



MTX-R 2ND STAGE REGULATOR



MAINTENANCE MANUAL FOR AUTHORISED TECHNICIANS

Document No. AP5837

Issue 1
10/05/2017

APEKS MARINE EQUIPMENT LTD, NEPTUNE WAY, BLACKBURN, LANCASHIRE. BB1 2BT
Tel: +44 (0) 1254 692200 Fax: +44 (0) 1254 692211 E-mail: info@aqualung.uk Web: www.apeks.co.uk

AMENDMENTS RECORD:

Amendments and approval of this document can only be carried out by the relevant people listed on the Approved list of signatures, which is listed in the Apeks Quality Manual. To instigate a change, a Task / Change request form, (Form No. 'DESI/10002'), must be completed and passed to the relevant person(s) for approval which are listed on the Approved List of Signatures. When approval has been granted and recorded this table can then be completed and the document up issued.

Change No.	Change Request No.	Description & Comments:	Change Date	New Issue No.	Changed By:	Approved By:

Contents

COPYRIGHT NOTICE.....	4
INTRODUCTION	4
WARNINGS, CAUTIONS & NOTES	4
SCHEDULED SERVICE	4
HOSE INSPECTION & CLEANING PROCEDURE.....	4
GENERAL GUIDELINES.....	5
GENERAL CONVENTIONS	5
DISASSEMBLY PROCEDURES.....	5
REASSEMBLY PROCEDURES.....	9
FINAL TESTING.....	14
CONVERTING TO LEFT HAND CONFIGURATION.....	16
TABLE 1 - TROUBLESHOOTING GUIDE.....	19
TABLE 2 - RECOMMENDED TOOL LIST	20
TABLE 3 - RECOMMENDED LUBRICANTS AND CLEANERS	21
TABLE 4 -TORQUE SPECIFICATIONS	22
TABLE 5 - TEST BENCH SPECIFICATIONS	22
CLEANING AND LUBRICATION PROCEDURE.....	23
EXPLODED PARTS DRAWINGS	24

COPYRIGHT NOTICE

This manual is copyrighted, all rights reserved. It may not, in whole or in part, be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine readable form without prior consent in writing from Apeks Marine Equipment Ltd. It may not be distributed through the internet or computer bulletin board systems without prior consent from Apeks Marine Equipment Ltd.

©2017 Apeks Marine Equipment Ltd.

MTX-R 2nd Stage Regulator Maintenance Manual
(AP2017 Issue 1)

INTRODUCTION

This manual provides factory prescribed procedures for the correct maintenance and repair of the Apeks MTX-R regulator. 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 authorised training through an Apeks Service & Repair Seminar. If you do not completely understand all of the procedures outlined in this manual, contact Apeks 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 emphasise important points, tips, and reminders.

SCHEDULED SERVICE

It is recommended that the Apeks MTX-R 2nd Stage regulator should be examined annually regardless of usage.

A full service should be performed every two years.

However, If you are at all unsure about the correct functioning of the Apeks MTX-R 2nd Stage then it must be officially inspected immediately.

All service and inspection details need to be documented to keep the *Limited Lifetime Warranty* in effect.

A Second Stage Official Inspection consists of:

1. Checking the lever height with setting tool.
2. Checking for opening effort that is within the acceptable range.
3. A pressurised immersion test of the entire unit to check for air leakage.
4. A visual inspection of the exhaust valve(s) to see that they are in good condition and that it is seating against a clean and undamaged surface.
5. Pulling back hose protectors and checking that the hoses are secure in the hose crimps.
6. A visual inspection of the mouthpiece looking for tears or holes and checking the general condition.

If a regulator fails steps 1,2 or 3 the entire regulator should be serviced. If a regulator fails step 4 it will be up to the technician's discretion whether or not a full service is required. Failure of step 5 or 6 requires replacement of the part.

HOSE INSPECTION & CLEANING PROCEDURE

Please refer to the separate document labelled "Hose Inspection & Cleaning Procedure" for full details of the maintenance of hoses which can be found in the Technical section of the Apeks website.

AQUA LUNG



**HOSE INSPECTION AND
CLEANING PROCEDURE**

GENERAL GUIDELINES

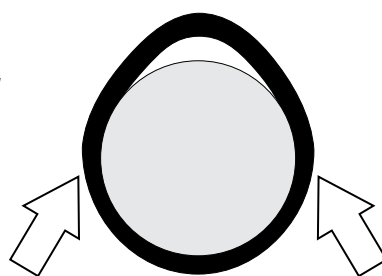
1. In order to correctly perform the procedures outlined in this manual, it is important to follow each step exactly in the order given. Read over the entire manual to become familiar with all procedures and to learn which specialty tools and replacement parts will be required before commencing disassembly. 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. During disassembly, reusable components should be segregated and not allowed to intermix with non-reusable parts or parts from other units. Delicate parts, including inlet fittings and valve seats which contain critical sealing surfaces, must be protected and isolated from other parts to prevent damage during the cleaning procedure.
4. Use only genuine Apeks parts provided in the 2nd stage service kit (AP0219). DO NOT attempt to substitute an Apeks 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.

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 anti-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 figure below) if possible, or use a brass, aluminium or plastic 'O' Ring removal tool. Avoid using hardened steel picks, as they may damage 'O' Ring sealing surfaces. 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; PN is Part Number.
5. Numbers in parentheses reference the key numbers on the exploded parts schematics. For example, in the statement, "...remove 'O' Ring (12) from...", the number 12 is the key number to the Blanking Piece 'O' Ring.

DISASSEMBLY PROCEDURES

 **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 regulator or how much use it has received since it was last serviced.

 **CAUTION:** Use only a plastic, brass or aluminium 'O' Ring removal tool (PN AT79) 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.

Removal of Hose

1. Using a 28mm spanner hold the Heat Exchanger (9) stationary while turning the Hose Swivel anticlockwise with a 11/16" spanner. Then using a 5mm Hex key and holding the hose swivel with the 11/16" spanner remove the Adapter Hose (33).



2. Remove the 'O' Rings (15) from inside the Hose Swivels on each end. Exercise caution not to scratch the 'O' Ring groove. Remove the 'O' Ring (26) from the Adapter Hose (33).



3. Pull back the two Hose Protectors (31) and inspect the Hose Crimps. If either Crimp is damaged or the Hose is pulling out of the crimp then the Hose must be replaced.



Removal of Mouthpiece

4. Using side cutters, snip the Tie Wrap (7) taking care not to damage the Mouthpiece (8). Remove the Mouthpiece.



Removal of Diaphragm

5. Using the MTX-R Front Cover Tool (PN AT94), unscrew the Case Cover (2).



NOTE: Ensure that the pegs on the tool fully engage on the case cover whilst unscrewing.



NOTE: The Front Cover (2) and Purge Button (1) should be cleaned complete. It is not necessary to remove the purge button when servicing.

6. Lift out the Diaphragm Cover (3) and Diaphragm (4). Inspect the Diaphragm. It should be supple and be free from damage. If it looks good, there is no need to replace it and it may be reused. If there is any sign of deterioration, it should be replaced.




Removal of Valve Assembly

7. Using an 28mm spanner, remove the Heat Exchanger (9).



8. Press the Lever (19) against the Valve Spindle (17). While keeping the Lever depressed, grasp the Bumper (28) and pull the Valve Spindle assembly out of the Case (6) or remove the Spindle by pushing on the threaded end.



 **NOTE:** The Venturi assembly may come out with the valve Spindle in step 8. If this is the case, depress the Lever and slide the Venturi Lever off.

9. Remove the Blanking Piece (11) and Venturi assembly (13 & 14) from the Case.



10. Remove O rings (10 & 12) from the Blanking Piece (11).



11. Remove O ring (12) from the Venturi Lever assembly.



12. It is NOT necessary to separate the Venturi assembly into its two separate parts unless the regulator is being converted to a different hand configuration. To separate them grasp the Venturi assembly (13 & 14) and push the Venturi Blank (13) off the Venturi Lever Body (14).



13. Remove the Bumper (28) with a flat screwdriver.



14. Turn the Adjusting Screw (27) clockwise (inward) one turn using a 5mm Hex Key. The Spring Pin (20) should drop out. If the Pin remains in the Valve Spindle, use a 1/16" dowel or punch to push it partially out, then use needle nose pliers to completely remove it from the Valve Body.



15. Unscrew the Adjusting Screw (27) and completely remove it from the Valve Spindle (17).



16. Remove the 'O' Ring (26) from the Adjusting Screw.



17. Remove the 'O' ring (10) from the Valve Spindle (17).



18. Insert a small 1/8" wooden dowel or small Hex key into the threaded end of the Valve Spindle (17) and push out the Shuttle Valve assembly (21-25). Separate the Shuttle Valve assembly by pulling on each end.



19. Using a fingernail, remove the Silicone Seat (21) from the shuttle valve (22).



20. Remove 'O' Ring (23) from the shuttle valve (22).



21. Using a Slotted Seat Adjuster (PN AT51/L), turn the Seat (16) six to seven full turns anti-clockwise. As the Seat is 'O' Ring sealed, it will not completely unscrew from the Valve Spindle (17). Insert a pair of external circlip pliers into the Valve Spindle (17), and pull the Seat (16) completely out.



22. Remove the 'O' Ring (15) from the Seat (16).



23. To remove the Spindle Collar (18), push both edges of the collar as shown.



NOTE: It is not necessary to remove the Spindle Collar (18) under normal servicing circumstances, unless it is deemed relevant by the service technician, for example if it is damaged or dirty.

24. To remove the Lever (19) pull one of the legs out of the Valve Spindle (17) and then ease the second leg out.



NOTE: The Lever (19) should be inspected for deterioration, it is NOT necessary to remove it from the Valve Spindle (17), unless it is deemed relevant by the service technician, for example if it is damaged or mis-shaped.

25. To remove the Exhaust Tees (30), depress the retaining button located in the centre (see picture) and slide the Left Hand Exhaust Tee off the Case (6). Then slide the Right Hand Exhaust Tee off the case.



Inspection and Removal of Exhaust Valve

26. Fold back the edges of the Exhaust Valve (29) 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 it may be reused. If there is any sign of deterioration, it should be replaced.



NOTE: If the Exhaust Valve (29) is to be removed, pinch the edge of the Valve and pull the tail through the hole in the Case (6).

This Ends Disassembly

Before starting reassembly, perform parts cleaning and lubrication according to the procedures outlined in 'Cleaning & Lubrication' on page 23.

REASSEMBLY PROCEDURES

Fitting Exhaust Valve and Exhaust Tees

1. If the Exhaust Valve (29) was removed, replace by threading the tail through the retaining hole on the outside of the Case (6) until the barb engages on the inside. If the Exhaust Valve is new, 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. Check that barb has engaged on inside of Case.

2. Check that the Exhaust Rib is firmly located in the Left Hand Large Exhaust Tee.



3. Align the Left Hand Exhaust Tee guide with the slots on the Case (6). Slide the Exhaust Tee onto the Case until the retaining button is positioned centrally over the Exhaust Valve (29). Align the Right Hand Exhaust Tee with the Case and slide into position until the retaining button clips underneath the Left Hand Exhaust Tee.



NOTE: The short exhaust kit used on the MTX-R Octopus follows the same procedure as explained in step 3.

Assembling and Fitting Valve Assembly

4. Install a new, lubricated 'O' Ring (10) onto the Valve Spindle (17).



5. Press a new, lubricated 'O' Ring (23) onto the stem of the Shuttle Valve (22).



6. Press a new Silicone Seat (21) into the front of the Shuttle Valve (22).



NOTE: Ensure the surface is clean and flat when pressing Shuttle Valve onto Silicone Seat.

NOTE: Ensure Silicone Seat has been fitted flush with Shuttle Valve.

7. Fit the Valve Spring (24) onto the leading edge of the Counterbalance Cylinder (25). Carefully guide the stem of the Shuttle Valve assembly through the Spring and into the Counterbalance Cylinder.

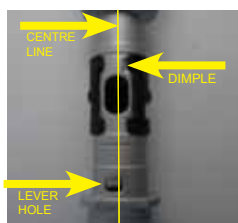


8. If the Spindle Collar (18) was removed during the disassembly process refit the Collar using a set of circlip pliers. Spread the Collar (18) and push it onto the Valve Spindle (17). Ensure that the arrow points towards the lever and the Collar locates in the groove on the Spindle (17).



CAUTION: Do not overstretch the Spindle Collar when replacing doing so may cause the Spindle collar to crack and break.

9. If you removed the Lever (19), position the Valve Spindle (17) so that the Lever Hole is to the left of the centre line and the groove is to the right of the centre line. (See photo below left). Insert the lever so that it points to the right of the Valve Spindle, as shown below.



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



10. Ensure that the Spindle Collar (18) is rotated to the correct position for the required Hose configuration.



LEFT HANDED



RIGHT HANDED

CAUTION: Ensure that the Spindle Collar clicks firmly into position and that the entire Valve Spindle Hole is visible.

WARNING: Ensure that the Spindle Collar is set in the correct position. Failure to do so will result in a substantial loss of breathing performance.

11. With the "feet" of the Shuttle Valve pointing downward (away from the Lever) and the Lever pointing straight up (perpendicular to the Valve Spindle), insert the Valve assembly into the Valve Spindle. Using your finger, press the Shuttle Valve assembly all the way into the Valve Spindle.



NOTE: Ensure that the Lever has a full range of movement and does not catch on the Valve Spindle. Ensure that the spring can be seen through the Valve Spindle Hole.

12. Install a new, lubricated 'O' Ring (26) onto the Adjusting Screw (27).



13. Install the Adjusting Screw into the Valve Spindle using a 5mm Hex Key. There should now be spring tension on the Lever. Continue to screw clockwise until the holes for the Spring Pin are clear.



14. Install the Spring Pin (20). Be sure that it sits evenly in the hole. Back the Screw Adjuster (27) out anti-clockwise to apply tension on the Pin to prevent it from falling out.



15. If the Venturi Lever Body was separated slide the Venturi Blank (13) onto the Venturi Lever Body (14). Align the Arrow on the Venturi Blank above the letter 'R' with the line on the Venturi Lever Body above the RIGHT text. Press the Venturi Blank firmly onto the end of the Venturi Lever Body, until it clicks into place.



NOTE: The Arrow and line must be aligned to ensure that the two parts fasten together correctly. Ensure that the correct configuration of regulator is selected. i.e. if the Regulator is to be configured as Right Handed, then the arrow must be aligned to the line with RIGHT underneath. See the section titled **Converting the MTX-R Regulator to Left Handed Configuration** on page 16 for further information.



CAUTION: Ensure that the parts of the Venturi Lever assembly are firmly pressed together. There should be a step as shown in the photo on the right above. An audible click should be heard when pressing together.

16. Install a new, lubricated 'O' Ring (12) onto the Venturi Lever assembly. Point the Venturi Lever assembly upward and insert it into the Case (6), on the side marked RIGHT.



17. Install a new, lubricated 'O' Ring (12) onto the Blanking Piece (11). Point the Blanking Piece upward and insert it into the Case. Press it against the Case so the 'O' ring is captured.



18. While depressing the Lever, insert the Valve Spindle through the Venturi Lever assembly and into the Case.



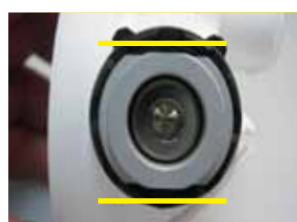
CAUTION: Ensure that the two flats and the two Lever feet engage in the tabs of the Blanking Piece.



19. Slide a new, lubricated 'O' Ring (10) down the threaded end of the Valve Spindle (17). Screw the Heat Exchanger (9), widest hexagon side facing outward, onto the Valve Spindle until finger tight.



20. On the opposite adjustment side of the spindle assembly, notice the two flats. Using a soft jaw vice, clamp the whole second stage using the flats to avoid the spindle turning within the case.



21. Using an 28mm crows foot, tighten the heat exchanger to a torque of 3 Nm (2.2 ft/lb).



CAUTION: Excessive tightening of the Heat Exchanger will damage the Blanking Piece and Case.

CAUTION: Ensure that the Lever is vertical after tightening.

22. Fit a new, lubricated 'O' Ring (15) onto the Seat (16).



23. Press the Seat assembly threaded end first into the Valve Spindle (17). Using the Slotted Seat Adjuster Tool (AT51/L), push the Seat into the Valve Spindle as far as it will go.



24. While holding the rim of the case at eye level, turn the seat clockwise until the lever drops about 4mm below the case rim.



Fitting Diaphragm

25. Position the Diaphragm (4) into the Case (6). Using your finger, work the edges of the Diaphragm into place so it sits evenly in the Case. Install the Diaphragm Cover (3) into the Case, over the Diaphragm.



CAUTION: Ensure Diaphragm is seated correctly and not creased.

26. Screw the Case Cover (2) onto the Case. Using the MTX-R Tool (AT94) tighten the Cover until it stops. Confirm that the Purge Button is properly aligned.



Fitting Hose and Mouthpiece


27. Add a new lubricated 'O' Ring (26) to the 3/8" end of the Adapter Hose (33). Install new, lubricated 'O' Rings (15) into the hose swivel at both ends.



28. Screw the Adapter Hose (33) into one end of the hose (32). Hold the hose swivel with an 11/16" spanner and torque to 5Nm (3.7 ft/lb) using a 5mm Hex Key Bit.



Before fitting hose, carry out vacuum test by holding thumb over Valve Spindle (17) to seal and inhale through mouthpiece outlet port. No air should be drawn in.

 **NOTE:** If air is drawn in refer to trouble shooting guide.

29. Fix the second stage into a soft jawed vice as explained in section 20.





30. Screw the Hose onto the second stage. Using an 11/16" crowsfoot and torque to 5Nm (3.7 ft/lb).



31. If equipped with a Comfo-bite Mouthpiece, make sure the 'bridge' of the Mouthpiece (8) is facing upward. Stretch the Mouthpiece over the second-stage Mouthpiece outlet port. At the base of the Mouthpiece is a groove for the Tie Wrap (7). Tighten the Tie Wrap so that the buckle points toward the Hose. Snip the excess with side cutters.



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

 **NOTE:** If your facility is equipped with a test bench, perform the tests before installing the mouthpiece. General instructions for performing bench tests are located in the next section "Final Testing."

32. After all testing has been completed, refit the Bumper (28) onto the Spindle (17).



This Completes Assembly

FINAL TESTING

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

Setting the Lever Height

1. Attach an Inline Adjustment Tool (AT72) to a regulator hose on a correctly set first stage. Refer to the appropriate first stage technical manual before attempting to perform any adjustments.



2. Screw the Inline Adjustment Tool onto the threaded end of the 2nd stage. Attach the first stage to a cylinder containing 207 Bar (3000 psi). Slowly open the cylinder valve and pressurise the regulator.



NOTE: If the 2nd stage is leaking turn the inline adjuster clockwise until the leaking stops.



3. Purge the 2nd stage 2 to 3 times to check there is air flow.



4. Strike the purge button again 3 times to check there is no free flow. If the 2nd stage does freeflow check the following 3 notes to determine the reason.



NOTE: Check the lever is vertical. Refer to steps 20 & 21 on page 12

NOTE: Check that the Venturi lever body is lined up with the venturi blank. Refer to step 15 on page 11.

NOTE: Check that the two flats and the two Lever feet engage in the tabs of the Blanking Piece. Refer to step 18 on page 12.

5. Place the "GAS FLOW" side of the testing puck section on the Front Cover Tool (AT94) over the purge button. There should be a flow of air, if not adjust the inline adjuster counter clockwise in 1/16 turns until there is a steady flow.



NOTE: Keep the puck in place whilst making adjustments

NOTE: "NO GAS" will be visible when performing gas flow setting.

CAUTION: The air flow should be continuous with no fluttering

CAUTION: Free flow test should be done every time the lever height has been adjusted.

6. Turn the puck section of the adjustment tool to the opposite side "NO GAS FLOW" to check that the lever is set correct and there is no flow of air.



NOTE: "GAS" will be visible on the tool when checking no gas flow.

NOTE: If there is gas flow, keep the puck on "NO GAS FLOW" and turn the inline adjuster clockwise in 1/16 increments until the flow ceases. Turn the puck back to "GAS FLOW" to make sure there is still air flow.

NOTE: It is important to ensure that the rim of the tool is concentric with the rim of the purge button throughout. Pressing on the logo with the tool misaligned will not measure the purge button depth and therefore give incorrect results.

Second Stage Opening Effort Test

1. Connect the first stage regulator with an interstage pressure gauge fitted to a calibrated test bench and pressurise the system to 207 bar. Fit the 2nd stage onto the Magnehelic mouth piece connector. Slowly open the flowmeter control knob (start vacuum) while watching both the magnahelic gauge and the intermediate pressure gauge.



2. When the intermediate pressure begins to drop, indicating the second-stage valve is open, the magnahelic gauge should indicate an opening effort of +1.9 in.H₂O (4.7 mbar) to +2.1 in.H₂O (5.2 mbar). If the reading is outside of these specifications, adjust the Screw Adjuster (27), turning clockwise to increase the opening effort or anti-clockwise to lower the opening effort. If this fails to give the correct reading refer to "Table 1 - Troubleshooting" for corrective actions.



3. With the 2nd stage still attached to the Magnehelic mouthpiece, turn the air supply off, the vacuum gauge should read above 100mm Hg (53.5" of water).



NOTE: If the Magnehelic 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 in normally through the mouthpiece. If you can draw air in or hear air flow refer to the trouble shooting guide on page 19.

External Leak Test

1. After disconnecting the regulator from the flow bench, connect it to a gas cylinder filled to approximately 200 bar. Open the cylinder valve to repressurise the regulator, and submerge the entire system in a test tank of clean water.



NOTE: The image shows the 1st stage attached to a high pressure extension and not a cylinder.

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: 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 air. Disassemble and remedy the problem, referring to "Table 1 - Troubleshooting."

Subjective Breathing Test

Depress the Purge Button fully to ensure that an adequate volume of air needed to clear the second stage flows through the mouthpiece. Then, inhale slowly but 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".

This Ends Final Testing

CONVERTING THE MTX-R REGULATOR TO LEFT HANDED CONFIGURATION



Right Handed Configuration



Left Handed Configuration

1. Using a 28mm spanner hold the Heat Exchanger (9) stationary while turning the Hose Swivel anti-clockwise with a 11/16" spanner.



2. Using the Tool (AT94), unscrew the Case Cover (2). Lift out the Diaphragm Cover (3) and Diaphragm (4).

NOTE: Ensure that the tool is firmly pressed against the Case Cover whilst unscrewing.



3. Using an 28mm spanner, remove the Heat Exchanger (9).



4. Press the Lever (19) against the Valve Spindle (17). While keeping the Lever depressed, grasp the Bumper (28) and pull the Valve Spindle assembly out of the Case (6) or remove the Spindle by pushing on the threaded end.



5. Remove the two 'O' Rings (10) & (12) from the Blanking Piece (11).



6. Grasp the Venturi Lever Assembly (13 & 14) and pull it out of the Case. Remove the 'O' Ring (12) from the assembly



NOTE: The Venturi Lever assembly may have come out with the valve Spindle in step 4. If this is the case, depress the Lever and slide the Venturi Lever assembly from the spindle.

7. Grasp the Venturi Lever Assembly (13 & 14) as shown and push the Venturi Blank (13) to separate it from the Venturi Lever Body (14).



8. Rotate the Venturi Blank (13) on the Venturi Lever Body (14). Align the Arrow below the letter 'L' on the Venturi Blank with the line on the Venturi Lever Body above the **LEFT** text. Press the Venturi Blank firmly onto the end of the Venturi Lever Body, until it clicks into place.



NOTE: The Arrow and line must be aligned to ensure that the two parts fasten together correctly. Ensure that the correct configuration of regulator is selected. i.e. if the Regulator is to be configured as Left Handed, then the arrow must be aligned to the line with **LEFT** underneath.

CAUTION: Ensure that the parts of the Venturi Lever assembly are firmly pressed together. There should be a step as shown in the photo on the right below. An audible click should be heard when pressing together.



9. Install a new lubricated 'O' Ring (12) onto the Venturi Lever assembly.



10. Point the Venturi Lever Assembly upward and insert it into the side of the Case (6) marked 'LEFT'. Press it against the Case so the 'O' ring is captured.



11. Install a new lubricated 'O' Ring (12) onto the Blanking Piece (11). Point the Blanking Piece upward and insert it into the Case on the side marked "RIGHT" (6). Press it against the Case so the 'O' Ring is captured.



12. Rotate the Spindle Collar (18) on the Valve Spindle (17) until it clicks into position. The Valve Spindle should look like the photo on the right.



CAUTION: Ensure that the Spindle Collar clicks firmly into position and that the entire Valve Spindle Hole is visible.

WARNING: Ensure that the spindle collar is set in the correct position. Failure to do so will result in a substantial loss of breathing performance. The photo below shows the Valve Spindle in both the Left and Right hand configurations.



LEFT HANDED



RIGHT HANDED

13. While depressing the Lever, insert the Valve Spindle through the Venturi Lever assembly and into the Case. Be sure that the two flats and the two Lever feet engage in the tabs of the Blanking Piece.



14. Slide a new lubricated 'O' Ring (10) down the threaded end of the Valve Spindle (17). Screw the Heat Exchanger (9), hexagon facing outward, onto the Valve Spindle until finger tight.



15. On the opposite adjustment side of the spindle assembly, notice the two flats. Using a soft jaw vice, clamp the whole second stage using the flats to avoid the spindle turning within the case.



16. Using an 28mm crows foot, tighten the Heat Exchanger (9) to a torque of 3 Nm (2.2 ft/lb).



CAUTION: Excessive tightening of the Heat Exchanger will damage the Blanking Piece and Case.

17. Ensure the Valve Spindle hole points to the top of the case.



CAUTION: Ensure that the Lever is vertical after tightening.

18. Position the Diaphragm (4) into the Case (6). Using your finger, work the edges of the Diaphragm into place so it sits evenly in the Case. Install the Diaphragm Cover (3) into the Case, over the Diaphragm.



CAUTION: Ensure Diaphragm is seated correctly and not creased.

19. Screw the Case Cover (2) onto the Case (6). Using Tool AT94 tighten the Cover until it stops. Confirm that the Purge Button is properly aligned.



Before fitting hose, carry out vacuum test by holding thumb over Valve Spindle (17) to seal and trying to breathe through mouthpiece outlet port. No air should be inhaled.

20. Fix the second stage into a soft jawed vice as explained in section 15.



21. Screw the Hose onto the second stage. Using an 11/16" crowsfoot and torque to 5Nm (3.7 ft/lb).



This Ends the Conversion Procedure. Proceed to Final Testing

NOTE: If your facility is equipped with a test bench, remove the mouthpiece as described on page 6. General instructions for performing bench tests are located in the section, "Final Testing" on page 14.

Table 1 - Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Leakage or freeflow from Second Stage	1. Excessively high first-stage intermediate pressure.	1. Refer to first-stage Troubleshooting Guide.
	2. Silicone Valve Seat (21) damaged or worn.	2. Replace Silicone Seating.
	3. Seat (16) adjusted incorrectly, Lever (19) set too high.	3. Reset Seat preliminary settings, and repeat Adjustment Procedures.
	4. Lever (19) bent.	4. Replace Lever.
	5. Seat (16) sealing surface damaged.	5. Replace Valve Seat.
	6. Valve Spring (24) damaged.	6. Replace Spring.
	7. Shuttle Valve 'O' Ring (23) damaged.	7. Replace 'O' Ring.
	8. Counter Balance Cylinder (25) bore damaged.	8. Replace Counter Balance Cylinder.
Low purge or excessive work of breathing (full cylinder)	1. Low first-stage intermediate pressure.	1. Refer to first-stage Troubleshooting Guide.
	2. Seat (16) adjusted incorrectly, Lever (19) set too low.	2. Reset Seat preliminary settings, and repeat Adjustment Procedures.
	3. Intermediate pressure hose clogged or obstructed.	3. Clean or replace Hose.
	4. Lever (19) bent or catching on Valve Spindle (17).	4. Replace Lever.
	5. Spindle Collar (18) incorrectly positioned on Valve Spindle (17).	5. Rotate Spindle Collar to correct position.
Water entering Second Stage or Vacuum test failure	1. Mouthpiece (8) damaged or incorrectly fitted.	1. Replace or re-fit Mouthpiece as appropriate.
	2. Diaphragm (4) damaged.	2. Replace Diaphragm.
	3. Diaphragm (4) improperly seated in Case (6).	3. Remove Front Cover (2) and Diaphragm Cover (3) properly reassemble Diaphragm (check for distortion).
	4. Exhaust Valve (29) damaged.	4. Replace Exhaust Valve.
	5. Case (6) damaged. (Check exhaust valve seating surface.)	5. Disassemble and replace Case.
	6. Heat exchanger (9) or Spindle (17) 'O' Ring (10) damaged.	6. Replace 'O' Ring.
	7. Venturi Lever assembly or Blanking Piece (11) 'O' Ring (12) damaged.	7. Replace 'O' Ring.

Table 2 - Recommended Tool List




PART #	DESCRIPTION	APPLICATION	IMAGE
AT79	O Ring Removal Pick	O Ring Removal	
AT94	Front Cover Tool	Case Cover Removal and Installation / Setting of Lever Height	
AT51/L	Slotted Seat Adjuster	Removal and Instalation of Seat	
N/A	Torque Wrench Nm or lb/ft	Hose and Heat Exchanger	
N/A	11/16" Adapter for Torque Wrench	Hose	
AT34	11/16" Spanner	Hose	
AT37	5mm Hex Key	Removal and Installation of Screw Adjuster and Adapter Hose	
N/A	Flat Screwdriver	Removal of Bumper	
N/A	Side Cutters	Tie Wrap and Exhaust Valve	
AT24	Internal Circlip Pliers	Seat Removal and Spindle Collar Fitting	
AT72	Inline Adjustment Tool	Setting Lever Height	
N/A	28mm Spanner	Heat Exchanger Removal	
N/A	28mm Crow's Foot Wrench	Heat Exchanger Fitting	
N/A	232 or 300 Bar Diving Cylinder	Final Testing	

Table 3 - Recommended Lubricants & Cleaners



LUBRICANT / CLEANER	APPLICATION	SOURCE
Christo-Lube® MCG-111 (Lubricant).	All O ring seals	Lubrication Technologies 310 Morton Street Jackson, OH 45640, USA (800) 477-8704, or Apeks Marine Equipment Ltd
PerFluoroLube® 20/1 (Lubricant).	All O ring seals	Performance Fluids Suite 101 Lomeshaye Buisness Park Turner Road Nelson Lancashire BB9 7DR
 CAUTION: Silicone rubber requires no lubrication or preservative treatment. DO NOT apply grease or spray to silicone rubber parts (eg. Diaphragm, Exhaust Valves.) Doing so may cause a chemical breakdown and premature deterioration of the material.		
Biox (Cleaning agent)	Biological immersion fluid for reusable stainless steel and brass parts	Biox LTD 52 Hughenden Avenue High Wycombe Bucks HP13 5SJ
White distilled vinegar (100gr.) (Cleaning agent)	Acid bath / ultrasonic cleaner for reusable stainless steel and brass parts	"Household" grade
 CAUTION: 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.		
Liquid dish washing detergent diluted with warm water (Cleaning agent)	Degreaser for stainless steel and brass parts, general cleaning solution for plastic and rubber	"Household" grade

Table 4 - Torque Specifications

PART NUMBER	DESCRIPTION / KEY NUMBER	TORQUE
AP2004S	Heat Exchanger	3 Nm / 2.2 ft/lb
AP0198/DSW	Double Swivel 3/8" Flexi	5 Nm / 3.7 ft/lb

Table 5 - Test Bench Specifications

TEST	CONDITION	ACCEPTABLE RANGE
Opening Effort	High Pressure > 50 Bar Gauge (725 psi) Medium Pressure 9.5 ± 0.5 Bar (137 ± 7.25 psi)	+1.9" to +2.1".H ₂ O (4.7 to 5.2 mbar)
External Leak	High Pressure > 50 Bar Gauge (725 psi) Medium Pressure 9.5 ± 0.5 Bar (137 ± 7.25 psi)	No Leaks Allowed

Cleaning & Lubrication Procedure

Cleaning Brass and Stainless Steel Parts

1. If required, pre-clean in warm, soapy water* using a nylon bristle tooth brush.
2. Thoroughly clean parts in an ultrasonic cleaner filled with a solution of household white distilled vinegar (Acetic Acid) mixed with fresh water (max 50% vinegar). Clean ultrasonically for 5 minutes (max 10 minutes). DO NOT place plastic, rubber, silicone or anodized aluminium 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/1.7Bar) filtered air. Inspect closely to ensure proper cleaning and like-new condition.

Cleaning Plastic & Rubber Parts

Parts made of plastic or rubber 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 acid solutions. Doing so may alter the physical properties of the component, causing it to prematurely degrade and/or break.

Lubrication and Dressing

All O rings should be lubricated with Christo-Lube MCG-111 or PerFluoroLube 20/1. 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 lubricant 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.

This exploded view diagram illustrates the components of a bicycle headlight assembly, numbered 1 through 33. The parts are arranged to show their relative positions and assembly sequence. Key components include:

- 1:** Small circular cap or seal.
- 2:** Large black mounting bracket or base.
- 3:** Black ring or spacer.
- 4:** Black ring or spacer.
- 5:** Small grey rectangular piece.
- 6:** Large white lens or reflector.
- 7:** Black ring or spacer.
- 8:** Black mounting bracket or base.
- 9:** Grey cap or seal.
- 10:** Small white ring or spacer.
- 11:** Black ring or spacer.
- 12:** Small white ring or spacer.
- 13:** Black ring or spacer.
- 14:** Black mounting bracket or base.
- 15:** Small white ring or spacer.
- 16:** Small grey rectangular piece.
- 17:** Long grey mounting bracket or base.
- 18:** Small black cap or seal.
- 19:** Small white ring or spacer.
- 20:** Small black cap or seal.
- 21:** Small grey rectangular piece.
- 22:** Small black cap or seal.
- 23:** Small grey rectangular piece.
- 24:** Small black cap or seal.
- 25:** Small white ring or spacer.
- 26:** Small grey rectangular piece.
- 27:** Small black cap or seal.
- 28:** Small white ring or spacer.
- 29:** Small black cap or seal.
- 30:** Small white ring or spacer.
- 31:** Small grey rectangular piece.
- 32:** Small black cap or seal.
- 33:** Small white ring or spacer.

1	AP0295	Purge Button Assembly	18	AP6215	Spindle Collar
2	AP2000SE	MTX-R Front Cover	19	AP2035	Lever
3	AP5802	Inner Cover	20	AP1151	Spring Pin
4	AP5803	Diaphragm Assembly	21	AP2034	Silicone Valve Seat
5	AP2037	Deflector	22	AP2036	Shuttle Valve
6	AP6300WD	MTX-R Case with Decal, White	23	AP2041	O Ring
7	AP1677	Tie Wrap	24	AP2021	Valve Spring
8	AP5324	Mouthpiece Comfobite	25	AP2038SQ	Counter Balance Cylinder
9	AP2004S	Heat Exchanger Satin	26	AP1409	O Ring
10	AP1267	O Ring	27	AP2006	Screw Adjuster
11	AP6211	Blanking Piece	28	AP2012W	Bumper, White
12	AP1438	O Ring	29	AP6223	Exhaust Valve
13	AP2014	Venturi Blank	30	AP6220/K	Long Exhaust Kit
14	AP6213	Venturi Lever Body	31	AP6236	Swivel Hose Protector
15	AP1154	O Ring	32	AP0198/DSW	Double Swivel 3/8" Flexi
16	AP2033	Seat	33	AP3050	Adapter Hose 3/8" UNF
17	AP2005S	Spindle MTX Satin			

Exploded Parts Diagram AP0065 MTX-R Octopus



All items in bold italics to be replaced when servicing. Service kit AP0219

1	AP0295Y	Purge Button Octopus Assembly	18	AP6215	Spindle Collar
2	AP2000SYE	MTX-R Front Cover Octo	19	AP2035	Lever
3	AP5802	Inner Cover	20	AP1151	Spring Pin
4	AP5803	Diaphragm Assembly	21	AP2034	Silicone Valve Seat
5	AP2037	Deflector	22	AP2036	Shuttle Valve
6	AP6300YD	MTX-R Case with Octopus Decal	23	AP2041	O Ring
7	AP1677	Tie Wrap	24	AP2021	Valve Spring
8	AP5324	Mouthpiece Comfobite	25	AP2038SQ	Counter Balance Cylinder
9	AP2004S	Heat Exchanger Satin	26	AP1409	O Ring
10	AP1267	O Ring	27	AP2006	Screw Adjuster
11	AP6211/Y	Blanking Piece, Yellow	28	AP2012	Bumper
12	AP1438	O Ring	29	AP6223	Exhaust Valve
13	AP2014Y	Venturi Blank, Yellow	30	AP6220/K	Long Exhaust Kit
14	AP6213	Venturi Lever Body	31	AP6236	Swivel Hose Protector
15	AP1154	O Ring	32	AP0198/DSW	Double Swivel 3/8" Flexi
16	AP2033	Seat	33	AP3050	Adapter Hose 3/8" UNF
17	AP2005S	Spindle MTX Satin			

Exploded Parts Diagram NP0064 MTX-R Nitrox



All items in bold italics to be replaced when servicing. Service kit AP0219

1	AP0295G	Purge Button Nitrox Assembly	18	AP6215	Spindle Collar
2	AP2000SE	MTX-R Front Cover	19	AP2035	Lever
3	AP5802	Inner Cover	20	AP1151	Spring Pin
4	AP5803	Diaphragm Assembly	21	AP2034	Silicone Valve Seat
5	AP2037	Deflector	22	AP2036	Shuttle Valve
6	AP6300WD	MTX-R Case with Decal, White	23	AP2041	O Ring
7	AP1677	Tie Wrap	24	AP2021	Valve Spring
8	AP5324/G	Mouthpiece Comfobite Green	25	AP2038SQ	Counter Balance Cylinder
9	AP2004S	Heat Exchanger Satin	26	AP1409	O Ring
10	AP1267	O Ring	27	AP2006	Screw Adjuster
11	AP6211/G	Blanking Piece Green	28	AP2012G	Bumper, Green
12	AP1438	O Ring	29	AP6223	Exhaust Valve
13	AP2014G	Venturi Blank Green	30	AP6220/K	Long Exhaust Kit
14	AP6213	Venturi Lever Body	31	AP6236	Swivel Hose Protector
15	AP1154	O Ring	32	AP0198/DSW	Double Swivel 3/8" Flexi
16	AP2033	Seat	33	AP3050	Adapter Hose 3/8" UNF
17	AP2005S	Spindle MTX Satin			



**MTX-R 2ND STAGE
REGULATOR
MAINTENANCE MANUAL
FOR
AUTHORISED TECHNICIANS**