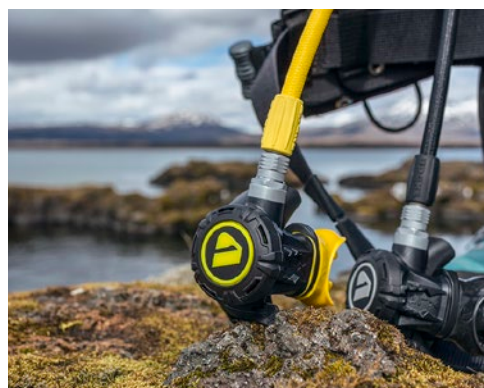




## *TECHNICAL MAINTENANCE MANUAL*



# **XL4 SECOND STAGE**

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XL4 Second Stage Technical Maintenance Manual

## INTRODUCTION

This manual provides factory prescribed procedures for the correct service and repair of the Aqua Lung or Apeks products described in this manual. It is not intended to be used as an instructional manual for untrained personnel.

The procedures outlined within this manual are to be performed only by personnel who have received Factory Authorized training through an Aqua Lung or Apeks Service & Repair Seminar. If you do not completely understand all of the procedures outlined in this manual, contact Aqua Lung to speak directly with a Technical Advisor before proceeding any further.

## WARNINGS, CAUTIONS, & NOTES

Pay special attention to information provided in warnings, cautions and notes that are accompanied by one of these symbols:



**WARNINGS** indicate a procedure or situation that may result in serious injury or death if instructions are not followed correctly.



**CAUTIONS** indicate any situation or technique that will result in potential damage to the product, or render the product unsafe if instructions are not followed correctly.



**NOTES** are used to emphasize important points, tips and reminders.

## SCHEDULED SERVICE

If the regulator is in good working order, it is permissible to overhaul it every other year with an inspection procedure being performed on the "off" years. For example:

**Year #1** : Inspection

**Year #2** : Overhaul

**Year #3** : Inspection

**Year #4** : Overhaul, and so on.

Both Inspections and Overhauls need to be documented in the Annual Service & Inspection Record located in the Owner's Manual to keep the Limited Lifetime Warranty in effect.



**NOTE:** A unit that receives heavy or frequent use, such as rental, instruction, or commercial applications, should be serviced at least twice a year - or more often - depending on the conditions of use and the manner in which it is maintained. (Refer to the care and maintenance procedures outlined in the Regulator Owner's Manual.)

## An Official Inspection consists of:

1. A pressurized immersion test of the entire unit to check for air leakage.
2. Checking for stable medium pressure that is within the acceptable range.
3. Checking for opening effort that is within the acceptable range.
4. Checking for smooth operation of the control knob and venturi switch.
5. A visual inspection of the filter for debris or discoloration.
6. A visual inspection of the exhaust valve to see that it is in good shape and that it's resting against a clean surface.
7. A visual inspection of the mouthpiece looking for tears or holes.
8. Follow Hose Inspection document for guidelines.

If a regulator fails item #1,2,3 or 4, the entire regulator should be overhauled. If a regulator fails #5,6,7 or 8, it will be up to the technician's discretion whether or not a full overhaul is required.

## GENERAL GUIDELINES

1. In order to correctly perform the procedures outlined in this manual, it is important to follow each step exactly in the order given. Read over the entire manual to become familiar with all procedures before attempting to disassemble the product in this manual, and to learn which specialty tools and replacement parts will be required. Keep the manual open beside you for reference while performing each procedure. Do not rely on memory.

2. All service and repair should be carried out in a work area specifically set up and equipped for the task. Adequate lighting, cleanliness, and easy access to all required tools are essential for an efficient repair facility.

3. As the product is disassembled, reusable components should be segregated and not allowed to intermix with nonreusable parts or parts from other units. Delicate parts, which contain critical sealing surfaces, must be protected and isolated from other parts to prevent damage during the cleaning procedure.

4. Use only genuine Aqua Lung or Apeks parts for the service of this product. DO NOT attempt to substitute an original part with another manufacturer's, regardless of any similarity in shape or size.

5. Do not attempt to reuse mandatory replacement parts under any circumstances, regardless of the amount of use the product has received since it was manufactured or last serviced.

6. When reassembling, it is important to follow every torque specification prescribed in this manual, using a calibrated torque wrench. Most parts are made of either marine brass or plastic, and can be permanently damaged by undue stress.

7. In order to make the product compatible with nitrox up to 40% O<sub>2</sub> (EAN40), the product must be properly cleaned, lubricated and assembled using genuine Aqua Lung or Apeks replacement parts. In addition, assembly must be carried out in a clean environment using powderless, latex gloves or equivalent. For more detailed information, be sure to read **Procedure A: Cleaning and Lubricating**.

## GENERAL CONVENTIONS

Unless otherwise instructed, the following terminology and techniques are assumed:

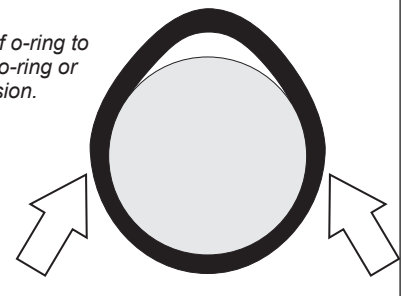
1. When instructed to **remove**, **unscrew**, or **loosen** a threaded part, turn the part counter-clockwise.

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

3. When instructed to **remove** an o-ring, use the pinch method (see illustration below) if possible, or use a brass or plastic o-ring removal tool. Avoid using hardened steel picks, as they may damage the o-ring sealing surface. All o-rings that are removed are discarded and replaced with brand new o-rings.

### Pinch Method

Press upwards on sides of o-ring to create a protrusion. Grab o-ring or insert o-ring tool at protrusion.



4. The following acronyms are used throughout the manual: **MP** is Medium Pressure; **HP** is High Pressure; **LP** is Low Pressure.

5. Numbers in parentheses reference the key numbers on the exploded parts schematics. **For example**, in the statement, "...remove the o-ring (7) from the crown (8)...", the number 7 is the key number to the crown o-ring.



## DISASSEMBLY PROCEDURE



**CAUTION:** Use only a plastic or brass o-ring removal tool when removing o-rings to prevent damage to the sealing surface. Even a small scratch across an o-ring sealing surface could result in leakage. Once an o-ring sealing surface has been damaged, the part must be replaced with new. **DO NOT** use a dental pick or any other steel instrument.



**NOTE:** Before performing any disassembly, refer to the exploded parts drawing, which references all mandatory replacement parts. These parts should be replaced with new, and must not be reused under any circumstances - regardless of the age of the product or how much use it has received since it was last serviced.

- 1** Remove the hose by using a 13/16" wrench to hold the inlet shroud (12) stationary, while turning the hose swivel counter-clockwise with a 11/16" wrench.



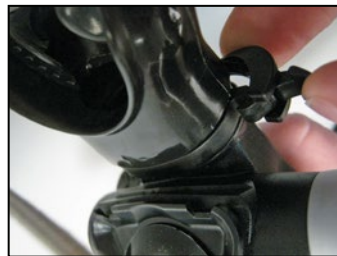
- 2** Follow all guidelines from the Hose Inspection & Cleaning Technical Maintenance Manual.



- 3** Place one finger into each side of the exhaust tee (26) and squeeze them together. Pull the exhaust tee away from the case (7).



- 4** Unfasten the mouthpiece clip (8) and pull the mouthpiece off the case (7).

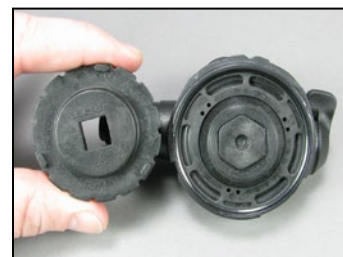


- 5** To remove the clamp ring (1), place your thumb on the top of the clamp ring as shown on the first image below. Grip the rest of the clamp ring and turn counter-clockwise. Separate the purge clamp ring (1) from the purge button assembly and the case (7).



**NOTE:** Failure to hold the clamp ring as outlined in section 5 may result in the cover being more difficult to remove due to pressure being applied to the locking mechanism.

- 6** Using the locking ring tool (RG911161), align the three kidney shaped pegs of the tool into the slots of the inner locking ring (4). Loosen the inner locking ring counter-clockwise and remove it from the case (7). Remove the friction ring (5) and the diaphragm (6) from inside of the case.



**7** Position the venturi lever (24) vertically. Using the venturi lever removal tool (RG911232), align the cutout in the tool so it will engage the tab of the venturi lever and evenly set the tool on the top of the case (7). Carefully pushing down on the tool will depress the tab of the venturi lever allowing you to remove the venturi lever from the case.



**CAUTION:** Take care not to damage or distort the venturi tab when removing the venturi lever (24). DO NOT depress the tab of the venturi lever too far, as this will result in permanent deformation.

**8** Slide the venturi lever (27) out from the body (7). Remove the o-ring (11) from the venturi lever taking care not to scratch the o-ring groove.



**9** Using a 13/16" wrench turn the inlet shroud (12) counter-clockwise to loosen & remove.



**10** The inlet shroud assembly (10/12) will remove as one. To separate, grip the regulator hose thread on the inlet fitting (10) and slide off the inlet shroud (12).



**NOTE:** There will be some slight resistance removing the two parts above due to the o-ring (11) underneath the inlet shroud (12).

**11** Insert a 5mm hex key into the reg hose threaded end of the inlet fitting (10) and turn the seat (14) **CLOCKWISE**. Carefully push the seat out the other end of the inlet fitting.



**CAUTION:** Take care when handling the seat (14). The sealing surface of the seat must be protected from damage or the regulator will leak.

**12** Remove the o-rings (11/13). Closely examine the seat for any scoring or nicks. If damage is found, discard the seat. Do not attempt to reuse. If the seat is in reusable condition, set it aside on a soft surface to prevent damage to the sealing edge.



**13** Insert the long end of the micro adjuster tool (RG911227) into the inlet fitting side of the case (7) and carefully push in to release the spindle body (16) from the case. Carefully remove the spindle body from inside the case.



**14** To remove the lever (15) from the spindle body (16), press a finger into the end of the spindle body to compress the spring (20). Carefully pull one of the legs of the lever out of the spindle body and then ease the second leg out. Remove the shuttle valve assembly from the spindle body. Separate the components of the shuttle valve assembly.

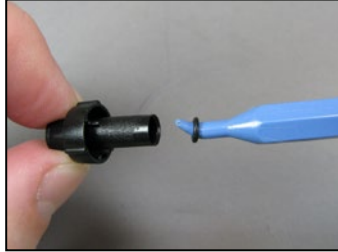
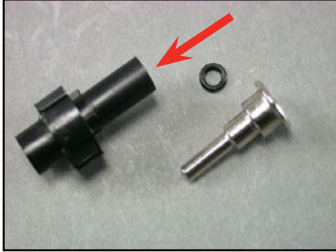




**15** Using your fingernail, remove the MP seat (17) from the shuttle valve (18).



**16** Confirm the o-ring (19) is removed from the spring carrier (21). If it cannot be found, make sure to look inside the shuttle valve (18).



**NOTE:** Check the spring carrier (21) for a small o-ring (19) that should be removed. If no o-ring is present, check inside the shuttle valve (18) for the o-ring.

**NOTE:** There is no need to remove the micro adjuster screw (23) from the spindle adjuster sleeve (22).



**17** Fold back the edges of the exhaust valve (25) and inspect underneath. The seating surface should be clean and free of damage. Inspect the exhaust valve, it should be supple and have well defined edges. If it looks good, there is no need to remove it and may be reused. If there is any sign of deterioration, it should be replaced.



**NOTE:** If the exhaust valve (25) is to be removed, pinch the edge of the valve and pull the tail through the hole in the case (7).

## THIS ENDS DISASSEMBLY

**NOTE:** Before beginning reassembly, perform parts cleaning and lubrication in accordance with **Procedure A: Cleaning and Lubricating**.

## INSPECTION PROCEDURE

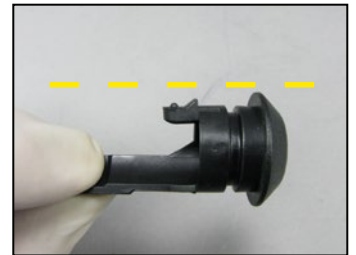
**NOTE:** Before performing any reassembly procedures, there are several parts that must be inspected. The following section details the parts and areas that must be checked.

**NOTE:** The following parts should be checked for cracks, deep scratches, excessive wear and tear and distortion. Sealing faces, grooves and bores should be checked for scratches.

**1** Inspect the back face of the front cover assembly (2). Check that the rubber purge spring is firmly located around the entire perimeter of the front cover.



**2** Check that the tab of the venturi lever (24) has not been over stressed and that it is level with the rest of the lever.



**3** Check that the spindle body (16) is free from scratches, cracks and distortion. Look for excessive wear around the lever holes. Check that the thread is in good condition.



## REASSEMBLY PROCEDURE

**NOTE:** Before performing any reassembly, it is important to inspect all parts, both new and those that are being reused, to ensure that every part and component is perfectly clean and free of any dust, corrosion, or blemishes. Before dressing each o-ring with Christo-Lube®, check to ensure it is clean, supple, and free of any blemish.

**WARNING:** Use only genuine Apek's® parts, sub-assemblies, and components whenever assembling any Apek's® product. DO NOT attempt to substitute an Apek's® part with another manufacturer's, regardless of any similarity in shape, size or appearance. Doing so may render the product unsafe, and could result in serious injury or death.

**1** If replacing the exhaust valve (25) thread the tail through the retaining hole on the outside of the case (7) until the barb engages on the inside. Cut off the excess stem with side cutters leaving approximately 5mm of the tail behind.



**WARNING:** Flooding may occur if the tail of the valve is not fully pulled through. Ensure that the barb has engaged on inside of case.

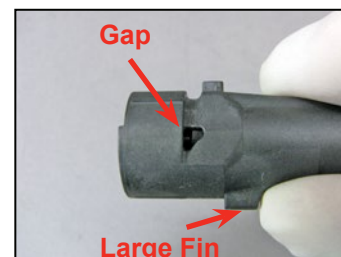
**2** Install o-ring (19) onto the spring carrier (21). Check the bore of the shuttle valve (18) to ensure that the old o-ring has been removed. Insert the spring carrier into one end of the spring (20) and the shuttle valve into the other, carefully guiding the end of the spring carrier into the bore of the shuttle valve.



**3** Carefully place the spindle adjuster sleeve (22) on the spring carrier (21). Ensure that the two legs of the spindle adjuster sleeve correctly line up with the slots in the spindle body (16). Check the spindle adjuster sleeve passes through the slots in the spindle body.



**4** Position the large fin of the spindle body (16) down. Press the end of the shuttle valve (18) to fully compress the spring (20), until it passes the triangular shaped hole in the spindle body. Insert the feet of the lever (15) one leg at a time into the gap, this retains the shuttle valve inside the spindle body.



**CAUTION:** Ensure that lever is not twisted and that legs are parallel. Lever should appear as that shown on the left, not as shown on the right. If necessary, gently squeeze legs together to straighten.



**NOTE:** Ensure that the lever has a full range of movement and does not catch on the valve spindle body. Ensure that the spring can be seen through the valve spindle hole.

**5** Carefully insert the silicone MP seat (17) into the end of the shuttle valve (18). Ensure the MP seat is sitting flush to the shuttle valve.



**6** Inspect the flat end of the micro adjuster tool (RG911227) and the spindle body assembly (14-22), take note of the cutout on the tool.





**7** Carefully insert the spindle body assembly into the case (6). Insert the tool into the venturi side of the case, carefully rotate the tool until the cutout in the tool engages with the spindle body assembly. Push the spindle body firmly into the case, ensuring that there is no gap between the two parts. Ensure that the lever (22) has a full range of movement and does not catch on the spindle body.



**CAUTION:** DO NOT use the lever to push the spindle body into the case as this will bend the lever.

**8** Critically inspect the seat (14) for any damage and replace if needed. Install o-ring (13) onto the seat.



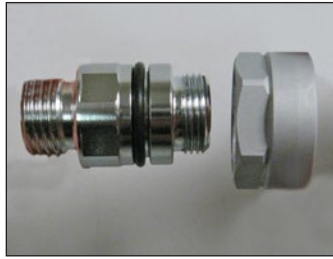
**9** Install o-ring (11) onto the inlet fitting (10).



**10** Carefully push the seat (16) threaded end first into the larger diameter bore of the inlet fitting (20). Using a 5mm hex key turn the seat **COUNTER-CLOCKWISE** so that it retracts into the inlet fitting until it bottoms out.



**11** Slide the inlet shroud (12) hex side first onto the inlet fitting (10) past the already installed o-ring.



**12** Thread the inlet shroud assembly (10/12) clockwise into the spindle body (16) until snug. Using a torque wrench with a 13/16" crow-foot, torque to 2.2 ft-lb (3 Nm).



**13** While holding the case (7) at eye level, use a 5mm hex key to turn the seat (14) clockwise until the lever (15) drops just below the rim of the case. Check by gently flicking the lever, it should bounce and have free movement. The lever should return to its set position, if it sticks then the lever is not square, fitted incorrectly or it is bent.



**CAUTION:** Ensure that the Lever moves freely and sits vertically within the case.

**14** Refit the diaphragm (6) into the front of the case (7). Using your finger carefully work the edges of the diaphragm into place so it sits evenly in the case. Insert the friction ring (5) into the case. Use the same technique to ensure it sits evenly onto the diaphragm.



**CAUTION:** Ensure that the diaphragm (6) and friction ring (5) are seated correctly and are not creased.

**15** Place the inner locking ring (4) with the flat side facing up onto the diaphragm (6). Use the diaphragm clamp tool (RG911161) to slowly tighten the inner locking ring clockwise into the case (7) until handtight. Once the diaphragm pad is secure, gently grip the diaphragm pad between the thumb and forefinger; gently pull from side to side to confirm diaphragm is secure.



**16** Install the o-ring (13) into the swivel end of the MP hose (28).



## ADJUSTING AND TESTING



**WARNING:** Compressed air can be highly explosive and is dangerous if misused. Ensure the cylinder valve is opened slowly. Use eye and ear personal protective equipment when performing any tests involving compressed air.

### ADJUSTING LEVER HEIGHT



**NOTE:** The inline adjustment tool (RA911123) can be used for crowns with a flat screwdriver slot or a hex hole. Set the inline tool to the hex slot setting.

**1** Spread the inline adjustment tool (RA911123) apart and thread it on the second stage inlet fitting.



**2** Confirm the male end of the MP hose is connected to a properly adjusted first stage regulator. Thread the swivel end of the hose to the other end of the inline tool. Finally, attach the first stage to a calibrated test bench or cylinder and slowly pressurize the first stage to 3,000 psi (207 bar).



**CAUTION:** Prior to adjusting and testing the second stage regulator, the accompanying first stage must be correctly serviced and adjusted to a stable MP and fully tested. Refer to the appropriate first stage technical manual before attempting to perform the adjustment and testing of the second stage.



**NOTE:** If The second stage is leaking, turn the inline adjuster clockwise until the leaking stops.

**3** Gently purge the second stage 2-3 times to confirm there is air flow.



**4** Place the "GAS FLOW" side of the lever setting tool (RA911116) onto the plastic pad of the diaphragm (6). Depress the diaphragm by pushing the tool in until it stops against the case (7).

If gas flows from the valve follow step 6.

If no gas flows from the second stage proceed to step 5.



**NOTE:** The second stage "SHOULD LEAK AIR" with this test. If it does not, the lever is set too low.



**CAUTION:** The air flow should be continuous with no fluttering.



**NOTE:** It is important to ensure that the rim of the lever setting tool (RA911116) is centered with the case (7). If the tool is misaligned it will not measure the purge button (depth of pressing) and sensitivity, correctly.

**5** Keeping the lever setting tool in place, press inward on the adjustment wheel of the inline tool. Slowly rotate the adjustment wheel until the inline tool engages the seat (14). Turn the seat counter-clockwise by approximately 1/16 of a turn. This will raise the lever (15). Continue to adjust in 1/16 turns until there is a steady flow of air.



**6** Place the **"NO GAS FLOW"** side of the lever setting tool (RA911116) onto the plastic pad of the diaphragm (6). Depress the diaphragm by pushing the tool in until it stops against the case (7).

**If no gas flows from the second stage proceed to step 8.**

**If gas flows from the valve follow step 7.**



**NOTE:** The second stage **"SHOULD NOT LEAK AIR"** with this test. If it does, the lever is set too high.

**7** Keeping the lever setting tool in place, press inward on the adjustment wheel of the inline tool. Slowly rotate the adjustment wheel until the inline tool engages the seat (14). Turn the seat clockwise by approximately 1/16 of a turn. This will lower the lever.

**Repeat From Step 3.**



**8** Turn off the air supply and purge the second stage by pressing the center pad of the diaphragm (6). Pull back on the adjustment wheel of the inline tool and remove it from the second stage. Remove the MP hose from the inline tool.



**CAUTION:** When removing the inline adjustment tool from the second stage, remember to pull the handwheel back to disengage it from the seat. Failure to perform this step can cause changes to your adjustment.

**9** Install the swivel end of the hose onto the second stage hand tight. Hold the inlet shroud (12) steady with a 13/16" wrench. Using a torque wrench with an 11/16" crow-foot, tighten the hose fitting to 45 in-lb (5 Nm).



**CAUTION:** Subjective breathing test must be performed every time the lever is adjusted.



## SECOND STAGE OPENING EFFORT TEST

**10** Insert the micro adjuster tool (RG911227) into the open side of the case (7), making sure that the hexagonal bit engages into the micro adjuster screw (23).



**11** Connect the first stage regulator to a calibrated test bench and pressurize the system to 3000 psi (207 bar).

a. Slowly open the flowmeter control knob (start vacuum) while watching both the magnahelic gauge and the intermediate pressure gauge.

b. When the MP gauge begins to drop, indicating the second-stage valve is open, the magnahelic gauge should indicate an opening effort of +1.4" to +1.6" (3.5 - 4.0mbar).

c. If the reading is outside of these specifications, turn the micro adjuster screw (15) counter-clockwise to lower the opening effort or clockwise to increase the opening effort.

If this fails to give the correct reading refer to **Table 1: Troubleshooting Guide** for corrective guidelines and specific procedures.



**NOTE:** A 2.5mm hex key can be used to adjust the micro adjuster screw (15) if a micro adjuster tool (RG911227) is not available. The open end of the case must be blanked off (place your thumb over opening) to obtain a reading on the test bench.

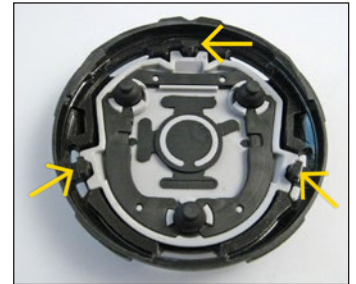
**12** With the second stage still attached to the magnahelic, turn the gas supply off. The vacuum gauge should read above 100mm Hg (53.5 in-H<sub>2</sub>O)



**NOTE:** If the Magnahelic being used isn't fitted with a vacuum gauge you will need to perform the test orally. Place your thumb over the inlet fitting and inhale normally through the mouthpiece. If you can draw air in or hear air flow refer to, **Table 1: Troubleshooting Guide**.

## FINAL ASSEMBLY

**1** Place the purge button (2) inside the clamp ring (1) ensuring the three locating tabs line up.



**2** Fit the front cover assembly onto the case (7) roughly at the 11 o'clock position then turn clockwise until the cover locks firmly into position.



**3** Install the o-ring (11) onto the venturi lever (24). Align the venturi lever in a vertical position with the case (7) and press the lever into place. Ensure that the venturi lever rotates freely and feels secure.



**NOTE:** The thumb grip section of the venturi lever needs to fit into the cutout section on the case.

**NOTE:** To check that the diaphragm (6) has sealed correctly, place your thumb over the end of the inlet fitting (10). Suck and hold at the mouthpiece port, a vacuum should be held without any leakage.

**4** If equipped with a Comfo-bite mouthpiece, make sure the 'bridge' of the mouthpiece (9) is facing upward. Stretch the mouthpiece over the outlet port. Wrap the mouthpiece clip around the mouthpiece so that the buckle points toward the hose. Fasten the clip, ensuring that the mouthpiece is securely held in place.



**WARNING:** Ensure that the mouthpiece is properly secured on the outlet port.

**5** Fit the bottom of the exhaust tee (26) over the bottom rim of the case (7). Place your thumbs in each exhaust port and push the exhaust tee up towards the mouthpiece (9). Ensure the exhaust tee fits over the case and is secure. Take care not to damage or dislodge the exhaust valve (25).



**NOTE:** Ensure the exhaust tee is fully captured by the case.

## THIS CONCLUDES REASSEMBLY

## FINAL TESTING

### EXTERNAL LEAK TEST

**1** After disconnecting the regulator from the test bench, connect it to a scuba cylinder filled to approximately 3,000 psi (207 bar). Open the cylinder valve to repressurize the regulator, and submerge the entire system in a test tank of clean water.



**2** Observe any bubbles arising from the submerged regulator over a one minute period. The recommended time is necessary due to slower bubble formation that occurs in smaller leaks. Bubbles indicate a leak, which requires the system to be disassembled at the source to check sealing surfaces, assembly sequence and component positioning in order to correct the problem(s).

**NOTE:** Do not confuse bubbles from trapped air with a true leak. If there is an air leak, bubbles will come out in a constant stream.

**NOTE:** Extremely small leaks may be better detected by applying a soap solution or Snoop™ to the leak area. Bubble streams will indicate the source of the leak. Before disassembling to correct any leaks, rinse the entire regulator thoroughly with fresh water and blow out all residual moisture with filtered, low-pressure (25 psi) air. Disassemble and remedy the problem, referring to **Table 1: Troubleshooting**.

### SUBJECTIVE BREATHING TEST

**3** Depress the purge button (2) fully to ensure that an adequate volume of air needed to clear the second stage flows through the mouthpiece.

**a.** Inhale slowly and deeply from the mouthpiece. A properly serviced and adjusted regulator should deliver air upon deep inhalation without excessive inhalation effort, freeflow, or fluttering of the second stage diaphragm. When exhaling, there should be no fluttering or sticking of the exhalation valve. If any of these problems occur, refer to **Table 1: Troubleshooting Guide**.

**b.** With the venturi lever set to the + position tap the purge button quickly, this should cause the regulator to freeflow. Stop the freeflow after a couple of seconds by placing a hand over the mouthpiece.


**c.** When completed, close the cylinder valve and depressurize the regulator. Remove the first stage from the cylinder valve and secure the dust cap in place.

**CAUTION:** Subjective breathing test must be performed every time the lever is adjusted.

## THIS CONCLUDES SERVICING OF THE XL4 SECOND STAGE

**TABLE 1: TROUBLESHOOTING GUIDE**














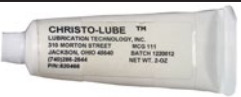
| <b>SYMPTOM</b>   | <b>POSSIBLE CAUSE</b>   | <b>TREATMENT</b>  |
|--|---|---|
| <b>Second Stage Air Leak or Free Flow</b>              | 1. Extremely high MP from first stage                                   | 1. Refer to First Stage Troubleshooting Guide                     |
|  | 2. The MP seat (17) is damaged  | 2. Replace the MP seat  |
|  | 3. The seat (14) was adjusted incorrectly or lever (15) is set too high | 3. Reset seat preliminary settings & repeat adjustment procedures |
|  | 4. The lever (15) is bent   | 4. Replace lever  |
|  | 5. The seat (14) sealing surface is damaged                             | 5. Replace valve seat   |
|  | 6. The valve spring (20) is damaged                                     | 6. Replace valve spring   |
|  | 7. Shuttle valve o-ring (19) is damaged                                 | 7. Replace o-ring   |
|  | 8. Shuttle valve (18) is damaged  | 8. Replace Shuttle valve  |
|  | 9. Venturi lever o-ring (11) is damaged                                 | 9. Replace o-ring   |
| <b>Low Purge or Labored Breathing on Full Cylinder</b> | 1. First stage has low MP   | 1. Refer to First Stage Troubleshooting Guide                     |
|  | 2. Seat (14) adjusted incorrectly or lever (15) is set too high         | 2. Reset seat preliminary settings & repeat adjustment procedures |
|  | 3. The MP hose is clogged or obstructed                                 | 3. Clean or replace the MP hose                                   |
|  | 4. The lever (15) is bent or catching on the valve spindle (16)         | 4. Replace lever  |
| <b>Water Entering Second Stage</b>                     | 1. Mouthpiece (9) incorrectly fitted                                    | 1. Refit or replace mouthpiece                                    |
|  | 2. The diaphragm (6) is damaged   | 2. Replace diaphragm  |
|  | 3. The diaphragm (6) is improperly seated in case (7)                   | 3. Remove front cover assembly & re-seat diaphragm properly       |
|  | 4. The exhaust valve (25) is damaged                                    | 4. Replace exhaust valve  |
|  | 5. The case (7) is damaged  | 5. Replace case   |
|  | 6. Heat exchanger o-ring (11) is damaged                                | 6. Replace o-ring   |
|  | 7. Venturi body o-ring (11) is damaged                                  | 7. Replace o-ring   |

 **NOTE:** This is a partial list of possible problems and recommended treatments. For more information, contact Aqua Lung's Technical Services Department for assistance with problems not described here.

 **CAUTION:** Recommended treatments which require disassembly of the regulator must be performed during a complete overhaul, according to the prescribed procedures for scheduled, annual service. Do not attempt to perform partial service.



**TABLE 2: LIST OF TOOLS**

| PART #          | DESCRIPTION   | APPLICATION   |
|-----------------|---|---|
| <b>RG911161</b> | Diaphragm Clamp Tool           | Removal/installation of inner locking ring (4)                          |
| <b>RA911143</b> | Brass O-ring Tool Kit          | Removal and replacement of o-rings                                      |
| <b>RA911141</b> | Plastic O-ring Tool            |   |
| <b>RA911116</b> | Lever Setting Tool             | Setting lever height  |
| <b>RG911227</b> | Micro Adjuster Tool            | Setting micro adjuster screw (23). Remove/replace spindle body assembly |
| <b>RG911232</b> | Venturi Lever Tool             | Removal of venturi lever (24)   |
| <b>RA911123</b> | Inline Adjuster Tool          | Adjusting lever height  |
| <b>N/A</b>      | (11/16", 13/16") Wrench      | Disassembly and assembly  |
| <b>N/A</b>      | (2.5mm, 5mm) Hex Key         | Removal/installation of seat (14), Micro adjuster (23)                  |
| <b>N/A</b>      | Torque Wrench                | Apply torque to parts listed in Table 3: Torque Specifications          |
| <b>N/A</b>      | (11/16", 13/16") Crow Foot   | Apply torque to parts listed in Table 3: Torque Specifications          |
| <b>N/A</b>      | Side Cutters                 | Trim exhaust valve  |
| <b>N/A</b>      | Magnifier with Illumination  | Sealing surface inspection  |
| <b>N/A</b>      | Ultrasonic Cleaner  | Brass and stainless steel parts cleaning                                |
| <b>N/A</b>      | Christo-Lube MCG-111         | Lubrication   |
| <b>N/A</b>      | Powderless Latex Gloves or Finger Cots  | Keep finger oils off of parts   |
| <b>N/A</b>      | Test Bench  | For testing   |
| <b>RS135111</b> | Second Stage Service Kit  | Service parts   |

**TABLE 3: TORQUE SPECIFICATIONS**



| PART #                           | DESCRIPTION / KEY ITEM # | TORQUE           |
|----------------------------------|--------------------------|------------------|
| RG912344                         | Inlet Shroud (12)        | 27 in-lbs (3 Nm) |
| RH114257<br>RH114119<br>RH113115 | MP Flex Hose (28)        | 45 in-lbs (5 Nm) |

**TABLE 4: TEST BENCH SPECIFICATIONS**

| TEST                         | CONDITION  | SPECIFICATION                                 |
|------------------------------|--|---|
| Leak Test                    | Inlet 2500-3000 psi (172-207 bar)                              | No leaks allowed                              |
| MP                           | Inlet 3000 psi (207 bar)                                       | 130-145 psi (9 - 10 bar)                      |
| Opening Effort<br>Std & Octo | Inlet 2500-3000 psi (172-207 bar)<br>MP 130-145 psi (9-10 bar) | + 1.4 - 1.6 H <sub>2</sub> O (3.5 - 4.0 mbar) |



## TABLE 5: RECOMMENDED CLEANERS & LUBRICANTS

| LUBRICANT/CLEANER   | APPLICATION   | SOURCE  |
|---|---|---|
| <p><b>Christo-Lube® MCG 111</b></p> <p><b>PerflouroLube 20/1</b></p>  | Lubricant for all o-rings   | <p>Aqua Lung, PN 820466,<br/>or<br/>Lubrication Technologies<br/>310 Morton Street<br/>Jackson, OH 45640<br/>(800) 477-8704</p> <p>Performance Fluids<br/>Ste 101 Lomeshaye Business Park<br/>Turner Road<br/>Nelson Lancashire BBP 7DR</p>     |
| <p> <b>CAUTION:</b> Silicone rubber requires no lubrication or preservative treatment. DO NOT apply grease or spray to silicone rubber parts. Doing so may cause a chemical breakdown and premature deterioration of the material.</p> |   |   |
| <b>White distilled vinegar</b><br>(diluted with water)  | Bath for reusable stainless steel and brass parts.  | “Household” grade   |
| <p> <b>CAUTION:</b> Do not use muriatic acid for the cleaning of any parts. Even if strongly diluted, muriatic acid can harm chrome plating and may leave a residue that is harmful to o-ring seals and other parts.</p>               |   |   |
| <p><b>Oxygen Compatible Solution</b></p> <p><b>Promoclean TP108</b></p> <p><b>Janitol Plus</b></p>  | Nitrox/O2 Cleaning  | <p>As Per Training</p> <p>INVENTEC PERFORMANCE<br/>CHEMICALS SA.<br/>20, Rue de bourgogne<br/>BP 211<br/>69802 SAINT-PRIEST cedex</p> <p>JOHN LAWSON DIST.<br/>SCOTSHAW BROOK HOUSE<br/>BRANCH ROAD<br/>LOWER DARWEN<br/>LANCASHIRE BB3 0PR</p> |
|   |   |   |
| <b>Liquid Dishwashing Detergent</b><br>(diluted with warm water)  | Degreaser for brass and stainless steel parts; general cleaning solution for plastic and rubber | “Household” grade   |



# PROCEDURE A: CLEANING & LUBRICATING

## AQUA LUNG AND APEKS REGULATORS AND NITROX

When it comes to issues of nitrox safety and compatibility, the concerns lie primarily with the regulator's first stage as it is subjected to high inlet pressures. High inlet pressures lead to adiabatic compression or heating of the gas. The Aqua Lung or Apeks regulator product described in this manual, when properly cleaned and assembled, is authorized for use with enriched air nitrox (EAN) that does not exceed 40% (EAN 40). It is authorized because it has undergone adiabatic compression testing and the authorized service kit components and lubricants are compatible in elevated oxygen environments. During cleaning, a mild detergent must be used to remove condensed hydrocarbons (compressor oils) from the inside passageways of the first stage. For the first stage to remain EAN40 compatible, only use hyperfiltered compressed gas (hydrocarbons < 0.1 mg/m<sup>3</sup>). Ordinary compressed breathing air (Grade E) usually does not meet this criterion. Once ordinary breathing air is used, the first stage is no longer EAN40 compatible until it is cleaned and serviced again.

Although regulator second stage components are not exposed to high pressure EAN, Aqua Lung and Apeks recommend that the same cleaning procedures be followed for the complete regulator. This prevents the possibility of cross contamination and guarantees the cleanliness of the entire regulator.

### Cleaning Brass and Stainless Steel Parts

1. Preclean in warm, soapy water\* using a soft nylon bristle brush.
2. Thoroughly clean parts in an ultrasonic cleaner filled with soapy water. If there are stubborn deposits, household white distilled vinegar (acetic acid) in an ultrasonic cleaner will work well. DO NOT place plastic, rubber, silicone or anodized aluminum parts in vinegar.
3. Remove parts from the ultrasonic cleaner and rinse with fresh water. If tap water is extremely "hard," place the parts in a bath of distilled water to prevent any mineral residue. Agitate lightly, and allow to soak for 5-10 minutes. Remove and blow dry with low pressure (25 psi) filtered air, and inspect closely to ensure proper cleaning and like-new condition.

### Cleaning Anodized Aluminum, Plastic & Rubber Parts

Anodized aluminum parts and parts made of plastic or rubber, such as box bottoms, box tops, dust caps, etc., may be soaked and cleaned in a solution of warm water mixed with mild dish soap. Use only a soft nylon toothbrush to scrub away any deposits. Rinse in fresh water and thoroughly blow dry, using low pressure filtered air.



**CAUTION:** Do not place plastic and rubber parts in contact with acid solutions. This could alter their physical properties and cause degradation and premature breakdown.

### Cleaning MP Hoses (Air use Only)

Follow Hose Inspection & Cleaning Guidelines for more detailed information

1. Hose fittings: Ultrasonically clean with soapy water; Use soft nylon bristle brush. If corrosion is evident, use a brass bristle brush.
2. Run water through hose if needed
3. Thoroughly rinse with fresh water
4. Blow out hose before installing



**CAUTION:** Do not place complete hose length in contact with acid solutions. This could alter their physical properties and cause degradation and premature breakdown.

### Lubrication and Dressing

Wear powderless, latex gloves when handling and lubricating o-rings. Keeping internal parts free from skin oils and other contaminants is important when running enriched air nitrox through a first stage. All o-rings should be lubricated with Christo-Lube® MCG-111. Dress the o-rings with a very light film of grease, and remove any visible excess by running the o-ring between thumb and forefinger. Avoid applying excessive amounts of Christo-Lube grease, as this will attract particulate matter that may cause damage to the o-ring.

\*Soapy water is defined as "household" grade liquid dishwashing detergent diluted in warm water.

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# MAINTENANCE NOTES

## XL4+/XL4



### KEY# PART# DESCRIPTION

|         |                 |   |
|---------|-----------------|---|
| -----   | <b>RS135111</b> | <b>Universal Second Stage Service Kit</b> |
| 1 ----  | RG912435        | Purge Clamp Ring, XL4+ (White)            |
| -----   | RG912434        | Purge Clamp Ring (Black)                  |
| 2 ----  | RG912440        | Purge Button, XL4+ (White)                |
| -----   | RG912438        | Purge Button                              |
| -----   | RG912441        | Purge Button, Yellow Octo                 |
| 3 ----  | RG912432        | Purge Spring                              |
| 4 ----  | RG912160        | Inner Locking Ring                        |
| 5 ----  | RG912297        | Friction Ring                             |
| 6 ----  | RG912238        | Diaphragm                                 |
| 7 ----  | RG912437        | Case w/Ex Tee & Valve, XL4+ (White)       |
| -----   | RG912436        | Case w/Ex Tee & Valve (Black)             |
| 8 ----  | RG912514        | Mouthpiece Clamp, XL4+ (Grey)             |
| -----   | RG911254        | Mouthpiece Clamp (Black)                  |
| 9 ----  | RG911123        | Mouthpiece, XL4+ (Grey)                   |
| -----   | RA117137        | Mouthpiece (Black)                        |
| -----   | RG912456        | Mouthpiece, Yellow                        |
| 10 ---- | RG912343        | Inlet Fitting, Shrouded                   |
| 11 ---- | <b>RG912225</b> | <b>O-ring (10 pk)</b>                     |

### KEY# PART# DESCRIPTION

|         |                 |  |
|---------|-----------------|--|
| 12 ---- | RG912344        | Inlet Shroud   |
| 13 ---- | <b>RG912222</b> | <b>O-ring (10 pk)</b>                                |
| 14 ---- | RG912237        | Seat   |
| 15 ---- | RG912281        | Lever  |
| 16 ---- | RG912163        | Spindle Body   |
| 17 ---- | <b>RG912198</b> | <b>MP Seat, Silicone</b>                             |
| 18 ---- | RG912112        | Shuttle Valve  |
| 19 ---- | <b>RG912235</b> | <b>O-ring (10 pk)</b>                                |
| 20 ---- | RG912080        | Spring   |
| 21 ---- | RG912342        | Spring Carrier                                       |
| 22 ---- | RG912429        | Spindle Adjuster Sleeve                              |
| 23 ---- | RG912296        | Micro Adjuster Screw                                 |
| 24 ---- | RG912162        | Venturi Lever  |
| 25 ---- | RG912196        | Exhaust Valve  |
| 26 ---- | RG912427        | Exhaust Tee, XL4+ (Grey)                             |
| -----   | RG912161        | Exhaust Tee (Black)                                  |
| 27 ---- | RG912414        | Hose Protector, Short, Black                         |
| 28 ---- | RH114257        | Hose, Flex, 3/8" X 30" White                         |
| -----   | RH114119        | Hose, Flex, 3/8" X 30" Black w/Long Hose Protectors  |
| -----   | RH113115        | Hose, Flex, 3/8" X 36" Yellow w/Long Hose Protectors |
| 29 ---- | <b>RG912229</b> | <b>O-ring (10 pk)</b>                                |

Part numbers in **BOLD ITALICS** indicate standard overhaul replacement part.



# XL4

**AUTHORIZED TECHNICIAN  
TECHNICAL MAINTENANCE MANUAL  
XL4 SECOND STAGE**



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