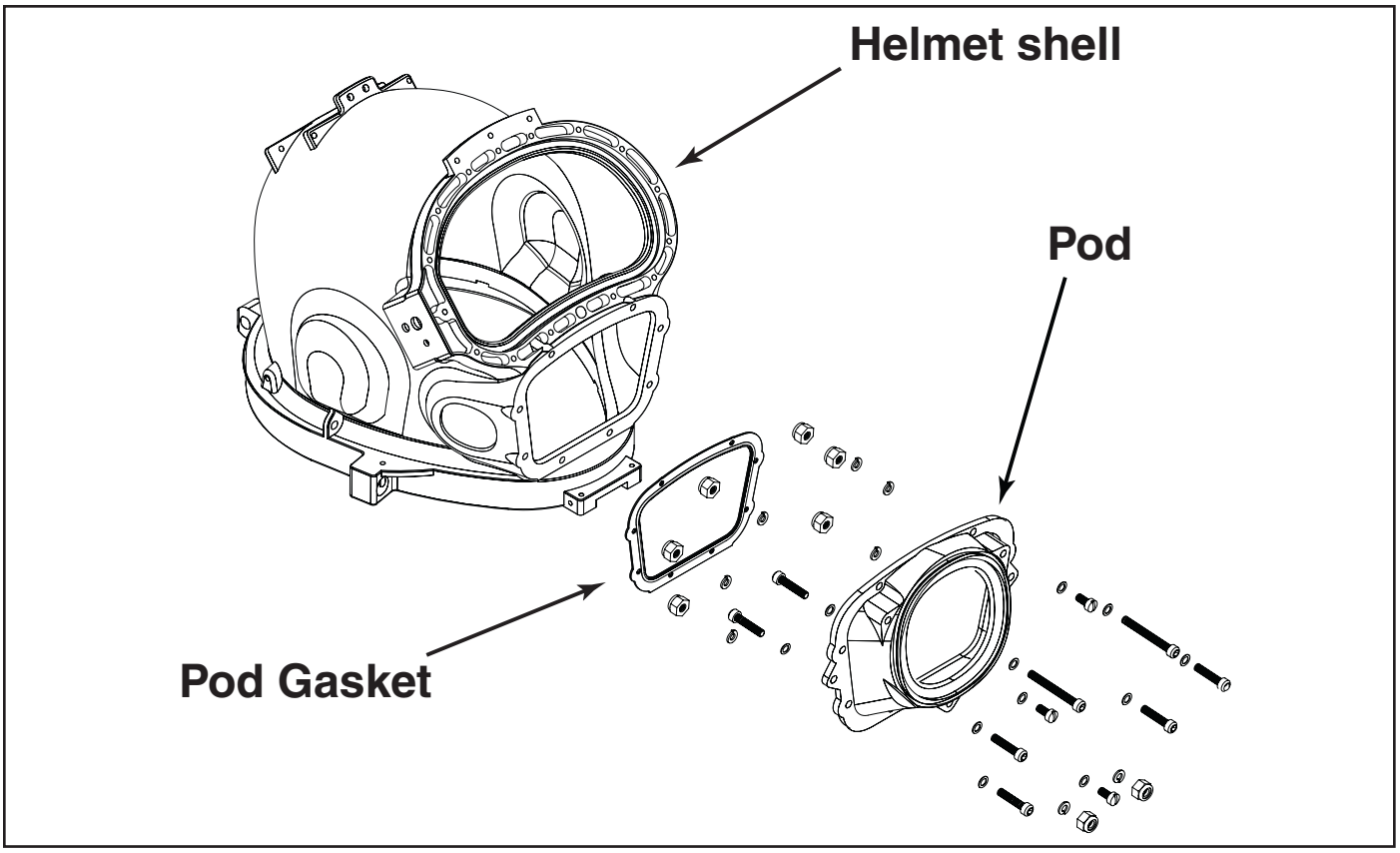
3) Mate the pod to the helmet shell.

4) Install the secondary washers and nuts and run the nuts up until they are finger tight. The nuts are positioned on the outside of the pod on the two bolts on the bottom, below the regulator.

5) Using the hex key and socket or wrench, tighten the nuts gradually in a staggered pattern, such as the one shown below. The nuts are properly tightened when the threaded end of each bolt is flush with (or just protruding through) the upper lip of the nylon insert in the nut.

Install and tighten the nuts and bolts in a staggered pattern, as shown here. Tighten the nuts gradually so that the tension is pulled up evenly on all four sides of the pod.





Always remember to install the pod gasket between the pod and the helmet. Note that there are three very short screws that are fastened into the pod but that do not fasten the pod to the helmet. Two of these very short screws are just above the regulator cover, separated by 120 degrees. The third short screw is at bottom dead center just below the regulator cover. These screws will be used to attach accessories to the helmet at a future date.

The two nuts below the regulator are installed on the outside of the pod.

6) Position the regulator in the pod.

7) Install the regulator washer and mount nut on the regulator as per previous instructions.

8) Install the oral/nasal mask as per this chapter.

9) Install the microphone as per Chapter 8.

10) Install nose block device as per this chapter.

11) Install the bent tube assembly as per this chapter.

12) Install the whisker spaces, kidney plates, and bolts that secure the whiskers.

13) Install the two snap tabs adjacent to the swing tongue catch assembly.

14) Install the chin strap as per Chapter 8.

15) Adjust the regulator per this chapter.

7.14 Reinstalling the Regulator on the Helmet

Tools Required:
Regulator removal tool
Flat blade torque screwdriver
13/16 open end wrenches

1) Install the washer and regulator assembly into the helmet pod, and thread the regulator mount nut, as you feed the regulator assembly into the pod, but just hand tight.

2) Work around the edge of the whisker where it meets the helmet shell to align the rubber grooves at the back of the whisker, to the grooves on the pod. Once the regulator is correctly positioned, finish tightening the mount nut to 80 inch pounds.

3) Install the bent tube into the inlet nipple, 3 or 4 turns. If needed, turn the regulator assembly on the helmet to allow alignment of the bent tube to the side block.

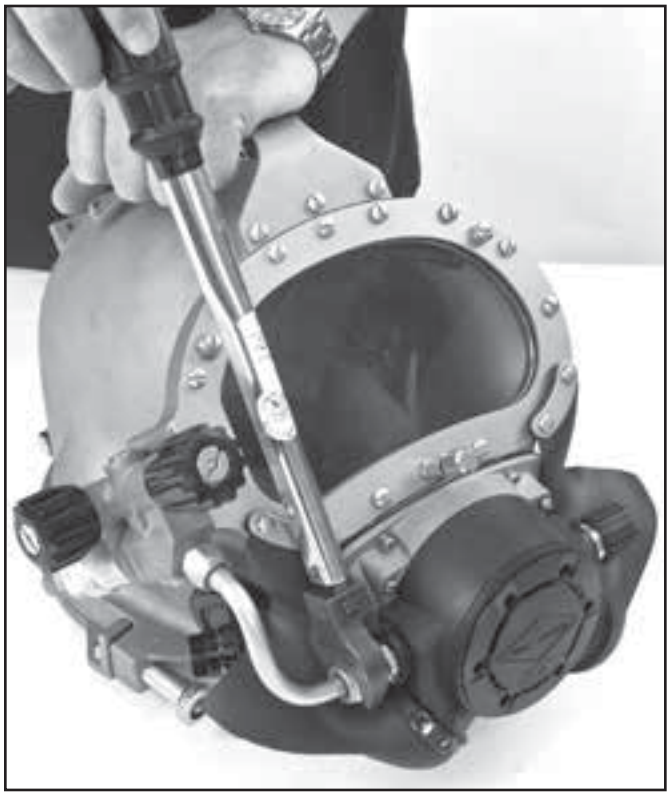
4) Lightly lubricate the male threads on the side block and swing the bent tube up into place and torque the bent tube to the side block.

Make sure the whisker spacers are in position before tightening the screws that secure the whiskers.

The whiskers are fastened to the face port using two screws on each side.

Only use a torque screwdriver to tighten the screws that secure the whiskers to the face port.

The regulator mount nut must be tightened to 80 inch pounds. Use a torque wrench to ensure the correct setting.



Make sure the connection between the bent tube and the regulator is snug.

⚠ CAUTION

The bent tube assembly for the KM77 is a unique design and is not interchangeable with the bent tube assembly used on other Kirby Morgan masks and helmets.

5) Install the diaphragm, thrust washer, flexible cover and cover ring to the regulator assembly using the special spanner wrench.

6) The whisker should have a straight angled surface from the helmet shell towards the outer edge of the regulator. Realign if needed.

7) Install the oral/nasal mask per this chapter.

8) Install the microphone in the oral/nasal mask per Chapter 8.

9) Install the nose block device per Chapter 8.

10) Install and tighten the whisker retainer screws to 15 inch pounds. Be sure to use a small amount of Loctite® 222 to secure the screws.

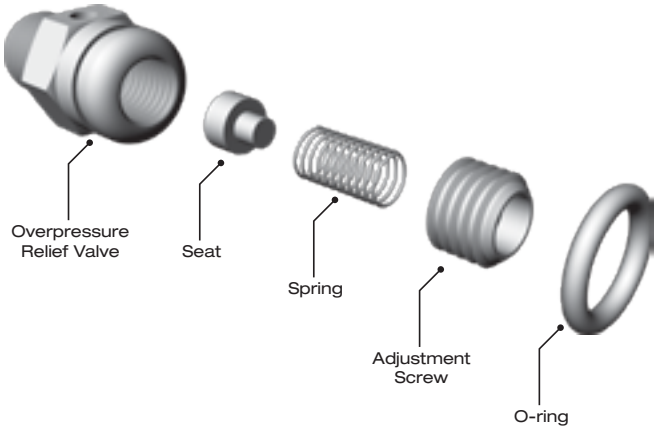
⚠ WARNING

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

Avoid any contact between Loctite® and the face port. This can cause the port to fail unexpectedly and drowning could result.

7.15 Overpressure Relief / Bleed Valve Overhaul Procedures



Over Pressure Relief Valve Component breakdown

7.15.1 Overpressure Relief Valve

The relief/bleed valve should ***always*** be used on all Emergency Gas Supply (EGS/bail-out) first stage regulators to prevent the hose from rupturing in the event the first stage pressure creeps. The Kirby Morgan relief valve body is made of stainless steel.

The basic components last a long time but the valve should be disassembled, cleaned, and inspected at least once a year or whenever it fails testing. The valve should be tested monthly. Cleaning and overhaul is easily performed using a nylon toothbrush and a 50/50 solution of vinegar and fresh water. Cleaning for 15 minutes in an ultrasonic sink, if available, with the 50/50 vinegar solution is highly recommended.

Repair parts are available. Normal replacement parts include the O-ring, soft seat, spring, and hex nut. The O-ring should be replaced at least annually. The other parts require replacement only if worn or damaged. An exploded view of the valve is located in all KMDSI Helmet and Band Mask Operations and Maintenance Manuals. The text on the next three pages refers to the drawing on this page.

Tools Required.
Torque wrench
1/2” open-end wrench attachment for torque wrench
1/8” Allen wrench
Nylon toothbrush
Vinegar, Fresh water
Mild dish soap
Ultrasonic sink, if available
Magnifying glass
New valve body o-ring

7.15.2 Overpressure Relief Valve Disassembly and Cleaning

⚠ WARNING

Do not use cleaning solvents (i.e. mineral spirits, bleach, etc.) when cleaning the relief/bleed valve. The use of cleaning solvents may lead to failure of the relief/bleed valve.

1) Turn off the gas supply to the first stage regulator, then bleed off any remaining pressure. Remove the first stage regulator from the air/breathing gas source so it cannot be accidentally turned on, i.e., pressurized. Make sure the intermediate pressure in the regulator hose is also fully drained of pressure.

2) Remove the relief/bleed valve from the regulator body using the 1/2” open-end wrench.

3) Remove, cut, and discard the relief/bleed valve body O-ring.

4) Using the 1/2” open-end wrench to hold the bleed/relief body, use the 1/8” Allen wrench to remove the Allen head adjustment screw. Then, shake out the spring and soft seat.

5) Place all parts in the 50/50 solution of vinegar and water and allow to soak for 15 to 30 minutes. If using an ultrasonic sink, reduce time to 15 minutes.

6) Using the nylon toothbrush, brush all components to remove corrosion and mineral deposits. Then, rinse with fresh water and blow or air dry.

7) Using the magnifying glass, carefully inspect all components for excessive corrosion and/or damage. Replace the spring and/or adjustment nut, if either part is excessively corroded or shows signs of wear and/or damage.

Inspect the soft seat for nicks, cuts, and wear and replace if any damage is found. Replace the entire assembly if any damage to the valve body is present.

NOTE: A deep groove in the soft seat is normal. Replacement is only necessary if the rubber seat is deteriorated, cut, and/or chipped.

7.15.3 Overpressure Relief Valve Reassembly

1) After cleaning, inspection and/or parts replacement, reassemble the valve by installing the soft seat, spring, and adjustment nut. Screw the adjustment nut down until it is approximately 1/2 thread from being flush with the top of the valve body.

2) Lightly lubricate a new body O-ring, then install on the valve body.

3) Test the relief/bleed valve according to the test procedure below.

7.15.4 Overpressure Relief Valve Lift Check/ Setting

Tools required:
Adjustable first stage scuba regulator or controlled adjustable pressure source
Intermediate pressure test gauge
Torque wrench
1/2" open-end wrench adapter for torque wrench
1/8" Allen wrench
HP air source {SCUBA tank) with at least 500 p.s.i.g. (34.4 bar).
Mild dish soap

The purpose of lift checking the relief/bleed valve is to ensure it operates properly, allowing excess pressure to escape in the event the first stage develops a slight leak. Without the relief/bleed valve, high-pressure gas will continue to increase until the emergency supply hose ruptures, possibly causing injury and a complete loss of the Emergency Gas System (EGS).

This procedure explains the steps necessary for readjusting the relief/bleed valve after it is cleaned, overhauled or any time the valve is tested.

NOTE: The relief/bleed valve is lift checked and/ or adjusted using an adjustable first stage regulator, equipped with a low-pressure test gauge, which is used for adjusting the intermediate pressure of scuba regulators. The check/adjustment can be performed using a standard scuba test stand, or a gas control console, using air or mixed gas with an oxygen content below 23% by volume.

⚠ WARNING

Ensure the relief/bleed valve is only installed in a low-pressure port of the first stage regulator. Installation in a high-pressure port will lead to loss of EGS supply and possible serious personal injury if the valve fails.

⚠ WARNING

Do not use oxygen, or mixed gas containing more than 23% oxygen by volume, for lift checking the relief/bleed valve. The use of oxygen, or mixed gas, in a high-pressure supply system not designed and cleaned for oxygen service, can result in a fire or explosion causing serious injury or death.

If a first stage scuba regulator is used, it must be able to be adjusted to the desired lifting pressure. The pressure gauge should be compared to a gauge of known accuracy.

NOTE: If the Allen screw on the relief/bleed valve hex nut is rotated too far, too fast, the relief/bleed valve will pop open. This could possibly require the air to be secured at the cylinder or supply source to reset the seat before the adjustment can be accomplished.

NOTE: The relief/bleed valve can be installed in any first stage regulator, providing the first stage has an intermediate setting of 135 - 165 p.s.i.g. (9.3 – 11.4 bar).

1) Install the relief valve in a low-pressure port on an adjustable 1st stage regulator. Or install on the scuba test stand.

2) Install the intermediate pressure gauge in one of the low-pressure ports of the first stage regulator.

3) Install the 1st stage regulator on the cylinder. Ensure the relief valve and intermediate pressure gauge are attached to low-pressure ports.

4) Wet the relief valve with soapy water to help indicate gas flow

5) Slowly bring up air pressure while watching the intermediate pressure gauge until the pressure gauge indicates 180- 200 p.s.i.g. (12.40-13.78 bar). If the re-

lief valve starts venting at a pressure below 180- 200 p.s.i.g. (12.40-13.78 bar), secure the air supply and adjust the adjustment screw in (clockwise) 1/8th turn. Slowly bring up pressure and recheck.

Continue this procedure as necessary until the relief valve consistently vents at a pressure between 180-200 p.s.i.g. (12.40-13.78 bar). If the valve does not start venting when the gauge reads 200 p.s.i.g. (13.78 bar), slowly back out on the adjustment screw (counter clockwise) until the valve starts venting, forming bubbles in the soap solution.

6) After the valve has been adjusted, adjust the 1st stage regulator intermediate setting to 135 p.s.i.g. (9.3 bar), re-wet the valve, then slowly increase the intermediate pressure on the 1st stage regulator one last time to recheck the lift pressure. The valve should start forming bubbles or venting between 180- 200 p.s.i.g. (12.40-13.78 bar).

7) After final lift check reset the regulator to the appropriate over bottom setting. Remove the intermediate pressure gauge.

TROUBLESHOOTING
Problem: Valve pops open and will not stop flowing:

Check: If while setting the relief/bleed valve the valve pops open and will not stop flowing, secure the air supply valve and allow the valve to reseat. Try the procedure again, ensuring that the supply valve is only slightly cracked open, allowing full test pressure but minimizing high flow potential.

Problem: After resetting the first stage to 135 p.s.i.g. (9.3 bar), the valve continues to leak:

Check: This indicates the valve body, seating surface or the soft seat is either dirty or damaged. Usually, cleaning both the metal body seating surface in the valve body and the soft seat will fix the problem.

If, after cleaning, the problem persists, replace the soft seat and spring and retest the unit. If the seat continues to leak, then replacement of the complete valve will be necessary.

The purpose of lift checking the valve is to ensure the relief operates properly allowing excess pressure to escape in the event the first stage develops a slight leak. This procedure also explains the steps necessary for readjusting after cleaning or overhaul.

Chapter 8
Mechanical System Maintenance

8.1 General

This chapter covers the maintenance and repair of all non-breathing system components of the Kirby Morgan 77 Diver's Helmet. Correct repairs will result in better communications and improved overall diver comfort and performance in getting the job done. Numbers appearing in parentheses below are "location" numbers that are used in the blowapart drawing at the rear of this manual.

⚠ WARNING

Use only KMDSI original replacement spares when repairing your helmet. The use of other manufacturer's parts will interfere with the performance characteristics of your life support equipment and may jeopardize your safety. Additionally, any substitutions will void all warranties offered by KMDSI.

All the spare parts in our catalog were specifically manufactured (or inspected and tested) for Kirby Morgan designed helmets and masks. When ordering spares, insist on KMDSI original parts.

⚠ WARNING

All parts on Kirby Morgan masks and helmets 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.

NOTE: For o-ring Removal/Inspection/Cleaning & Installation see Chapter 6. For General Cleaning Guidelines, including KMDSI recommended cleaning, sanitizing solutions, and procedures, see Chapter 6.

8.2 Helmet Shell Inspection

The helmet shell is constructed using stainless steel It is extremely durable but can be damaged.

Helmets that have suffered damage may be repairable, but repairs to the helmet shell must only be accomplished by KMDSI technicians that have been trained and certified by KMDSI.

1) Visually inspect the helmet shell exterior for obvious signs of damage including cracks, gouges or depressions.

NOTE: The helmet should not be used if it has any gouges deeper than 1/16 inch. Repairs should only be completed by a KMDSI trained and certified repair technician that has received certification for helmet shell repairs by KMDSI or Dive Lab Inc. Any signs of cracks or depressions with fractures or other damage should be checked by an authorized KMDSI repair facility or a technician certified by KMDSI in specialized stainless steel repair.

⚠ WARNING

Do not attempt to re-thread the helmet shell for the port retainer screws by yourself. If the installation is done improperly, the port retainer can come loose and the helmet could flood resulting in drowning. Repairs should be only be completed by technicians specifically trained and certified in these procedures.

8.3 Nose Block Assembly

8.3.1 Nose Block Assembly Removal

Tools Required:
Slip Joint Pliers and a Rag or cloth
7/16 ” Open-End Wrench

1) Hold the nose block knob with a pair of pliers padded by a cloth, while unscrewing the nose block device with your hand.

2) After the knob is removed, loosen and remove the packing nut.

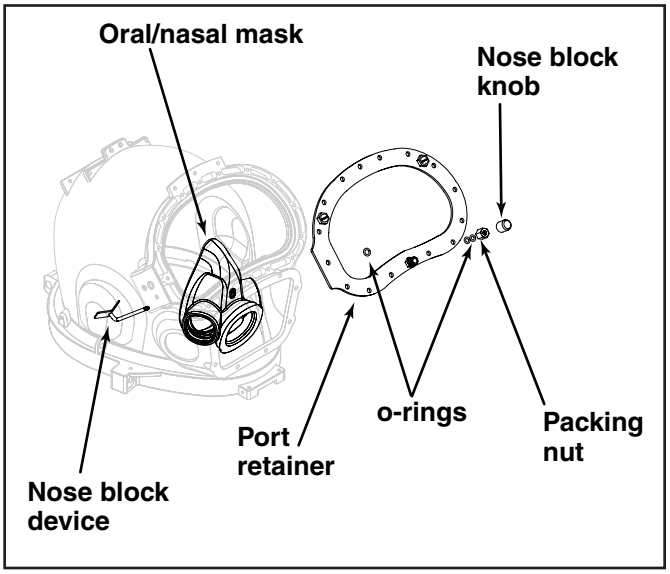
3) Slip the two o-rings off the end of the shaft of the nose block device and slide the nose block device out through the oral nasal mask.

4) The padded end of the shaft may be bent with pliers to better fit an individual. A larger pad of rubber can also be glued onto this pad.

The threads of the nose block penetrator should be lubricated periodically. All of the parts of the nose block device (with the exception of the o-ring that seals on the back side of the port retainer) can be seen here.

⚠ WARNING

Do not breathe the fumes from uncured neoprene cement. These fumes are dangerous and can cause unconsciousness. They can also cause long term damage to body tissue. Read and follow all precautions listed on the neoprene cement can. Allow neoprene cement to cure for a minimum of 24 hours before using helmet.



Blowapart drawing of the nose block device and supporting hardware.

8.3.2 Nose Block Device Replacement

1) Prior to reassembly, lubricate the two o-rings (82).

2) Slide the shaft through oral nasal mask in the helmet shell.

3) Place both o-rings on the shaft, followed by the packing nut and the knob.

4) Tighten the packing nut until snug. Do not over tighten, as this will make it difficult to slide the nose block device in and out.

5) Tighten the knob with the pliers, padded by a cloth, while holding the pad end with your hand.

Install the nose block device through the interior of the oral nasal mask.

Do not tighten the nose block packing too much or the nose block device will not slide easily.

Properly installed nose block device.

8.4 Handle

8.4.1 Handle Removal

Tools Required:
Flat blade screwdriver
Torque screw driver and flat blade attachment

The handle is a convenient location to mount cameras, lights, and other instruments.

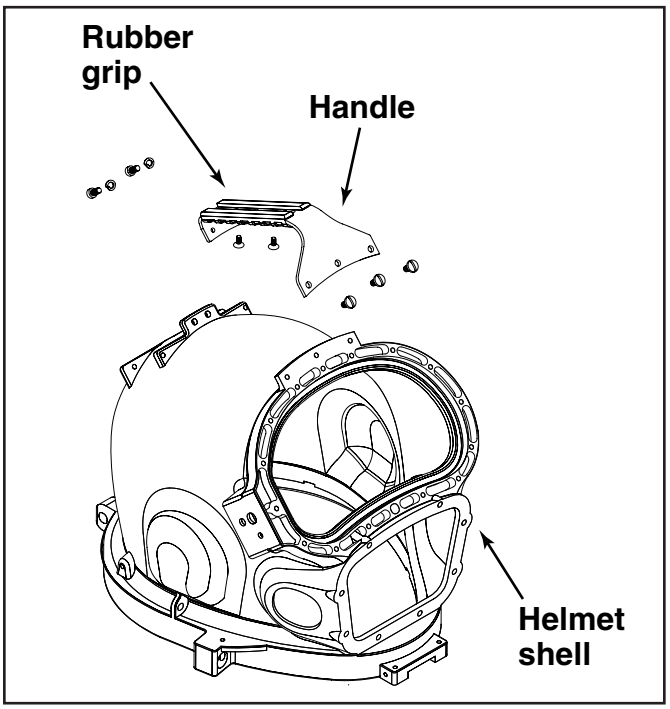
1) The handle is removed by first unscrewing the front three handle retainer screws.

2) Remove the rear handle mount screws and washers. You can then remove the handle.

Unscrew the front three handle retainer screws.

Remove the screws at the rear of the handle.

The handle can be replaced easily.



Blowapart drawing of the handle and helmet shell.

8.4.2 Handle Grip Rubber

Required tools:
Flat blade torque screwdriver
Loctite® 222

The rubber grip on the handle is easily replaced.

8.4.2.1 Handle Grip Rubber Removal

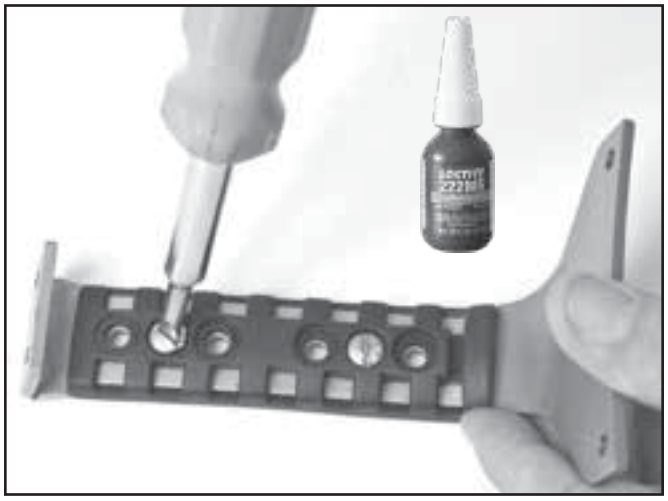
1) Remove the screws and washers.

2) Pull the rubber off the handle.

8.4.2.2 Handle Grip Rubber Replacement

1) Slide a new grip onto the handle.

2)Install the screws and washers with Loctite® 222 and tighten to 10 inch pounds. The tips of the bolts will protrude slightly from the other side of the handle.



Tighten the screws to 10 inch pounds. The tips will protrude slightly through the other side of the handle.

8.4.3 Handle Replacement

1) Position the handle on the helmet.

2) Apply Loctite® 222 to the screws. Install all of the screws, both front and rear, finger tight. Be sure to install the washers with the rear bolts.

3) Gradually tighten the bolts in a staggered pattern, back to front.

4) Tighten the front bolts to 15 inch pounds.

5) Tighten the rear bolts to 15 inch pounds.

Tighten the screws on the front of the handle to 15 inch pounds.

Tighten the screws on the rear of the handle to 15 inch pounds.

8.5 Face Port

8.5.1 General

The face port, or viewing lens, is made of a polycarbonate plastic. Small scratches on the exterior are not important, as they tend to disappear underwater. However, the face port is easily replaced by removing the port retainer and reinstalling a new o-ring and face port.

The face port should be replaced anytime cracks are present or anytime nicks and scratches deeper than 1/16" are present or anytime the condition is questionable.

⚠ WARNING

Never use aerosol-propelled sprays near the face port of the Kirby Morgan 77. The propellant used in these aerosols can invisibly damage the 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.

8.5.2 Face Port, Port Retainer, and Nose Block Device Removal

Tools Required:
7/16 " Open-end Wrench
1/4 " Flat Blade Attachment on
Torque Screwdriver
Slip Joint Pliers and a Rag or cloth

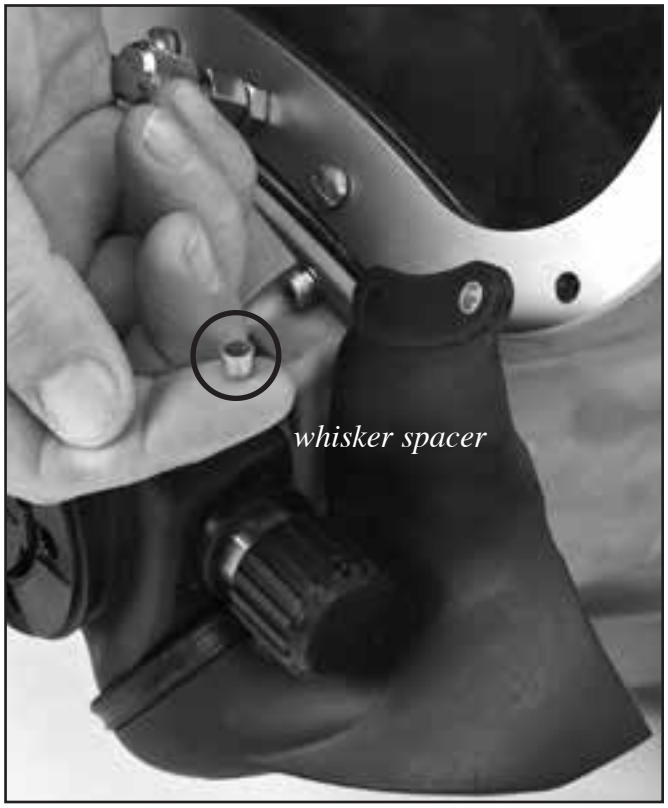
NOTE: Wrap a rag around the nose block knob while removing to prevent chrome damage when turning with pliers.

1) First remove the nose block device knob then the packing nut and slip the o-rings off the nose block shaft.

2) Pull the nose block device out through the interior of the oral/nasal mask.

3) Next, unscrew the eleven port retainer screws and four whisker screws with kidney plates and spacers. Pull the retainer clear of the helmet shell.

Remove the screws that secure the port retainer.



Don't misplace the whisker spacers.

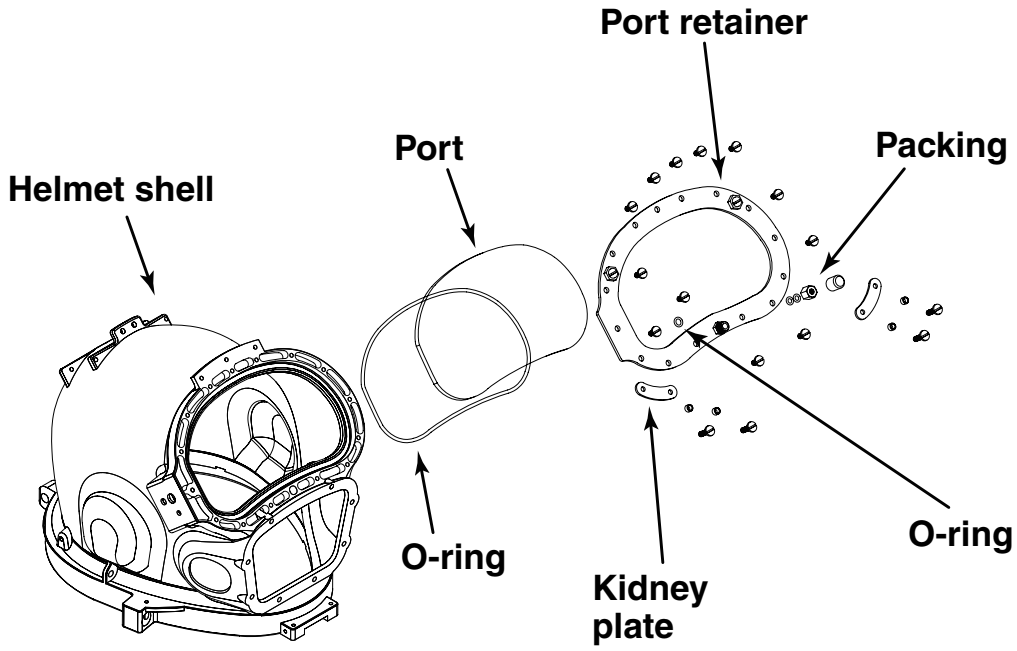
Remove the port retainer.

Remove the face port.

4) Be sure not to lose the small o-ring that is located on the back side of the port retainer at the nose block device packing.

5) The four whisker spacers must not be misplaced. They will usually be found lodged in the whisker.

6) Remove the old port and sealing o-ring.

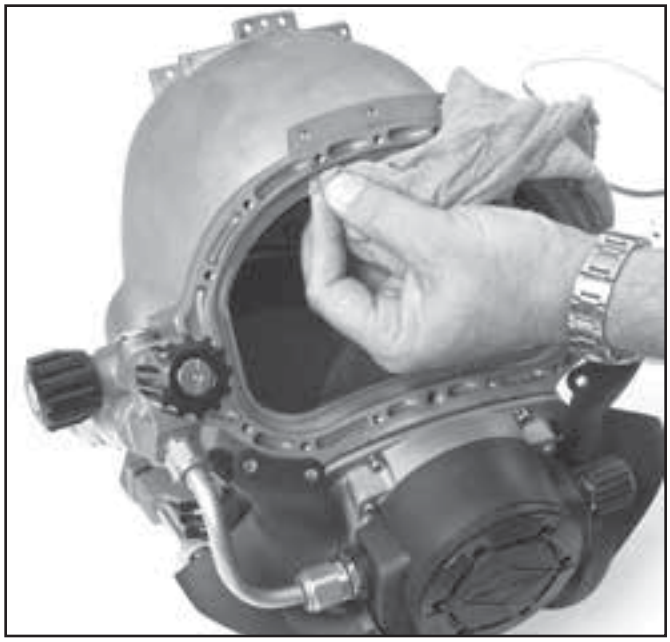


KM77 Port retainer system.

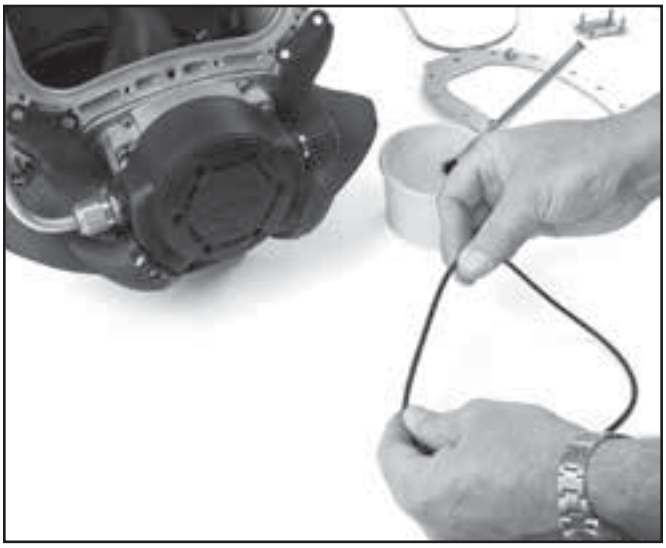
8.5.3 Face Port, Port Retainer and Nose Block Replacement

⚠ WARNING

The o-ring used with the face port of the Kirby Morgan masks and helmets is made from a special compound and has unique dimensions. It is a softer durometer o-ring than is commonly available. There are no equivalent o-rings manufactured by other vendors. This o-ring must be replaced with a new KMDSI o-ring. Failure to do so could lead to seal failure resulting in leaks or flooding.

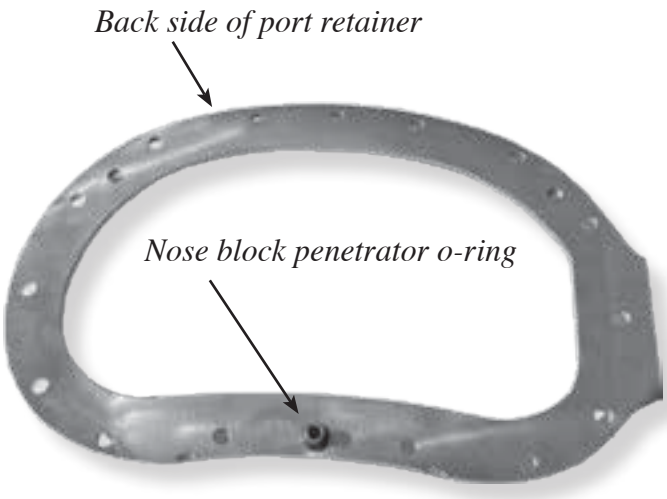


Clean the o-ring groove prior to replacing the port o-ring.



Lubricate the port o-ring prior to installing it in the o-ring groove.

The port o-ring must be in good condition and properly installed to seal correctly.



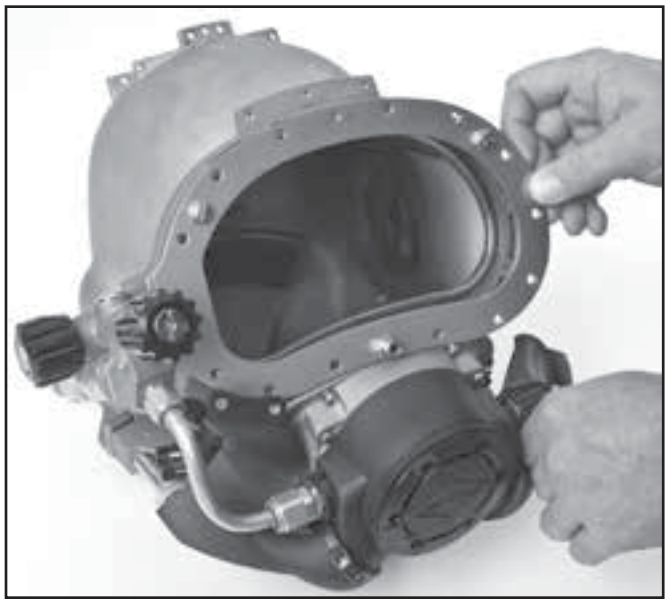
Be sure to install the o-ring on the back of the port retainer.

1) Clean the face port o-ring groove, carefully inspecting it for any damage.

2) Lightly lubricate the port o-ring with Christo-Lube® lubricant and replace in the helmet shell.

3) Place the face port into the helmet shell making sure the o-ring is in its groove evenly.

4) Slip the o-ring on the small tube that protrudes from the rear of the port retainer nose block guide.



Place the port retainer on the helmet shell.

Always use a torque screwdriver to check the tension of the port retainer screws. Although the handle has been removed from this helmet, it is not necessary to remove the handle to remove the port retainer on the KM77.

⚠ WARNING

Always be sure to use a torque screwdriver to check the tension of the port retainer screws.

⚠ WARNING

Avoid any contact between Loctite® and the face port. This can cause the port to fail unexpectedly and drowning could result.

5) Place a small amount of Loctite® 222 onto the end two or three threads of each of the port retainer and whisker screws.

Place the port retainer onto the helmet shell, holding it in place against the face port and face port o-ring while the fifteen screws, are all run in loose.

6) Using a torque screwdriver slightly tighten each opposing screw evenly. Start at the center line of the helmet and work outwards in a circular pattern. Repeat this process, one after another, until all screws are evenly torqued to 15 inch pounds and the o-ring has completely sealed the face port.

When removing and replacing the port retainer, it is crucial that the KMDSI recommended torque specs be followed when tightening the port retainer screws.

7) Install the nose block device from the interior of the oral/nasal mask and out through the nose block guide on the port retainer.

8) Slide the two lubricated o-rings onto the shaft of the nose block device.

9) The packing nut is threaded into place followed by the nose block device knob.

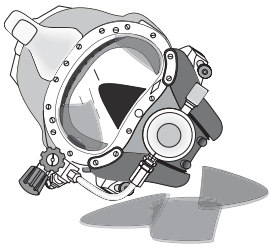
10) Tighten the packing nut until some resistance is felt when the nose block device knob is pushed in and out. Tighten the nut until it cannot be loosened by hand, then another half turn. If the packing nut is too tight the nose block device cannot slide in and out.

11) The nose block device knob should be tightened to the shaft using a padded pair of pliers, while holding the nose block pad on the inside of the helmet.

⚠ WARNING

The face port for all Kirby Morgan helmets and KMB 28 mask are not interchangeable. Do not attempt to use a face port from a KMB 28 in a Kirby Morgan helmet. Although the port will fit into the helmet shell, it will not seal properly. This could lead to flooding of the helmet, resulting in serious personal injury or death.

⚠ WARNING



The face port is very strong. However, certain chemicals will attack the port and weaken it. Some solvents used for grease removal will also attack the port. Use only mild soap solutions to clean the face port. Improper application of cleaning agents may cause the port to fail without warning. This could lead to drowning.

8.5.4 Special Note Regarding Ports

NOTE: There are two different face ports available for KMDSI helmets and masks. One port specifically fits the Kirby Morgan helmets and the KMB 18. One port only fits the KMB 28 Band Mask. These two ports are not interchangeable. The face port for the SuperLite®-17A/B the SuperLite®-17K, SuperLite®-27, SL-17C, the Kirby Morgan 37, 47, 57, 77 and the KMB 18 Band mask is Part #520-004. The face port for the KMB 28 Band Mask is Part #520-128.

8.5.5 Port Retainer

The port retainer is made of stainless steel like most of the components of the helmet. The nose block guide is threaded into the port retainer, and is easily replaced if damaged. Under normal use, the port retainer should never need replacement.

⚠ WARNING

Use only genuine KMDSI face ports. An aftermarket face port's thickness or outer periphery may be incorrect and cause the helmet to flood. It could also be made of inferior materials causing it to fail. This could result in serious injury or death.

8.6 Neck Dam

There are two neck dams that may be used with the helmet; a neoprene neck dam, which is standard, and an optional latex neck dam. Instructions for both types will be found here.

8.6.1 Removal of the Neck Dam

Tools required:
7/64 inch Allen wrench attachment on torque screwdriver
#2 Phillips head attachment on torque screwdriver
X-ACTO® knife or razor blade
Needle nose pliers
Small punch

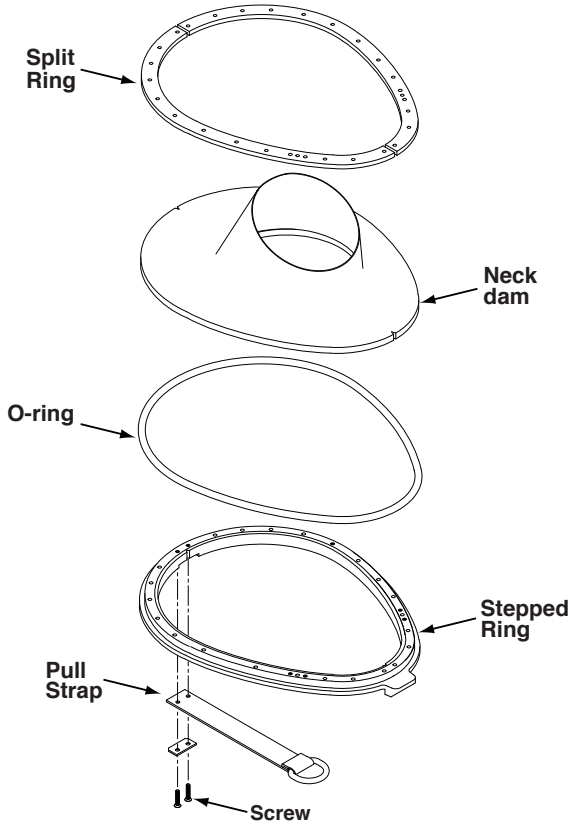
1) Remove the o-ring from the groove on the outside of the neck ring assembly.

2) Use the hex key and unscrew all the screws from the stepped neck dam ring.

3) Separate the split neck dam rings and neck dam from the stepped neck dam ring.

4) Discard the old neck dam.

5) Clean all parts as needed.



Blowapart drawing of neck dam assembly for the helmet.

8.6.2 Neoprene Neck Dam Replacement

Tools Required:
7/64 inch Allen wrench attachment on torque screwdriver
#2 Phillips attachment on torque screwdriver
Small, sharp punch

⚠ WARNING

KMDSI neoprene neck dams come in a variety of sizes. Be sure to obtain the right size neck dam for your neck. A neck dam that is too tight will be very uncomfortable and can cause you to pass out.

New neck dams are supplied with no holes punched in them for the mounting screws. As the screws are inserted and tightened they cut their own holes in the neck dam.

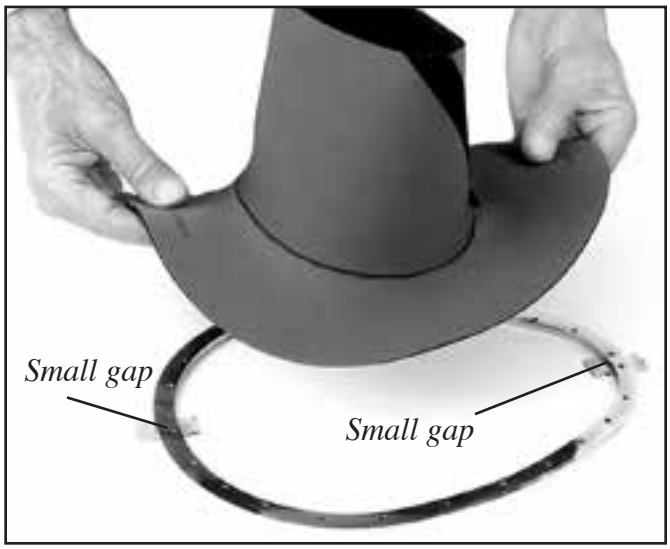
Before starting installation, note the index marks, "notches" on the neck dam. These will line up with the ends of the two split rings. You may find it useful to use a small piece of tape to hold the split rings in alignment.

The base of the neck dam will be marked and notched for alignment with the joints on the split rings.

1) Lay the split neck dam ring on a flat level work table with the two mating edges lined up to face each other with a small gap (.060-.080 inch) between them. Tape the two rings together with a small bit of duct tape. Then flip the rings over so the tape is on the bottom.

2) Position the neck dam on top of the split rings so the small opening is "up" or on top and the large opening is "down" or on the bottom. The neck dam will be inside out, with the seam tape that covers the diagonal seam on the outside of the neck dam. The base of the neck dam will be marked and notched for alignment with the joints on the split rings.

Tape the two rings together with a small bit of duct tape.



Place the neck dam on top of the split rings.

Place the stepped neck dam ring on top of the neck dam.

3) Place the stepped ring over the neck dam. The countersunk holes must be on top while the step must be on the bottom. The tongue on the front of the stepped ring will stick up above the ring, too.

4) The alignment marks on the neck dam must be positioned directly over the joints in the split rings. The neck dam must also be properly aligned from side to side with the curvature of both the split rings and the stepped ring.

5) Using a small, sharp punch, push through the neoprene and align the holes on either side of the groove for the pull strap.

6) Apply a small amount of silicone grease to the tip of the screws that will secure the neck dam. This keeps them from binding in the neoprene on installation.

7) Insert the Allen head screws into the aligned holes on either side of the pull strap groove and start the screws. You must apply enough pressure to penetrate the neoprene. Once the threads engage continue tightening the screws three turns.

8) Use the punch to align the two screw holes at the base of the tongue on the stepped ring and start the screws in these holes. Tighten the screws three turns.

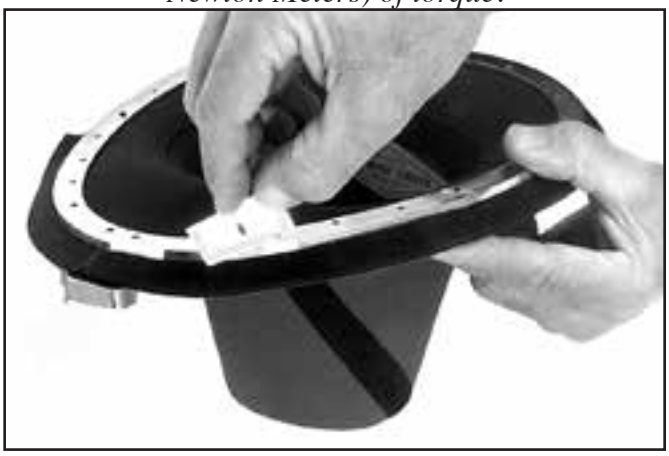
9) Press down on the stepped ring midway between the two ends of the ring. Pull the edge of the neck dam through the gap between the two sets of rings. The neck dam should protrude an equal distance all along the length of the ring between the two ends.

10) Install a screw at the widest diameter of the stepped ring on one side and tighten three turns once you have penetrated the neoprene.

11) Install another screw directly across from the one installed in Step #10, at the widest diameter of the stepped ring. Be sure that the neck dam protrudes from between the rings the same distance all the way around.

Use a small, sharp punch to locate the bottom hole.

Tighten all the screws to 10 inch pounds (1.1 Newton Meters) of torque.



Trim the excess neoprene using a sharp razor.

12) Install the remaining screws as previously explained.

13) Install the pull strap assembly as per this Chapter.

14) Tighten all the screws to 10 inch pounds (1.1 Newton Meters) of torque.

15) Allow the neck ring assembly to sit for 24 hours. This will give the neoprene time to compress and take a set.

16) Re-torque all screws after 24 hours to 10 inch lbs (1.1 Newton Meters).

17) Trim the excess neoprene that sticks out beyond the stepped ring. Use a sharp razor to start the cut. Once the cut is started, pull on the neoprene and maintain tension on it as you continue cutting. The cutting edge of the blade should follow the outside rim of the split rings. The point of the blade should be directed inside against the corner where the top of the stepped ring meets the step. You must have a clean cut with no loose strips of neoprene hanging from the neck dam that could interfere with the seal of the o-ring.

18) Check the torque adjustment on the neck ring assembly on a regular basis to help prevent failure of the neck seal.

19) New neoprene neck dams may need to be stretched to fit the diver's neck properly. The best method is to stretch the neck dam over a scuba cylinder and allow it to sit overnight.

8.6.3 Latex Neck Dam Replacement

Tools Required:
7/64" Allen Wrench.
#2 Phillips Screwdriver
Torque Screwdriver with a 7/64" Allen wrench attachment and #2 Phillips head screwdriver attachment.
Silicone Grease.
Felt Tip pen.
Sharp Razor Blade

New neck dams are supplied without mounting screw holes punched in them. As the mounting screws are inserted and tightened they cut their own holes in the neck dam.

1) Install the split rings inside the trimmed outer lip of the neck dam. Turn the neck dam over and lay it flat on the work surface. The split rings will now be hidden by the neck dam.

2) Place the stepped neck dam ring on top of the neck dam.

3) Align and center the stepped ring to the split rings by looking at both ends. Feel the inside edge of the stepped ring and the split rings by pressing on the dam. This will help you center the split rings.

⚠ CAUTION

The neck dam, stepped ring and split rings MUST be properly aligned in order to get the screws to thread correctly.

Install the split rings inside the trimmed outer lip of the neck dam.

4) Lubricate the tips of the neck dam mounting screws lightly with silicone grease. This will prevent them from grabbing and twisting the rubber.

5) Use the punch to align the holes, if necessary, and start mount screws into each one of the split rings, one on either side of the groove where the pull strap is mounted. This will help hold and align everything while the other screws are being put in.

6) Use a torque screwdriver with a 7/64" Allen wrench attachment. Press down and turn the screw at the same time. This will punch the hole in the neck dam and start the mount screw into the split ring.

7) Tighten the screws to 10 inch lbs (1.1 Newton meters) of torque.

⚠ CAUTION

The center screws cannot be torqued with a torque screwdriver, "hand torquing" these with a 7/64" Allen wrench is sufficient.

Center the split rings by pressing on the dam and feeling the inside edge of the stepped ring and the split rings.

Use the screw to punch through the neck dam.

8) Install a second set of screws in the two holes immediately adjacent to the tongue on stepped ring.

9) Once the 4 "holding" screws are in place, screw the rest of the neck dam mount screws in until snug. Then torque the neck dam mount screws in a staggered pattern, taking up the tension a little bit at a time, until 10 inch pounds (1.1 Newton Meters) is reached on each individual screw.

10) Use a sharp razor blade to trim the excess latex off the outside flap on the neck dam.

8.6.4 Trimming a Latex Neck Seal

Tools Required:
Large, sharp scissors

Anytime you replace the neck dam, it may need to be adjusted (trimmed) to fit properly. New neck dams are cone shaped and may be too tight if not properly fitted to the diver's neck.

1) To trim the neck dam, have your tender hold the neck dam open so that the two "edges" of the neck dam are parallel. The neck dam should be under slight tension but should not be stretched beyond its normal length.

2) Trim the neck dam with the largest, sharpest scissors available in order to make as few cuts as possible. There should be no jagged edges on the neck dam or it may tear. Trim only 1/4 inch (6.0 mm) off the neck dam at a time, trying it on after each trim.

3) When you are done, the neck dam should be just snug enough that it does not leak. This may feel a bit snug above water, but will be very comfortable under water.

Trim latex neck dams with the largest, sharpest scissors available.

⚠ WARNING

Never dive with a neck dam that is too tight. A neck dam that is too tight could cause the diver to pass out due to pressure on the carotid artery in the neck. This could lead to severe personal injury or death.

8.7 Neck Dam Pull Strap

8.7.1 Neck Dam Pull Strap Removal

Tools Required:
#2 Phillips attachment on torque Screwdriver

The neck dam pull strap may become worn through use. If it is only slightly frayed it is possible to singe the nylon with a match to help prevent further deterioration.

1) Unscrew the two screws that secure the strap plate to the stepped neck dam ring

8.7.2 Neck Dam Pull Strap Replacement

1) Position the strap plate over the pull strap.

2) Screw the two screws through the strap plate until the heads of the screws bottom out against the strap plate. Do not overtighten.

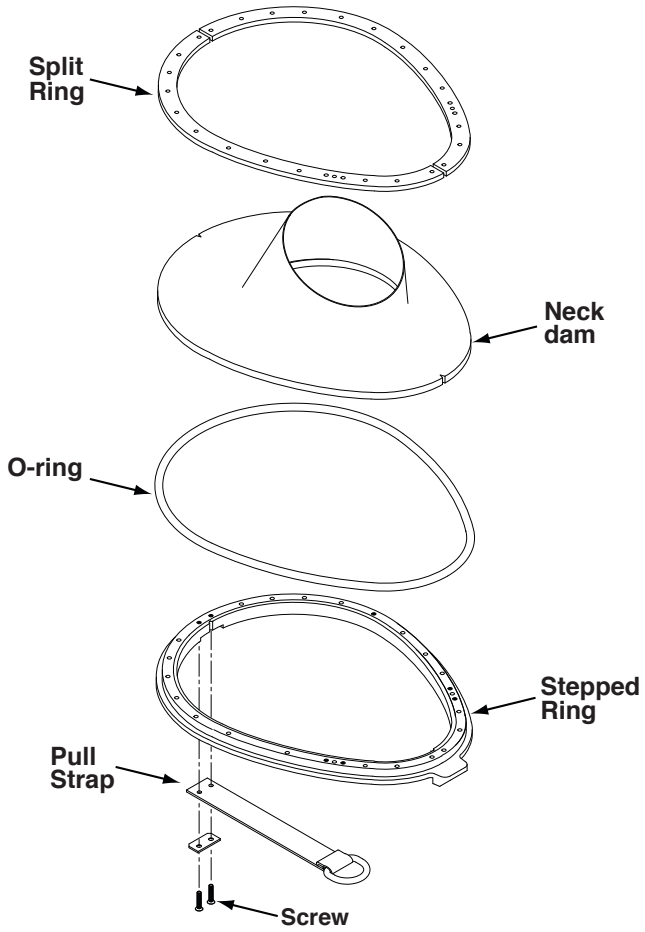


Diagram of the pull strap.

8.8 Snap Tabs, Chin Strap, and Earphone Retainers

On the KM77, all of the snap tabs fasten into the helmet ring on the base of the helmet. They are all secured by bolts that are fastened with Loctite®. These include the bolts that secure the chin strap and the earphone retainers.

8.8.1 Snap Tab Removal

Required Tools:
Phillips head screwdriver

1) Remove the head cushion and chin cushion.

2) Remove the screw securing any snap tab that needs replacement.

Removing the snap tab that also holds the earphone retainer.

8.8.2 Snap Tab Replacement

Required Tools:
Phillips head screwdriver on torque screwdriver
Loctite® 222
Plastic mallet

1) If you are replacing snap tabs associated with an earphone retainer clip or chin strap, the snap tabs are incorporated into these components and cannot be replaced separately.

2) Remove any corrosion from the sealing surface with a soft brush and dilute white vinegar solution. Rinse thoroughly and ensure the threads are completely dry before continuing installation.

3) Apply Loctite® to the threads of the screw that secure the snap tab.

4) Thread the screw into the hole in the helmet ring, taking care to ensure the base of the snap tab is aligned within the slot for the snap tab. Apply 25 inch pounds of torque.

Snap tabs must be installed with Loctite®.

⚠ WARNING

Avoid any contact between Loctite® and the face port. This can cause the port to fail unexpectedly and drowning could result.

8.8.3 Chin Strap Removal

Tools Required:
Phillips screwdriver
The chin strap must be replaced as a complete unit.

1) Remove the two screws that secure the chin strap to the helmet shell. Clean any sealant or debris from the holes.

2) Remove the worn chin strap and discard.

8.8.4 Chin Strap Replacement

1) Put Loctite® on the screws that secure the screws that hold the chin strap.

2) Install the two screws that hold the chin strap in position, using the two screws supplied with the chin strap replacement kit.

3) Tighten the screws with a torque screwdriver to 25 inch pounds.

4) The adjustment strap should pull toward the right side of the helmet when it is on your head.

Apply Loctite® to the screws that secure the chin strap.

The chin strap should be installed so that it pulls to the right when the helmet is on your head.

Following the replacement of any snap tabs, be sure to install the head cushion and chin cushion prior to diving.

⚠ CAUTION

Use good ventilation when using Loctite®. Fumes from this material may irritate your lungs. Read and follow the directions in the MSDS before using this material.

⚠ CAUTION

Wear hand protection when using Loctite®. This material may irritate your skin. Read and follow the directions in the MSDS before using this material

⚠ CAUTION

Wear eye protection when using Loctite®. This material may irritate your eyes. Read and follow the directions in the MSDS before using this material.

8.9 O-Ring Seal Replacement

The o-ring on the neck dam ring assembly must be replaced annually, or whenever it shows signs of wear. The o-ring makes the seal between the helmet ring on the base of the helmet and the neck dam ring assembly.

To replace the o-ring, simply stretch it over the bottom of the sides of the neck dam ring assembly. The o-ring must be lubricated with a light coating of silicone grease before each diving day.

Lubricate the o-ring with a light coating of silicone grease before each diving day.

⚠ WARNING

The o-ring on the neck dam ring of the Kirby Morgan helmets is made from a special compound and has unique dimensions. It is a softer durometer o-ring than is commonly available. There are no equivalent o-rings manufactured by other vendors. This o-ring must be replaced with a KMDSI o-ring. Failure to do so could lead to seal failure and helmet flooding. This could lead to drowning.

8.10 Helmet Ring

8.10.1 Helmet Ring Repairs

The metal ring on the base of the helmet is part of the helmet shell casting. If the ring is damaged, such as damage to the sealing surface, or the ring is bent, the helmet must be returned to KMDSI through your authorized dealer for repair or replacement.

⚠ WARNING

The sealed pull pins must operate properly. If they do not lock properly the helmet could come off the diver underwater and drowning could result. If they do not release when needed, they could make it impossible to remove the helmet in an emergency situation. Do not use the helmet unless the pins are operating correctly.

8.11 Sealed Pull Pins

The sealed pull pins that lock the helmet on the diver cannot be serviced in the field. If these pins do not work properly the pins must be returned to an authorized dealer for replacement.

KMDSI recommends that these pins be serviced annually. Your KMDSI dealer can provide you with either new pins (Part # 505-110) or factory refurbished ones (Part # 505-115). Your old pins can also be refurbished.

Refurbished pins are hand engraved with a "S/R" on the body. Refurbished pins can only be made available if serviceable used pins are returned to the dealer and forwarded to KMDSI.

8.11.1 Removal of Sealed Pull Pins

Tools Required:
7/64 Hex Key on Torque Screwdriver

1) Unscrew the hex head screws from the helmet ring on the base of the helmet.

2) Remove the sealed pull pins by pulling them out of the helmet ring.

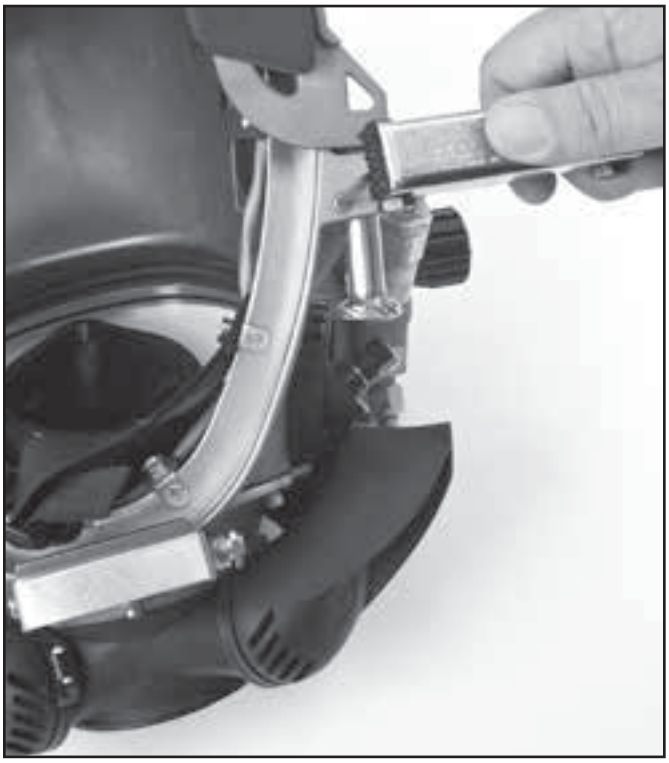
3) Return the pins to your authorized dealer for replacement.

8.11.2 Replacement of Sealed Pull Pins

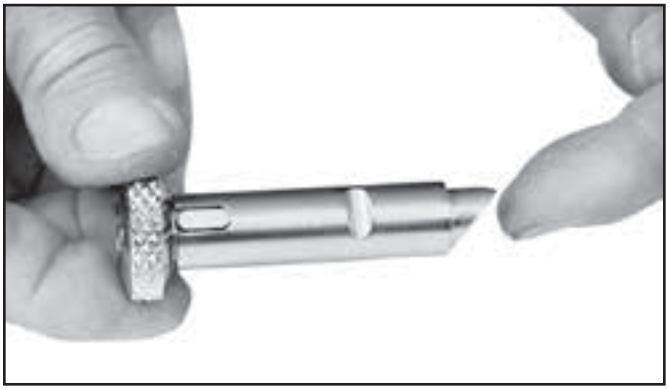
1) Insert the pin(s) into the helmet ring on the base of the helmet. The cam angle must be correct for the pins to work.

2) Apply a small amount of Loctite® 222 small screw thread locker on the ends of the screws.

3) Insert the screws into the helmet ring and tighten to 5 inch lbs of torque.



Unscrew the hex head bolts.



The cam angle must be correct for the pins to work properly.

⚠ CAUTION

Wear hand protection when using Loctite®. This material may irritate your skin. Read and follow the directions in the MSDS before using this material

The screws that secure the sealed pulled pins must be properly installed and torqued.

⚠ CAUTION

Wear eye protection when using Loctite®. This material may irritate your eyes. Read and follow the directions in the MSDS before using this material.

⚠ CAUTION

Use good ventilation when using Loctite®. Fumes from this material may irritate your lungs. Read and follow the directions in the MSDS before using this material.

8.12 Swing Tongue Catch

The swing tongue catch assembly helps to provide alignment for the front of the neck ring assembly, as well as making it easier to remove the helmet. The swing tongue catch should rarely need attention or service, unless damaged accidentally.

8.12.1 Disassembly of the Swing Tongue Catch

Tools Required:
Flat blade screw driver

1) Prior to servicing the swing tongue catch, the pod and regulator assembly must be removed if the spring is to be removed. (You can also use a 90 degree screwdriver to remove the spring.) See Chapter 7 for the procedure for removing the pod and regulator assembly.

2) Remove the screw on the port side of the swing tongue catch.

3) Remove the spring spacer.

4) Remove the screw from the starboard side of the swing tongue catch.

5) Remove the washer and the spacer. The swing tongue catch should disengage from the spring now.

Remove the screw from the port side of the swing tongue catch.

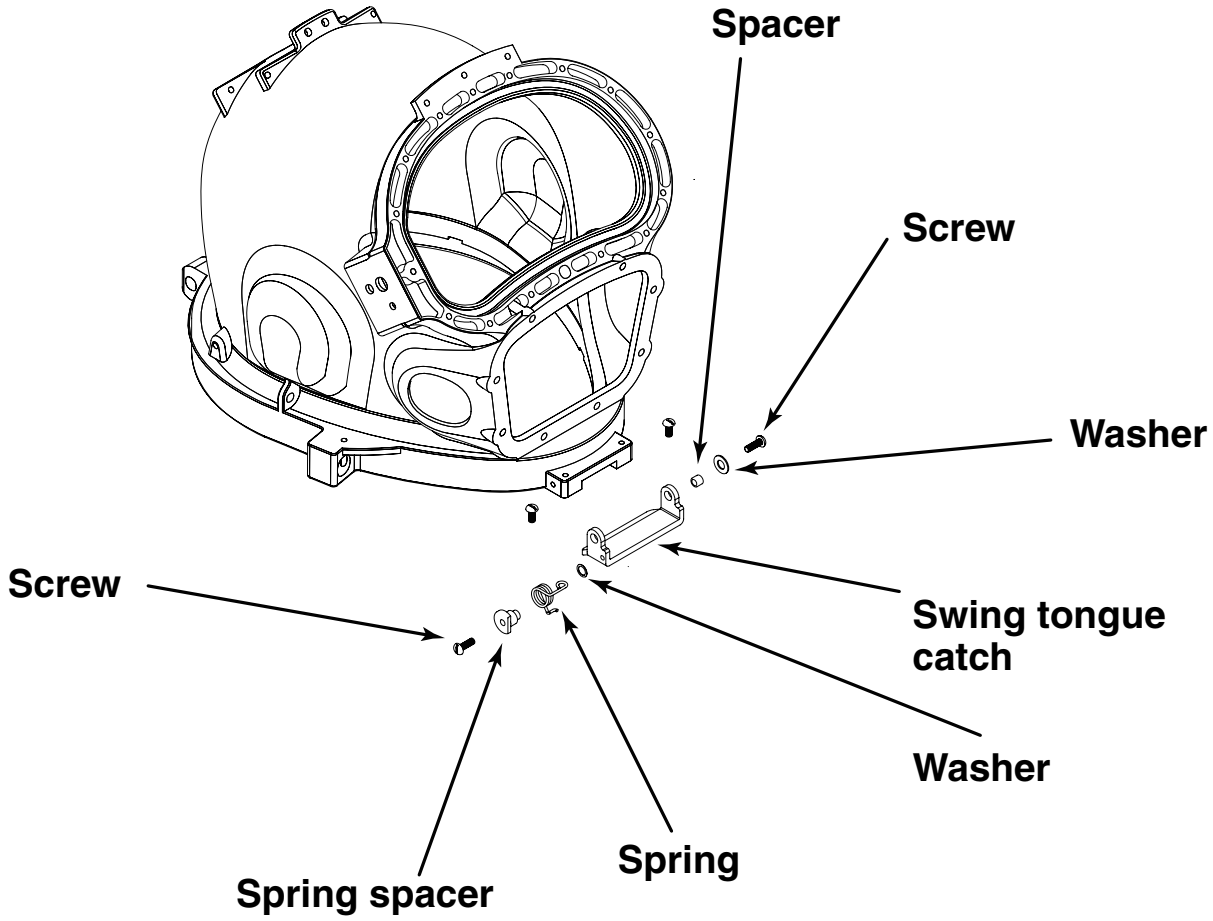


Diagram of the swing tongue catch.

To replace the spring, you will also need to remove the screw on the starboard top of the tongue on the helmet. To access this screw, you will need to either remove the pod/regulator, or use a 90 degree screwdriver.

8.12.2 Reassembly of the Swing Tongue Catch

Note: A drop of Loctite® should be used on all bolts used in the assembly of the swing tongue catch.

1) Insert the washer between the tongue on the helmet and the swing tongue catch.

2)Place the looped end of the spring on the top surface of swing tongue mounting plate as shown. Insert the mount screw through the loop and tighten the screw.

Align the straight section of the spring with the front edge of the mounting area and tighten the screw to 20 inch pounds. This will properly position the spring to align with the tongue catch and side mounting hole.

The threads of the spring spacer should be lightly coated with Loctite® prior to assembly.

All of the screws in the swing tongue catch assembly should be lightly coated with Loctite® prior to assembly.

3) Insert the hooked end of the spring into the small hole in the swing tongue catch. Slip the swing tongue catch over the tongue of the helmet ring on the base of the helmet. The spring end goes on the right side.

4) Insert the screw and spring spacer into the spring and thread the screw into the tongue on the helmet ring. Run the screw in until it is just snug.

5) Place the washer and spacer on screw and insert the screw through the hole on the left end of the swing catch.

6) Tighten screw while ensuring that the spacer fits through the hole in the swing catch and no binding occurs.

7) Tighten all three screws to 20 inch pounds (2.25 Newton Meters) of torque.

8) Test the function of the swing catch. Also, test prior to diving with the system to ensure proper operation.

9) If needed, reinstall the pod and regulator assembly per Chapter 7.

Properly assembled swing tongue catch.

⚠ CAUTION

Use good ventilation when using Loctite®. Fumes from this material may irritate your lungs. Read and follow the directions in the MSDS before using this material.

⚠ CAUTION

Wear hand protection when using Loctite®. This material may irritate your skin. Read and follow the directions in the MSDS before using this material

⚠ CAUTION

Wear eye protection when using Loctite®. This material may irritate your eyes. Read and follow the directions in the MSDS before using this material.

8.13 Locking Collar

Proper function of the locking collar is essential since this device helps hold the helmet on the diver's head.

8.13.1 Locking Collar Removal

Tools Required:
9/16 inch Open End Attachment on Torque Wrench (or box wrench & socket)
9/16 inch Open End Wrench

If the locking collar is damaged through careless handling it may need to be replaced.

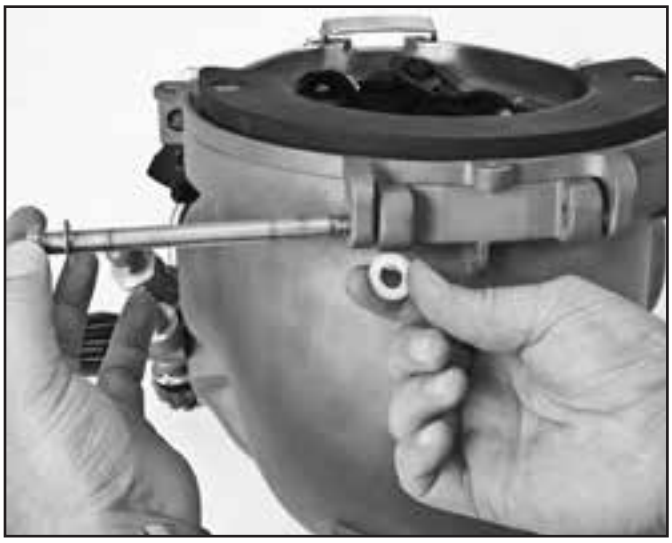
1) Use the two open end wrenches to remove the bolt from the collar.

2) Slide the bolt out of the hinge. Take care not to lose the two Teflon® washers that sit between the locking collar and the rear hinge mounts on the helmet ring.

3) Turn the sealed pull pins until they are disengaged and lift the locking collar away.

4) Clean all parts that will be reused.

Loosen the bolt to remove it from the hinge.



Slide the bolt out from the hinge, taking care not to lose the Teflon® washers.

8.13.2 Locking Collar Disassembly

Tools Required:
3/8" Slot blade attachment on torque screwdriver
7/8" Open end wrench

1) Prior to disassembly of the locking collar, mark the position of the adjustment nuts on the collar so that it will be easy to reinstall the neck pad.

2) Unscrew and remove the two screws that hold the neck pad. Take care not to lose the T-washers or adjustment nuts.

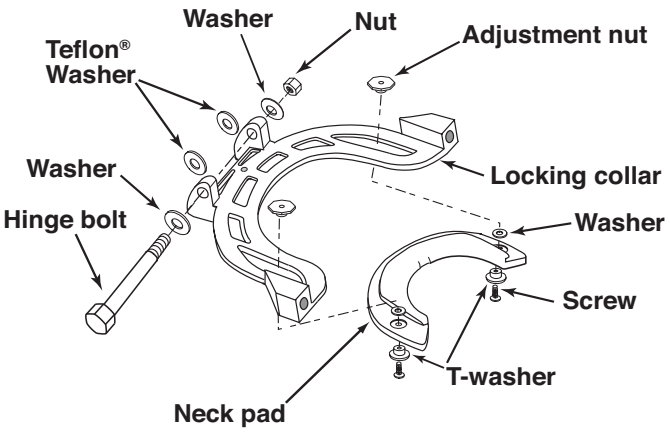
3) Slide the neck pad off the locking collar.

4) If the neck pad needs replacement, remove and save the screws T-washers and adjustment nuts for reuse, or replace them if damaged.

Prior to disassembly of the locking collar, mark the position of the washers.

Slide the neck pad off the locking collar.

Unscrew the two screws that hold the neck pad.



Exploded view of the locking collar assembly.

8.13.3 Locking Collar Reassembly

Tools Required:
3/8" Slot blade attachment on torque screwdriver
7/8" Open end wrench

1) Inspect the Teflon® washers for wear. Replace if necessary.

2) Inspect the neck pad. Replace if damaged.

3) Install the T-washers in the recesses in the neck pad.

4) Slide the neck pad onto the locking collar. The neck pad must be oriented so that the groove for the pull strap will be on the inside of the helmet. The large flange on the neck pad must be on the outside of the locking collar.

5) Align the neck pad using the previous position of the mount nuts. Insert the screws and tighten them with the adjustment nuts.

6) With the helmet resting face down, place the locking collar in position on the hinge on the bottom of the helmet ring, but do not close the catch mechanism.

7) Insert the bolt through one of the washers and through the locking collar hinge just far enough so that the tip of the hinge pin shows at the first bolt hole on the locking collar hinge.

8) Slide one of the Teflon® washers between the locking collar and hinge block on the rear of the helmet ring.

9) Push the bolt through the opening in the washer and all the way through both hinge blocks until the tip of the bolt just protrudes from the opening in the second hinge block.

10) Slide the second Teflon® washer between the hinge block and the locking collar.

11) Push the bolt through the opening in the second Teflon® washer and the locking collar until it protrudes from the locking collar.

12) Install the second washer onto the protruding hinge pin.

13) Tighten the nut until the bolt threads just protrude past the end of the nylock insert.

Make sure to re-install the Teflon® washers.

The end of the bolt should protrude past the end of the nylock insert.

8.14 Head Cushion and Chin Cushion

8.14.1 Head Cushion Foam

The head cushion foam must be replaced when the foam begins to crumble. Order Replacement Foam Kit (Part #510-672). A loose head cushion will create a sloppy fit to the helmet and cause discomfort to the diver.

8.14.2 Chin Cushion Foam

Like the head cushion, the foam in the chin cushion must be replaced when the foam begins to crumble. The foam for the chin cushion is included when the kit for the head cushion is ordered.

The head cushion foam is easily replaceable.

The chin cushion.

⚠ WARNING

A loose fitting head cushion will cause poor oral/nasal mask fit resulting in CO_2 buildup in the helmet. This condition could lead to a build up in CO_2 (Hypercapnia), possibly resulting in unconsciousness, serious injury or death.

Note: If the head moves, the helmet should follow.

8.15 Communications System

8.15.1 General

The communications system in Kirby Morgan helmets requires regular attention and maintenance for proper function. Clear two way speech communications between the diver and the surface crew is one of the most important capabilities of surface supplied diving operations.

8.15.2 Earphone Inspection

To service the earphones, first remove the head cushion from the helmet. The earphones can be carefully pulled out of the retainers in the helmet shell for inspection and disassembly.

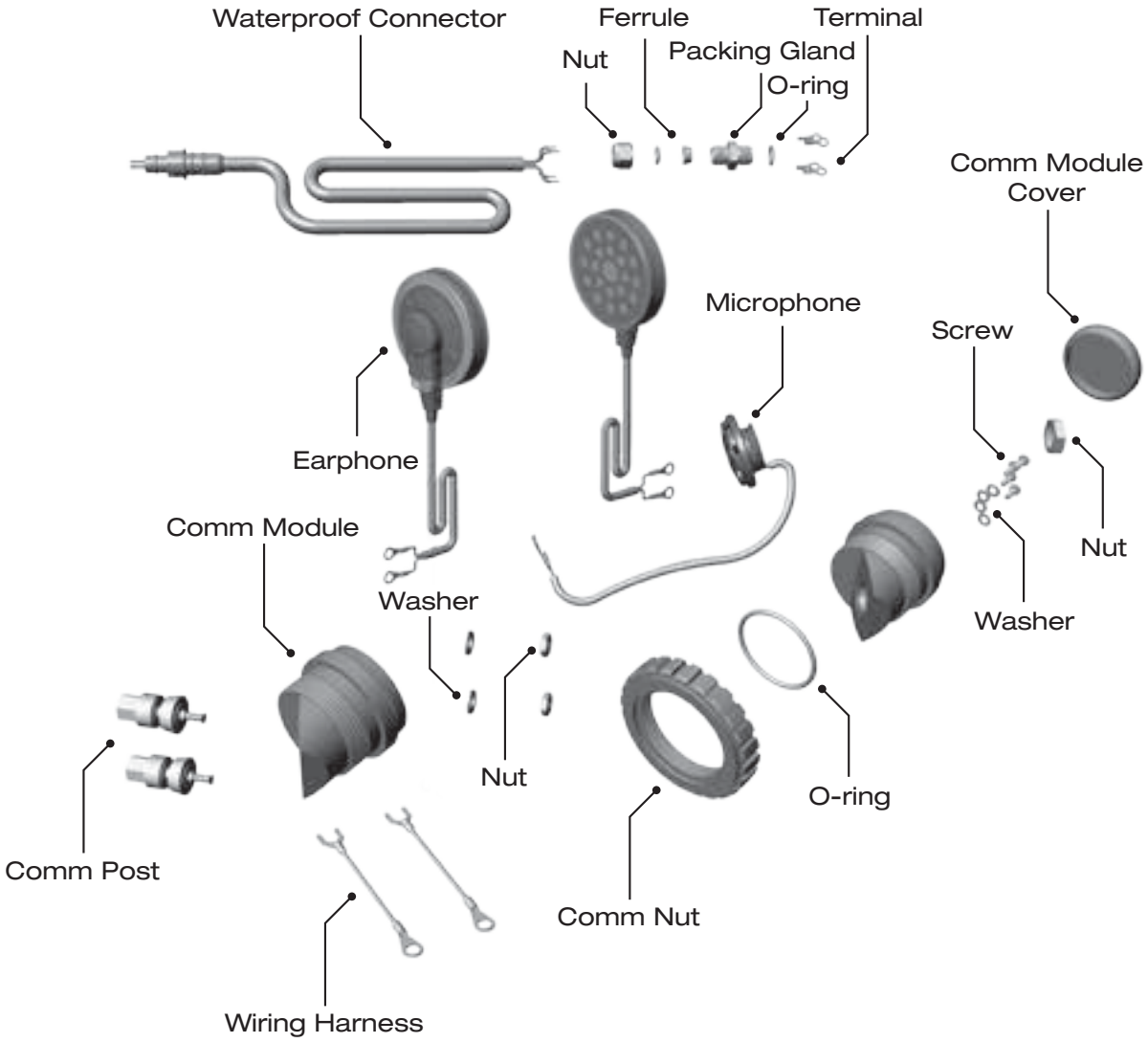
1) Remove the (clear) cover first and slide it along the wire to get it out of the way. Remove the earphone protector and then peel back the (black) rear cover.

2) Check the wire connections. They should be solid.

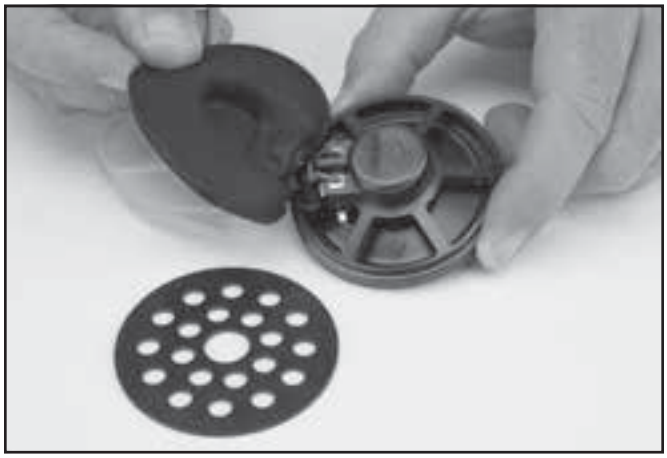
Removing the rubber cover from the earphone.

3) Check the mylar diaphragm. If the mylar is torn or loose, replace the entire unit, see "8.15.6 Earphone And Wire Assembly Replacement" on page 153.

4) If the rubber covers are worn or damaged, replace them also.



The components of the communications system are shown here in exploded view.



Inspect the mylar earphone.

8.15.3 Removal of Communications Assembly

Tools Required: None

The communication module and retainer nut should be checked daily for proper installation and tightness. The best way to check is by simply loosening the mount nut by hand (Counter clockwise ⅛ to ¼ turn) then retightening by hand. Three fingers, is all that is required. The module does not need to be tightened excessively to maintain a proper seal.

The entire communications assembly can be replaced as follows:

1) Slide the earphones out of the retainers.

2) Pull the microphone out of the oral/nasal mask.

Remove the earphones from the earphone retainers.

The microphone must be removed from the oral/nasal mask.

The large plastic nut is removed from the communications module.

The modular communications system can be rapidly replaced.

3) Unscrew the nut on the outside of the helmet shell.

4) Push the communications module into the helmet shell interior. Remove the o-ring.

5) The entire communications assembly can be replaced with a spare assembly for the most rapid turnaround.

8.15.4 Replacement of Communications Assembly

1) Install the o-ring on the communications module.

2) Carefully push the communications module through the opening in the helmet shell. The communications posts, or waterproof connector assembly if present, should be pointed toward the rear of the helmet.

3) Screw the nut onto the communications module. Tighten by hand until snug against the helmet. Do not use a wrench to tighten this part.

4) Place the earphones in the earphone retainers.

5) Route the earphone wires so they do not obscure the diver's vision. The wire for the left speaker is tucked into the space between the bottom of the oral nasal mask and the helmet shell.

The nut must be securely fastened to hold the com module in position. Hand tighten only.

⚠ WARNING

The communication retainer nut should never be tightened using a spanner or other tool. Tightening the retainer ring using a tool will add excessive strain to the parts and could cause damage to the module allowing the module to break free, resulting in flooding of the helmet which could cause injury, or drowning.

8.15.5 Microphone Replacement

Tools Required:
1/8 inch Flat Blade Attachment on Torque Screwdriver

The entire microphone is replaced the same as the earphones by removing the wire lugs from the communications module and replacing the entire unit.

1) Remove the entire communications assembly as per this chapter.

2) Remove the rubber cover.

3) Remove the screws and washers from the communications module.

4) Lift the terminal lugs out of the communications module. **Note the position of the terminal wires.**

5) Install the terminals for the replacement microphone. Note that the wires must go on separate terminals, just as before.

6) Install the microphone in the oral nasal mask.

Install the microphone in the oral nasal mask.

8.15.6 Earphone And Wire Assembly Replacement

NOTE: If only the earphone speaker is damaged, it can be replaced by removing the tie-wrap inside of the covers, unscrewing the wire connection and replacing the necessary components. There is no need to completely remove the assembly from the communications module.

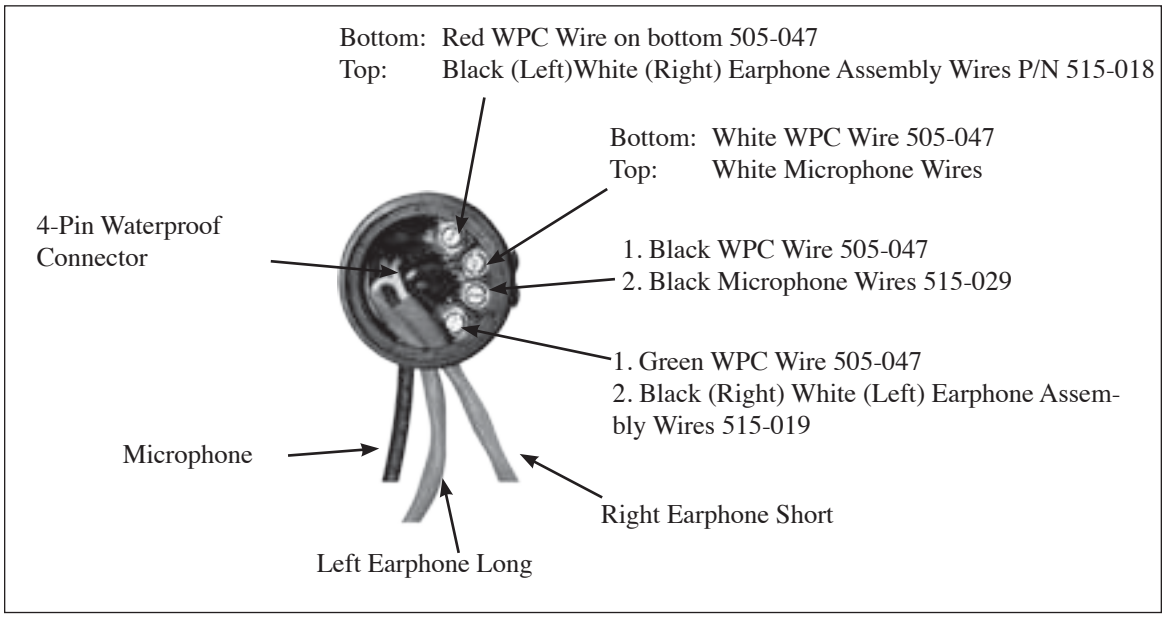


Diagram depicting correct earphone wire insertion for the Waterproof Connector

Tools Required:
1/8 inch Flat Blade Attachment on Torque Screwdriver

The earphones may be replaced individually if needed, however, if one is "bad", the other earphone will probably need to be replaced soon, too.

1) Remove the entire communications assembly as per this chapter.

2) Remove the rubber cover of the communications module.

3) Remove the screws and washers from the communications module.

4) Lift the terminal lugs out of the communications module. **Note the position of the terminal wires.**

5) Install the terminals for the earphones. Note that the wires must go on separate terminals as before.

8.15.7 Waterproof Connector

Kirby Morgan helmets are supplied either with a waterproof connector or an optional set of terminal posts. The waterproof connector is subject to failure if the helmet receives rough handling. To replace the connector use the following procedure.

8.15.7.1 Connector Removal

Tools Required:
3/4 inch Open End Wrench
1/8 inch Flat Blade Attachment on Torque Screwdriver

1) Remove the communications assembly from the helmet as per this chapter.

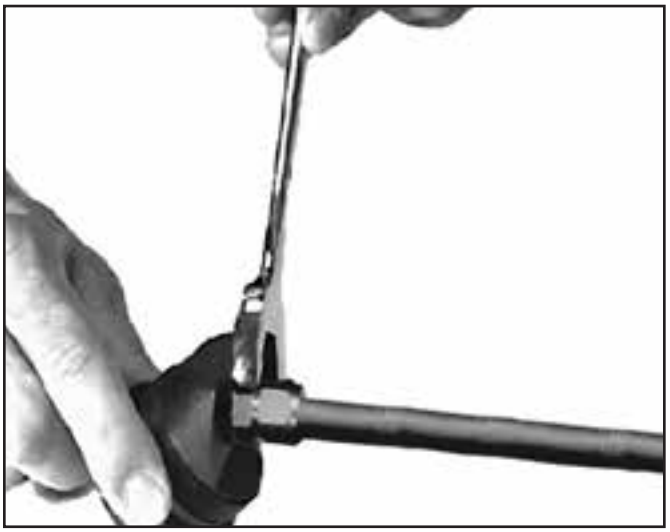
2) Remove the rubber cover.

3) Remove the screws and washers from the communications module.

4) Remove the earphone and microphone wire lugs from the interior of the communications module.

5) The nut in the packing gland interior of the communications module will not turn, as it will jam against the interior of the communications module. Use the 3/4 inch wrench to unscrew the waterproof connector.

6) Pull the connector through the module.



Use a 3/4 inch wrench to unscrew the waterproof connector.

Pull the connector out of the module.

8.15.7.2 Connector Replacement

1) Insert the new waterproof connector assembly (146) into the communications module.

2) Screw the waterproof connector into the nut. Tighten until snug.

3) Slip the earphone and microphone wires back into the module.

4) Place the screws with washers through the opening on the terminal lugs in the connector and earphone and microphone.

5) Thread the screws into the communications module.

6) Tighten the screws until snug. Do not overtighten.

7) Install the rubber cover.

8.15.8 Terminal Connections in the Waterproof Connector

Installing the Mount Nut.

Installing the black wire.

Tightening the Mount Nut.

Installing the white wire.

Installing the green wire.

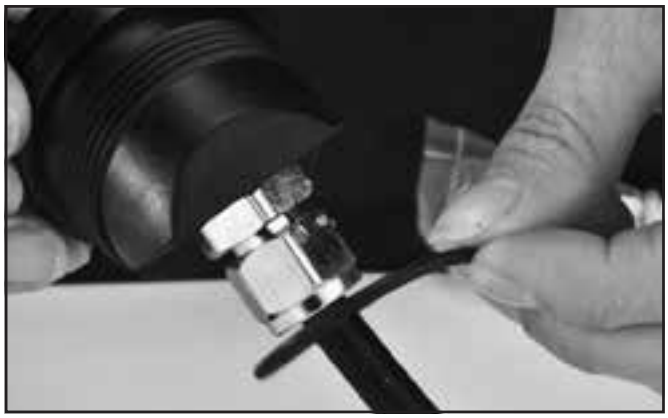
Installing the red wire.

Installing the red microphone wire.

Installing the white microphone wire.

Installing the right earphone wires.

Installing the left earphone wires.



Installing the O-ring.

8.15.9 Communications Posts

8.15.9.1 Communications Post Removal

Tools Required;
3/8 inch Open End Wrench
Flat Blade Attachment on Torque Screwdriver

1) Remove the communications assembly from the helmet as per this chapter.

2) Remove the rubber cover.

3) Remove the screws and washers from the communications module.

4) Remove the earphone and microphone wire lugs from the interior of the communications module.

5) Remove the nuts, the wiring harness and washers from the communications posts.

6) Remove the communications posts from the module.

7) Remove all traces of silicone sealant from the communications module.

8.15.9.2 Communications Post Replacement

1) Apply fresh RTV (silicone sealant) to the base of the communications posts.

2) Insert the communications posts into the module.

3) Install the washers on the communications posts, then the wiring harnesses.

4) Screw the nuts on the communications posts and tighten until snug. Do not overtighten.

5) Wipe off any excess silicone sealant from the module.

6) Slip the earphone and microphone wires back into the module through the slot in the side of the module.

7) Place the screws with washers through the opening on the terminal lugs in the earphones, microphone, and wiring harnesses.

8) Thread the screws into the communications module.

9) Tighten the screws until snug; do not overtighten.

10) Install the rubber cover.

11) Reinstall the communications assembly into the helmet shell per this chapter.

Use a wrench to tighten the binding post nuts.

⚠ CAUTION

Use good ventilation when using RTV sealant. Fumes from this material may irritate your lungs. Read and follow the directions in the MSDS before using this material.

⚠ CAUTION

Wear eye protection when using RTV sealant. This material may irritate your eyes. Read and follow the directions in the MSDS before using this material.

⚠ CAUTION

Wear hand protection when using RTV sealant. This material may irritate your skin. Read and follow the directions in the MSDS before using this material

Chapter 9.0
Accessories for the Kirby Morgan 77

9.1 Introduction
This section provides the manufacturer's advice on how to install KMDSI accessories including a low pressure inflator hose and the weld lens assembly. The installation procedures shown here are typical for most Kirby Morgan masks and helmets.

9.2 Low Pressure Inflator Hose
The low pressure inflator system may be used with either a buoyancy compensator or dry suit systems. For certain pieces of equipment it may be necessary to use a longer inflator hose than is originally supplied by the manufacturer of the low pressure system.

9.2.1 Installation of the Low Pressure Inflator Hose
Tools Required:
5/32 inch allen wrench attachment on torque wrench

1) Remove the plug from the side block. Save this plug.

2) Check the O-ring on the low pressure whip to be sure it is present and in good condition. Carefully screw the low pressure whip into the side block.

3) Tighten fitting to the specifications provided by the dry suit manufacturer. Do not overtighten.

4) Pressurize helmet and test connection for leaks.

⚠ WARNING

When using the low-pressure port on the side block for attachment of a low-pressure hose, a hose with built in flow restriction must be used. Without a restrictor, a hose failure could deplete the Emergency Gas Supply very rapidly leading to suffocation. This could result in serious personal injury or death.

Remove the plug from the side block and install the inflator hose here.

Thread the hose into the side block opening.

9.3 Weld Lens Assembly

9.3.1 Weld Lens Assembly Installation

Tools Required:
3/8 inch Open End Wrench
1/4 inch Flat Blade Attachment on Torque Screwdriver

1) Remove the two plug screws from the port retainer. Refer to the drawing included with the weld lens assembly kit for the remainder of the location numbers.

2) Insert the screws through the weld lens mount

3) With the shield facing out from the helmet or mask, install and tighten the two mount screws into the port retainer ears.

4) Tighten the two lock nuts on the ends of the hinge studs so that the welding lens assembly can be flipped up, but will not fall down from its own weight.

Remove the two plug screws from the port retainer.

Install the screws through the mount ears.

Tighten the weld lens assembly.

⚠ WARNING

Use only the screws provided with the Weld Lens Kit for installation of this assembly. Longer screws will damage the helmet shell and/or the threaded inserts. This could cause flooding through the port.

9.4 Weld Shield Assembly

9.4.1 Weld Shield Assembly Installation

Tools Required:
3/8 inch Open End Wrench
1/4 inch Flat Blade Attachment on Torque Screwdriver

1) Remove the two plug screws from the port retainer. Refer to the drawing included with the weld shield assembly kit for the remainder of the location numbers.

2) Insert the mount screws through the spacer washers and then through the weld shield mount ears.

3) With the shield facing out from the helmet or mask, install and tighten the two mount screws into the port retainer.

9.5 Use of Quick Disconnect

A Quick Disconnect can be used with all bail-out systems. It provides greater convenience on deck while dressing the diver. It also makes it possible to separate the attachment of the bail-out from the helmet should the diver become entangled underwater. All quick disconnects used must be of good quality and be capable of supplying gas without any additional flow restriction. All quick disconnects used in countries that adhere to CE standards must be CE approved.

A quick disconnect hose may be installed in any low pressure port of the diver's bailout regulator. The connector splits the hose into two halves, with a male connector on one end and a female connector on the other. The female connector should be equipped with a sleeve lock that must be properly aligned before the hose can be disengaged.

One end of the hose with the connector attaches to the emergency valve assembly, while the other end of the hose with its mating connector attaches to any of the standard low pressure ports on the KMDSI SuperFlow® first stage regulator (or any high performance regulator) used for the bail-out supply.

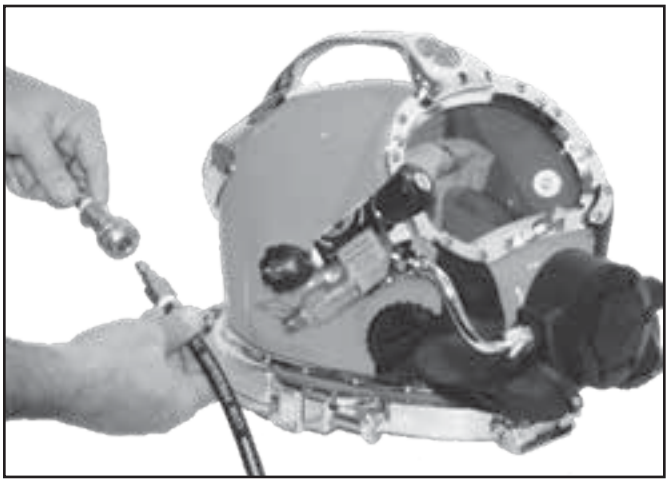


Table of Equivalents

To convert units appearing in Column 1 (left column) into equivalent values in Column 2 (center column), multiply by factor in Column 3. Example: To convert 7 gallons into cubic inches, multiply 7 × 231 = 1617. To convert units appearing in Column 2 (center) into equivalent values of units in Column 1 (left), divide by factor in Column 3. Example: To convert 25 horsepower into Btu per minute, divide 25 by 0.02356 = 1061

To Convert Into	Into To Convert	Multiply By Divide By
Atmospheres	Feet of Water	33.9
Atmospheres	Inches of Mercury (Hg)	29.92
Atmospheres	PSI (LBS per Sq. Inch	14.7
BTU	Foot Pounds	778.3
BTU per hour	Watts	0.2931
BTU per minute	HorsePower	0.02356
Celsius (Centigrade)	Fahrenheit	°C x 1.8 + 32
Centimeters	Inches	0.3937
Cubic Centimeters	Gallons (U.S. Liquid)	0.0002642
Cubic Centimeters	Liters	0.0001
Cubic Feet	Cubic Inches	1728
Cubic Feet	Gallons (U.S. Liquid)	7.48052
Cubic Inches	Cubic Feet	0.0005787
Cubic Inches	Gallons (U.S. Liquid)	0.004329
Days	Seconds	86.400
Degrees (Angle)	Radians	0.01745
Feet	Meters	0.3048
Feet	Miles	0.0001894
Feet of Water	Atmospheres	0.0295
Feet of Water	Inches of Mercury (Hg)	0.8826
Feet of Water	PSI (Lbs per Sq. Inch)	0.4335
Feet per Minute	Miles per Hour	0.01136
Feet per Second	Miles per Hour	0.6818
Foot-Pounds	BTU	0.001286
Foot-Pounds per Minute	Horsepower	0.0000303
Foot-Pounds per Second	Horsepower	0.001818
Gallons (U.S. Liquid)	Cubic Feet	0.1337
Gallons (U.S. Liquid)	Cubic Inches	231
Gallons of Water	Pounds of Water	8.3453
Horsepower	BTU per Minute	42.44
Horsepower	Foot-Pound per Minute	33,000
Horsepower	Foot Pounds per Second	550
Horsepower	Watts	745.7
Hours	Days	0.04167
Hours	Weeks	0.005952
Inches	Centimeters	2.54
Inches of Mercury (Hg)	Atmospheres	0.03342
Inches of Mercury (Hg)	Feet of Water	1.133
Inches of Mercury (Hg)	PSI (Lbs. per Sq. Inch)	0.4912
Inches of Water	PSI (Lbs. per Sq. Inch)	0.03613
Liters	Cubic Centimeters	1000
Liters	Gallons (U.S. Liquid)	0.2642
Micron	Inches	0.00004
Miles (Statute)	Feet	5280
Miles per hour (MPH)	Feet per Minute	88
Miles per hour	Feet per Second	1.467
Ounces (Weight)	Pounds	0.0625
Ounces (Liquid)	Cubic Inches	1.805
Pints (Liquid)	Quarts (Liquid)	0.5
Pounds	Grains	7000
Pounds	Grams	453.59
Pounds	Ounces	16
PSI (Pounds per Sq. Inch)	Atmospheres	0.06804
PSI (Pounds per Sq. Inch)	Feet of Water	2.307
PSI (Pounds per Sq. Inch)	Inches of Mercury (Hg)	2.036
Quarts	Gallons	0.25
Square Feet	Square Inches	144
Temperature (°F - 32)	Temperature (°C)	0.5555
Tons (U.S.)	Pounds	2000
Watts	Horsepower	0.001341

Appendix 1: Torque Specifications

Loc. #	Part #	Description	Torque in Inch Pounds	Torque in Newton Meters
Side Block Drawing				
116	555-117	Adapter, brass (umbilical)	See Note 1	See Note 1
126	550-046	Inlet nipple, EGS valve	40	4.5
130	350-062	Low presssure plug, large	20	2.25
131	550-178	Stud	20 *Loctite® 262*	2.25 *Loctite® 262*
137	550-568	Bonnet, defogger valve	100	11.3
142	550-564	Side block bent tube adapter	100 *Loctite® 222*	11.3 *Loctite® 222*
144	550-094	Low pressure plug, small	20	2.25
151	550-551	Bonnet, EGS valve	100	11.3
123	555-195	One way valve body	150	17
117	555-195	One way valve seat	150	17
Helmet Drawing				
17, helmet assy drawing	530-083	Screw, sideblock	35	4
21, helmet assy drawing	530-317	Nut, air train assy	35	4

KM 77 Torque Table #2 - Helmet Shell & Neck Ring

Helmet Drawing				
6	530-058	Screw, handle rear	15 *Loctite® 248*	1.7 *Loctite® 248*
12	530-052	Screw, handle grip	*just until rubber begins to extrude*	
9	530-059	Screw, handle front	15 *Loctite® 248*	1.7 *Loctite® 248*
22	530-059	Screw, port retainer	15 *Loctite® 248*	1.7 *Loctite® 248*
23	550-566	Adapter port retainer plug	15 *Loctite® 268*	1.7 *Loctite® 268*
24	530-052	Screw, port retainer plug	20 *Loctite® 248*	2.25 *Loctite® 248*
25	550-062	Knob, nose block	*Tighten to bottom out*	
47	530-070	Screw, whisker kidney plate/anode	15 *Loctite® 248*	1.7 *Loctite® 248*
51	530-035	Screw, tongue catch	20 *Loctite® 248*	2.25 *Loctite® 248*
58	530-045	Screw, tongue catch	20 *Loctite® 248*	2.25 *Loctite® 248*
50	530-032	Screw, tongue catch spring	12 *Loctite® 248*	1.3 *Loctite® 248*
70	530-015	Screw, pull pin assembly	12	1.4

66	530-037	Screw, earphone retainer	25 *Loctite® 248*	2.8 *Loctite® 248*
66	530-037	Screw, snap tab	25 *Loctite® 248*	2.8 *Loctite® 248*
not numbered	530-037	Screw, chin strap assembly	25 *Loctite® 248*	2.8 *Loctite® 248*
not numbered	550-577	Nose block guide	30 *Loctite® 268*	3.4 *Loctite® 268*
Locking Collar Drawing				
196	530-064	Screw, neck pad	35	4
Neck Ring Assembly Drawing				
201	530-024*	Screw, split ring	14	1.58
202	530-022	Screw, stepped ring	14 *Loctite® 222*	1.58 *Loctite® 222*
203	530-220	Screw, pull strap	14 *Loctite® 222*	1.58 *Loctite® 222*
KM 77 Torque Table #3 - Regulator				
163	350-025	Packing nut, regulator knob	40	4.5
33	550-372	Regulator mount nut	80	10
KM 77 Torque Table #4 - Communications				
107	550-040	Mount nut, communications packing gland	20	2.25
101	530-308	Nut, communications posts	*Snug—DO NOT overtighten* RTV Sealant	
113	555-178	Packing nut, waterproof connector	20	2.25
KM 77 Torque Table #5 - Miscellaneous				
—	200-017	Overpressure Relief Valve	20	2.25
—	530-210	Weld Lens Mount Bolt	23	2.6
—	555-210	Restrictor Adaptor	20	2.25

Note 1: Use Teflon® tape for one to one and a half wraps, starting two threads back from the pipe thread end of the fitting to avoid getting Teflon® tape in the valve. Tighten pipe thread using good engineering practices.

Note 2: For a neoprene neck dam, re-torque every 12 to 24 hours.

** See Note 2 ** Use Loctite® 222 or equivalent medium strength thread locking compound.*

Checklist, Maintenance, and Pre-Dive Inspections

For the most current check lists, helmet maintenance procedures, and pre-dive inspections, please check on the Internet at www.divelab.com.

Appendix A2
Maintenance and Inspection Procedures

The following section describes the maintenance and inspection procedures that are used to complete the Annual, Monthly and Daily Checklists, to ensure optimum reliability and performance. These procedures are additionally utilized in conjunction with the daily pre and post dive maintenance checklists. The following service intervals are the minimum recommended for helmets being used under good conditions. Helmets used in harsh conditions, i.e., contaminated water, welding / burning operations, or jetting may require more frequent servicing.

The intention of the maintenance and overhaul program is to help maintain all helmet components in good working order in accordance with KMDSI factory specifications. It will also help to identify worn or damaged parts and components before they affect performance and reliability. Whenever the serviceability of a component or part is in question, or doubt exists, replace it. All helmet components and parts have a service life and will eventually require replacement.

NOTE: The side block does not need to be removed from the helmet annually, providing, after removal of side block components, there is no corrosion and verdigris. Kirby Morgan recommends that every three years the side block assembly be physically removed from the helmet per Section 7.3. Clean and inspect the stud and securing screw, replace if bent, stripped, or any damage is detected.

NOTE: The pipe thread fittings used on the umbilical adapter and the emergency gas valve are the only fittings that require sealing with Teflon® tape. Do not use liquid sealant. When installing Teflon® tape on pipe threads, apply the tape starting one thread back from the end of the fitting. Apply the tape in a clockwise direction under tension. 1-1½ wraps is all that is needed. The use of more than 1½ wraps could cause excess Teflon® tape to travel into the breathing system. Do not overtighten when installing.

Chapters 6, 7 and 8 of this maintenance manual gives guidance on all routine and corrective maintenance and repairs. Disassembly and reassembly of components is explained in a step-by-step manner that may not necessarily call out that all O-rings and normal consumable items will be replaced. The manual is written in this way so that if an assembly, component, or part is being inspected or disturbed between normal intervals it is acceptable to reuse O-rings and components providing they pass a visual inspection . When conducting annual or scheduled overhauls all O-rings should be replaced. The side block should be removed from the helmet at least every three years (or 400 operating hours) so that the stud and securing screw can be inspected. All O-rings should be lightly lubricated with the applicable lubricant.

Lubrication / Cleanliness:
Helmets intended for use with breathing gas mixtures in excess of 50% oxygen by volume, should be cleaned for oxygen service. They must only be lubricated with oxygen compatible lubricants such as Christo-Lube® or Krytox®. All air supply systems must be filtered and must meet the requirements of grade D quality air or better. Helmet breathing gas systems/gas train components used for air diving should only be lubricated with silicone grease Dow-Corning® 111® or equivalent. KMDSI uses Christo-Lube® at the factory for lubrication of all gas train components requiring lubrication, and highly recommends its use.

Before 1999, Kirby Morgan Dive Systems, Inc., used Danger and Warning Notices in the helmet and mask owner's manual limiting the breathing gas percentage to less than 23.5 percent oxygen. This was due primarily to cleaning issues in regards to possible fire hazards and was in compliance with the recommendations of the Association of Standard Test Methods (ASTM), National Fire Protection Agency (NFPA), and the Compressed Gas Association (CGA) as well as other industry standards.

During the 1990's, open circuit scuba use of enriched-air (Nitrox) by technical and recreational divers became very popular, and as use increased, so did the number of combustion incidents during the mixing and handling of the breathing mixtures. These combustion incidents brought attention to the dangers and inherent risks associated with oxygen and oxygen enriched gas mixtures.

Kirby Morgan cannot dictate or override regulations or recommendations set forth by industry standards or governing bodies pertaining to enriched gas use. However, it is the opinion of Kirby Morgan that breathing gas mixtures up to 50% oxygen by volume should not pose a significant increased risk of fire or combustion in Kirby Morgan helmets and masks

low-pressure components and does not warrant the need for the stringent specialized oxygen clean post-sampling and particulate analysis normally accomplished for components used in high pressure oxygen valves, regulators, and piping systems. The decision for using 50% has been primarily based on a long history of operational field use.

As long as Kirby Morgan helmets and masks are cleaned and maintained in accordance with the maintenance manual, the equipment should not pose a significant increased risk of a fire or ignition originating in the helmet or mask low-pressure (<250 p.s.i.g. /<17.2 bar or less) components when used with enriched gases of up to 50% oxygen. However, CAUTION should be exercised any time enriched gases are handled or used.

In general, helmets and masks used primarily for mixed gas use are subject to far less oil and particulate contamination than those used for air diving. For this reason, helmets and masks commonly used with both air and enriched breathing gases should be cleaned and maintained with greater care and vigilance. It is important that all internal gas-transporting components, i.e., side block, bent tube, and demand regulator assemblies remain clean and free of hydrocarbons, dirt, and particulates. Whenever the equipment is depressurized, all exposed ports or fittings should be plugged/capped to help maintain foreign material exclusion.

Gas train components should be cleaned according to the procedures outlined in the operations manual at least annually and/or whenever contamination is suspected or found. Helmet interior and exterior surfaces should be cleaned at least daily at the completion of daily diving operations. Helmets and masks used in waters contaminated with oils and other petroleum or chemical contaminants may require cleaning after each dive.

Helmet and mask components requiring lubrication should be lubricated sparingly with lubricants approved for oxygen use such as Christo-Lube®, Krytox®, or Fluorolube®. KMDSI highly recommends using Christo-Lube®, and uses Christo-Lube® during the assembly of all KMDSI gas train components.

Regardless of the approved lubricant used, never mix different kinds of lubricants. Persons mixing handling and working with breathing gases should be properly trained in all aspects of safe gas handling.

⚠ WARNING

Do not use lubricants of any kind on the diaphragm or exhaust valves. Use of lubricants can attract and hold debris that could interfere with the proper operation of the regulator.

NOTE: Refer to Chapter 7 for removal and disassembly / reassembly procedures.

NOTE: The helmet weights do not need to be removed from the helmet unless fiberglass damage is present or suspected.

NOTE: During annual overhauls, all O-rings and soft goods, i.e., valve seats and washers should be replaced. KMDSI offers kits that have all the necessary parts.

NOTE: The neck dam rubber need not be replaced if the inspection reveals no damage or significant wear and the rubber components are not dried out.

NOTE: The oral nasal mask and oral nasal valve requires replacement, only if inspection reveals damage, distortion, or signs of damage.

NOTE: All threaded fasteners and parts require careful cleaning and inspection as well as the mating parts. Replace any and all threaded parts or components that show signs of wear or damage.

KMDSI highly recommends a certified KMDSI repair technician make all repairs and that only genuine KMDSI repair and replacement parts be used. Owners of KMDSI products that elect to do their own repairs and inspections should only do so if they possess the knowledge and experience. All inspections, maintenance and repairs should be completed using the appropriate KMDSI Operation and Maintenance Manual.

Persons performing repairs should retain all replacement component receipts for additional proof of maintenance history. Should any questions on procedures, components, or repairs arise, please telephone Kirby Morgan Dive Systems, Inc., at 1-805-928-7772 or E-mail them at kmdsi@kirbymorgan.com or telephone Dive Lab, Inc., at 1-850-235-2715 or E-mail them at divelab@aol.com.

Appendix 3
Supply Pressure Requirements & Tables

Table 1 should be used whenever low pressure compressors are used or when using surface control panels that are limited to outlet pressures within the range of 220 psig or less.
It is important to insure the required outlet pressure from the table can be maintained in a stable manner at the surface to insure adequate supply at depth.
When used with high pressure consoles that can regulate pressures greater than 220 psig use Appendix 3 Table 3 SuperFlow® / SuperFlow® 350 Regulator High Pressure Regulated Source.

Diver Work Rates

The divers work rate, also known as respiratory minute volume (RMV), is basically how hard the diver breathes. As the diver's physical exercise increases, so does the ventilation rate. Proper training teaches the diver to never push the work rate beyond normal labored breathing. (This is in the 30-50 RMV range). To put things in perspective, heavy work for a physically fit person:

Swimming at one knot is about	38 RMV
Running at 8 miles per hour is about	50 RMV

Once the diver hits 55 RMV, he is entering the extreme range. Many fit divers can do 75 RMV for one to two minutes providing the inhalation resistive effort of the breathing system is not much above 1-1.3 J/L. The divers work rate should never be so heavy that the diver cannot maintain a simple conversation with topside.

When the work rate gets into the moderately heavy to heavy range 40-50 RMV the diver needs to slow down!

Working to the point of being excessively winded should be avoided at all costs!

Working at rates greater than 58 RMV underwater is extreme, and can pose hazards that are not present when doing extreme rates on the surface. When underwater, inhalation and exhalation resistive effort increases due to the density of the breathing gas and resistive effort of the equipment. The increase in resistive effort can cause an increase in blood level CO_2 because the diver cannot ventilate as freely as when breathing at the surface. When breathing air at the deeper depths, nitrogen narcosis can mask CO_2 symptoms which can then snowball into even heavier breathing, often resulting in confusion, panic, and in rare cases muscle spasm, unconsciousness, sometimes resulting in death. In some rare cases high ventilation rates has been suspected as the cause of respiratory barotraumas, including arterial gas embolism. The possibility of suffering a respiratory over inflation event during high work rates while underwater could be even greater for divers that smoke, or have previous known or unknown lung disease or respiratory damage. The safest course for the diver is to keep the equipment properly maintained for peak performance and to know and understand the capabilities and limitations of the equipment including all breathing supply systems they use.
The output capability of the supply system including umbilicals should be known to all that use it and periodic tests should be done to insure flow capability.

Use Of Low Pressure Supply Table

The low pressure supply tables were developed to simplify calculation of supply pressure. In order to get the required volume to the diver, you need to have the proper supply pressure. The table starts at 90 psig and increases in 10 psig increments. The user simply selects the lowest pressure that best represents the low cycling pressure of the compressor being used. The table basically shows the maximum depth that can be attained while breathing at RMV's (breathing rates in liters per minute) listed. It is strongly recommended that divers plan for a minimum supply pressure that will allow the diver to work at no less that 50 - 62.5 RMV.

Appendix 3 Table 1 Work Rate Expressed as Respiratory Minute Volume (RMV)*

Work Load	RMV	Cubic Feet/Minute (CFM)	Equivalent Land Based Exercise
Rest	7-10 RMV	0.2 - 0.35 CFM	
Light Work	10-20 RMV	0.35 - 0.7 CFM	Walking 2 miles per hour
Moderate Work	20-37 RMV	0.7 - 1.3 CFM	Walking 4 miles per hour
Heavy Work	37-54 RMV	1.3 - 1.9 CFM	Running 8 miles per hour
Severe Work	55-100 RMV	1.94 - 3.5 CFM	
* *source: U.S. Navy Diving Manual*			

Appendix 3 Table 2 REX® Regulator® Low-Pressure Compressor Supply Pressure Requirements Table*

Supply Pressure Surface Gauge Reading	RMV (Respiratory Minute Volume)	Maximum Recommended Depth		Required SCFM**	Required SLPM**
		FSW	MSW		
90 P.S.I.G . (6.21 BAR)	40 (heavy work)	104	32	7.0	198
	50 (heavy work)	76	23	7.0	198
	62.5 (severe work)	61	18.8	7.5	212
	75 (severe work)	50	15.4	8.0	227
100 P.S.I.G. (6.9 BAR)	40 (heavy work)	108	33	7.25	205
	50 (heavy work)	90	27	7.9	223
	62.5 (severe work)	75	22.9	8.7	246
	75 (severe work)	59	18	8.9	252
110 P.S.I.G. (7.59 BAR)	40 (heavy work)	117	35	7.7	218
	50 (heavy work)	100	30	8.6	244
	62.5 (severe work)	83	25	9.3	263
	75 (severe work)	68	21	9.7	275
120 P.S.I.G. (8.28 BAR)	40 (heavy work)	127	38.7	8.2	232
	50 (heavy work)	113	34	9.4	266
	62.5 (severe work)	93	28	10	283
	75 (severe work)	75	23	9.7	275
130 P.S.I.G. (8.97 BAR)	40 (heavy work)	145	44	9.1	258
	50 (heavy work)	125	38	10	283
	62.5 (severe work)	106	32	11	311
	75 (severe work)	85	26	11.36	322
140 P.S.I.G. (9.66 BAR)	40 (heavy work)	160	48	10	283
	50 (heavy work)	135	41	11	311
	62.5 (severe work)	114	35	12	340
	75 (severe work)	92.5	29	12	340
150 P.S.I.G. (10.35 BAR)	40 (heavy work)	170	52	10.5	297
	50 (heavy work)	149	45	11.7	331
	62.5 (severe work)	126	38	13	368
	75 (severe work)	105	32	13.3	377

Appendix 3 Table 2 REX® Regulator® Low-Pressure Compressor Supply Pressure Requirements Table Continued*

Supply Pressure Surface Gauge Reading	RMV (Respiratory Minute Volume)	Maximum Recommended Depth		Required SCFM**	Required SLPM**
		FSW	MSW		
160 P.S.I.G . (11.04 BAR)	40 (heavy work)	186	57	11.3	320
	50 (heavy work)	157	48	12.2	345
	62.5 (severe work)	134	41	13.4	379
	75 (severe work)	112	34	14	396
170 P.S.I.G. (11.73 BAR)	40 (heavy work)	203	62	12.2	345
	50 (heavy work)	170	52	13	368
	62.5 (severe work)	143	43	14	396
	75 (severe work)	121	37	14.9	422
180 P.S.I.G. (12.42 BAR)	40 (heavy work)	219	67	13	368
	50 (heavy work)	180	55	13.7	388
	62.5 (severe work)	158	48	15.4	436
	75 (severe work)	130	39	15.7	445
190 P.S.I.G. (13.11 BAR)	40 (heavy work)	220	67	13	368
	50 (heavy work)	192	58	14.5	411
	62.5 (severe work)	165	50	16	453
	75 (severe work)	141	43	16.8	476
200 P.S.I.G. (13.80 BAR)	40 (heavy work)	220	67	13	368
	50 (heavy work)	205	62	15.3	433
	62.5 (severe work)	174	53	16.7	473
	75 (severe work)	147	45	17.4	493
210 P.S.I.G. (14.49 BAR)	40 (heavy work)	220	67	13	368
	50 (heavy work)	214	65.8	16	453
	62.5 (severe work)	186	56	17.6	498
	75 (severe work)	159	48	18.5	524
220 P.S.I.G. (15.18 BAR)	40 (heavy work)	220	67	13	368
	50 (heavy work)	220	67	16.3	462
	62.5 (severe work)	194	59	18.2	515
	75 (severe work)	165	50	19	538

The above values were derived from actual breathing simulator tests using an ANSTI wet simulator with 600' long umbilical 3/8'' I.D (9.5mm) at Dive Lab, Inc. The respiratory work rates and test procedures used are based on internationally recognized test practices and procedures.

*** includes a 20% safety factor*

Note: Most sustained work rates by professional divers average between 20 to 40 RMV. When calculating supply requirements, KMDSI® recommends using no less than 40 RMV.

For more information, check the Dive Lab website, www.divelab.com Click on Technical Section and check for Surface-Supplied Breathing Requirements.

Appendix 3 Table 3 Topside High-Pressure Regulator Settings for use with the Kirby Morgan REX® Regulator®

Depth		Regulator Setting P.S.I.G.		Regulator Setting BAR	
FSW	MSW	Optimum P.S.I.G.	Maximum P.S.I.G.	Optimum BAR	Maximum BAR
0-60	0-18	140	200	9.7	13.8
61-100	19-30	165	220	11.4	15
101-132	31-40	180	250	12.4	17
133-165	41-50	220	300	15	20.7
166-220	51-67	270	300	18.6	20.7

Performance is based on a minimum of 75 RMV to depths of 220 FSW (67 MSW) using a 3/8 (9.5mm) umbilical 600 foot (183 meters) long, made up of two 300 foot (91 meter) sections.