User Manual for
Amron International, Inc.

Amron Models 450M-01 and 450M-02
Overboard Dump Chamber BIBS Mask

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AMRON MODELS 450M-01 & 450M-02

OVERBOARD DUMP CHAMBER BIBS MASK

USER MANUAL

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PATENTS

1. The Amron BIBS Mask holds patent number 8,336,547 issued in the United States of America and International PCT Patent Application Number US2012/066144.

WARNINGS

- ***Any service or maintenance performed on the 450M Overboard Dump Chamber BIBS Mask shall be done only by those facilities experienced in or by personnel knowledgeable in oxygen equipment. An Amron BIBS Mask Certified Training Course is available and recommended for service personnel.***

- ***All procedures described in this manual shall be performed in an area free of oil, grease, flammable solvents or other combustible materials. Such materials, as well as dust, lint and fine metal filings all have the potential to combust and might— when exposed to oxygen under pressure— ignite and result in an explosion and/or fire.***

- ***The Amron 450M Breathing System was designed and is for use within a hyperbaric chamber only and is not intended for medical treatment in hyperbaric chambers.***

- ***To protect the 450M-02 lightweight flexible Exhaust hose from collapsing when not in use, fit a 3 barg relief valve between the exhaust hose and the BPR.***

- ***The Amron 450M Overboard Dump Chamber BIBS Mask is NOT intended for and must NOT be used underwater.***

1. OVERVIEW

1.1 Introduction and Operation

This manual provides factory suggested procedures and instructions for operating, maintaining and servicing the Amron 450M Overboard Dump Chamber BIBS Mask. The Amron 450M Mask is life-support equipment and at least one mask for each chamber occupant is required at a minimum. Amron recommends a spare mask be available as well.

The Amron 450M Overboard Dump Chamber BIBS Mask is designed to administer and supply oxygen or an oxygen-helium mixture to its operator. To minimize risk of combustion or explosion, ensure the Mask is clean and free from any combustible material. i.e. oils, solvents, metal shavings, etc. Refer to the diving table below which shows the gases to be used at different depths.

Acceptable Gas	Depth Range (MSW / FSW)
Oxygen	10-19 / 33-62
Breathing Quality Air	10-50 / 33-164
HeliOx	10-450 / 33-1476

The Demand Regulator is designed to operate at an inlet pressure of 6 to 13 BAR over the chamber pressure, with a pressure drop during inhalation not to exceed 30% of the supply pressure. To obtain the least amount of breathing resistance and the best overall performance, the demand regulator should be adjusted so that any loosening of the adjustment knob would cause free flow. Refer to the diving table below which indicates the demand pressure over chamber pressure at different depths.

Gas	Depth (MSW / FSW)	Demand Setting (BAR / PSI)
Air / Oxygen	10-19 / 33-62	8 / 115
Air	20-30 / 65-98	9 / 130
Air	30-50 / 98-164	12 / 175
HeliOx	10-50 / 33-164	6 / 87
HeliOx	50-100 / 164-328	7 / 101
HeliOx	100-200 / 328-656	9 / 130
HeliOx	200-300 / 656-984	11 / 160
HeliOx	300-450 / 984-1476	12.5 / 181

The Exhaust Regulator is designed to exhaust each exhalation outside of the chamber at atmospheric pressure and operates at a negative differential pressure between 1-4 BAR, with a pressure increase during exhalation not to exceed 30% of the exhaust pressure. A Back Pressure Regulator (BPR) must be installed for chambers reaching depths of 30 MSW or greater. Refer to the diving table below which indicates the BPR setting at different depths.

Gas	Depth (MSW / FSW)	BPR Setting (BAR / PSI)
Air / Oxygen / HeliOx	10-19 / 33-62	*
Air / HeliOx	20-30 / 65-98	*
Air / HeliOx	30-50 / 98-164	3.5 / 50
HeliOx	50-400 / 164-1312	3 / 43.5
HeliOX	450 / 1476	3.5 / 50

The Amron 450M Overboard Dump Chamber BIBS Mask includes a Twin Hose Assembly consisting of a Demand and Exhaust hose that is compatible with all the above listed gases.

NOTE – For the Demand and Exhaust Hose of the 450M-01:

The hose manufacturer documentation states that the hoses are *"RECOMMENDED FOR: Handling mixtures of oxygen, helium and nitrogen gases customarily used in diving applications as air breathing hose."*

NOTE – For the Demand Hose of the 450M-02:

The hose manufacturer documentation states that the hoses are *"RECOMMENDED FOR: Handling mixtures of oxygen, helium and nitrogen gases customarily used in diving applications as air breathing hose."*

NOTE – For the Exhaust Hose of the 450M-02:

To prevent the 450M-02 lightweight flexible exhaust hose from collapsing when not in use, Amron recommends using a 3 barg relief valve between the exhaust hose and the back pressure regulator (BPR).

The Amron 450M Overboard Dump Chamber BIBS Mask has an Umbrella Relief Valve installed inside the Main Regulator Housing. This is a safety feature that has been designed into the Breathing System to relieve any excessive, internal negative pressure. The Umbrella Relief Valve is designed to activate at a negative internal pressure of 37 mbar ± 5 mbar (15" H20 ± 2" H20) @ 23-24°C (74-75°F).

1.2 General Guidelines and Conventions

It is important to read over the entire manual and become familiar with all of the procedures and tools required before starting any service or repair. When servicing or repairing, keep the manual open and available for reference while performing the procedure and perform each step of the procedure in the exact order as it is described.

Perform each service or repair in a designated work area that is set-up with adequate lighting and easy access to all the required tools. The work area should be clean and have plenty of room to layout parts during disassembly and for cleaning.

During disassembly, segregate replacement and worn parts from non-replacement parts. Use only Amron specified parts when replacing components. Do not try and substitute an Amron component with a different manufacture's part. While a different manufactures part may look similar in size and shape, Amron's components are unique and have subtle, yet, very important differences.

In this manual, these terminologies and techniques will be assumed, unless otherwise stated:

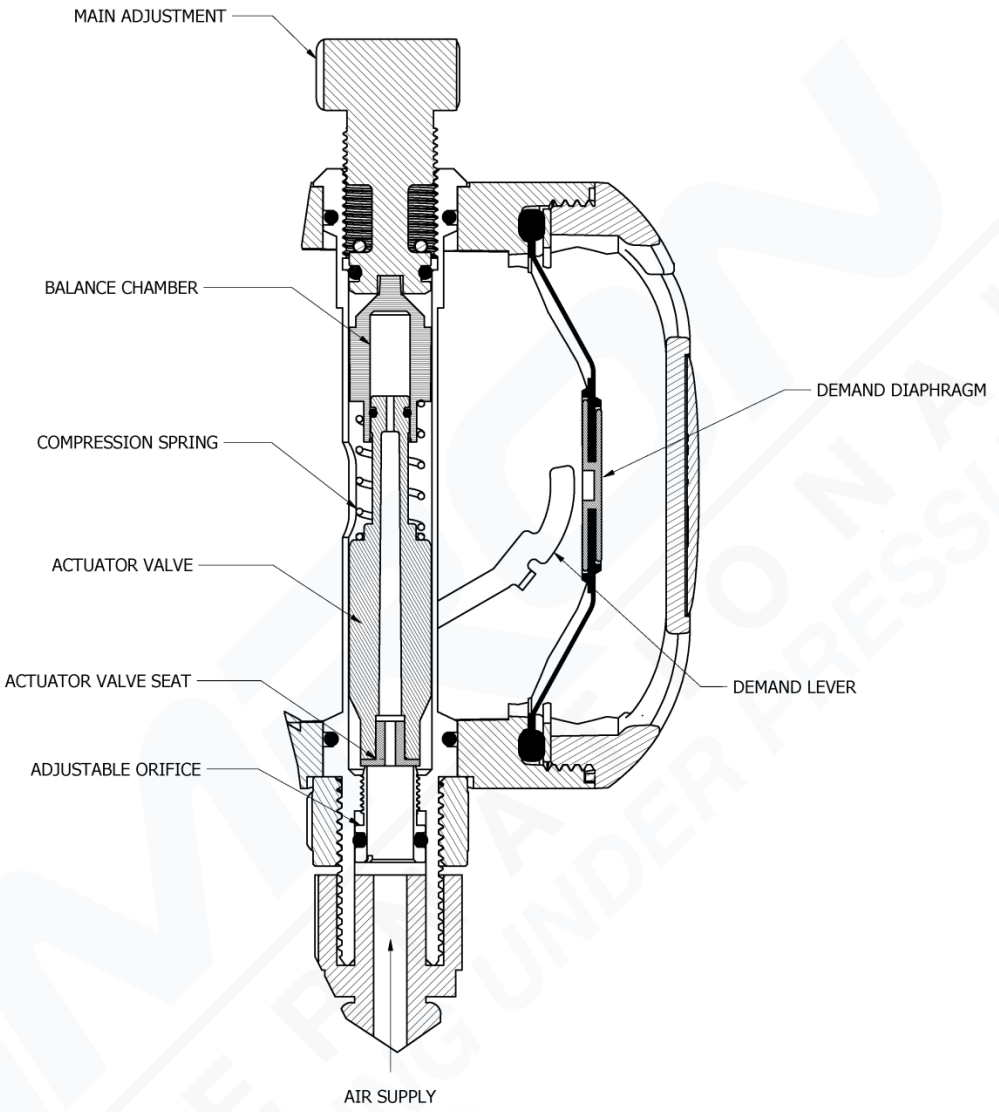
1. When it states to unscrew, screw out, loosen, or remove a threaded part, turn the part counter clockwise.

2. When it states to screw, screw in, install, or tighten a threaded part, turn the part clockwise.

3. When removing an O-ring, pinch both sides of the O-ring to form a gap at the top and grab the O-ring. Or use a non-steel O-ring removal tool.

4. All O-rings that are removed need to discarded and replaced with new O-rings.

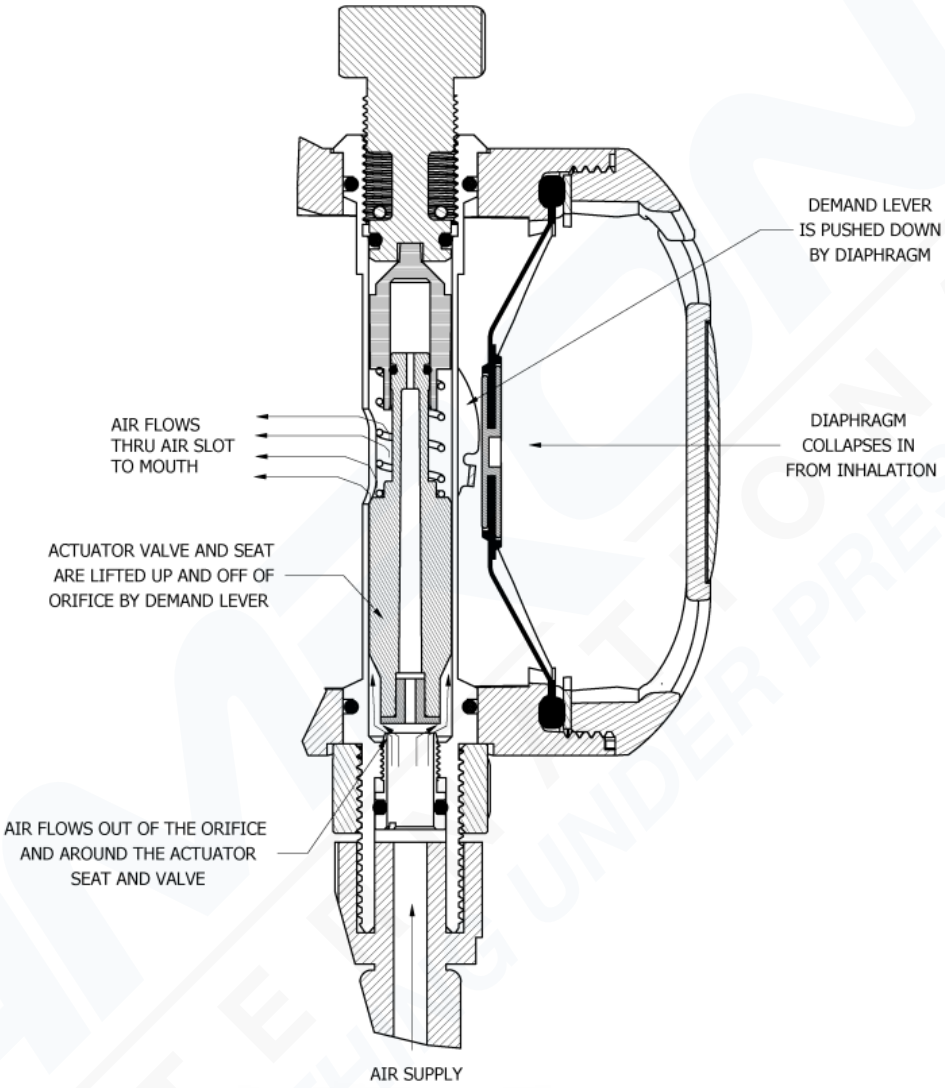
1.3 Functionality and Nomenclature – Demand Regulator



DEMAND REGULATOR W/ AIR ON
AT REST WAITING FOR INHALATION

The Demand Main Adjustment controls the location of the floating Balance Chamber, which dictates the gap between the Actuator Valve and the Balance Chamber. Hence, it controls the Spring Load acting on Actuator Valve Seat against the Orifice. Not enough Spring Load will cause the system to free flow, too much and it will make inhalation difficult.

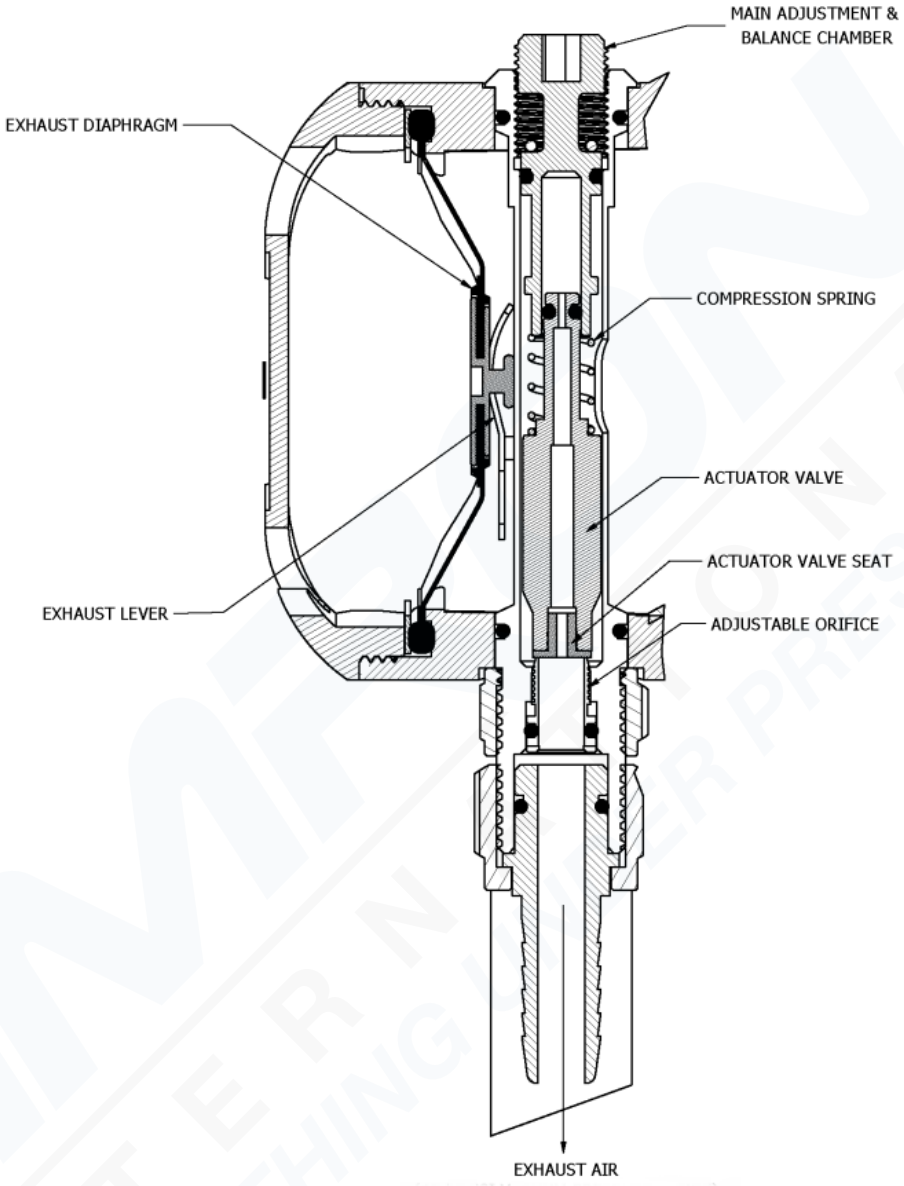
A small hole in the Valve Seat, which opens into the Balance Chamber, creates a pneumatically balance system on both sides of the Actuator Valve.



DEMAND REGULATOR W/ AIR ON
DURING INHALATION

When a breath is taken, the inhalation pressure pulls in the Demand Diagram which pushes down the Demand Lever. The Demand Levers arms pivot against the Demand Tube and Pushes on the Actuator Valves Arms and forces the Actuator Valve up. This compresses the spring, lifts the Actuator Valve Seat off of the Orifice, and allows the inlet air to enter the Demand Tube, flow around the Seat and Actuator Valve, and flow out the air slot into the Operators mouth.

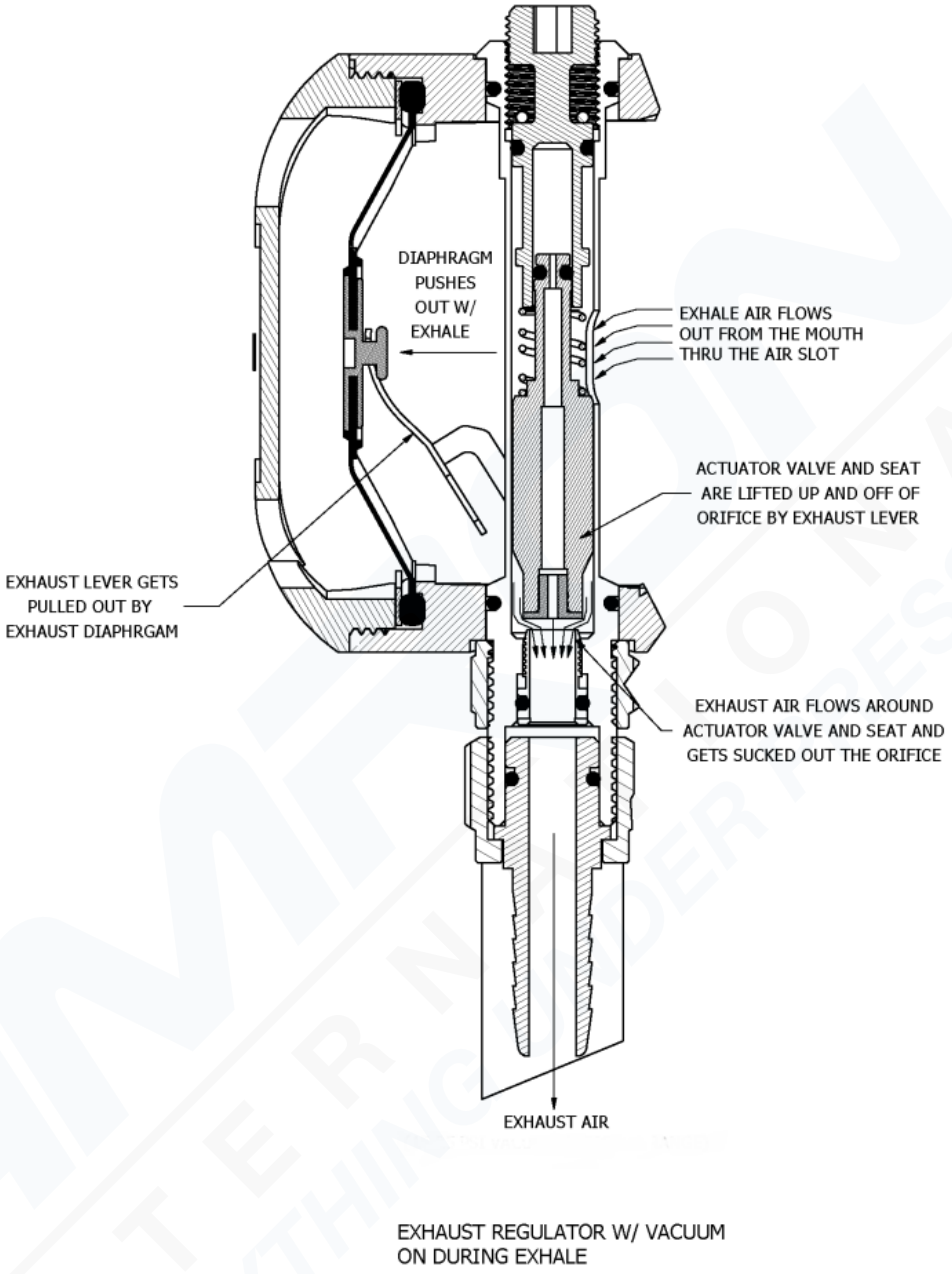
1.4 Functionality and Nomenclature – Exhaust Regulator



EXHAUST REGULATOR W/ VACUUM
ON AT REST WAITING FOR EXHALE

The Exhaust Main Adjustment is also a fixed Balance Chamber. It adjusts the gap between the Actuator Valve and therefore controls the Spring Load acting on Actuator Valve Seat against the Orifice.

A small hole in the Valve Seat, which opens into the Balance Chamber, creates a pneumatically balance system on both sides of the Actuator Valve.



When a breath is exhaled, the exhalation pressure pushes out the Exhaust Diagram which pulls up the Exhaust Lever. The Exhaust Lever's arms pivot against the Exhaust Tube and Pushes on the Actuator Valves Arms and forces the Actuator Valve upward. This action compresses the spring, lifts the Actuator Valve Seat off of the Orifice, and opens the vacuum, which pulls the exhaled air into the Exhaust Tube through the air slot; the air then flows around the Actuator Valve and Seat, and flows out the orifice.

1.5 Unpacking the Mask

The Amron 450M Overboard Dump Chamber BIBS Mask is shipped in one box, although several components inside are packaged separately and some assembly is required before it can be placed into operation.

Components in shipping box:

1) 450M Mask Assembly in a sealed bag.

2) Twin Hose Assembly in a sealed bag with O2 Cleaning Certificate.

3) Demand Hose and Exhaust Hose Quick Disconnect (QD) Sockets.

4) Certificate of Conformance.

1.6 Preparing the Mask for Operation

1) Remove Mask Assembly from its sealed bag.

2) Remove the Twin Hose Assembly from its sealed bag.

3) Attach the Twin Hose Assembly to the Mask Assembly. (Ref Section 5.6 Attaching Hoses).

4) Remove the Demand Hose and Exhaust Hose QD and connect them to the Demand and Exhaust Manifolds inside the chamber. (Ref Section 1.7 Interface Connections).

5) Attach the Demand and Exhaust Hose to the QD Sockets. (Ref Section 1.7 Interface Connections).

6) Set Demand and Exhaust Gas Pressure based on the reference chart from Section 1.1 Introduction and Operation.

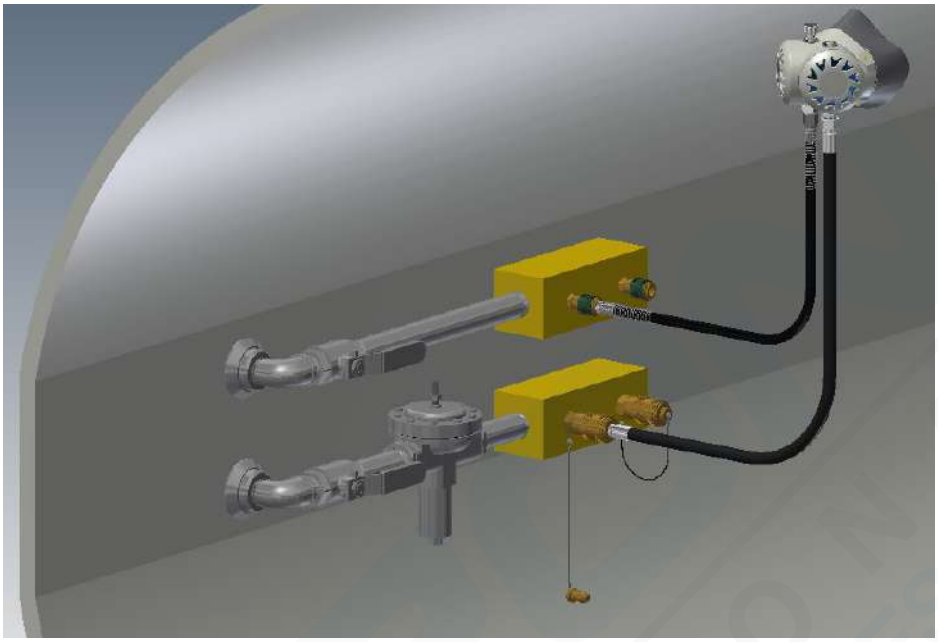
7) Mask is now ready for operation.

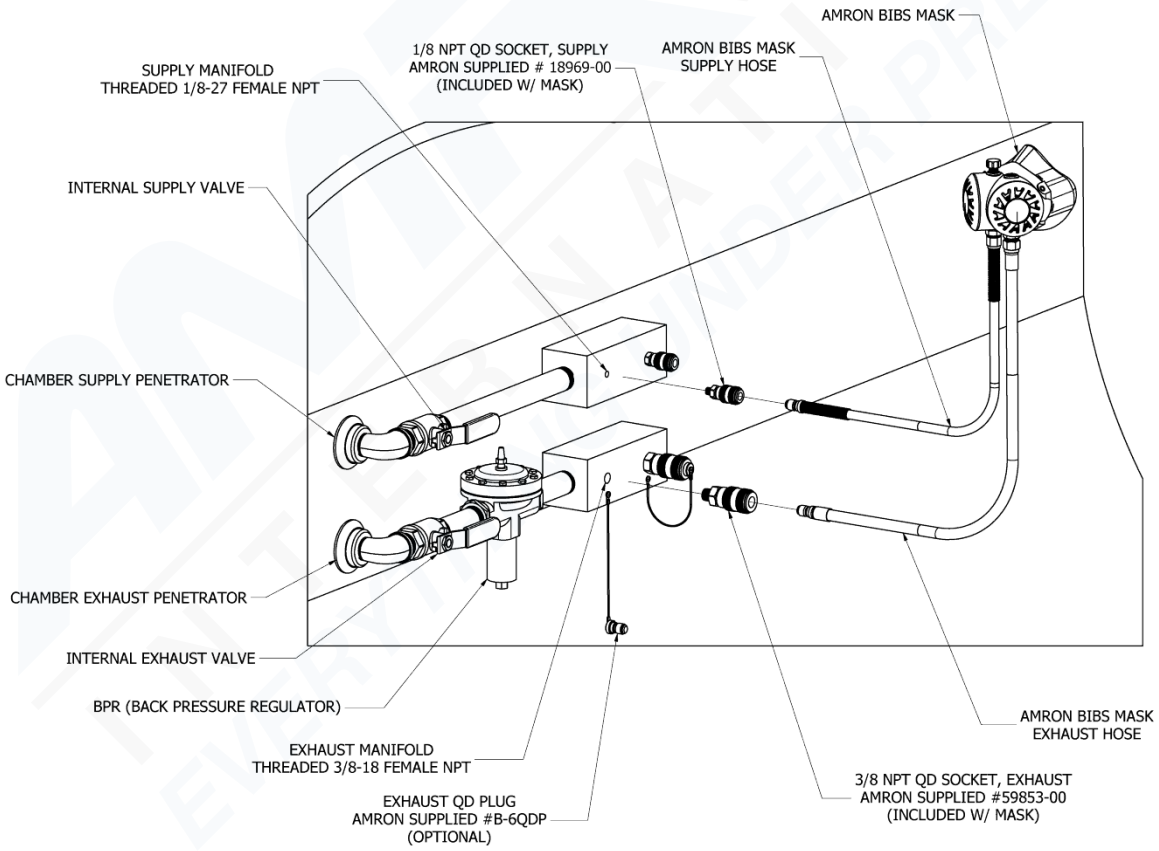
8) Prior to donning the mask, move the head net to the side and insert the users face into the Oral Nasal.

9) Take several breaths to verify the vacuum on the exhaust and that there is enough supply pressure. Breathing should be comfortable and not require much effort.

10) A Magnehelic can be used to verify that both the demand and exhaust valves cracking pressure is below 3 mbar (1.2" H20)

1.7 Interface Connections

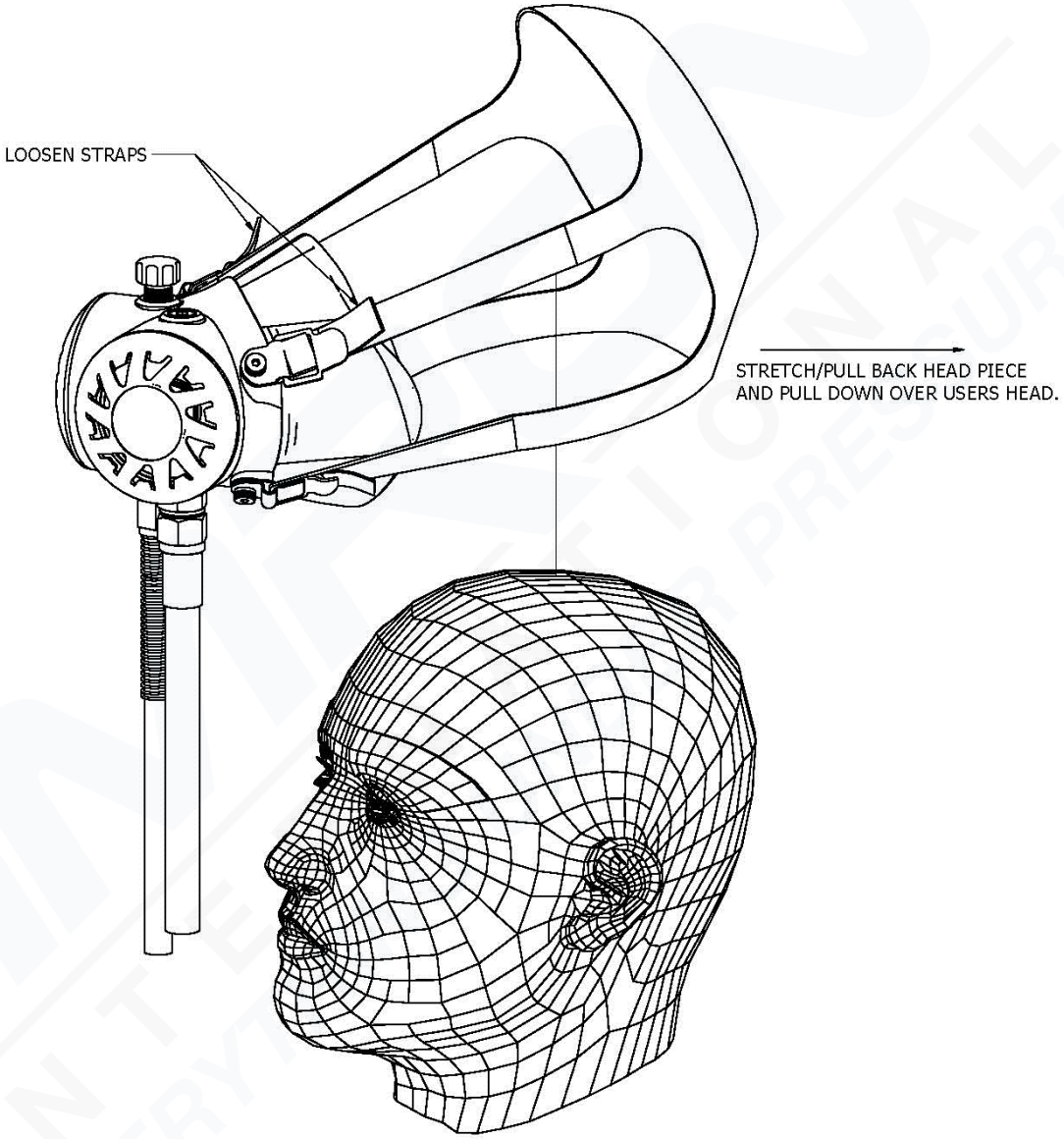




1.8 Donning the Mask

1) Loosen all 4 straps.

2) Stretch/pull back the Net portion of the Head Piece.



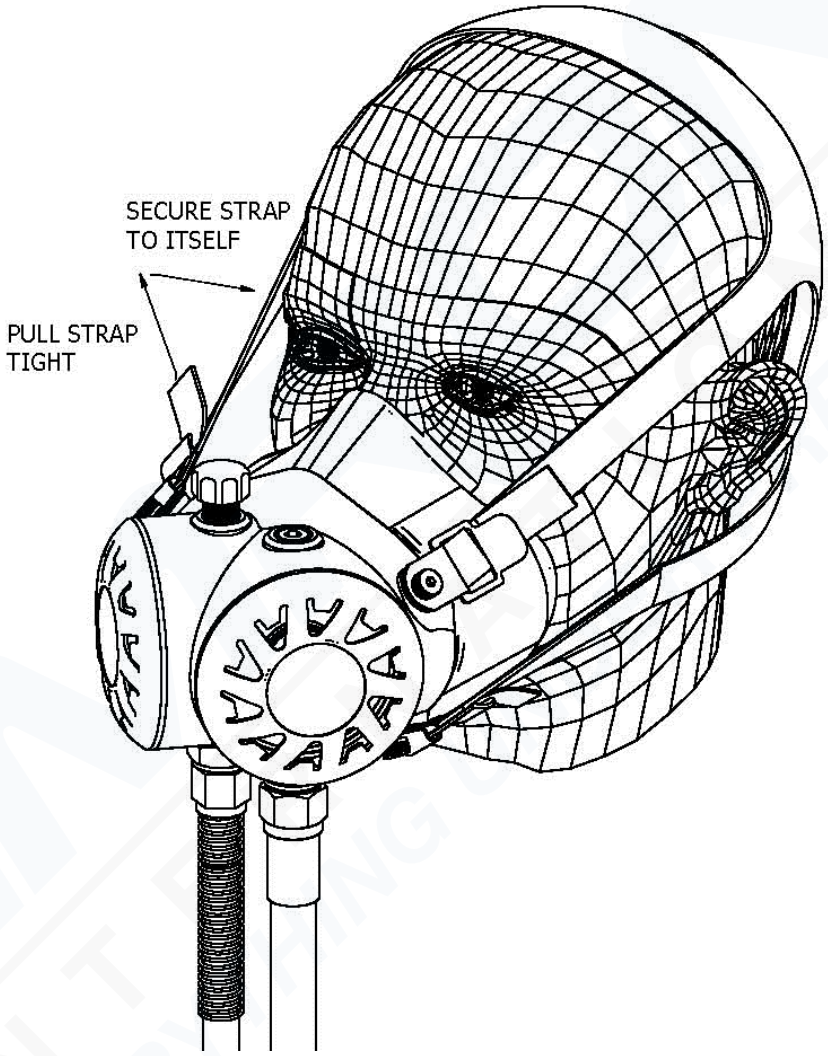
3) Pull the Head Piece down over the user's head until the head piece feels center on the user's head and the lower straps come up from below the ears.

4) Place the Oral Nasal onto the users face and ensure the Oral Nasal is centered and in the proper position to form an airtight seal.

5) Alternate tightening all four straps by pulling on each straps end until there is a comfortable compression along the entire sealing surface.

6) Take several breaths to confirm there is an airtight seal between the Oral Nasal and the user's face, by feeling for leaks around the entire outside sealing surface during exhalation.

7) Once the mask is tightened, secure the straps slack by pushing the straps end onto the strap portion in tension. The Velcro on the straps end will keep the strap slack secure.



1.9 Wearing the Mask

The Amron 450M Overboard Dump Chamber BIBS Mask was designed to be worn within hyperbaric chambers that can achieve extreme depths. The twin hose assemblies can tend to feel heavy at times due to the fact they are designed to withstand high pressures and suctions at these deep depths. That is why it is recommended by Amron that the Mask be worn lying down with the hoses being supported on the operator's chest or worn in a seated position with the hoses straight and free from kinks or bends. It is important that the twin hoses are routed in a way to minimize any torque or force exerted onto the Mask to maximize comfort.

Amron recommends that at times when an operator is inclined or required to move suddenly, stand up or walk around in the chamber while wearing the mask, that the operator grab onto and support the twin hose assembly while doing such activities, as illustrated below.

2. RECOMMENDED TOOLS, LUBRICANTS AND CLEANERS

2.1 Recommended Tools:

- 1/4'' Flat Head Screw Driver
- 11/16'' Open End Wrench
- 13/16'' Open End Wrench
- O-ring Removal Tool
- Pliers
- 1/8'' Allen Wrench
- 3/16'' Allen Wrench

2.2 Required Lubricants:

- Christo-Lube™ MCG-111-2OZ

2.3 Recommended Cleaners:

- Soap and warm water
- SaniZide-Plus disinfectant

3. GENERAL CARE

3.1 Maintenance Schedule – Every Dive

Inspection

1) A general inspection should be performed before and after each use.

2) Inspect Diaphragms, Face Seal, Gaskets, O-rings and other “soft” parts for damage. Rips, punctures and tears may result in an improper seal and jeopardize the Overboard Dump Chamber BIBS Mask from functioning properly.

3) Inspect and activate Valve Levers on both Demand and Exhaust for proper function and range of motion.

4) Inspect hoses, fittings, nuts and all other threaded parts for burrs, cross threading, or damage.

5) Look for any missing hardware.

Cleaning

1) This section contains general cleaning procedures. They should be used as guidelines, as each customer or company should have their own standards and procedures for cleaning and disinfecting life support equipment.

2) After each use, remove the Face Seal from the Main Regulator Housing and clean with soap and warm water. Rinse and dry completely before storing. SaniZide-Plus can be used for disinfecting.

3) Update Service Log after completion of maintenance (Chapter 8).

Storing

1) When it’s not being used, the Amron 450M Overboard Dump Chamber BIBS Mask should be stored in a dry cool place, immediately after cleaning. Storage temp should not exceed 45°C (113°F) or drop below -15°C (5°F)

3.2 Maintenance Schedule - 6 Month

1) Disassemble entire assembly every 6 months to a year. (See Disassembly and Assembly Procedures sections).

2) Clean all parts with soap and warm water.

3) Rinse and dry completely before storing and using.

4) SaniZide-Plus can be used for disinfecting.

5) Lubricate all rubber seals using Christo-Lube™.

6) Update Service Log after completion of maintenance (Chapter 8).

3.3 Maintenance Schedule - 1 Year

1) Replace all rubber parts and Seals. i.e. Diaphragms, Oral Nasal, O-Rings, Umbrella Valve, Actuator Valve. Use Rebuild Kit # 660-0002-01.

2) Update Service Log after completion of maintenance (Chapter 8).

3.4 Maintenance Schedule – 5 Year

1) Replace Twin Hose Assembly

2) Update Service Log after completion of maintenance (Chapter 8).

4. DISASSEMBLY PROCEDURES

4.1 Detaching Hoses

1) Detach the Demand Hose from the Demand Regulator by unscrewing the hose nut. May require an 11/16'' open end wrench if the nut is too tight.

2) Detach the Exhaust Hose from the Exhaust Regulator by unscrewing the hose nut. May require a 13/16'' open end wrench if the nut is too tight.

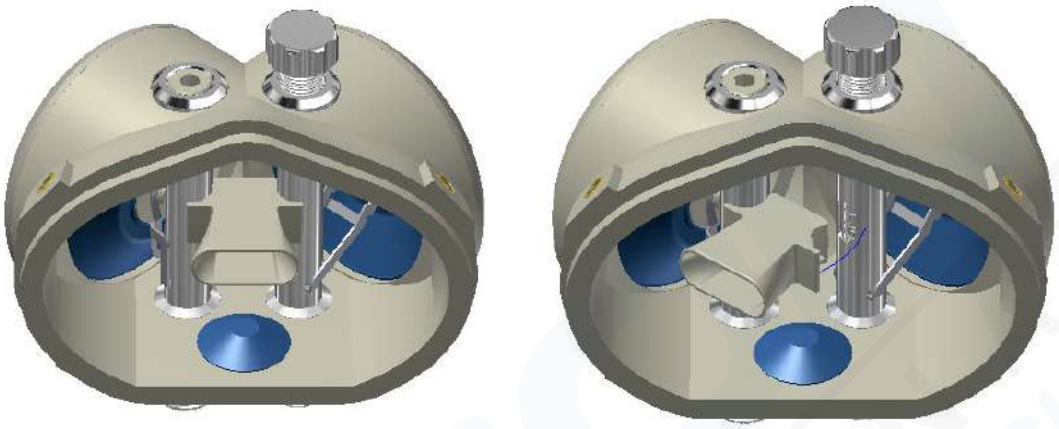
3) Inspect O-rings on both glands for wear and damage. Replace as needed.

4.2 Disassembly of the Face Seal & Gas Router

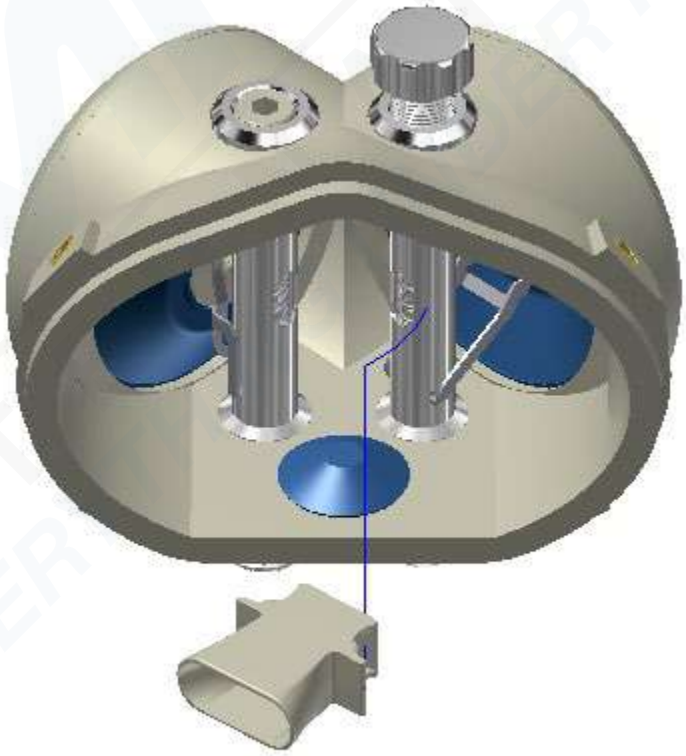
1) To remove Face Seal from Main Regulator Housing, grab the Face Seal at a point close to where it meets the Housing and pull away from the Housing.

2) Once the Face Seal is detached at that point, peel back the Face Seal away from the Housing to detach completely.

3) To remove Gas Router, grab one side of the Gas router and pull, pivoting the Gas Router on the opposite tube.



4) Remove the Gas Router by pulling straight out.



4.3 Disassembly of the Diaphragm

1) Unscrew Diaphragm Cover and remove from the demand side.

2) Remove Diaphragm Spacer and Demand Diaphragm by pulling it straight out.

3) Unscrew Diaphragm Cover and remove from the Exhaust side.

4) Remove Diaphragm Spacer by pulling straight out.

Caution: Do Not Pull the Exhaust Diaphragm Straight Out. It is hooked onto the Exhaust Lever and must be unhooked before it can be removed.

5) Unhook the Exhaust Diaphragm from the Exhaust Lever by sliding the Exhaust Diaphragm down the Exhaust Lever to the circular opening, allowing it to detach.

4.4 Disassembly of the Demand Regulator

1) To remove the Demand Regulator from the Main Regulator Housing, remove the Captivating Nut on the bottom. May require a 13/16'' open end wrench.

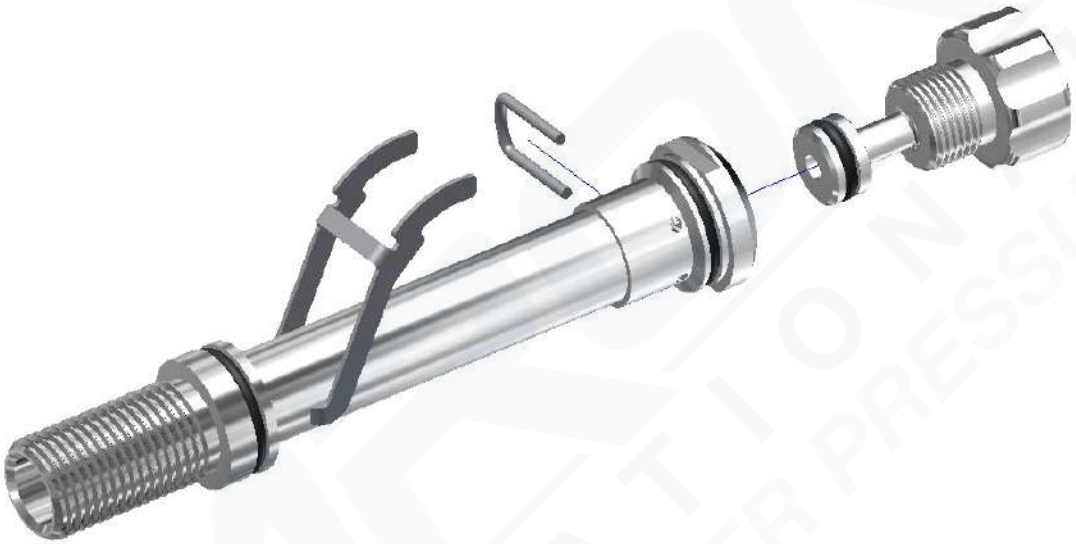
2) Squeeze and hold Demand Lever so that the Lever is resting against the Demand Tube.

3) While holding the Demand Lever down, press on threaded end of Demand Tube, forcing the Demand Regulator Assembly to be removed out the top.

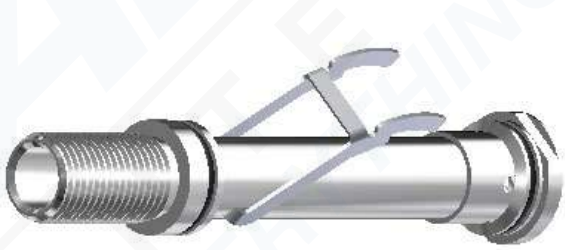
4) To disassemble Demand Regulator, remove Retaining Clip. (may need to turn Main Adjustment in or out to release any tension on the Clip)

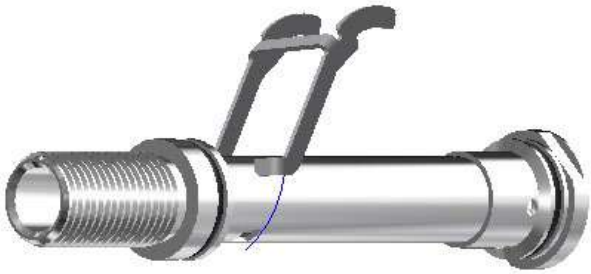
5) Unscrew Main Adjustment and remove.

6) Inspect O-rings on the Main Adjustment for wear and damage. Replace as needed.

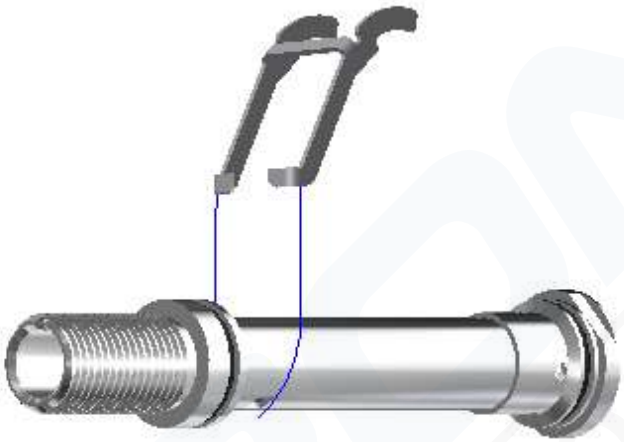


7) Remove Demand Lever by grabbing one of the lever arms and pull it out of the broached slot in the demand tube. Then rotate the lever over the tube until the lever no longer straddles the demand tube.





8) Remove the other arm of the lever out of the broached hole.



9) Remove Internals by tipping Demand tube up. Actuator, spring and Balance Chamber will slide out.

10) Unscrew Orifice Assembly with 1/4'' Flat head screw driver or adjusting tool 6 to 7 turns. The Orifice Assembly is O-ring seal so it will not simply fall out, it needs to be pulled out by either external C-clip pliers or a non-steel O-ring removal tool.

11) Inspect all O-rings and Valve Seat for wear. Remove and Replace O-rings annually and when required due to excessive wear.

4.5 Disassembly of the Exhaust Regulator

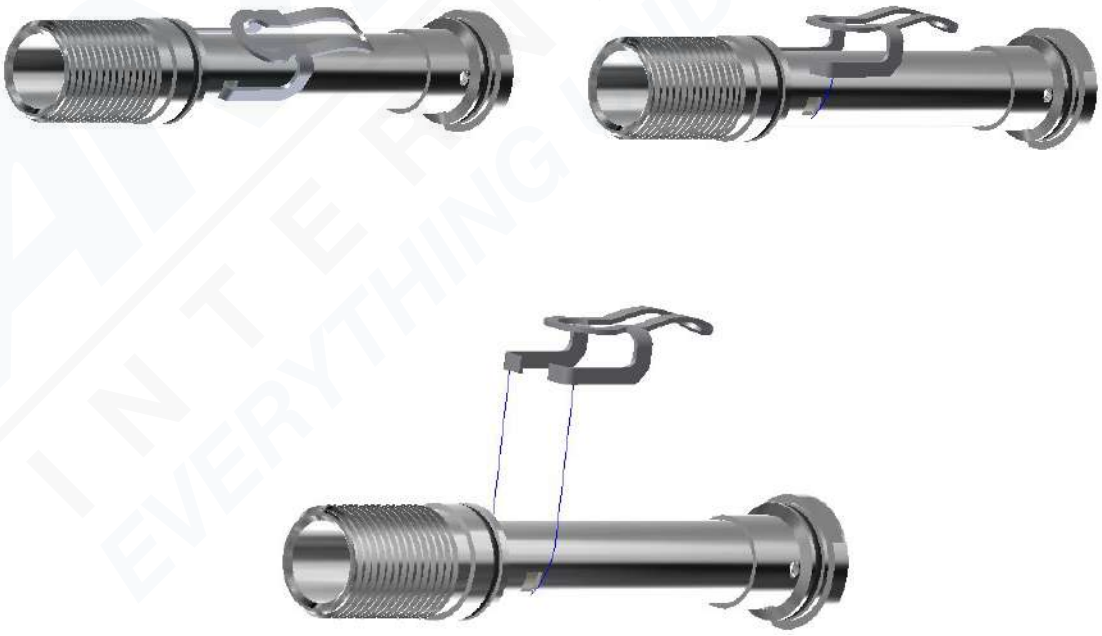
1) To remove the Exhaust Regulator from the Main Regulator Housing, remove the Captivating Nut on the bottom; which may require a 13/16'' open end wrench.

2) Press on the threaded end of Exhaust Tube forcing the Exhaust Regulator Assembly to be removed out the top.

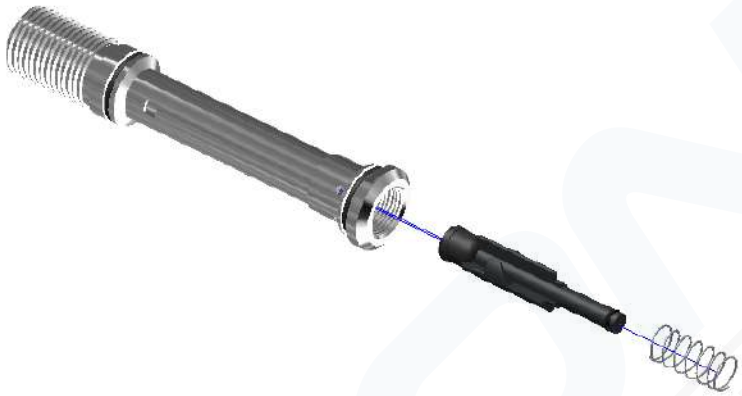
3) To disassemble the Exhaust Regulator, remove the Retaining Clip. This may require turning the Main Adjustment in or out to release any tension on the clip. Unscrew Main Adjustment and remove using 3/16'' Allen wrench.

4) Inspect the O-ring on the Main Adjustment for wear and damage. Replace as needed.

5) Remove Exhaust Lever by grabbing one of the lever arms and pull it out of the broached slot in the exhaust tube. Then rotate the lever slightly and remove the other lever arm out of the broached hole.



6) To remove the Exhaust Regulators internals, tip entire assembly up. Actuator and spring will slide out.

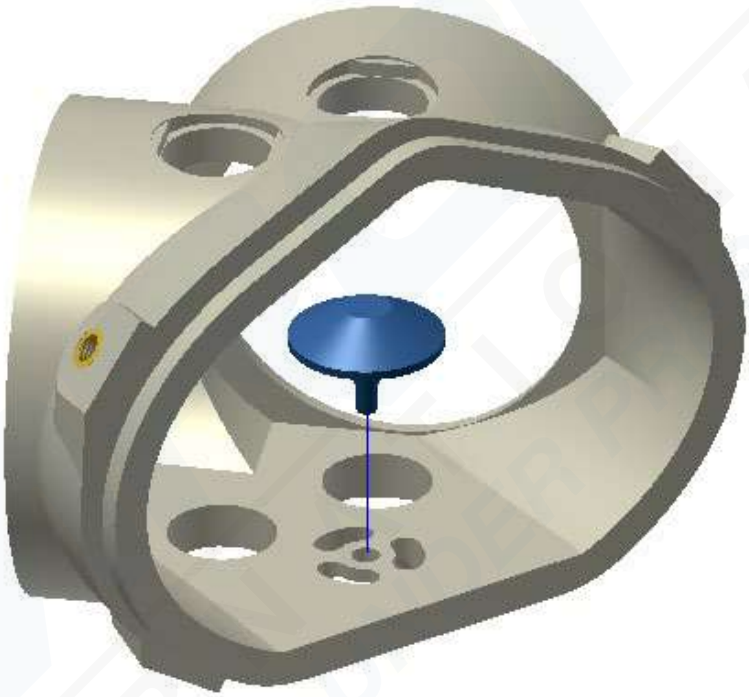


7) Unscrew Orifice Assembly with 1/4'' Flat head screw driver or adjusting tool 6 to 7 turns. The Orifice assembly is O-ring seal so it will not simply fall out. It will need to be pulled out by either external c-clip pliers or a non-steel O-ring removal tool.

8) Inspect all O-rings and Valve Seat for wear. Remove and replace O-rings annually and when required due to excessive wear.

4.6 Disassembly of the Umbrella Relief Valve

1) To remove the Umbrella Relief Valve from the Main Regulator Housing, grab the Umbrella Relief Valve on the inside of the Housing. Pull the Umbrella Relief Valve up, while at the same time, pushing on the Umbrella Relief Valve stem from the outside.



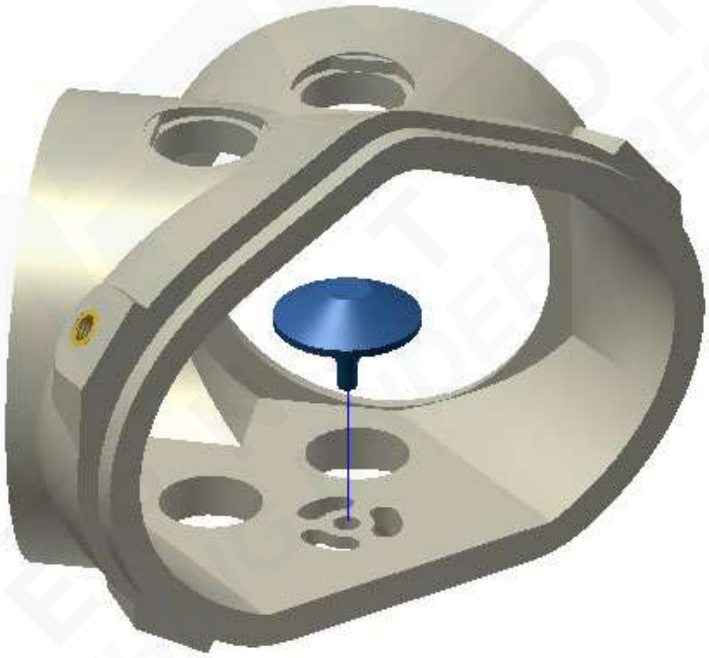
5 ASSEMBLY PROCEDURES

5.1 Assembly of the Umbrella Relief Valve

1) To install the Umbrella Relief Valve to Main Regulator Housing, feed the Umbrella Relief Valve stem into center hole on the inside bottom of the Main Regulator Housing (center hole is located in the middle of the 3 kidneys).

2) Grab the Umbrella Relief Valve stem from the outside of the Housing with a pair of pliers and pull until the Umbrella Relief Valve snaps into place.

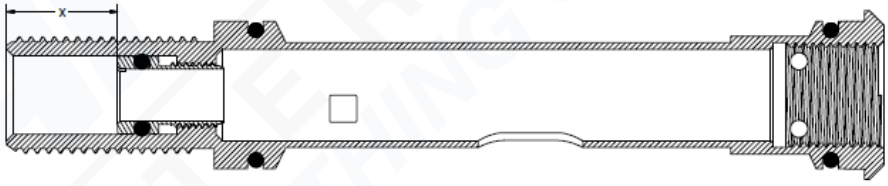
3) Cut Umbrella Relief Valve stem even with bottom of housing once installed.



5.2 Assembly of the Exhaust Regulator

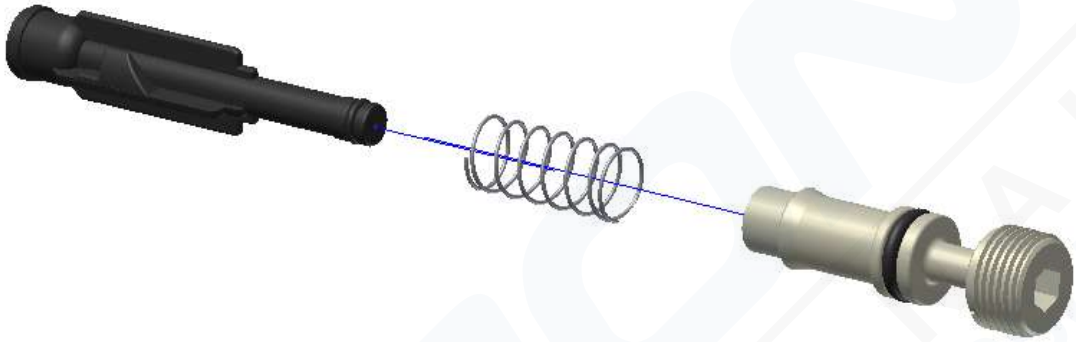
1) To assemble the Exhaust Regulator, apply a light coat of Christo-Lube™ on the Orifice O-ring and install the Orifice Assembly into the Exhaust Tube by inserting it into threaded end of the Exhaust Tube.

2) With a 1/4'' flathead screwdriver, screw the Orifice Assembly all the way in, until it bottoms out. Then unscrew the Orifice Assembly 2 and 3/4 turns. (Approximately 0.535"-0.540" when measured from the back of the orifice to the back of the tube. See Figure Below.) This will set the Orifice in the proper location.



3) Apply a light coat of Christo-Lube™ on the O-ring on the Actuator Valve and Insert the Actuator Valve into the Exhaust Adjustment and work it back and forth, lubricating both parts, then remove.

4) Assemble the Actuator Valve, Spring and Exhaust Adjustment.

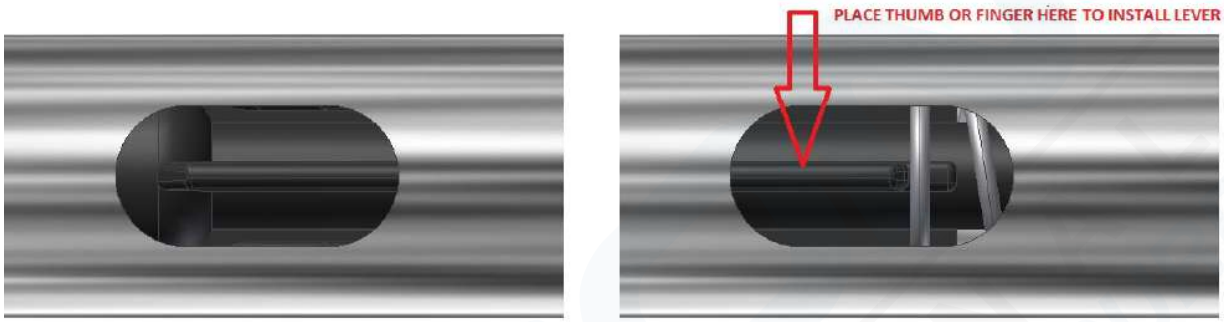


5) Apply a light coat of Christo-Lube™ on the O-ring of the Exhaust Adjustment and Install Assembly into the Exhaust Tube.

- ***Alignment of the Actuator Valve is crucial when installing. The arms of the Actuator Valve must be in the correct position in order to be activated by the Exhaust Lever in the proper manner.***

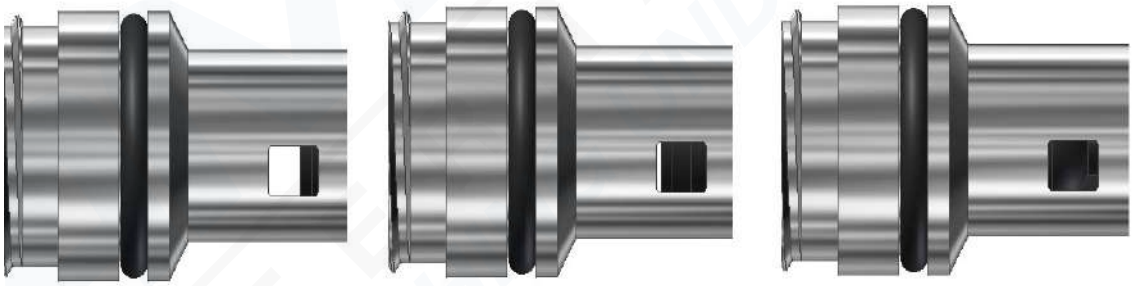
- ***On the Exhaust Regulator, the arms of the Actuator Valve are pointed up. (Away from the air slot)***

- ***The Actuator Valve must remain straight and centered during the installation, so that the Actuator Valves arms will line up with Exhaust Lever arms once installed. To ensure the Actuator Valve is straight and centered, it is best to use the air slot as a window and keep the lower fin of the Actuator Valve center and straight in the window.***



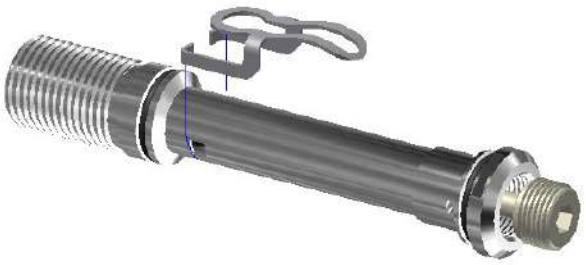
6) Feed the Actuator Valve and Spring into the Exhaust Tube, using the air slot as a window to watch the lower fin to assure the Actuator Valve stays centered and is going in straight.

7) Use the broached hole in the side of the Exhaust Tube as another window, checking the Actuator Valves depth, making sure the Actuator Valves Seat and Head go past the broached hole.



8) Once the ball end of the Actuator Valves head has past the broached hole, **place your thumb or finger on top of the lower fin of the actuator in the air slot**. (**See Figure Above.)** This will hold the actuator centered and won't allow it to spin while installing the lever. Then install the Exhaust Lever.

9) Install the Exhaust Lever one arm at a time on the side of the Exhaust Tube opposite the air slot.



- ***Keeping your thumb or finger on the lower fin through the Air Slot, will hold it and make sure the Actuator Valve remains straight and centered while installing the Exhaust Lever.***

10) Keep feeding the Actuator Valve, Spring and Exhaust Adjustment until it engages with the Exhaust Lever.

11) Screw in the Exhaust Adjustment using a 3/16'' Allen wrench, screwing it in until the top of Adjustment is flush with the top of the Exhaust Tube.

12) Install the Retaining Clip.

- ***Exhaust Regulator Assembly is complete. Confirm the exhaust lever has a 1/16 to 1/8" of play and the valve is sealed by providing a slight suction on the threaded end of the exhaust tube. Orifice needs to be screwed in more if the lever is too tight and the valve won't seal.***

13) Apply a light coat of Christo-Lube™ to both O-rings on the Exhaust Tube.

14) Insert Exhaust Regulator Assembly into the top of the Main Regulator Housing, threaded end first.

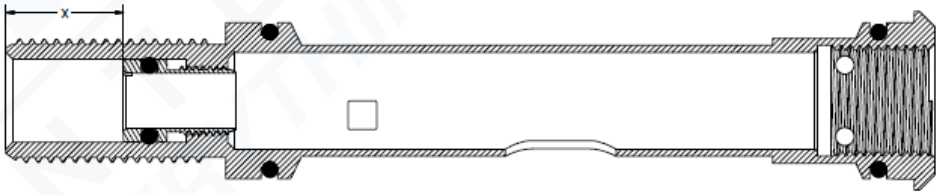
15) Feed the Exhaust Regulator through the Main Housing, ensuring that the flats on the Exhaust Tube align with the flats on the Housing and the Exhaust Lever is facing out toward the Diaphragm.

16) Attach Captivating Nut and hand-tighten.

5.3 Assembly of the Demand Regulator

1) To assemble the Demand Regulator, first apply a light coat of Christo-Lube™ on the Orifice O-ring and install the Orifice Assembly by inserting it into threaded end of the Demand Tube.

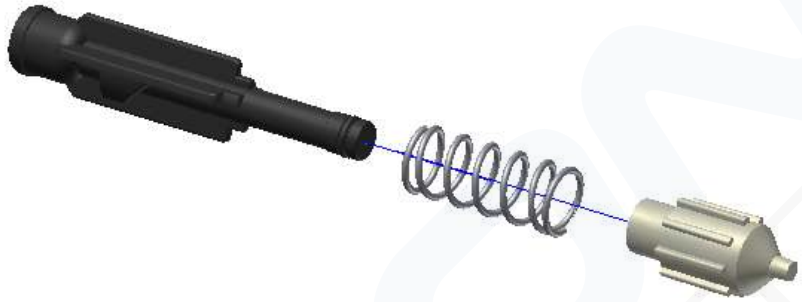
2) With a 1/4'' flathead screwdriver, screw the Orifice Assembly all the way in, until it bottoms out. Then unscrew the Orifice Assembly 2 and 3/4 turns. (Approximately 0.535"-0.540" when measured from the back of the orifice to the back of the tube. See Figure Below.) This will set the Orifice in the proper location.



- ***When using an Orifice adjustment tool with air: Screws in orifice until it bottoms out, then unscrew two turns. You must complete assembly procedure for demand regulator before using orifice adjustment tool. Hook up adjustment tool to demand regulator and unscrew orifice with tool until regulator begins to free flow, then screw in a 1/4 turn.***

3) Apply a light coat of Christo-Lube™ on the O-ring on the Actuator Valve and Insert the Actuator Valve into the Balance Chamber and work it back and forth, lubricating both parts, then remove.

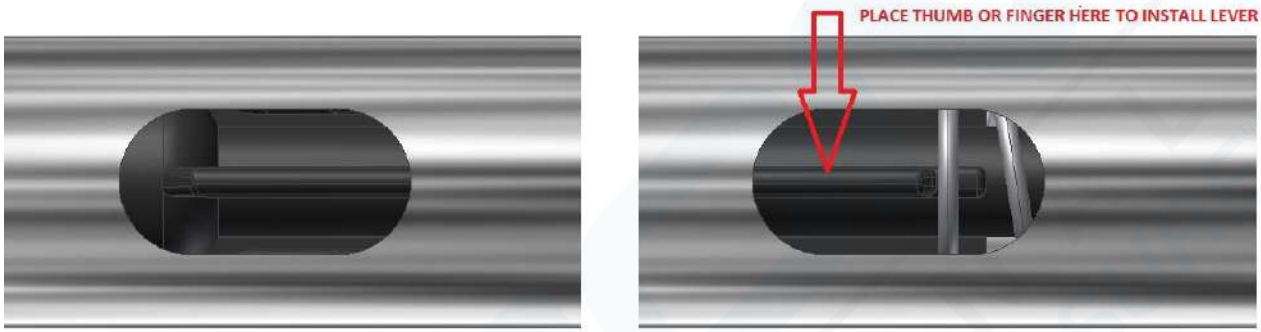
4) Assemble the Actuator Valve, Spring and Balance Chamber.



5) Install Assembly into Demand Tube.

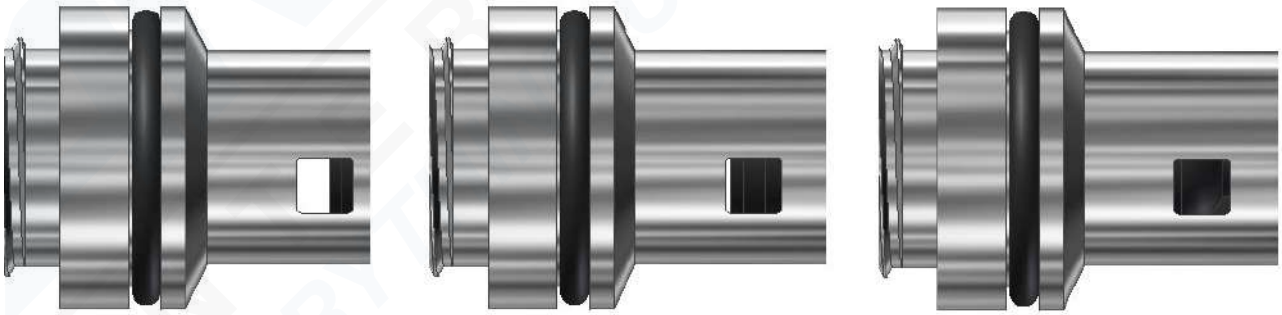
- ***Alignment of the Actuator Valve is crucial when installing. The arms of the Actuator Valve must be in the correct position in order to be activated by the Demand Lever in the proper manner.***
- ***On the Demand Regulator, the arms of the Actuator Valve are pointed down toward the air slot.***

- ***The Actuator Valve must remain straight and centered during the installation, so that the Actuator Valves arms line up with the Demand Lever arms. To ensure the Actuator Valve is straight and centered, it is best to use the air slot as a window and keep the top fin of the Actuator Valve centered and straight in the window.***



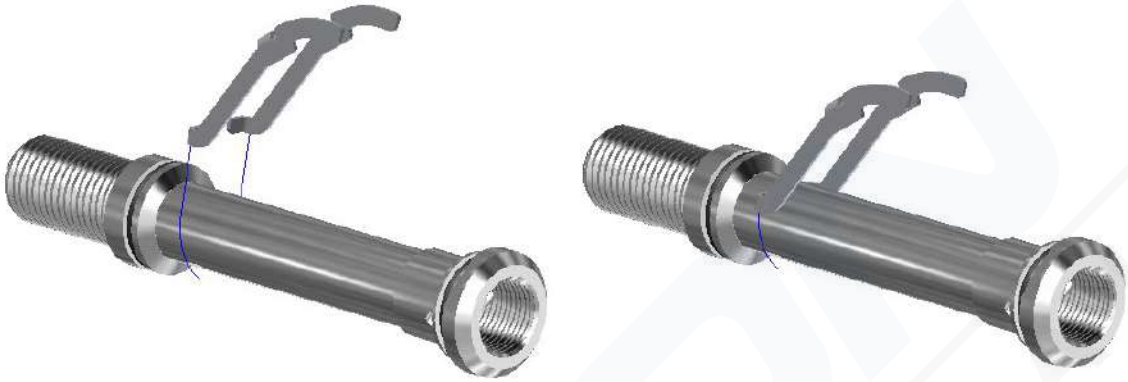
6) Feed the Actuator Valve, Spring and Balance Chamber into the Demand Tube, use the air slot as a window to watch the top fin to assure the Actuator Valve stays centered and is going in straight.

7) Use the broached hole in the side of the Demand Tube as another window, checking the Actuator Valves depth, making sure the Actuator Valves Seat and Head go past the broached hole.



8) Once the ball end of the Actuator Valves head has passed the broached hole, **place your thumb or finger on the top fin of the actuator in the air slot**. **(See Figure Above.)** This will hold the actuator centered and won't allow it to spin while installing the lever. Then install the Demand Lever.

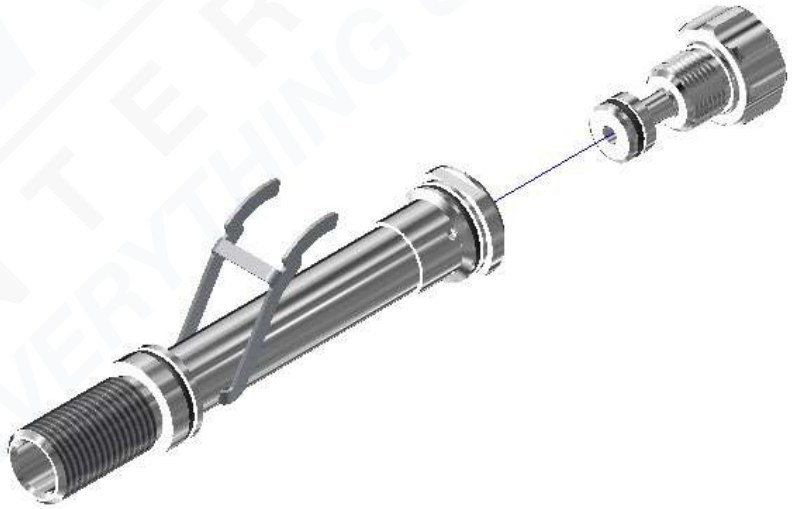
9) Install the Demand Lever one arm at a time on the side of the Demand Tube opposite the air slot.



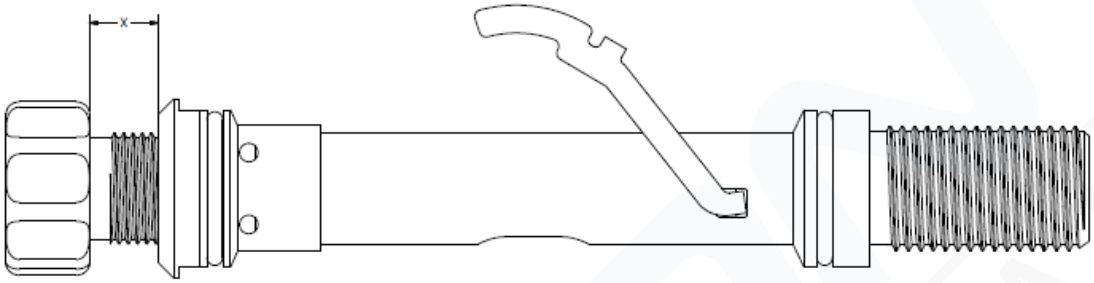
- ***Keeping your thumb or finger on the top fin through the Air Slot, will hold it and make sure the Actuator Valve remains straight and centered while installing the Demand Lever.***

10) Keep feeding the Actuator Valve, Spring and Balance Chamber Assembly until it engages with the Demand Lever.

11) Apply a light coat of Christo-Lube™ to the Main Adjustment O-ring and install Main Adjustment into Demand Tube.



12) Screw in Main Adjustment to appropriate dimension to reflect desired Demand Pressure Setting. (see Chart Below. Values below are reference only and may need to be adjusted once in use)



Demand Pressure (BAR / PSI)	X Dimension (mm / Inches)
6 / 87	7 / 0.275
8 / 115	6 / 0.240
10 / 145	5 / 0.200
12 / 175	4 / 0.160

13) Install Retaining Clip.

14) Apply a light coat of Christo-Lube™ to both O-rings on the Demand Tube.

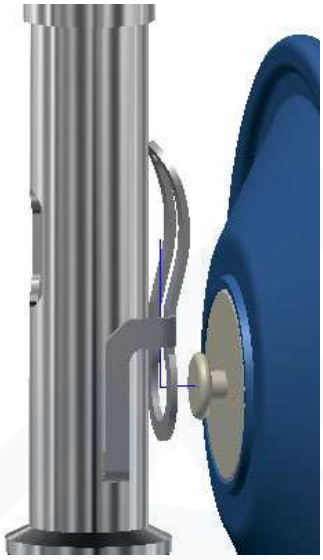
15) To install Demand Regulator Assembly into the Main Regulator Housing, insert the threaded end of the Demand Regulator into top of the Main Housing.

16) Squeeze and hold Demand Lever so that the Lever is against the Demand Tube and feed Demand Regulator Assembly into Main Housing, ensuring that the flats on the Demand Tube align with the flats on the Housing and the Lever is facing out toward the Diaphragm.

17) Attach Captivation Nut and hand-tighten.

5.4 Assembly of the Diaphragm

1) Install the Exhaust Diaphragm by inserting the round tip or the Exhaust Diaphragm into the round relief section of the Exhaust Lever and then slide up into place.



2) Install the Demand Diaphragm, Spacers and Diaphragm Covers. Screw on Diaphragm Covers until the Covers hit the thread stop and lock in place (Note: Logo will be straight when cover is locked in proper location).

5.5 Assembly of the Gas Router & Face Seal

1) To install Gas Router, make sure the Gas Router's centerline is centered between the Demand and Exhaust Tubes and that it is elevated just above air slots in the Demand and Exhaust Tubes.

2) Push the Gas Router evenly from both sides, snapping it onto to both the Demand Tube and Exhaust Tube at the same time.

3) Slide the Gas Router down the Demand and Exhaust Tubes until it snaps into the air slot on both tubes.

- ***The Gas Router has an Exhaust Side and a Demand Side. The Exhaust side has a gas channel that goes all the way through. Ensure it's in its proper orientation before snapping it in place.***

4) To install Face Seal to Main Regulator Housing, align the nose of the Housing with the nose of the Face Seal and insert lip of Face Seal into cavity of the Main Regulator Housing.

5) Work your way around the Housing, stretching the Face Seal over the Main Regulator Housing and pressing the Face Seal lip into the Housing cavity as you go around.

5.6 Post Assembly Inspection

1) Check to make sure retaining clips are installed in the regulator valves.

2) Make sure regulator valves are completely installed in housing (No gap between the top of the Regulator Tubes and the Regulator Housing. No gap between the Captivation Nut and Regulator Housing).

3) Check Demand Lever for Proper play, Tension and Engagement with the Actuator (Should be 2-4mm of play before Lever engages).

4) Check Exhaust Lever to make sure it's hooked on to the Diaphragm. Check Lever to ensure there is slight spring tension.

5) Make Sure the Gas Router is installed properly (Ref Sec 5.5).

6) Check for Diaphragms and Washers. Make sure Diaphragm Covers are all the way tightened. Diaphragm Covers have a locking tab that ensures they stop at the right tightness and apply the proper tension on the Diaphragms. Amron logos will align horizontally if correct.

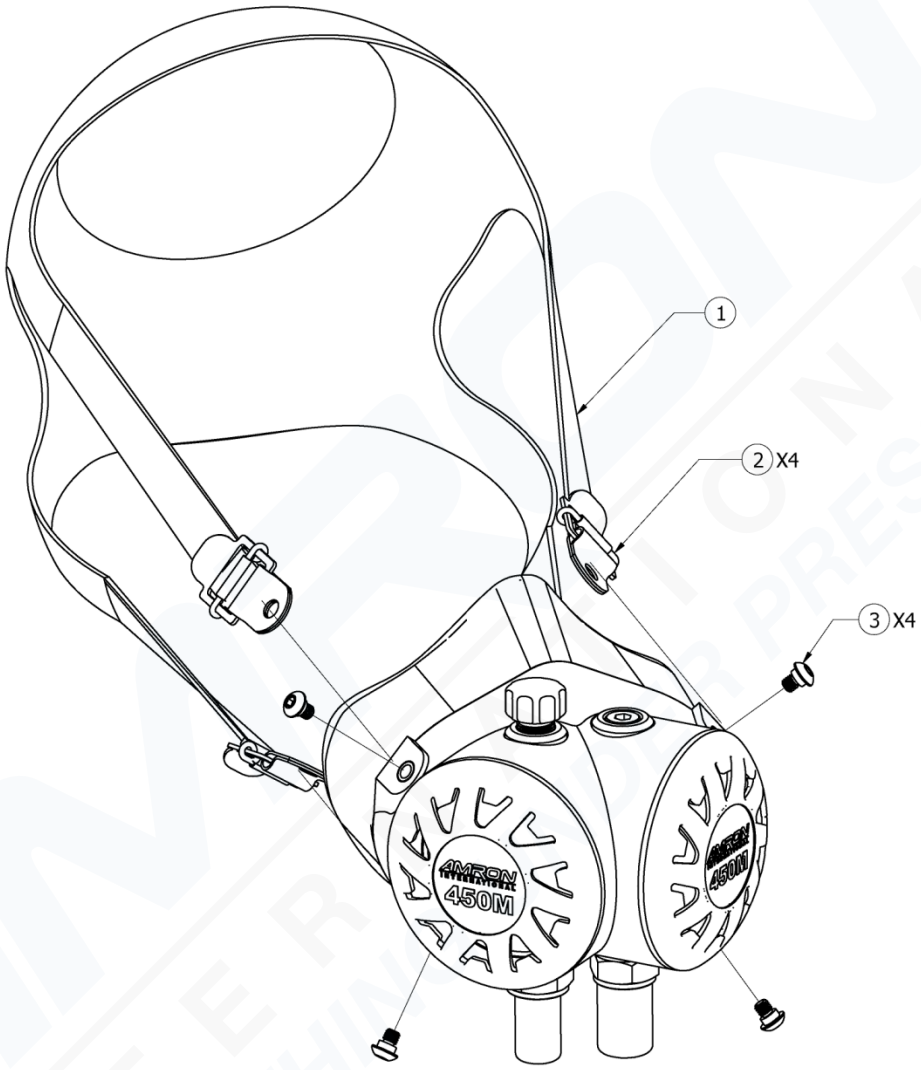
5.7 Attaching Hoses

1) Attach the Demand and Exhaust Hoses, Hand Tight.

2) Proceed to Section 1.6 Preparing the Mask for Operation

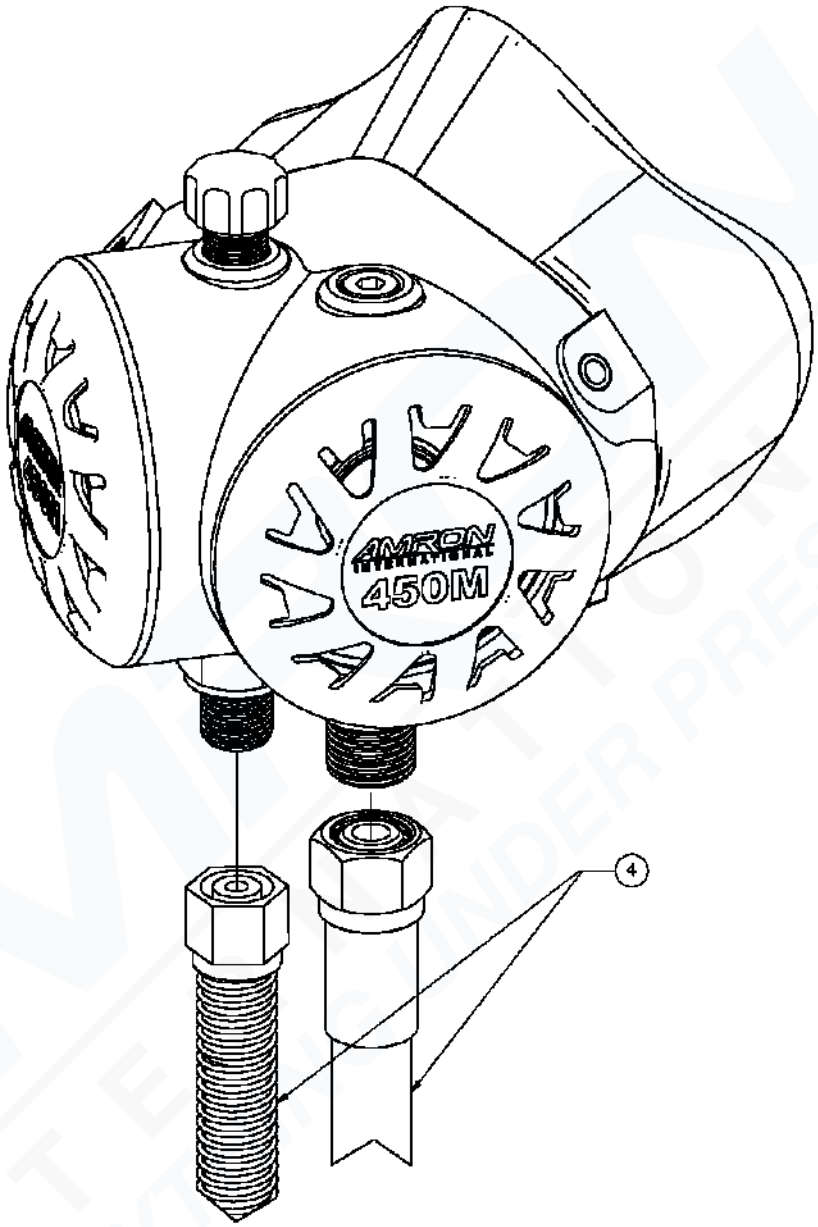
6 EXPLODED PARTS DRAWING AND PARTS LIST

6.1 Head Support Assembly



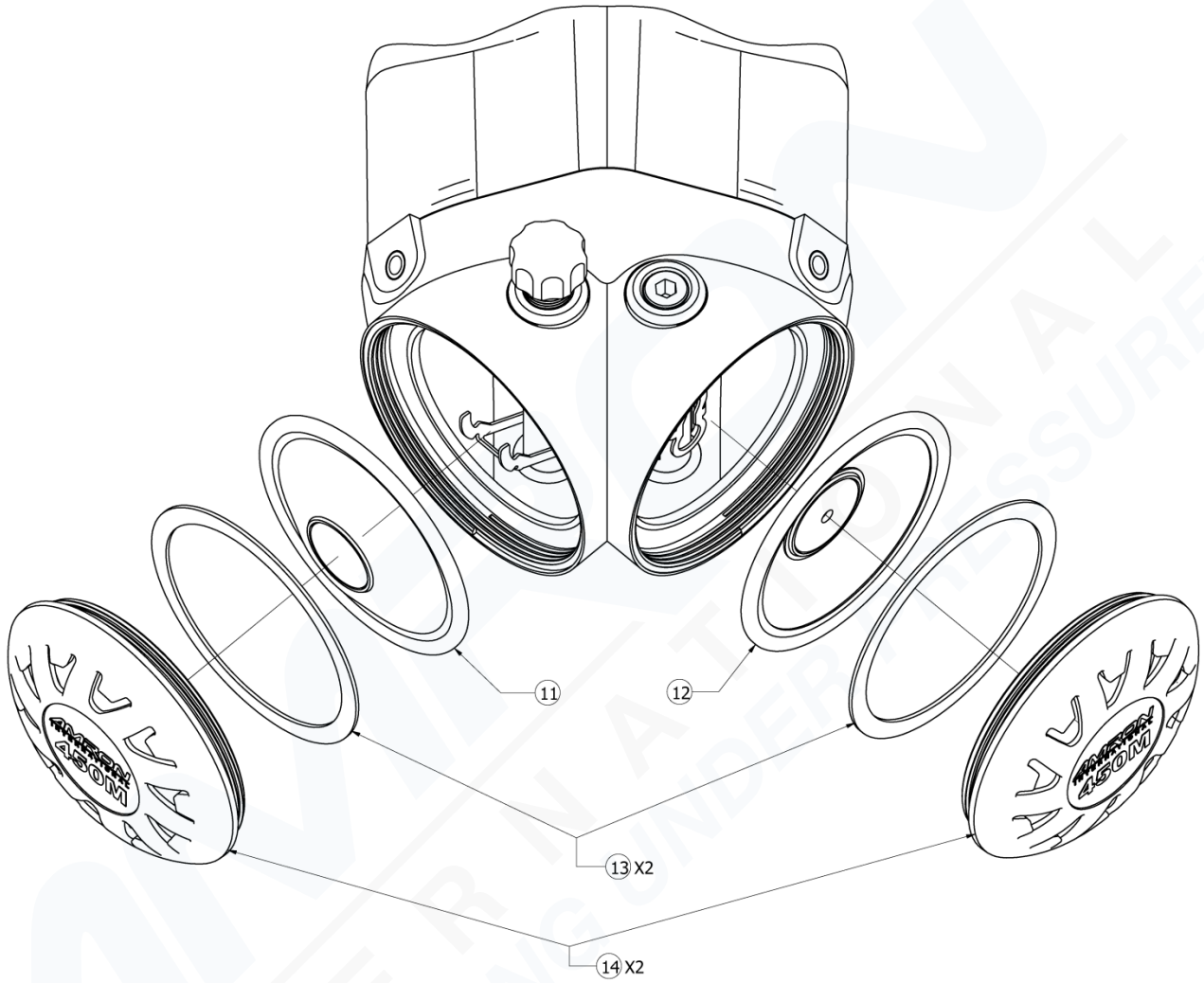
REF	PART #	DESCRIPTION	MATERIAL
1	460-0001-01	Head Support, Mesh	Headnet: Polyester Straps: Nylon
2	345-0004-01	Web Buckle	316 Stainless Steel
3	340-0026-01	Shoulder Screw	316 Stainless Steel

6.2 Hoses



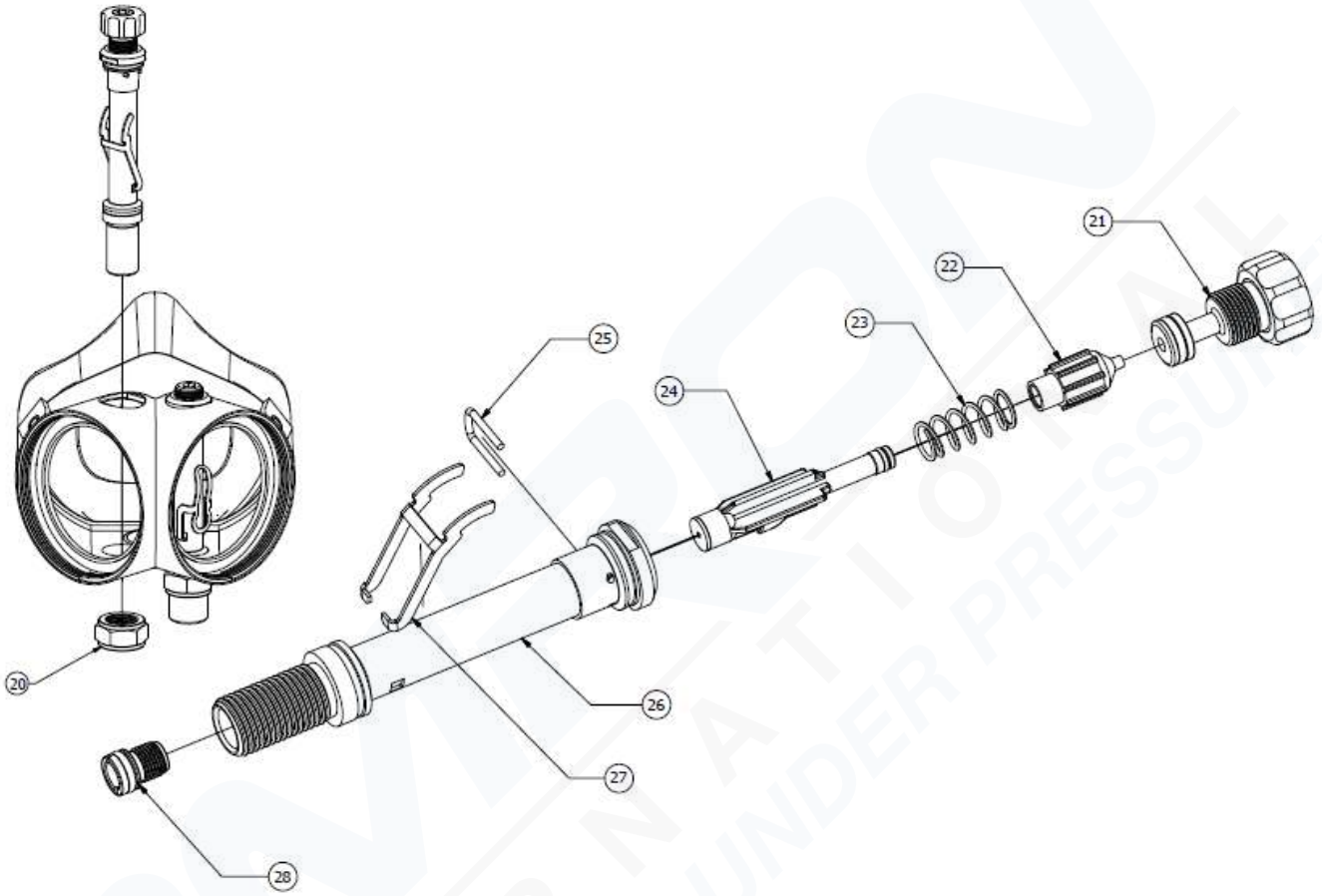
MODEL	REF	PART #	DESCRIPTION	MATERIAL
450M-01	4	540-0004-01	Dual Hose Assembly	Demand Hose: Nitrile/Braided Synthetic Yarn Exhaust Hose: Nitrile/Steel Wire Braided Hose Glands & Nuts: Brass/Nickel/Chrome Ferrules & Springs: Stainless Steel O-rings: Viton
450M-02	4	540-0030-01	Dual Hose Assembly	Demand Hose: Nitrile/Braided Synthetic Yarn Exhaust Hose: Co-polymer Hose Glands & Nuts: Brass/Nickel/Chrome Ferrules & Springs: Stainless Steel O-rings: Viton

6.3 Diaphragms



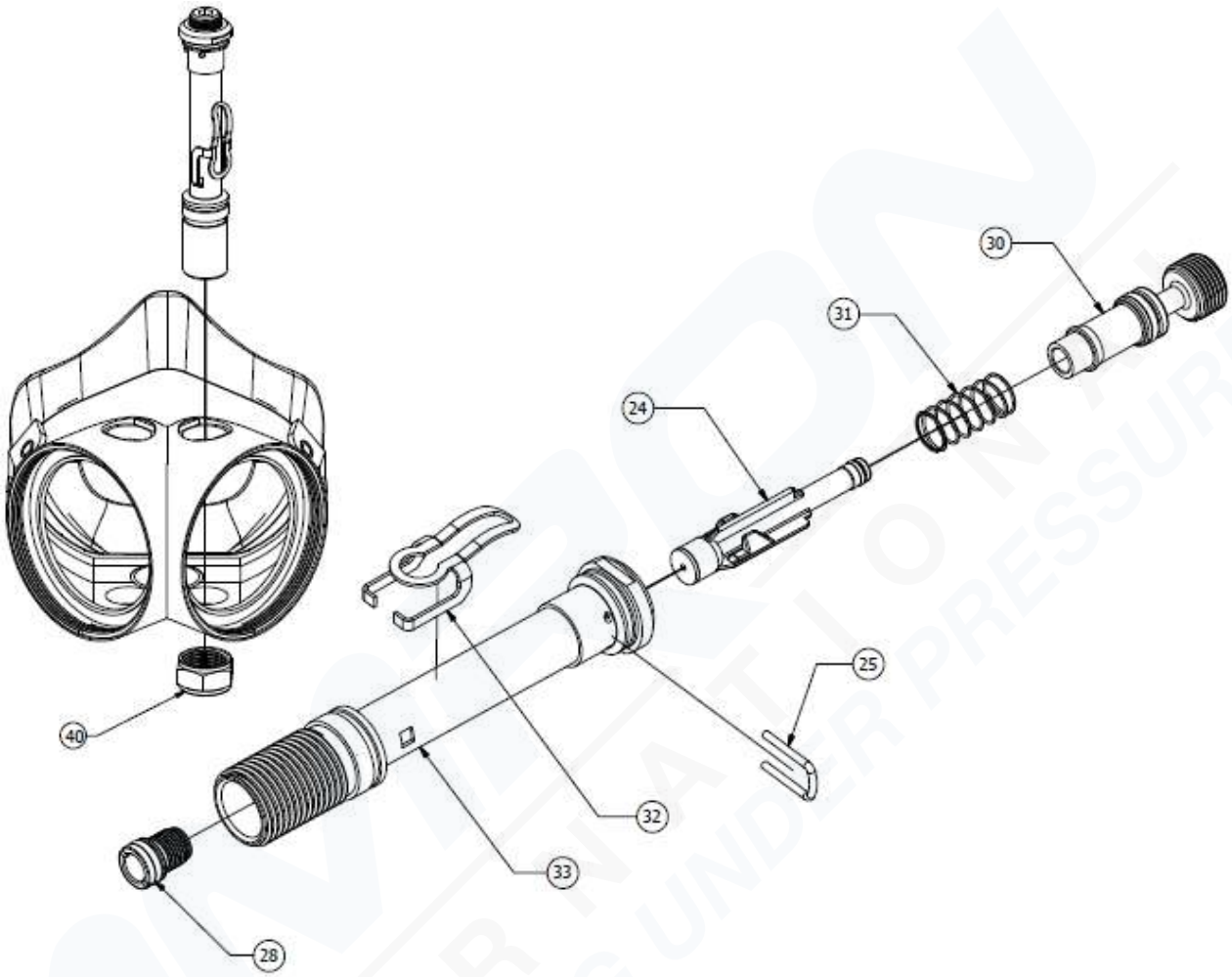
REF	PART #	DESCRIPTION	MATERIAL
11	550-0006-01	Demand Diaphragm Assembly	Silicone, PC/ABS Blend
12	550-0007-01	Exhaust Diaphragm Assembly	Silicone, PC/ABS Blend
13	270-0008-01	Diaphragm Washer	PC/ABS Blend
14	550-0005-01	Diaphragm Covers	PC/ABS Blend

6.4 Demand Regulator Assembly (P/N 540-0001-01)



REF	PART #	DESCRIPTION	MATERIAL
20	340-0009-01	Captivation Nut, Demand	316 Stainless Steel
21	540-0014-01	Main Adjustment Assembly	316 Stainless Steel, Viton
22	270-0007-01	Balance Chamber	PC/ABS Blend
23	320-0023-01	Spring, Demand Actuator	316 Stainless Steel
24	540-0012-01	Actuator Valve Assembly	Ultem, Viton
25	340-0008-01	Retaining Clip	316 Stainless Steel
26	540-0015-01	Demand Tube w/ Seals	316 Stainless Steel, Viton
27	345-0001-01	Demand Lever	316 Stainless Steel
28	540-0008-01	Orifice w/ Seal	316 Stainless Steel, Viton

6.5 Exhaust Regulator Assembly (P/N 540-0025-01)

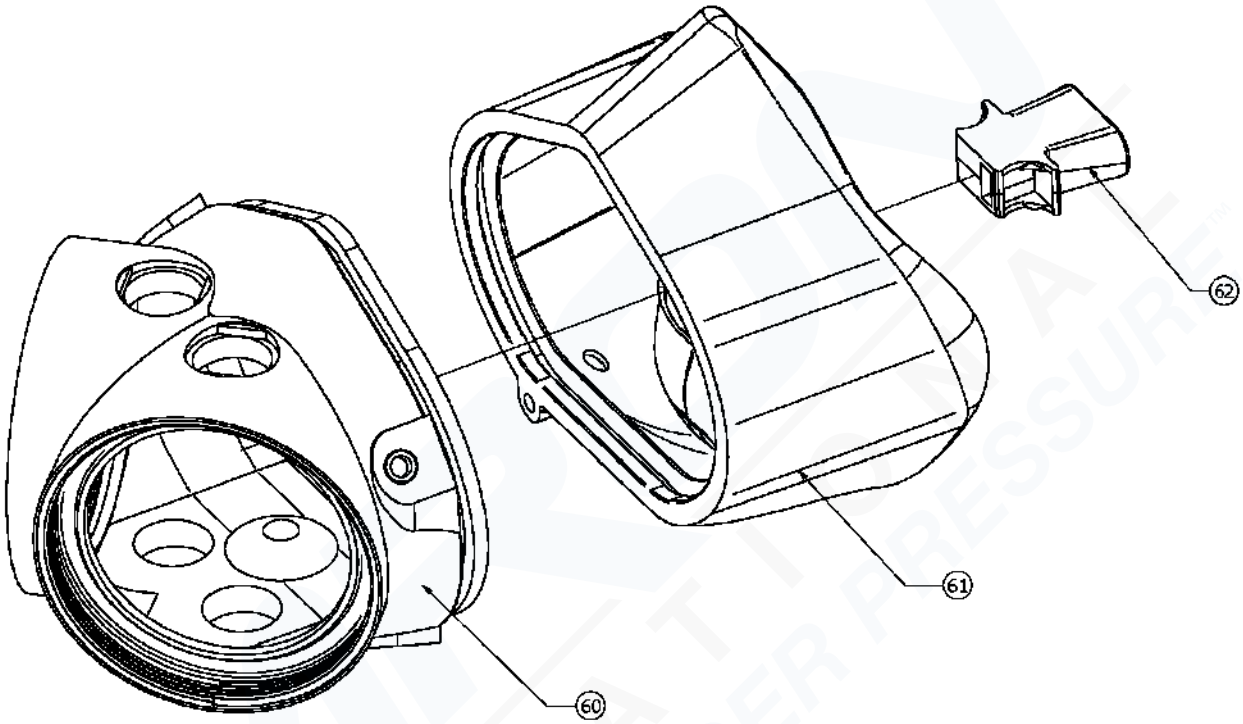


REF	PART #	DESCRIPTION	MATERIAL
24	540-0012-01	Actuator Valve Assembly	Ultem, Viton
25	340-0008-01	Retaining Clip	316 Stainless Steel
28	540-0022-01	Orifice w/ Seal	316 Stainless Steel, Viton
30	540-0010-01	Exhaust Balance Chamber Assembly	PC/ABS Blend
31	320-0011-01	Spring, Exhaust Actuator	316 Stainless Steel
32	345-0002-01	Exhaust Lever	316 Stainless Steel
33	540-0023-01	Exhaust Tube w/ Seal	316 Stainless Steel, Viton
40	340-0010-01	Captivation Nut, Exhaust	316 Stainless Steel

Recommended: Back Pressure Regulators:

- Tescom High Flow Negative Bias BPR P/N 26-2912-282A
- Divex Back Pressure Regulator Order Code RP700

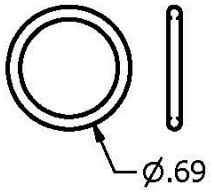
6.6 Regulator Housing Assembly, Face Seal, & Gas Router



REF	PART #	DESCRIPTION	MATERIAL
60	540-0013-01	Regulator Housing Assembly	PC/ABS Blend, Brass
61	250-0001-01	Face Seal, Silicone	Silicone
62	270-0012-01	Gas Router	Thermoplastic

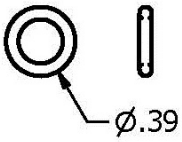
6.7 Recommended Spare Parts

220-0001-01
O-RING, TUBES



220-0002-01
O-RING, ORIFICE &
ADJUSTMENT

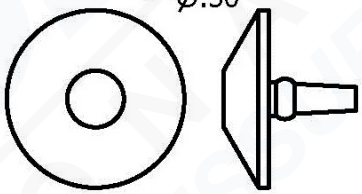
220-0003-01
O-RING, ORIFICE &
DEMAND HOSE



220-0007-01
O-RING,
EXHAUST HOSE

220-0013-01
O-RING,
ACTUATORS

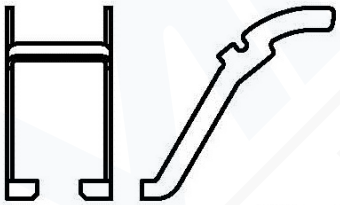
260-0002-01
UMBRELLA VALVE



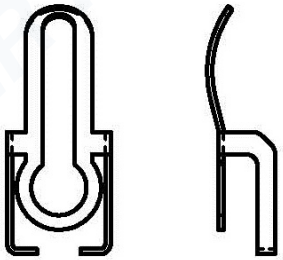
320-0023-01
SPRING, DEMAND

320-0011-01
SPRING, EXHAUST

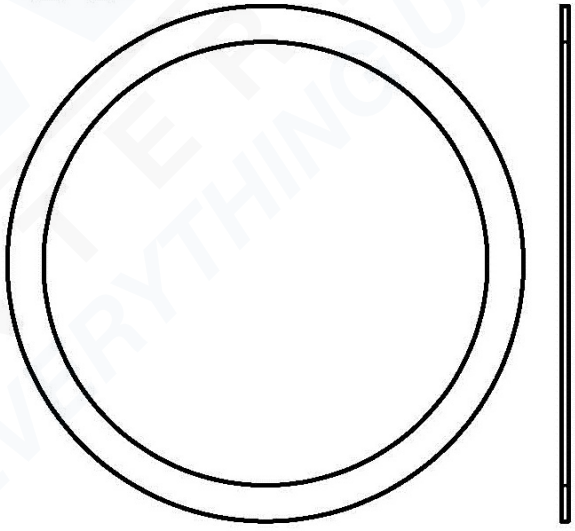
345-0001-01
DEMAND LEVER

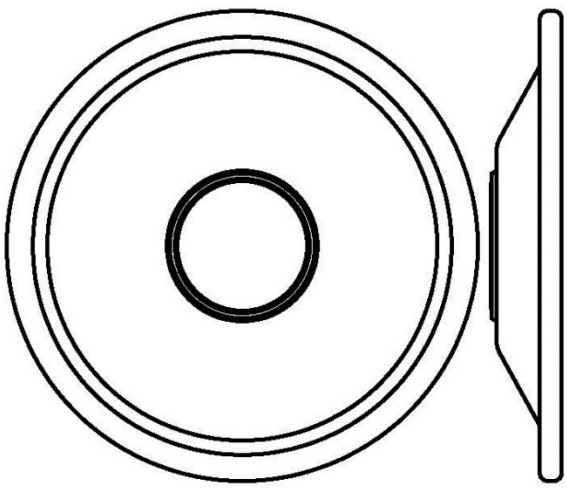


345-0002-01
EXHAUST LEVER

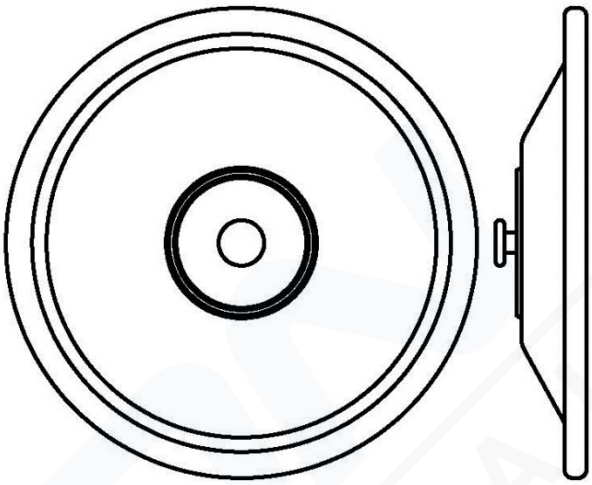


270-0008-01
DIAPHRAGM WASHER





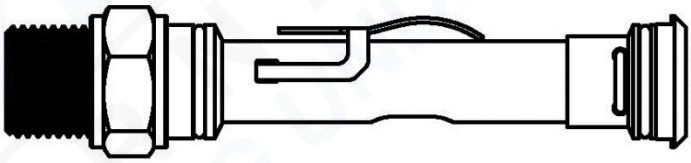
550-0006-01 DEMAND DIAPHRAGM ASSEMBLY



550-0007-01 EXHAUST DIAPHRAGM ASSEMBLY

540-0012-01
ACTUATOR
ASSEMBLY

540-0001-01
DEMAND REGULATOR
ASSEMBLY



540-0025-01
EXHAUST REGULATOR
ASSEMBLY

Rebuild Kit (P/N 660-0002-01)

PART #	DESCRIPTION	QTY
220-0001-01	O-ring, Tubes	4
220-0002-01	O-ring, Orifice & Adjust	2
220-0003-01	O-ring, Orifice & Hose	2
220-0007-01	O-ring, Exhaust Hose	1
220-0013-01	O-ring, Actuator	2
260-0002-01	Umbrella Valve	1
320-0023-01	Spring, Demand	1

PART #	DESCRIPTION	QTY
320-0011-01	Spring, Exhaust	1
345-0001-01	Demand Lever	1
345-0002-01	Exhaust Lever	1
270-0008-01	Diaphragm Washer	2
550-0006-01	Demand Diaphragm	1
550-0007-01	Exhaust Diaphragm	1
540-0012-01	Actuator Assembly	2

6.8 Optional Parts List

Back Pressure Regulator:

- Tescom High Flow Negative Bias BPR: **P/N 26-2912-282A**
- Divex Back Pressure Regulator: **Order Code RP700**

Demand Regulator

- Tescom High Flow Pressure Reducing Regulator: P/N 44-1300 Series

Microphone and Cable Assembly:

- Amron P/N 550-0010-01

Preferred Lubricant:

- Christo-Lube™ **MCG-111-20Z**

Exhaust QD Plug:

- Amron P/N B-6QDP

7. TROUBLESHOOTING

Problem	Probable Cause	Solution
Breathing System is free flowing on Demand side	Main Adjustment is too far out. (Not enough compression on the Spring for the Seat to seal on Orifice)	Screw Main Adjustment in until free flow stops.
	Demand Air Pressure is too high.	Reduce the demand air pressure. See chart based on depth.
	Orifice is too far out. (In this case, the Demand Lever will feel tight with no play, since it's holding all the spring load)	Adjust Orifice in to proper location. See Assembly procedures for location. When Orifice is in proper location, Demand Lever will be slightly loose and have a little play **(When adjusting the Orifice, while valve is assembled, always press Demand Level down to raise Seat off Orifice as not to spin Orifice on and into Seat)
	Damage to Actuator Valve Seat.	Replace Actuator Valve.
	Damage to Orifice.	Replace Orifice.
Difficult to Inhale	Main Adjustment is too far in. (Too much compression on the spring)	Adjust Main Adjustment out until demand starts to free flow. Then adjust it back in slightly, just enough until the free flow stops. (Use Fine Tune Adjustment to be really precise and maximize performance)
	Demand Air Pressure is too low.	Increase the demand air pressure. See chart based on depth.
	Demand Lever is improperly set. (Lever arms not lifting actuator valve)	Properly set Demand Lever so that it activates Actuator Valve in the correct manner.
	Orifice is too far in. (Demand Lever will be very loose)	Adjust Orifice out to proper location. See Assembly procedures for location. **(When adjusting the orifice, while valve is assembled, always press Demand Level down as not to spin orifice on and into Seat)

Problem	Probable Cause	Solution
Exhaust valve has a continuous vacuum	Main Adjustment is too far out. (Not enough compression on the Spring to get the Seat close enough to the Orifice for the vacuum to grab it)	Adjust the Main Adjustment in until the seat gets grabbed by the vacuum.
	Orifice is too far out. (In this case, the exhaust lever will feel tight with no play, since it's holding all the spring load)	Adjust Orifice in to proper location. See Assembly procedures for location. When Orifice is in proper location, Exhaust Lever will be slightly loose and have a little play **(When adjusting the Orifice, while valve is assembled, always lift Exhaust Lever up to raise Seat off of Orifice as not to spin Orifice on and into Seat)
	Damage to Actuator Valve Seat.	Replace Actuator Valve Seat.
	Damage to Orifice.	Replace Orifice.
Difficult to Exhale	Main Adjustment is too far in. (Too much compression on the Spring)	Adjust Main Adjustment out as far as possible as long as you don't pull a continuous vacuum.
	Vacuum Pressure is too high.	Adjust Exhaust Vacuum Pressure down. See Chart based on depth.
	Exhaust Lever is improperly set. (Lever arms not lifting Actuator Valve or Lever isn't attached onto Exhaust Diaphragm)	Properly set Exhaust Lever so that it activates Actuator Valve in the correct manner and it is properly attached to the Exhaust Diaphragm.
	Orifice is too far in. (Exhaust Lever will be very loose)	Adjust Orifice out to proper location. See Assembly procedures for location. **(When adjusting the Orifice, while valve is assembled, always lift Exhaust Lever up as not to spin Orifice on and into Seat)
	Vacuum Hose not connected, Vacuum manifold valve is closed.	Check Hose connections and ensure the vacuum manifold valve is open.

Problem	Probable Cause	Solution
System isn't sealed, there's an air leak	Face Seal isn't properly attached to the Main Regulator Housing. Umbrella Valve is missing or is improperly installed. A rip, puncture, or tear in the Diaphragm or in any of the sealing O-rings.	Check edges where Face Seal is attached, make sure properly attached. Check that the Umbrella Valve is properly installed. Inspect the Diaphragm and the sealing O-rings.

8. PERFORMANCE DATA AND SERVICE LOG

Date	Maintenance Done/ Parts Replaced	Each Dive	6 Months	1 Year	5 Year	Units Condition	Serviced By