

APEKS TX 50

Regulator



TECHNICAL MANUAL

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TX 50 TECHNICAL MANUAL, PN 100580

TX 50 with Yoke PN# AP0500
TX 50 with DIN PN# AP05001

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Warnings, Cautions and Notes:

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



WARNINGS indicate a procedure or situation that may result in serious injury or death if the 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 and could subsequently result in injury to the user.



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

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INTRODUCTION


This manual provides factory prescribed procedures for the correct service and repair of the Aqua Lung® or Apeks regulator 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 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.

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

Scheduled Service

If the regulator is subjected to less than 50 dives per year, 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 in the back of the Owner's Manual to keep the Limited Lifetime Warranty in effect. If a regulator is subjected to more than 50 dives per year, it should receive the complete overhaul.

 **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 intermediate 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. Pulling back hose protectors and checking that the hoses are secure in the hose crimps.

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 regulator is disassembled, reusable components should be segregated and not allowed to intermix with nonreusable parts or parts from other units. Delicate parts, including inlet fittings and crowns 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® parts provided in the overhaul parts kit for this product. DO NOT attempt to substitute an Aqua Lung® 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 regulator compatible with nitrox up to 40% O₂ (EAN40) after maintenance, the regulator 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 Lubrication** at the back of this manual.

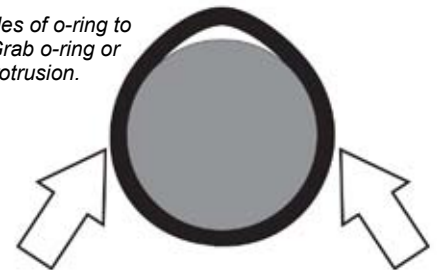
General Conventions

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

1. When instructed to **remove, unscrew, or loosen** a threaded part, turn the part counterclockwise.
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 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 or brass o-ring removal tool (PN 944022) 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.

Dry Swivel Turret (DST) First Stage Disassembly

1 Using the appropriate sized open end wrench, remove all the hoses from the first stage body. Using the o-ring removal tool (PN 944022) remove the o-ring from the male end of the hose and discard.



2 Using a 5mm hex key, remove a single HP blanking plug (19).



3 Install vice mounting tool (PN 100395) into the open HP port.



WARNING: If using a CO2 cartridge instead of PN 100396, ensure that it has been discharged prior to use.

CAUTION: If using a CO2 cartridge, thread an HP port adapter (PN 101785) onto the end. This will prevent the threads from breaking off in the first stage.

4 Secure the vise mounting tool and first stage into a bench vise adapter (PN 100398) or vise.



5 Insert the Apeks pin spanner (PN AT30) into the hole of the environmental end cap (26). Ensure that the pin spanner is sitting flush to avoid damage to the end cap. Turn the environmental end cap counter-clockwise to remove from the diaphragm clamp (21). Remove and discard the hydrostatic diaphragm (25).



6 Turn the first stage over to remove the hydrostatic transmitter (23) from the first stage.



7 Use the pin spanner to turn the diaphragm clamp (21) counter-clockwise to loosen. Remove from vise and continue to unscrew the diaphragm clamp by hand. The spring (1) and spring carrier (2) will come out once the diaphragm clamp is removed.



CAUTION: The spring and spring carrier will come out once the diaphragm clamp is completely removed. Ensure the first stage is over a workbench when removing the diaphragm clamp to avoid losing or damaging parts.

NOTE: You may encounter a new revision spring carrier. This was an inline change made as a cost savings. Either version of the spring carrier is acceptable to use.

Original Spring Carrier



Revised Spring Carrier



8 Remove the spring adjuster (22) from the diaphragm clamp (21) using a 6mm hex key. Using a LP air nozzle inserted into the MP port, blast a small amount of air into the first stage to remove the diaphragm (3). Keep your finger over the diaphragm to prevent it from ejecting. Discard diaphragm.



CAUTION: Never remove the diaphragm by prying or digging around the edges. This will cause irreversible damage to the first stage body.

9 Remove the valve lifter (4) out of the first stage body (5). Insert a 6mm hex key into the end of the turret retaining bolt (15) and turn counter-clockwise to remove. Remove the spring (12) and HP valve (11).



10 Using the o-ring removal tool (PN 944022), remove the o-ring (13) from the outside and o-ring (17) from the inside of the turret retaining bolt (15). Discard both o-rings.



11 Lift out the o-ring (16) and blue thrust washer (14) from the top of the turret (8). Remove o-ring (7) from the body (5). Using a 5mm hex key, remove the remaining MP and HP blanking plugs (9,19). Remove o-rings (10,20) from the blanking plugs. Discard all o-rings.



Yoke Disassembly

1 Unscrew the yoke screw (30) from the yoke clamp (27). Remove the protective cap (28) from the yoke screw and pull the o-ring (29) off the protective cap and discard.



2 Install first stage into bench vise and using a 3/4 inch closed end wrench, remove the yoke clamp connector (32). Lift off the yoke clamp (27) and distance piece (6).



3 Remove the conical filter (36) and o-ring (10) from the yoke clamp connector (32). Use a 6mm hex key to remove the filter guard (31) from the clamp connector. Discard filter, guard and o-ring.



DIN Disassembly

1 Secure the vise mounting tool and first stage into a bench vise. Use a 6mm hex key to loosen the handwheel connector (34). Lift off the handwheel connector, handwheel (35) and distance piece (6).



2 Push the conical filter (36) and o-ring (10) out of the handwheel connector (34) using the end of the seat installation/extraction tool (PN 109437) and discard.



3 Remove the face o-ring (29) from the handwheel connector (34) and discard.



This Concludes the Disassembly of the DST First Stage.

Before starting reassembly, perform parts cleaning and lubrication in accordance with Procedure A: Cleaning and Lubricating on page (27).

REASSEMBLY PROCEDURES

DST First Stage Assembly

1 Install the valve lifter (4) into the body (5). Seat the diaphragm (3) evenly into the body on top of the valve lifter.



2 Place the spring carrier (2) on top of the diaphragm (3), followed by the spring (1).



3 Install the spring adjuster (22) into the diaphragm clamp (21) far enough for a couple of threads to catch. Install the vise mounting tool into the HP port and secure in a bench vise. Thread the diaphragm clamp to the body (5) and tighten down using the Apeks spanner wrench (AT30) until you get metal to metal contact.



4 Use a 6mm hex key, tighten down the spring adjuster (22) until 1-2 threads ($\frac{1}{4}$ " from top) are exposed.



5 Turn the first stage over, hold the HP valve (11) by the stem and insert it into the body (5). Install the spring (12) onto the HP valve shaft.



6 Install the o-ring (7) onto the body (5). Place the turret (8) onto the body and carefully push down.



7 Install the blue washer (14) into the turret (8). Place the o-ring (16) on top of the blue washer.



8 Install the small o-ring (17) into the turret bolt (15). Place the larger o-ring (13) at the base of the threads.



9 Install the turret bolt (15) through the turret (8). Using a 6mm hex key, tighten the turret bolt until snug.



10 With the first stage mounted in a bench vise, use a torque wrench with a 6mm hex key adapter to tighten the turret bolt (15) to 70 in-lbs (8 Nm).



Yoke Reassembly

1 Press the filter guard (31) into the yoke clamp connector (32). Make sure the feet of the guard are facing upward and the guard is fitted evenly.



2 Place an unlubricated o-ring (10) into the yoke clamp connector (32). Then place the filter (36) into the connector.



3 Slide the yoke clamp connector (32) through the yoke clamp (27) with the filter facing upward. Place the distance piece (6) on the other side.



4 Hold the body (5) with the inlet opening facing down, carefully thread the Yoke clamp connector (32) into the body until snug.



CAUTION: The yoke clamp assembly must be held vertically while being installed upwards into the body until snug. Failure to do this can cause the o-ring not to seat properly which in turn will create a high pressure leak.

5 Thread a vise mounting tool into the first stage then install into a bench vise. Using a torque wrench with a 3/4" box wrench, torque the yoke clamp connector (32) to 14.7 ft-lbs (20 Nm).



6 Add o-ring (29) to the dust cap. Attach the dust cap (28) to the yoke clamp (27) by stretching it over the flange at the top of the yoke clamp. Thread the yoke screw (30) into the yoke clamp. Remove the first stage from the bench vise and remove the vise mounting tool.



NOTE: After completing the yoke connection installation, go directly to the section on ADJUSTING THE FIRST STAGE on pg 11.

DIN Reassembly

1 Insert an unlubricated o-ring (29) into the face of the handwheel connector (34). Insert an unlubricated o-ring (10) into the back-side of the handwheel connector



2 Place the small end of the conical filter (36) into the handwheel connector (34).



3 Slide the handwheel connector (34) through the handwheel (35). Place the distance piece (6) onto the connector with the curved part facing out.



4 Thread the DIN connector upwards into the first stage body until snug.



CAUTION: The DIN connector must be held vertically while being installed upwards into the body until snug. Failure to do this can cause the o-ring not to seat properly which in turn will create a high pressure leak.

5 Thread a vise mounting tool into the first stage then install into a bench vise. Using a torque wrench with a 6mm hex key adapter, torque the handwheel connector (34) to 14.7 ft-lbs (20 Nm). Remove the first stage from the bench vise and remove the vise mounting tool.



ADJUSTING THE FIRST STAGE

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 using compressed air.

1 Install o-rings (10,13,20) onto all port plugs (9,18,19). Using a 5mm hex key, install the port plugs into the body and tighten until snug.



2 Replace the o-ring on the male end of the MP hose. Thread the hose into one of the MP ports on the first stage. Install the MP test gauge (PN 111610) on the female end of the hose.



3 Attach the first stage to a calibrated test bench or a cylinder filled to 3000 psi (206 bar). **Open the bleed valve on the MP gauge.**



CAUTION: Before pressurizing your first stage, check that your MP test gauge has an overpressure bleed or bleed valve. If it does not, you must attach a properly adjusted second stage to the first stage to provide a safety bleed valve if the MP exceeds 145 psi (10 bar). Failure to relieve increasing MP may result in damage to the test gauge or the MP hose.

WARNING: If the pressure gauge rapidly exceeds 145 psi (10 bar), there is a HP leak. Quickly close the cylinder valve and purge the second stage or reopen the bleed valve of the test gauge and close the cylinder valve. Failure to do so may cause a rupture to the MP hose and/or MP gauge, which in turn can lead to personal injury. Refer to *Table 1: Troubleshooting Guide on p. 21* for the causes of high or unstable MP.

WARNING: Be certain not to install a MP hose into the HP port via an adapter. Doing so may cause the hose to rupture when pressurized, and could result in serious personal injury.

4 With the bleed valve open, slowly open the cylinder valve ¼ turn. While watching the gauge, close the bleed valve, if the MP exceeds 145 psi (10 bar) quickly open the bleed valve and close the cylinder. If the MP is stable and does not continue to rise, open the cylinder valve all the way.



5 Adjust the MP using a 6mm hex key. To increase the MP, turn the adjustment screw in ¼ turn increments clockwise. Using the bleed valve on the gauge, cycle the first stage several times after each adjustment. To decrease the MP, turn the adjustment screw counter-clockwise. Set the MP to 130-145 psi (9-10 bar).



6 Let the first stage stand pressurized for several minutes. Check that the MP, remains stable. If the MP rises more than 5 psi (0.3 bar), it indicates a leak. If the MP is stable, close the valve, purge the line, and pressurize once again to perform the final check and assembly.



4 With the end cap in place, recheck the MP to confirm there has been no change.



FIRST STAGE FINAL ASSEMBLY

NOTE: The following steps must be performed while the first stage is still pressurized.

1 With the first stage still pressurized, insert the hydrostatic transmitter (23) into the dry chamber and through the adjustment screw (22).



2 Install a new hydrostatic diaphragm (25) into the environmental end cap (26).



3 Thread the end cap (26) onto the dry chamber until hand tight. Using the pin spanner (PN AT30), tighten the end cap until snug.



5 Close the cylinder valve and depressurize the regulator. Remove the test gauge and reinstall the port plug.

THIS CONCLUDES ASSEMBLY OF THE DST FIRST STAGE

DISASSEMBLY PROCEDURES

TX 50 Second Stage Disassembly

1 Using two 11/16 inch open end wrenches, hold the heat exchanger (2) stationary and turn the hose swivel nut counterclockwise to remove the second stage.



2 Carefully remove the o-ring from the swivel end of the hose and discard. Pull back the hose protectors and inspect the hose crimps. If the crimp is damaged or the hose is pulling out of the crimp, the hose must be replaced.



3 Use the Apeks cover tool (PN AT31) to remove the case cover (7) from the case (10).



4 Push in the tabs on the back side of the purge button (5) to release it from the case cover (7). Separate the spring (6) from the purge button.



5 Remove the diaphragm cover (8) and diaphragm (9) from the case (10). Use an 11/16 inch open end wrench to remove the heat exchanger (2) from the case.



6 Turn the adjusting screw (23) out counter-clockwise until it stops. Hold the lever (21) down and slide the valve spindle (20) out of the case (10). Remove the valve spindle o-ring (3), it might remain in the left side of the case.



7 Slide the venturi lever (16) out of the case. Remove o-ring (12) from venturi lever and discard.



NOTE: The venturi lever may have come out with the valve spindle in the previous step. If this has happened, hold down the lever and slide the venturi lever off the valve spindle.

8 Turn the adjusting screw (23) in one turn to release the pressure on the pin (17). The pin will drop out of the valve spindle (20).

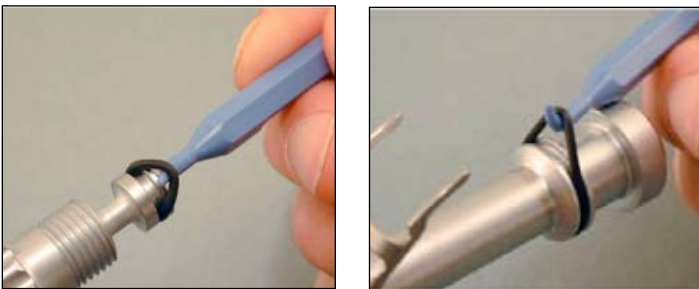


NOTE: If the pin remains in the valve spindle, it is ok to push it out using the seat extraction tool.

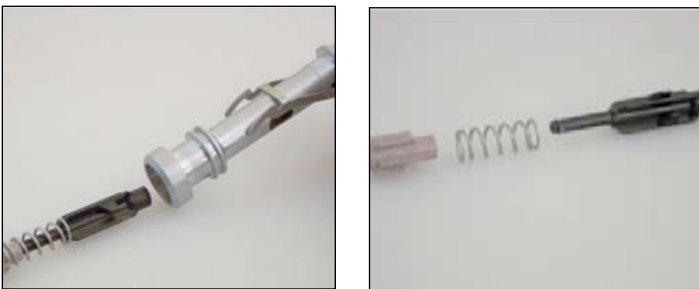
9 Unthread the adjusting screw (23) from the valve spindle (20). Use your fingernail to remove the plug (22) from the adjusting screw.



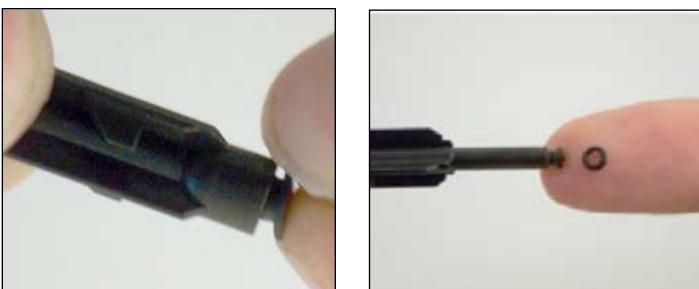
10 Remove the o-ring (24) from the adjusting screw (23) and o-ring (3) from the valve spindle (20). Discard o-rings.



11 Insert a small 1/8" wooden dowel into the threaded end of the valve spindle (20) to push out the shuttle valve assembly, counter balance cylinder, valve spring & shuttle valve (25-29). Separate the shuttle valve assembly once removed.



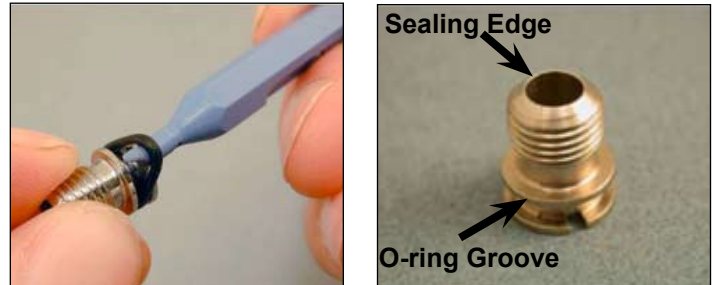
12 Remove the MP seat (29) and o-ring (27) from the shuttle valve (28). Discard both the MP seat and o-ring.



13 Insert the seat adjustment tool (PN AT51) into the threaded end of the valve spindle (20) and turn the seat (18) out 6-7 turns counter-clockwise. Place the seat extraction tool into the opposite end of the valve spindle and push to remove the seat.



14 Remove the o-ring (19) from the seat (18) and discard. Closely inspect the sealing edge and o-ring groove of the seat for damage. If damage is found, replace the seat.



15 Inspect the lever (21) for damage. If it is necessary, remove the lever carefully one leg at a time from the valve spindle (20).



NOTE: The lever does not need to be removed during service, unless following inspection it appears to be bent or damaged.

16 Remove the exhaust tee (15) by folding the ends inward and pulling straight out.



17 Inspect the exhaust valve (11) for damage.



NOTE: Exhaust valve does not need to be removed during service unless it is going to be replaced.

18 Carefully cut the mouthpiece clamp (13) with side cutters and pull the mouthpiece (14) off the case (10). Inspect the mouthpiece for cuts, holes or other damage, replace if necessary.



This Concludes the Disassembly of the TX 50 Second Stage.

Before starting reassembly, perform parts cleaning and lubrication in accordance with *Procedure A: Cleaning and Lubricating on page (27)*.

REASSEMBLY

1 If the exhaust valve (11) was removed, replace by pushing the tail through the retaining hole on the outside of the case (10) until the barb engages on the inside. Align the rib so it is horizontal. If the valve is new, cut off the excess stem with side cutters leaving approximately 1/8 inch 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.

WARNING: Flooding may occur if the rib of the valve is not positioned horizontally in the case. Confirm the rib is positioned horizontally.

2 Position the exhaust tee (15) with the case (10). Clip one corner of the tee onto the case. Stretch the other corner over the case and then stretch the bottom of the tee onto the case.



3 Install the o-ring (3) onto the valve spindle (20).



4 Install the o-ring (27) onto the stem of the shuttle valve (28). Push the MP seat (29) into the front of the shuttle valve.



NOTE: Ensure MP seat has been fitted flush with the shuttle valve.

5 Fit the valve spring (26) onto the leading edge of the counter balance cylinder (25). Carefully guide the stem of the shuttle valve (28) through the spring and into the counter balance cylinder.



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.



6 If the lever (21) was removed, install the lever in correct orientation. With air outlet hole facing you and threaded end to the right, lever should be pointing to the left.



7 With the "feet" of the shuttle valve (28) pointing downward (away from the lever) and the lever (21) pointing straight up (perpendicular to the valve spindle), insert the valve assembly (25-29) into the valve spindle (20). 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.

8 Install the o-ring (24) onto the adjusting knob (23).



9 Install the adjusting knob (23) into the valve spindle (20). There should now be spring tension on the lever (21).



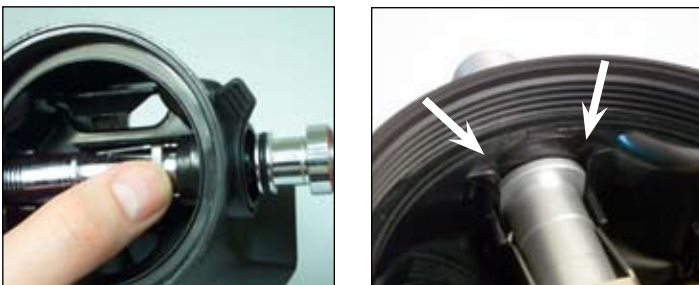
10 Continue to screw the adjusting knob (23) clockwise into the valve spindle (20) until the holes for the spring pin (17) are clear. Install the spring pin. Be sure that it sits evenly in the hole. Back the adjusting knob out counter clockwise to apply tension to the pin and keep it from falling out.



11 Install the o-ring (12) onto the venturi lever (16). Point the venturi lever upward and insert it into the case (10). Press it against the case so the o-ring is seated in the groove.



12 While depressing the lever (21), insert the valve spindle (20) through the venturi lever (16) and into the case (10). Be sure the valve spindle engages the two index flats molded into the case. Gently release the lever.



CAUTION: Do not allow the lever to spring up forcefully as it passes through the case. This could cause the lever to disengage from the shuttle valve, requiring disassembly of the valve spindle assembly.

13 Slide the o-ring (3) down the threaded end of the valve spindle (20). Screw the heat exchanger (2) clockwise with the hexagon facing outward, onto the valve spindle until hand tight. Using a torque wrench with an 11/16" crow-foot, tighten the heat exchanger to a torque of 45 in-lbs (5 Nm).



CAUTION: Ensure that the lever is vertical after tightening.

CAUTION: Excessive tightening of the heat exchanger will damage the two flats inside the case.

14 Fit the o-ring (19) onto the seat (18). Press the seat, threaded end first, into the valve spindle (20). Using the seat installation tool, push the seat into the valve spindle as far as it will go.



15 While holding the rim of the case (10) at eye level, use the seat adjustment tool (PN AT51) to turn the seat (18) clockwise until the lever drops about $\frac{1}{8}$ " below the case rim. Then, turn the seat counter clockwise until the lever is level with the case rim.



16 Position the diaphragm (9) into the case (10). Using your finger, work the edges of the diaphragm into place so it sits evenly in the case. Install the diaphragm cover (8) into the case, over the diaphragm.



CAUTION: Inspect the diaphragm strike plate for any signs of distortion. If the strike plate shows any sign it must be replaced with a new one. See *Technical Bulletin #17, April 4, 2006*.

17 Place the small diameter end of the spring (6) onto the purge button (5). Orient the case cover (7) with the slotted openings pointing to the right. Properly align the purge button and press it into the case cover until it snaps into place.



18 Thread the case cover (7) onto the case (10) by hand until snug. Using the cover tool (PN AT31) tighten the cover until it stops. Confirm that the purge button is properly aligned.



NOTE: Perform the following suction test prior to fitting the hose: hold your thumb over the regulator inlet to seal, then breath through the mouthpiece outlet port. You should not be able to draw air in.

19 Replace the plug (22) into the adjustment knob (23).



20 Install the o-ring into the swivel end of the hose.



NOTE: It is recommended that the final adjustment be performed prior to installing the mouthpiece. Refer to *Final Adjustment Procedures* on page 19.

THIS ENDS REASSEMBLY OF THE TX50 SECOND STAGE

FINAL TESTING

External Leak Test

1 Using an in-lb torque wrench with a 9/16" crow-foot, torque the MP hose to 40 in-lbs (4.5 Nm) to the first stage. Install a properly adjusted second stage to the female end of the MP hose. Connect the first stage to a cylinder filled to approximately 3000 psi (206 bar). Slowly open the cylinder valve to pressurize the regulator and submerge the entire system in a test tank of clean fresh 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, this would require the system to be disassembled at the source to check sealing surfaces, assembly sequence and component positioning in order to correct the problem(s). If any bubbles are visible, refer to **Table 1: Troubleshooting Guide, p. 21**



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.

3 If there are no leaks, close the cylinder valve and depressurize the regulator. Remove the first stage from the cylinder valve and secure the dust cap in place.

THIS CONCLUDES SERVICING OF THE DST FIRST STAGE

FINAL ADJUSTMENT PROCEDURES

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.

Adjusting Lever Height

1 Attach the in-line adjustment tool (PN 100190) to the 2nd stage. Attach the 2nd stage to a properly adjusted first stage or calibrated test bench. Slowly pressurize the system to 3,000 psi (206 bar).



2 Make sure that the adjustment knob (23) is turned all the way out and then 1/8 turn in and that the venturi lever (16) is set to the "+" position.

3 Give a quick tap to the purge button. This should cause the second stage to freeflow. Stop the freeflow after a couple of seconds by placing a hand over the mouthpiece.

4 Place the end of the TX lever height tool (PN AT69) onto the purge button (5) with the "NO GAS FLOW" up. Depress the purge button by pushing the tool towards the second stage until it stops against the front cover. If air does not flow from the second stage, the lever height has been set correctly, proceed to step 6. If air flows from the valve, proceed to step 5.



5 Using the in-line adjustment tool, turn the seat (18) clockwise approximately 1/16 of a turn. Repeat step 4.

6 Place the end of the TX Lever Height Tool onto the purge button (5) with the “GAS FLOW” up. Depress the purge button by pushing the tool towards the second stage until it stops against the front cover. If air flows from the second stage the lever height has been set correctly. If air does not flow from the valve, proceed to step 7.



7 Using the in-line adjustment tool, turn the seat (18) counter-clockwise approximately 1/16 of a turn. Repeat from step 4.

2nd Stage Opening Effort Test

1 With the regulator still pressurized, slowly open the flowmeter control knob (start vacuum) while watching both the magnehelic gauge and the MP gauge.

2 When the MP begins to drop, indicating the second stage valve is open, the magnehelic gauge should indicate an opening effort of +1.0 to +1.5 in-H₂O (2.5-3.7 mbar). If the reading is outside of these specifications, reference **Table 1, Troubleshooting Guide (pg 22)** for corrective actions.

FINAL ASSEMBLY

1 Depressurize the regulator and remove the in-line adjustment tool from the MP hose and the second stage. Thread the MP hose onto the second stage. While holding the heat exchanger (2) stationary with an 11/16" open end wrench. Use an in-lb torque wrench and a 11/16" crow-foot to torque the hose to 45 in-lbs (5 Nm).



2 If equipped with a comfort bite mouthpiece (14), make sure the 'bridge' of the mouthpiece is facing upward. Install the mouthpiece over the outlet port of the case (10). Install the mouthpiece clamp (13) in the groove so that the buckle points toward the hose. Tighten the clamp and snip the excess with side cutters.



WARNING: Ensure that the mouthpiece is properly secured on the oral boss.

FINAL TESTING PROCEDURES

External Leak Test

1 After disconnecting the regulator from the test bench, connect it to a scuba cylinder filled to approximately 3000 psi (206 bar). Open the cylinder valve to pressurize 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, this would require 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 (50 psi) air. Disassemble and remedy the problem, referring to **Table 1: Troubleshooting Guide, p. 22**.

Subjective Breathing Test

1 Depress the second stage purge to ensure that the volume of airflow is adequate to clear the second stage.

2 Breathe deeply from the mouthpiece. A properly serviced and adjusted regulator should deliver a smooth, uninterrupted airflow upon deep inhalation; without excessive effort, hesitation, or freeflow. If any abnormalities or problems occur, refer to **Table 1: Troubleshooting Guide, p. 22**.

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

THIS CONCLUDES THE SERVICE PROCEDURES FOR THE TX50 SECOND STAGE REGULATOR

Table 1: First Stage Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	TREATMENT
High Pressure Creep (also causes second-stage leaks)	1. HP valve (11) worn or damaged.	1. Replace HP valve.
	2. HP valve seat worn or damaged.	2. Replace body (5).
	3. Turret bolt (15) internal wall damaged.	3. Replace turret bolt.
	4. HP o-ring (13) damaged.	4. Replace o-ring.
	5. HP o-ring (17) damaged.	5. Replace o-ring.
External Air Leakage or Hydrostatic Diaphragm distended or burst	1. Blanking plug o-rings worn,damaged or missing. (10,13,20).	1. Replace o-rings.
	2. Diaphragm (3) worn or damaged.	2. Replace diaphragm.
	3. Hydrostatic diaphragm (25) worn or damaged.	3. Replace hydrostatic diaphragm.
	4. Diaphragm seating surface damaged.	4. Replace body (5).
	5. Diaphragm clamp (21) loose.	1. Tighten diaphragm clamp.
	6. Connector o-ring (10) worn or damaged.	2. Replace o-ring.
	7. Turret bolt o-ring (16) worn or damaged.	3. Replace o-ring.
Restricted Air Flow or High Inhalation Resistance Through Entire System	1. Cylinder valve not completely open.	1. Open valve and check fill pressure.
	2. Cylinder valve needs service.	2. Switch to a different cylinder.
	3. Filter (36) is clogged.	3. Replace filter.
	4. Very low medium pressure.	4. Adjust MP to between 130-145 psi (9-10 bar).

Table 2: Second Stage Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Leakage or freeflow from TX Second Stage	1. Excessively high first-stage intermediate pressure.	1. Refer to Table 1 - First Stage Troubleshooting Guide.
	2. MP Seat (29) damaged or worn.	2. Replace Rubber Seating.
	3. Seat (18) adjusted incorrectly, Lever (21) set too high.	3. Reset Seat preliminary settings, and repeat Adjustment Procedures.
	4. Lever (21) bent.	4. Replace Lever.
	5. Seat (18) sealing surface damaged.	5. Replace Valve Seat.
	6. Valve Spring (26) damaged.	6. Replace Spring.
	7. Shuttle Valve o-ring (27) 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 (18) adjusted incorrectly, Lever (21) 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 (21) bent or catching on Valve Spindle (20).	4. Replace Lever.
Water entering TX Second Stage	1. Mouthpiece (14) damaged or incorrectly fitted.	1. Replace or re-fit Mouthpiece as appropriate.
	2. Diaphragm (9) damaged.	2. Replace Diaphragm.
	3. Diaphragm (9) improperly seated in Case (10).	3. Remove Front Cover (7) and Diaphragm Cover (8) properly reassemble Diaphragm (check for distortion).
	4. Exhaust Valve (11) damaged.	4. Replace Exhaust Valve.
	5. Case (10) damaged. (Check exhaust valve seating surface.)	5. Disassemble and replace Case.
	6. Heat exchanger o-ring (3) damaged.	6. Replace o-ring

Table 3: List of Tools and Service Kits

















PART #	DESCRIPTION	APPLICATION
111610	MP Test Gauge 	Medium pressure testing
108362	MP Gauge Softcase 	Protective Case for MP Test Gauge
944022	Brass O-ring Tool Kit 	Removal and installation of o-rings
103102	Plastic O-ring Tool 	
10-102-400	O-ring Tool 	Removal of o-rings
109437	Seat Installation Tool 	Seat (18) removal/replacement
AT30 2-Needed	Pin Spanner 	Removal and installation of Diaphragm Clamp (21) and Environmental End Cap (26)
100395	Vise Mount Tool 	Mounting first stage into bench vise
9-44592	(9/16" x 5/8") Open End 	Disassembly and assembly
9-44388	Combo Wrench (11/16")	
N/A	Torque Wrench (30-120 in-lbs) 	Apply torque to parts listed in Table 3: Torque Specifications, p. 25
N/A	Torque Wrench (10-150 ft-lbs) 	Apply torque to parts listed in Table 3: Torque Specifications, p. 25
9-44363	Flex Wrench 	Disassembly and Assembly
9-43625	11/16" Crow Foot 	Apply torque to parts listed in Table 3: Torque Specifications, p. 25
8367A23	(5mm) Hex Key Adapter 	Apply torque to parts listed in Table 3: Torque Specifications, p. 25
8367A24	(6mm) Hex Key Adapter	
55015A27	3/4" Box Wrench 	Apply torque to parts listed in Table 3: Torque Specifications, p. 25
AT51	Seat Adjustment tool 	Seat (18) removal and replacement

Table 2: List of Tools and Service Kits







PART #	DESCRIPTION	APPLICATION
100190	In-line Adjustment Tool 	Final adjustment and tuning
AT31	TX Cover Tool 	Assembly/disassembly of case cover (7)
AT69	Lever Height Tool 	Lever Height Measurement
9-45171	Side Cutters 	Cut clamp (13), trim exhaust valve (11)
9-BA819009	Magnifier with Illumination 	Sealing surface inspection (uses 2 ea. AAA batteries)
N/A	Ultrasonic Cleaner	Brass and stainless steel parts cleaning
8204-66	Christo-Lube MCG-111 	Lubrication
AP0241/AA	First Stage Service Kit	Service Parts
AP0219/AA	Second Stage Service Kit	Service Parts

Table 4: Torque Specifications
First Stage

PART #	DESCRIPTION / KEY ITEM #	TORQUE
AP1407 AP1471	Yoke Connector (32) DIN Handwheel Connector (34)	14.7 ft-lbs (20 Nm)
AP1486	Turret Retaining Bolt (15)	70 in-lbs (8 Nm)
AP0203 AP1408 AP1487 AP1413	MP Hose Blanking Plugs (9, 18, 19)	40 in-lbs (4.5 Nm)

Second Stage

PART #	DESCRIPTION / KEY ITEM #	TORQUE
AP5002	Heat Exchanger (2)	45 in-lbs (5 Nm)
AP0203	MP Hose	45 in-lbs (5 Nm)



Table 5: Test Bench Specifications
First Stage

TEST	CONDITION	SPECIFICATION
Leak Test	Inlet 2500 - 3000 psig (206 bar)	No leaks allowed
MP	Inlet 2500 - 3000 psig (206 bar)	130 - 145 psi (9-10 bar)
MP Creep	Inlet 2500 - 3000 psig	5 psi (0.25 bar) max for 15 seconds after cycling (purging) regulator

Second Stage

TEST	CONDITION	SPECIFICATION
Leak Test	Inlet 2500 - 3000 psig (206 bar)	No leaks allowed
MP	Inlet 2500 - 3000 psig (206 bar)	130 - 145 psi (9-10 bar)
Opening Effort	Inlet 2500 - 3000 psig MP 130 - 145 psi (9-10 bar)	+ 1.0 - 1.5 H ₂ O (2.5 - 3.7 mbar)

Table 6: Recommended Cleaners and Lubricants

LUBRICANT/CLEANER	APPLICATION	SOURCE
Christo-Lube MCG 111	All o-rings	Aqua Lung, PN 820466, or Lubrication Technologies 310 Morton Street Jackson, OH 45640 (800) 477-8704
 CAUTION: 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.		
Oakite #31	Acid bath for reusable stainless steel and brass parts.	Oakite Products, Inc. 50 Valley Road Berkeley Heights, NJ 07922
 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.		
White distilled vinegar	Acid bath for reusable stainless steel and brass parts.	"Household" grade
Liquid dishwashing detergent (diluted with warm water)	Degreaser for brass and stainless steel parts; general cleaning solution for plastic and rubber.	"Household" grade

Procedure A: Cleaning and Lubricating

Aqua Lung and Apeks First Stages and Nitrox

When it comes to issues of nitrox safety and compatibility, the concerns lie primarily with the 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 hyper filtered compressed gas (hydrocarbons < 0.1 mg/m³). 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 recommends 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 nylon bristle tooth 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 acid solutions. Doing so may alter the physical properties of the component, causing it to prematurely degrade and/or break.

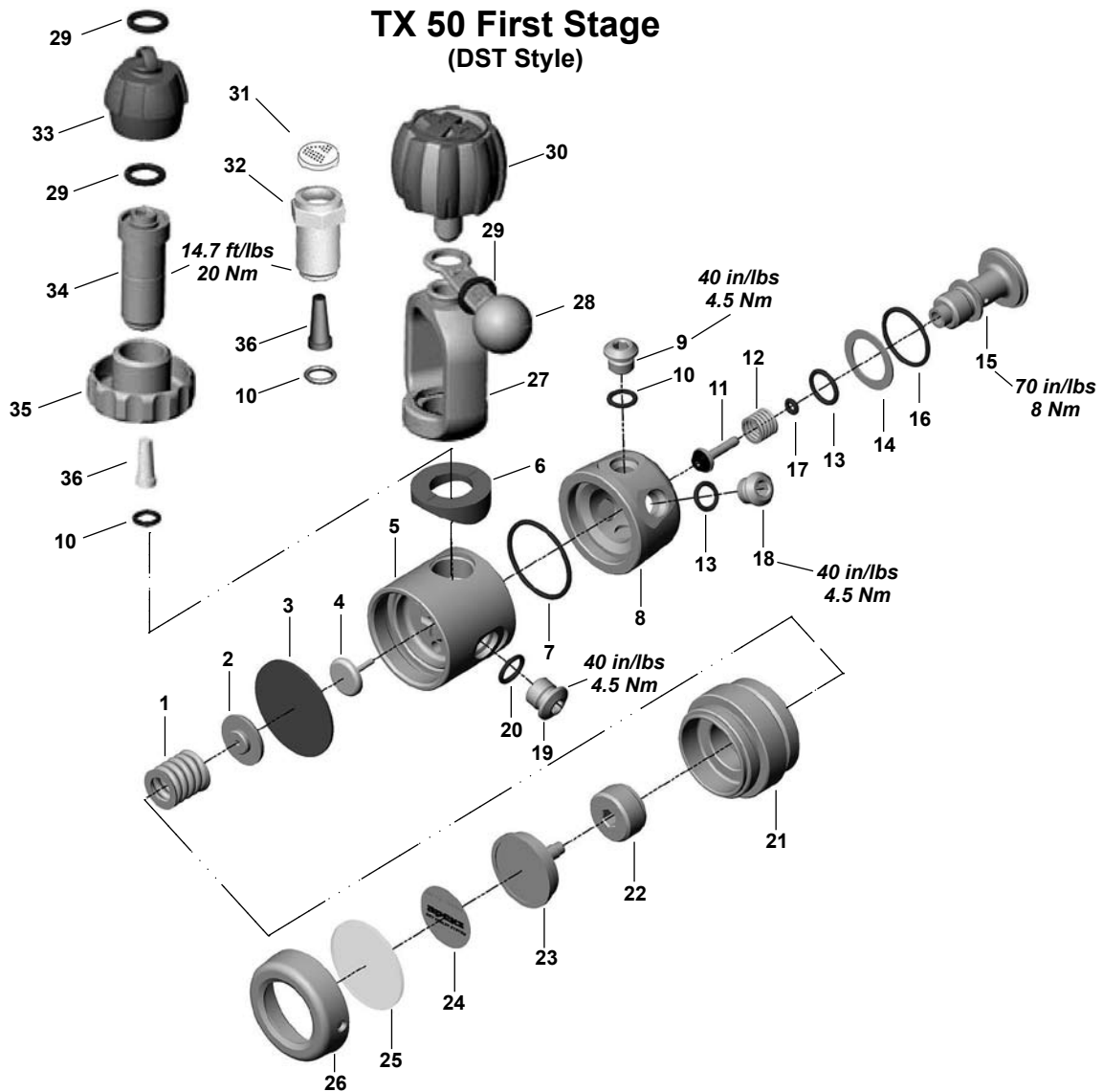
Cleaning Hoses

1. Hose fittings: Ultrasonically clean with soapy water*; vinegar OK on tough corrosion
2. Run soapy water through hose if needed
3. Thoroughly rinse with fresh water
4. Blow out hose before installing

Lubrication and Dressing

If planning to use enriched air nitrox through a first stage, wear powderless latex or nitrile 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.



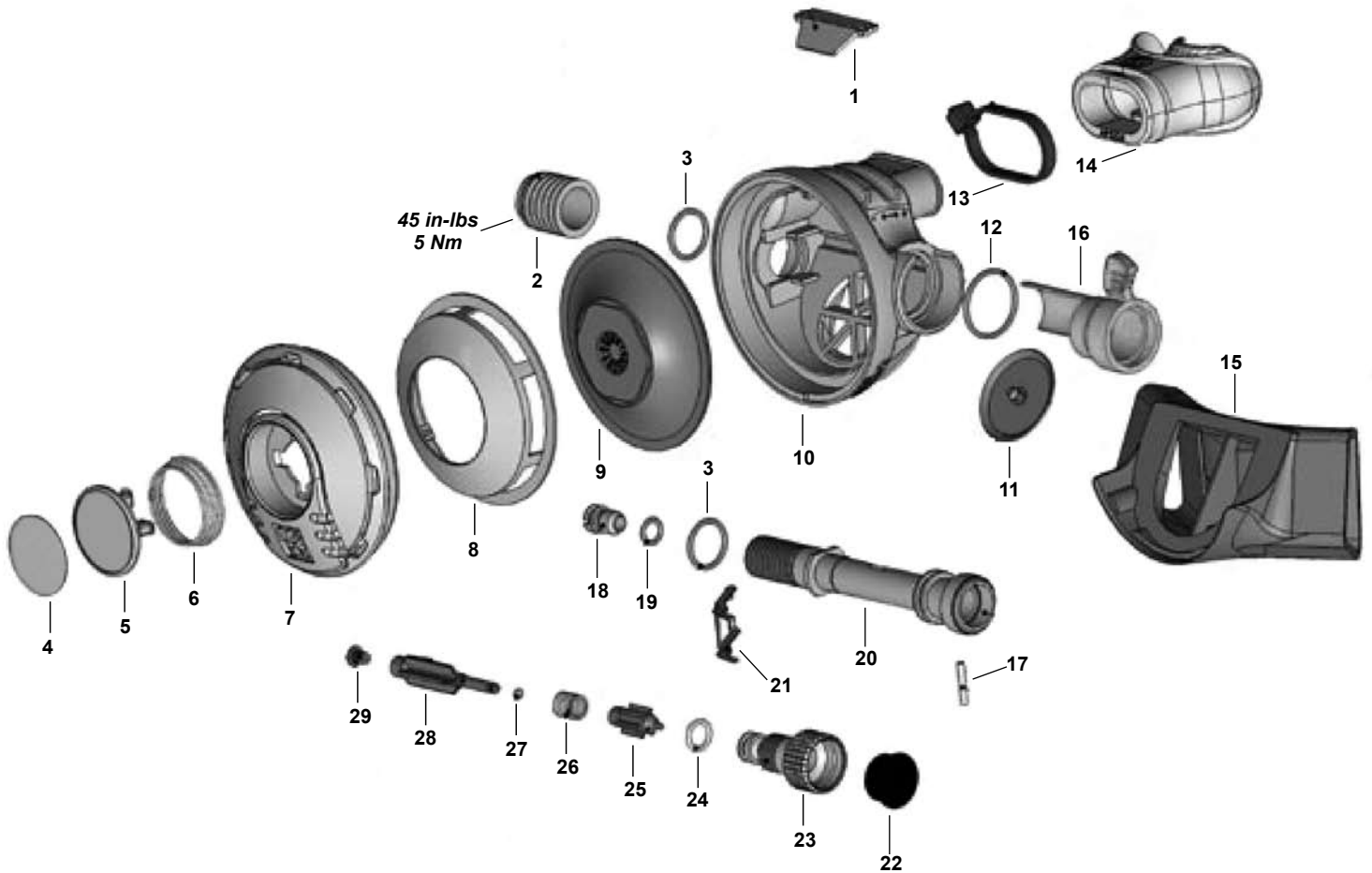
Key #	Part #	Description
-----	AP0230	TX50, First Stage w/Yoke
-----	AP0230-1	TX50, First Stage w/DIN
-----	AP0241/AA	Service Kit, Diaphragm First Stage
-----	AP0211	Din Connector Assembly
1 ----	AP1475	Spring
2 ----	AP1476	Spring Carrier
3 ----	AP1478	Diaphragm
4 ----	AP1479	Valve Lifter
5 ----	AP1480	Body
6 ----	AP1446	Distance Piece
7 ----	AP1420P	O-ring (10 pk)
8a ----	AP5103	Turret with 3/8" MP Port, XTX
8b ----	AP1481	Turret with 1/2" MP Port, /TX
9 ----	AP1408	Blanking Plug 3/8"
10 ----	AP1409P	O-ring (10 pk)
11 ----	AP1419	HP Valve
12 ----	AP1415	Spring
13 ----	AP1410P	O-ring (10 pk)
14 ----	AP1414	Thrust Washer
15 ----	AP1486	Turret Retaining Bolt
16 ----	AP1438P	O-ring (10 pk)
17 ----	AP1299P	O-ring (10 pk)
18 ----	AP1487	Blanking Plug 1/2", TX

Key #	Part #	Description
19 ----	AP1413	Blanking Plug 7/16"
20 ----	AP1445P	O-ring (10 pk)
21 ----	AP1473	Diaphragm Clamp
22 ----	AP1474	Spring Adjuster
23 ----	AP1483	Hydrostatic Transmitter Decal
25 ----	AP1482	Hydrostatic Diaphragm
26 ----	AP1484	Environmental End Cap
27 ----	AP1403	Yoke Clamp
28 ----	AP1404	Protective Cap
29 ----	AP1166P	O-ring (10 pk)
30 ----	AP1402	Yoke Clamp Screw, Comolded
31 ----	AP1406/1	Filter Guard
32 ----	AP1407	Yoke Clamp Connector
33 ----	AP6202	Protective Cap DIN
34 ----	AP1471	Handwheel Connector
35 ----	AP1470	Handwheel 300 Bar
36 ----	AP1472	Conical Filter

NOTE: Service kit AP0241/AA contains parts for multiple model Apeks regulators. Excess parts should be discarded.

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

TX50 Second Stage



Key #	Part #	Description
----	AP0510SQ	TX50, Second Stage w/ 1/2" Hose
----	AP0503	TX50 Octopus
----	AP0219/AA	Universal Second Stage Repair Kit
1----	AP2037	Deflector
2----	AP5002	Heat Exchanger, TX50
3----	AP1267P	O-Ring (10 pk)
4----	AP5004/1	Decal, TX50
5----	AP2053	Purge Button
6----	AP2020	Spring
7----	AP2026	Case Cover, TX50
----	AP2026/Y	Case Cover, Yellow, Octopus or Nitrox
8----	AP2025	Diaphragm Cover
9----	AP2023	Diaphragm
10----	AP5001	Case
11----	AP1429	Exhaust Valve
12----	AP1438P	O-Ring (10 pk)
13----	104913	Mouthpiece Clamp
14----	AP5324K	Mouthpiece, Comfobite
15----	AP2040	Exhaust Tee
16----	AP2039	Venturi Lever, TX50
17----	AP1151	Spring Pin
18----	AP2033	Seat
19----	AP1154P	O-Ring (10 pk)
20----	AP2028	Valve Spindle, TX50

Key #	Part #	Description
21----	AP2035	Lever
22----	AP2030	Plug
23----	AP2029	Adjusting Screw, TX50
24----	AP1409P	O-Ring (10 pk)
25----	AP2038	Counter Balance Cylinder
26----	AP2021	Valve Spring
27----	AP2041P	O-Ring (10 pk)
28----	AP2036	Shuttle Valve
29----	AP2034	MP Seat
Hose & Hose O-rings (not shown)		
N/S----	AP0203	Hose, MP, 1/2" X 29"
N/S----	AP1410P	O-ring, Hose End, Male 1/2" (10 pk)
N/S----	AP1154P	O-ring, Hose End, Swivel (10 pk)

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

Maintenance Notes

Maintenance Notes



**APEKS TX50 REGULATOR
TECHNICAL MANUAL**

AQUA  LUNG®

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