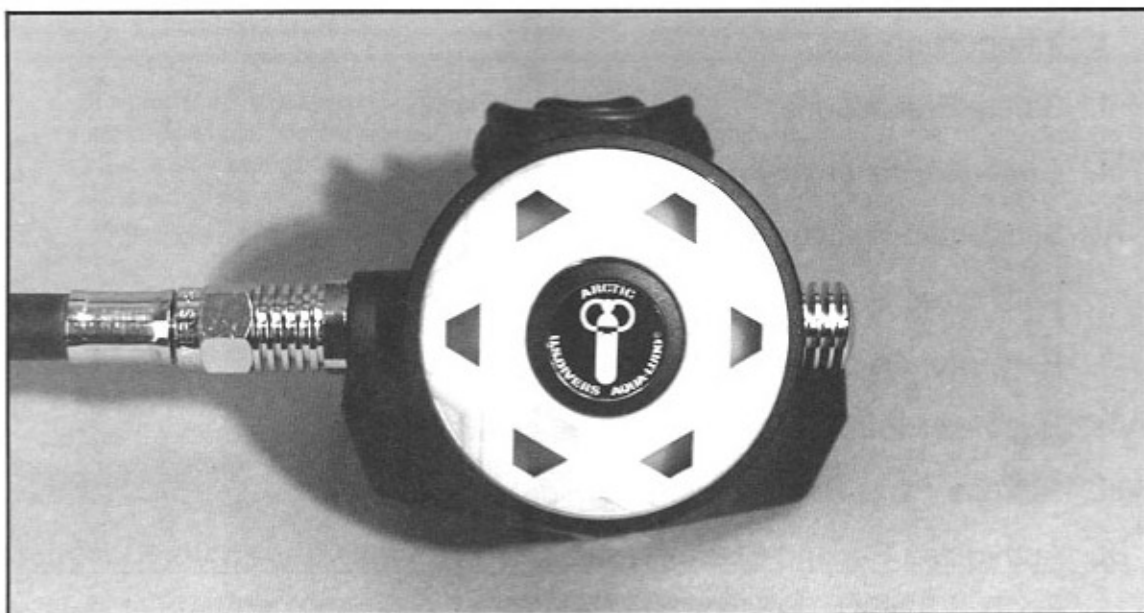


ARCTIC SECOND-STAGE



REPAIR & MAINTENANCE MANUAL

 **U.S. DIVERS®**
AQUA-LUNG

2340 Cousteau Court / Vista, CA 92081

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I. Introduction

This manual provides instruction for the maintenance and overhaul of the Arctic second-stage regulator series. Maintenance and overhaul procedures outlined within this manual are to be performed by personnel who completed the U.S. Divers® Aqua-Lung® maintenance instruction program and achieved certification as a qualified repair technician.

II. Safety Precautions

If a procedure has a special warning, caution or note associated with it, you will be alerted with the italicized words, "Before proceeding, read the following warning (caution or note) that pertains to step x." Next to all warnings will be the word "STOP" in white letters on a black octagon (figure 1). Next to all cautions will be a white exclamation point overlaid on a black triangle (figure 2). Next to all notes will be a white capital N overlaid on a gray circle (figure 3).



Figure 1



Figure 2



Figure 3

Warnings, Cautions and Notes Defined

A warning is used before a procedure that will result in serious injury or death if the procedure is not followed carefully.

A caution is used prior to any maintenance technique that will result in damage to parts if that technique is not followed carefully.

A note is used before any maintenance technique that is important enough to emphasize.



WARNING: U.S. Divers' SCUBA equipment (regulators, octopus, buoyancy compensators, cylinders, valves and gauges) is designed and intended for use only with clean, compressed atmospheric air (21% oxygen and 79% nitrogen). DO NOT use any other gas or enriched oxygen mixture above 21% oxygen. Failure to adhere to this warning may result in serious injury or death due to fire and explosion, or the serious deterioration or failure of the equipment.

III. General (Preventative) Maintenance

Providing the best possible preventative routine maintenance before and after dives will help to ensure the maximum life of the Arctic series regulators. To consistently achieve this goal, there are a number of simple, but important, routine maintenance procedures that should be followed by the diver after every use of the equipment. They are not meant to be field repair operations, and, for you who must advise the customer, these recommendations are intended as "Service Tips."



NOTE: Refer customer to the U.S. Divers® Aqua-Lung® Regulator Owners Manual, PN 1019-97.

1. After each day of diving, the regulator must be cleaned, inspected and prepared for the next use or storage. As soon as the regulator is removed from the SCUBA cylinder(s), install the dust cap over the regulator first-stage inlet port. This cap is normally attached to the regulator yoke and, therefore, has been

underwater. Blow all the water out of the cap first. Failure to do this results in water entering the first-stage, causing corrosion. Also, make sure the O-ring is inside the dust cap. In most cases, it also serves as a spare O-ring in case of damage to the O-ring on the cylinder valve. This important soft seal should be inspected regularly and replaced if it shows signs of wear or aging.

If the regulator is equipped with the Arctic regulator DIN adapter, then, after removing the DIN adapter regulator from the SCUBA cylinder, install the dust cap over the adapter. Be sure to blow the dust cap completely dry. Failure to do this will result in water entering the first-stage regulator, causing corrosion.

2. There are two methods of routinely cleaning the Arctic series regulators after each dive:

■ The "pressurized" method

The first (and preferred) method is the "pressurized" procedure.

- a. Remove the dust cap. Attach the regulator to a charged SCUBA cylinder.
- b. Open the cylinder valve slowly to pressurize the regulator.

Before proceeding, read the following note that pertains to step C.



NOTE: Soaking regulator parts in warm water will remove more salt and mineral deposits than will conventional rinsing.

- c. Soak the regulator with fresh, warm (not over 120°F) tap water to remove salt and mineral deposits. Allow the water to enter the second-stage mouthpiece. Depress the purge button for a few seconds while water is in the second-stage. To remove excess water after soaking is complete, purge the second-stage a few more times.
- d. Disconnect the first-stage from the SCUBA cylinder.
- e. Dry the dust cap before putting it over the inlet port of the first-stage regulator.
- f. To air dry, lay the regulator on a clean towel, away from direct sunlight.



CAUTION: First-stage regulators equipped with a DIN regulator adapter must be cleaned with the pressurized method only. Failure to pressurize the DIN regulator will cause water to enter the first-stage regulator, causing corrosion.

■ The "non-pressurized" method

A non-pressurized procedure can be performed if no charged cylinder is available.

- a. Soak the entire first-stage with warm, fresh tap water with the dust cap in place.
 - b. Soak the second-stage regulator. **DO NOT PUSH IN THE PURGE BUTTON** while soaking the second-stage because this allows water to enter the hose and first-stage causing corrosion. Blow out excess water from the second stage after soaking.
 - c. To air dry, lay the regulator on a clean towel, away from direct sunlight.
3. After air drying, store the regulator as follows:
 - a. Store in a clean equipment box or, as an alternative, seal inside a plastic bag.
 - b. It is a good practice to wipe the rubber parts with a light application of silicone grease using an impregnated cloth if the regulator is to be stored for a long period of time.



CAUTION: Never store the regulator while still connected to a SCUBA cylinder. **DO NOT** use any type of solvent to clean any part of the regulator. **DO NOT** carry the SCUBA cylinder by the regulator or hoses; such abuse will eventually damage the regulator or the cylinder valve. **DO NOT** loosen or remove the secondary diaphragm retaining ring or the secondary diaphragm from the first-stage; this will result in loss of silicone fluid, making the regulator unfit for cold water use.

IV Scheduled Maintenance

1. Do not assume that a regulator is in good working order because of storage or infrequent use. Remember, either prolonged or improper storage can still result in internal corrosion or deterioration of O-ring seals.
2. A regulator must be cleaned and adjusted frequently. As an authorized U.S. Divers Aqua-Lung repair technician, it is your responsibility to inform your staff and customer that the regulator requires inspection and/or overhaul with scheduled parts replacement at least once a year. Failure to have regulators inspected and/or overhauled annually will void the limited lifetime warranty for the regulator. Frequent use in clean, fresh water environments might require cleaning and an overhaul every six months. Use as rental equipment and/or in salt, chlorinated (swimming pool), or polluted water might require cleaning every three to six months. Remember that chlorinated water is an especially bad environment for regulators because the chlorine deteriorates the neoprene rubber components.
3. You should advise your customers to regularly inspect the sintered filter (if not fitted with a DIN connector) in the high pressure inlet port of the first-stage regulator. If it is discolored or corroded, replacement by trained personnel is required. Also, at this point, the entire regulator may need a general overhaul with replacement of all soft seals and non-reusable components. Rust (red powder) or aluminum oxide (gray powder) deposits on the sintered filter are usually an indication that salt water has entered the SCUBA cylinder and caused internal corrosion. The customer must be notified that their SCUBA cylinder(s) should be visually inspected and cleaned, or hydrostatically tested as required.
4. When counseling your customers on preventative maintenance, inform them that no other adjustment or maintenance of their regulator is recommended by U.S. Divers. For adjustments such as the intermediate pressure setting or proper lubrication, take the regulator to a qualified dealer or return it to the factory.



FINAL NOTE: Service your regulator often - your personal safety and the mechanical integrity of your regulator depend on it.

V. Authorized Second-Stage Regulator Disassembly

A. General Considerations

1. This section presents step-by-step disassembly procedures for the Arctic Regulator Series. It is important that the sequence be followed exactly in the order given. Read over the entire manual prior to overhaul to become familiar with maintenance procedures. Take special note of all tables, especially the Replacement Parts Listing in Section VIII, Table 3 - Recommended Lubricants and Cleaners and Table 5 - Recommended Tool List.
2. Disassembly of the Arctic regulator 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. As each regulator is disassembled, the components to be reused should be segregated and not allowed to intermix with components from other regulators. Special tools (see Table 5 - Recommended Tool List) are required for disassembly and subsequent assembly.
3. Before disassembling the Arctic regulator, perform a pretest. By following the test described in Section X or Table 1 Testing Procedures and making reference to the Troubleshooting Table 2, pages 15 through 16, you will be able to determine the need for parts replacement.



NOTE: This manual provides disassembly and reassembly procedures for the Arctic second-stage regulators only. For proper maintenance of the Arctic first-stage regulator, see the SEA Service Manual (PN 7802-12).

B. Arctic Second-Stage Disassembly

1. While holding the inlet fitting (item 20) with a 19mm open-end wrench, use a 11/16 inch open-end wrench to unscrew counterclockwise and remove the swivel end of the intermediate pressure hose (item 30).
2. Remove and discard the O-rings (items 28 & 29) from the intermediate pressure hose.
3. Using the Box Top Wrench (U.S.D. PN 1019-40), unscrew the box top (item 24) counterclockwise and remove it.

Before proceeding, read the following caution that pertains to step 4.



CAUTION: Be careful when removing the purge button (item 23). The purge button is under spring tension and will pop out of place when removed from the box-top assembly.

4. Remove the purge button (item 23) by squeezing all four (4) of the clips towards the center of the box top (item 24). Next, separate the purge spring (item 22) from the purge button.
5. Carefully lift out the thrust washer (item 26) and the diaphragm (item 25).

Before proceeding, read the following caution that pertains to step 6.



CAUTION: During removal of the inlet fitting (item 20), depress the lever (item 7). Failure to keep the lever depressed could cause damage to the crown seating surface of the inlet fitting.

6. With the lever depressed, use a 19mm open-end wrench to unscrew counterclockwise and remove the inlet fitting (item 20).

Before proceeding, read the following note that pertains to step 7.



NOTE: The crown (item 19) cannot be completely removed from the inlet fitting (item 20) by using a screwdriver. Once the crown threads have disengaged from the inlet fitting, the seat extractor tool (PN 1094-36) or wood dowel must be used to push it free from the hose end of the inlet fitting.

7. Using the Arctic In-line Adjustment Tool (PN 1094-46) or a medium flat blade screwdriver, begin to remove the crown (item 19) by turning the tool or screwdriver counterclockwise. Once the crown threads have disengaged from the inlet fitting (item 20), place the seat extractor tool (PN 1094-36) or a small wood dowel into the inlet fitting and gently dislodge the crown (see figure 4). Remove and discard the crown O-ring (item 18). Remove and discard the inlet fitting's external O-ring (item 21).

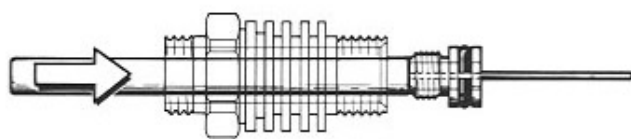


Figure 4

Before proceeding, read the following caution that pertains to step 8.



CAUTION: The disc and retainer assembly (items 15 & 16) is under spring tension. Be careful when removing these parts. This will help prevent damage or loss of parts.

8. While holding the intermediate nut (item 12) with a 7mm open-end wrench, place the disc and retainer wrench (PN 1094-44) over the end of the retainer (item 16). While still holding the intermediate nut with the 7mm wrench, turn the disc and retainer wrench counterclockwise and remove the disc and retainer along with the spring (item 17). Remove and discard the disc (item 15).
9. Place a 5mm Allen wrench into the ribbed plug (item 14) and turn the wrench counterclockwise to remove the plug.
10. Remove the lever support and lever assembly (item 6) from inside the box bottom (item 2). Next, remove and discard the O-ring (item 13).
11. While holding the sheath (item 9) with your fingers, or gently holding it with small pliers, place a 7mm open-end wrench over the intermediate nut (item 12) and turn the 7mm wrench counterclockwise and remove the nut.
12. Insert the Arctic 5.5mm specialty nut driver (PN 1094-48) into the open end of the lever support (item 6). While holding the locknut (item 11) with the nut driver, insert the blade of a small flat blade screwdriver (PN 1016-84 Adjustment Tool screwdriver) into the sheath (item 9) and locate the slot on the connector rod (item 8). See figure 5. Next, turn the nut driver counterclockwise and remove the locknut. Discard the used locknut.
13. Slide the sheath and connector rod (items 8 & 9) out from the lever support (item 6).
14. Remove the washer and lever (items 10 & 7) from the lever support (item 6).
15. Slide the connector rod (item 8) out of the sheath (item 9).
16. Pull off the exhaust tee (item 5). Next, remove the exhalation valve (item 4) by pressing on the valve bead from inside the box bottom with your thumb.
17. Remove the plastic mouthpiece clamp (item 3) by snipping it carefully with wire cutters or pliers. Next, pull off the mouthpiece (item 1).

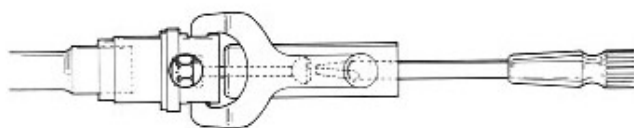


Figure 5

This concludes the disassembly of the Arctic second-stage regulator.



NOTE: This manual provides disassembly and reassembly procedures for the Arctic second-stage regulator only. For proper maintenance of the SEA first-stage regulator, see SEA Service Manual (PN 7802-12).

VI. Regulator Parts Cleaning

In conjunction with this section, the service technician should refer to the list of Recommended Lubricants and Cleaners in Table 3.



CAUTION: NEVER expose plastic or rubber parts to solvents or caustic cleaning agents of any type. Never use aerosol silicone sprays to lubricate or clean plastic or rubber parts, as the propellant gas or carrier solvent may attack or weaken them.



- A. All original soft seals and expendable parts need not be cleaned as they are routinely replaced during normal maintenance and overhaul (See section VIII). The other rubber and plastic parts - diaphragm, mouthpiece, exhaust tee, box top, thrust washer, box bottom, and sheath, which are not usually replaced (unless damaged) during a standard overhaul, should be cleaned with a mild, warm water (not over 120°F) detergent solution. Then, they should be thoroughly rinsed in clean, fresh water and blown dry with filtered, low-pressure air (30 psig). A soft nylon bristle brush may also be used, taking care not to scratch or abrade the rubber or plastic parts.



NOTE: Clean the retainer (item 16) and the crown (item 19) with extra care, especially the seating surfaces. Next, thoroughly rinse all metal parts to completely eliminate loosened material. Immerse components in the ultrasonic cleaning solution, and comply with specific instructions for the detergent. If Oakite #31 is used in the ultrasonic cleaning tank, follow instructions carefully. If an acetic acid (household white vinegar) solution is used, a cleaning time of 10 to 15 minutes will suffice, using a recommended concentration of one part acetic acid to one part water.

- B. After disassembly, give all metallic parts a preliminary cleaning in a warm detergent/water solution. Use a soft nylon bristle brush if mineral encrustation or corrosion is present. **DO NOT** use a wire brush! The locknut (item 11), however, is a standard overhaul replacement part and does not need to be cleaned. The preferred and recommended cleaning procedure for metallic parts utilizes an ultrasonic cleaning tank with a suitable detergent.



CAUTION: Excessive cleaning times beyond those recommended may damage plated parts. After completion of ultrasonic cleaning, remove all metal parts and thoroughly rinse with clean, fresh water and blow dry with low-pressure (30 psig) air. Only brass, plated brass, and stainless steel parts should be immersed in acid cleaning solution, such as Oakite #31.

- C. If no ultrasonic cleaning tank is readily available, then use the following, less preferred, chemical procedure: First, using a soft bristle brush, remove any loose adherent or flaking material. Place metal parts in a recommended acid bath solution (e.g., Oakite #31, see Table 3) and gently agitate for three to four minutes. Afterwards, remove and rinse with clean, fresh water and blow dry with filtered low pressure (30 psig) air.

VII. Regulator Parts Inspection

General Procedures

1. All soft seals and nonreusable components in the Arctic regulator are routinely replaced during general overhaul. Refer to the Routine Parts Replacement Schedule following this section.
2. It is still important, however, to visually inspect all soft seals, especially O-rings, for any defects, including any molding flaws, before installation.
3. All reusable metal components must be thoroughly visually inspected for any cracks, burrs, scoring, and corrosion using a high intensity light and magnifier.
4. Examine all plated surfaces for blisters, peeling and continuity of plating. Replace if necessary.
5. Inspect all threaded components for deformation, galling, cross-threading, or stripping. Replace if necessary.
6. Check all sliding, reciprocating or rotating parts for nicks, burrs, scratches, or scoring. Replace if necessary.

7. All plastic parts must be closely inspected for distortion, cracking, deformation, or solvent attack. Replace if necessary.
8. All O-ring surfaces must be completely smooth and free of nicks, burrs, scoring, corrosion, or pitting. Replace if necessary.

Specific procedures

9. Inspect the retainer (item 16) for nicks, pitting, scratches, and defective plating. The through hole located on the seating side of the retainer should be clear and free of debris. Replace if necessary.
10. Examine the crown seat (item 19) for nicks, pitting, scratches, or defective plating. Replace if necessary.
11. Check the demand lever (item 7) for bending, distortion, or excessive wear of the nylon button. Replace the lever if necessary.
12. Inspect the connector rod (item 8) for bending, distortion, or excessive wear of the threads or screwdriver slot. Replace if necessary.
13. Inspect the second-stage diaphragm (item 25) for cuts, nicks, pinholes, or other evidence of mechanical damage. Check the condition of the rubber for signs of deterioration such as cracking, crazing, or hardening. Ensure that the round, stainless steel plate is firmly bonded to the surface of the diaphragm. Replace the diaphragm if necessary.
14. Thoroughly inspect the second-stage hose (item 30) for any signs of general deterioration of the rubber, including crazing or superficial cracking, shrinking or hardening. Ensure the outer jacket under the crimped portion of the end fittings is not cut through showing the braided reinforcement underneath. There should be no evidence that the hose is "pulling out" of the end fittings. Inspect the male threads for damage or stripping. Maximum service time for rental hoses is one year; inspect your personal second-stage hose after each dive. Replace the hose if necessary.
15. Finally, refer to the Troubleshooting Table for additional problem areas - their causes and recommendations for cleaning and replacement.

VIII. Routine Parts Replacement Schedule

Part #	Description	Item #	Qty. Needed
1049-13	Clamp	3	1
1067-22	Locknut	11	1
8200-45	O-ring	13	1
1067-38	Disc	15	1
8200-10	O-ring	18	1
8200-14	O-ring	21	1



NOTE: U.S. Divers recommends that parts listed under "Routine Parts Replacement Schedule" be replaced every year for regulators used exclusively for recreational diving. The second-stage diaphragm and exhaust valve need only be replaced if damage, signs of age, or chemically-induced deterioration are seen.

IX. Authorized Second-Stage Regulator Reassembly

This subsection presents a detailed, step-by-step reassembly procedure for the Arctic second-stage. It is important that the sequence be followed exactly in the order given.



NOTE: Lightly lubricate all O-rings with silicone lubricant (PN 0501-16) during reassembly.

1. Affix the mouthpiece (item 1) to the box bottom (item 2) and fasten the mouthpiece in place with a new mouthpiece clamp (item 3). The lock tab on the mouthpiece clamp should be aligned with the air-inlet boss of the box bottom (see figure 6). Tighten the mouthpiece clamp with pliers and snip the extra length with wire cutters.
2. Insert the exhalation valve (item 4) into the box bottom (item 2) by pressing in on the center of the exhalation valve with your thumb. Be sure the exhalation valve is properly seated. Next, refit the exhaust tee (item 5).
3. While holding the lever support (item 6) with the notched groove facing up, slide the lever (item 7), with its button facing up, into the notched groove of the lever support (see figure 7). Set the assembly aside.
4. Install the connector rod (item 8) in the non-beveled side of the sheath (item 9).
5. Pass the threaded end of the connector rod (item 8) through the opening in the lever side of the lever support (item 6). See figure 8.
6. Insert the small screwdriver blade of the 1016-84 adjustment tool into the sheath (item 9) to hold the connector rod in place.
7. Place the washer (item 10) over the threaded portion of the connector rod. Apply a small amount of silicone grease on the locknut (item 11) to help retain it in the end of the 5.5mm nut driver. Place the locknut (item 11) into the long end of the 5.5mm nut driver. Thread the locknut onto the threaded end of the connector rod (item 8) by turning the nut driver clockwise. See figure 9.
8. Hold the lever support assembly (item 6) by the lever support with your thumb and index finger. Tighten the locknut (item 11) clockwise until the sheath (item 9) touches the lever support (item 6). Then, turn the locknut (item 11) counterclockwise two full (360°) turns. The lever support assembly is now properly adjusted.
9. First, thread the intermediate screw (item 12) clockwise into the end of the sheath (item 9) by hand. Then, while holding the sheath (item 9) with your fingers, or



Figure 6

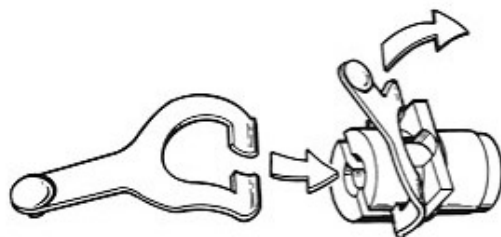


Figure 7

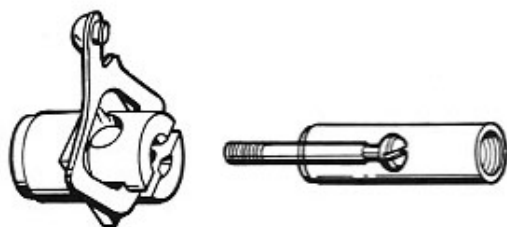


Figure 8

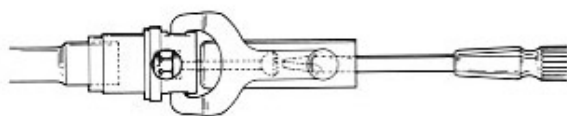


Figure 9

gently with small pliers, use a 7mm open-end wrench and snug the intermediate screw hand tight by turning it clockwise.

10. Place the lever support assembly (item 6) into the box bottom (item 2).
11. Lightly lubricate the O-ring (item 13) with Dow Corning 111 (pure silicone grease). Place the O-ring in the groove of the box bottom. Next, lightly lubricate the first two threads of the ribbed plug (item 14).
12. Thread the ribbed plug (item 14) clockwise into the box bottom (item 2) until its threads engage with those of the lever support (item 6).
13. Connect a 5mm Allen wrench adapter to a torque wrench. Tighten the ribbed plug (item 14) clockwise to 22 ± 3 inch-pounds.
14. Install a new disc (item 15) into the end of the retainer (item 16). Place the spring (item 17) over the threaded end of the retainer.
15. Drop the retainer and spring assembly (items 16 & 17) - spring end first - into the inlet fitting boss of the box bottom (item 2). Next, while holding the intermediate screw (item 12) with a 7mm open-end wrench, gently compress the disc and retainer assembly with the disc and retainer wrench. Once the threads of the retainer are aligned with those of the intermediate screw, turn the disc and retainer wrench clockwise until snug. Remove the 7mm wrench and disc and retainer wrench.
16. Lightly lubricate the O-ring (item 18) and install it on the crown (item 19). Place a small amount of silicone grease on the first two threads of the crown. Insert the crown (item 19) into the inlet fitting (item 20) cone seating surface first. Push the crown with the seat extractor into the inlet fitting until it stops (see figure 10).
17. With a medium flat blade screwdriver or Arctic In-line Adjustment Tool, turn the crown (item 19) clockwise until the first two threads of the crown are visible at the end of the inlet fitting (item 20). See figure 11.
18. Lightly lubricate the O-ring (item 21) and install it on the crown side of the inlet fitting (item 20). Place a small amount of silicone grease on the first two threads of both ends of the inlet fitting.
19. While depressing the lever (item 7), thread the inlet fitting (item 20) clockwise into the box bottom (item 2), first by hand, then tighten the inlet fitting with a 19mm torque wrench to 55 inch-pounds.
20. Mount the spring (item 22) on the purge button (item 23). Place the purge button and spring assembly on the box top (item 24) and compress the spring until the four (4) arms of the purge button snap into place.
21. Place the diaphragm (item 25), with its metal plate facing the lever (item 7), into the box bottom (item 2), followed by the thrust washer (item 26). Next, thread the box top (item 24) clockwise onto the box bottom; first by hand, then snug it in place using the box top wrench.

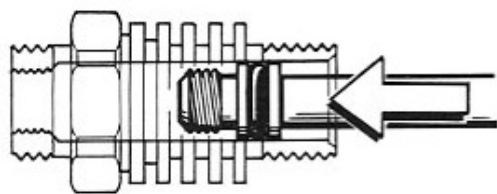


Figure 10

TWO THREADS

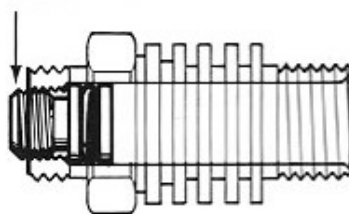


Figure 11

This concludes the reassembly of the Arctic second-stage regulator.

X. Authorized Regulator Adjustment and Testing

Prior to adjusting and testing the Arctic second-stage regulator, the first-stage regulator must be fully assembled and adjusted. To properly assemble and adjust the first-stage regulator, refer to the U.S. Divers Conshelf SEA Service Manual (PN 7802-12).

After following the first-stage reassembly procedures, proceed as follows:



NOTE: Before placing the Arctic regulator back in service, the following sequence of adjustments is necessary. The use of a flow bench is the preferred device to ensure the quality of your adjustments. This will enable the service technician to check critical performance requirements of the regulator more precisely. If no test bench is available, use of a SCUBA cylinder (the less preferred testing procedure) will follow this section.

A. Preliminary Procedures: Attachment of First-Stage to Second-Stage

1. Install the two lubricated O-rings (items 28 & 29) on the intermediate-pressure hose (item 30).
2. Attach the hose (item 30) to $\frac{1}{2}$ -inch low-pressure port on the first-stage body using an $\frac{11}{16}$ " torque wrench. Tighten the hose clockwise to a torque of 40 inch-pounds.
3. Connect the first-stage regulator to a source of low-pressure (500 psig) breathing air. While firmly holding the free end of the second-stage hose, carefully open the air source control valve, allowing a small quantity of air to flow through the open hose. This will flush any dust or debris from the interior of the hose. Close the air source control valve.
4. Slide the O-ring sealed adjustment pin of the Arctic In-line Adjustment Tool into the open end of the inlet fitting (item 20). Next, hand tighten the swivel nut clockwise to secure the tool to the second-stage regulator (see figure 12).
5. Thread the swivel end of the hose (item 30) attached to the first stage regulator clockwise onto the In-line Adjustment Tool until hand tight.

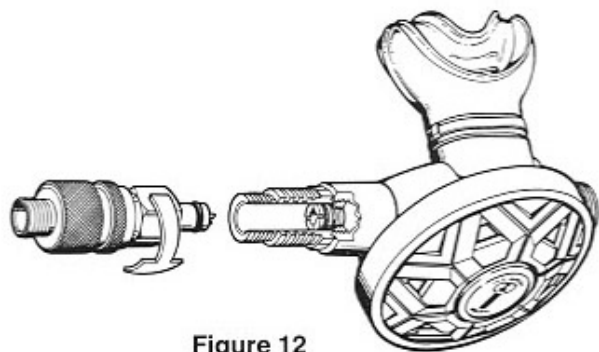


Figure 12

B. Second-Stage Adjusting and Testing

In conjunction with this subsection, refer to Table 1 "Test Bench Specification" on page 14.

Before proceeding, read the following note that pertains to step 1.



NOTE: If the second-stage leaks when the regulator is pressurized, depress the purge button and adjust the crown by turning the In-line Adjustment Tool handwheel clockwise $\frac{1}{4}$ turn. Then release the purge. If the regulator still leaks, repeat as necessary. If adjusting the crown does not stop the leak, see Troubleshooting Guide on page 15.

1. With the regulator attached to the flow test bench, slowly pressurize the regulator to 3000 ± 100 psig. The intermediate pressure gauge should indicate a "lockup" pressure of 135 ± 5 psig. Adjust the intermediate pressure if necessary.

Before proceeding, read the following caution that pertains to step 2.



CAUTION: Always depress the purge button when adjusting the crown (item 19) with the In-line Adjustment Tool. Failure to do so can cause damage to the disc (item 15), requiring its replacement. The In-line Adjustment Tool handwheel must be compressed to engage the split screw drive head to the crown (item 19). See figure 13.

2. Once you have established the proper intermediate pressure of 135 ± 5 psig, depress the purge button while compressing the handwheel on the Adjustment Tool. Turn the Adjustment Tool handwheel counterclockwise $\frac{1}{4}$ turn then release the purge button. If no air leak is detected, depress the purge button again and turn the Adjustment Tool handwheel counterclockwise $\frac{1}{4}$ turn and release the purge button. Repeat until an air leak is detected. Once an air leak is detected, depress the purge button and turn the Adjustment Tool handwheel clockwise just until the leak stops. Once the leak has stopped, turn the adjustment tool handwheel 30° to 45° clockwise. The second-stage has now been properly adjusted. Depressurize the regulator and remove the In-line Adjustment Tool. Next, thread the swivel end of the intermediate pressure hose to the inlet of the second-stage regulator. Tighten the hose using an $\frac{11}{16}$ -inch torque wrench to 40 inch-pounds.
3. **Second-Stage Air Flow Test**
With the regulator still attached to the flow test bench, repressurize the regulator to 3000 ± 100 psig. Place the second-stage mouthpiece over the mouthpiece adapter. Slowly turn the flowmeter control knob until the flow reaches a minimum of 15 SCFM (425 liters per minute). The reading on the Magnahelic gauge (inhalation/exhalation effort gauge) should indicate no more than $+6.0''$ H₂O. If the reading is over $+6.0''$ H₂O, refer to Troubleshooting Table 2 on page 15 for corrective guidelines and specific procedures.
4. **Second-Stage Opening Effort Test**
Next, shut off the flowmeter control knob. Slowly turn the flowmeter control knob back on while watching both the magnahelic gauge and the intermediate pressure gauge. When the intermediate pressure gauge begins to drop below the intermediate pressure "lockup," the Magnahelic gauge should indicate an opening effort of $+0.6''$ of H₂O to $1.5''$ of H₂O. If the opening effort is not within this range, refer to the Troubleshooting Table 2, page 15, for corrective guidelines and specific procedures.
5. **Second-Stage Purge Flow Test**
Turn off the flowmeter control knob. Next, while the second-stage is still mounted on the mouthpiece adapter, watch the flowmeter gauge and fully depress the purge button. The flowmeter gauge must indicate a minimum of $+5.0$ SCFM (142 L.P.M.). If the purge flow is less than $+5.0$ SCFM, refer to the Troubleshooting Table 2, page 15, for corrective guidelines and specific procedures. When purge flow is correct, remove the second-stage from the mouthpiece adapter on the flow test bench.
6. **Leakage Test**
After final reassembly and adjustment of the Arctic regulator, the following simple test for external leakage is recommended.

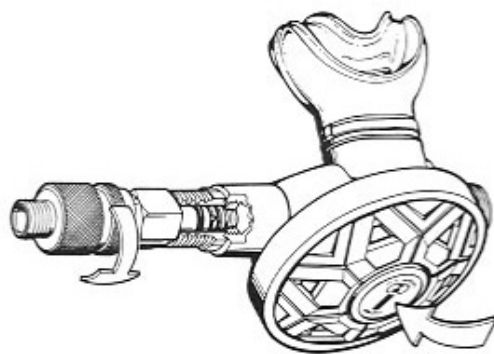


Figure 13



NOTE: The mouthpiece of the regulator must point straight down or free-flow may result when submerged in water.

- a. With the first- and second-stages attached to a high pressure air supply, submerge the entire system in a test tank of clean water.

- b. Turn on the high-pressure supply.
- c. Observe any bubbles arising from the submerged regulator over a one minute period. The recommended time is necessary due to lower bubble formation that occurs in cases of smaller leaks. Bubbles indicate a leak, which means the regulator must be disassembled to check all sealing surfaces, assembly sequence and component positioning in order to correct the problem(s).



NOTE: An alternate method for visually detecting regulator leakage is to apply a soap solution to possible leakage areas using a small, clean brush. Bubble streams will pinpoint 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 (30 psig) air. Disassemble and remedy the problem, referring to the Troubleshooting Table as needed.

7. Subjective Breathing Test

In general, the properly overhauled and adjusted regulator, upon breathing in and out of the mouthpiece slowly and deeply 4 or 5 times, should deliver air to the user 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 the Troubleshooting Table for corrective guidelines and specific procedures. Also, conduct a purge flow test by depressing the purge button fully. An adequate volume of air should flow through the mouthpiece.

This concludes the reassembly and testing of the Arctic second-stage regulator.

XI. Authorized Regulator Adjustment and Testing (without Test Bench)

If a flow test bench is not available for testing the Arctic regulator, perform the following adjustment and testing procedures. In conjunction with this section, the technician should refer to Table 1, "Test Bench Specifications" on page 14.

A. Second-Stage Adjusting and Testing

1. After following the preliminary procedures in Section X, attach a spare intermediate-pressure hose (item 30) to one of the open low-pressure ports on the first-stage body.
2. Thread the intermediate test pressure gauge (PN 1116-10) onto the free end of the intermediate-pressure hose. Make sure that the bleeder valve of the test pressure gauge is open prior to pressurizing the regulator.

Before proceeding, read the following note that pertains to step 3.



NOTE: If the second-stage leaks when the regulator is pressurized, depress the purge button and adjust the crown by turning the In-line Adjustment Tool handwheel clockwise $\frac{1}{4}$ turn. Then release the purge. If the regulator still leaks, repeat as necessary. If adjusting the crown does not stop the leak, see Troubleshooting Table on page 15.

3. Connect the first-stage regulator to a fully charged SCUBA cylinder. Slowly pressurize the regulator to 3000 ± 100 psig. The intermediate test pressure gauge should indicate a "lockup" pressure of 135 ± 5 psig. Adjust the intermediate pressure if necessary.

Before proceeding, read the following caution that pertains to step 4.



CAUTION: Always depress the purge button when adjusting the crown (item 19) with the In-line Adjustment Tool. Failure to do so can cause damage to the disc (item 15), requiring its replacement. The In-line Adjustment Tool handwheel must be compressed to engage the split screwdriver head to the crown (item 19). See figure 14.

4. Once you have established the proper intermediate pressure of 135 ± 5 psig, depress the purge button while compressing the handwheel on the Adjustment Tool. Turn the Adjustment Tool handwheel counterclockwise $\frac{1}{4}$ turn, then release the purge button. If no air leak is detected, depress the purge button again and turn the Adjustment Tool handwheel counterclockwise $\frac{1}{4}$ turn and release the purge button. Repeat until an air leak is detected. Once an air leak is detected, depress the purge button and turn the Adjustment Tool handwheel clockwise just until the leak stops. Once the leak has stopped, turn the adjustment tool handwheel 30° to 45° clockwise. The second-stage has now been properly adjusted. Depressurize the regulator and remove the In-line Adjustment Tool. Next, thread the swivel end of the intermediate-pressure hose to the inlet of the second-stage regulator. Tighten the hose using an $\frac{1}{16}$ " torque wrench to 40 inch-pounds.
5. **Second-Stage Purge Flow Test**
 - a. With the regulator still attached to the SCUBA cylinder, re-pressurize the regulator. Fully depress the purge button. This should result in a moderate flow rate of air exiting the mouthpiece.
 - b. Repeat this procedure several times. Refer to the Troubleshooting Table to correct any air flow problems.
6. **Opening Effort Check**

Assuming there are no air-flow problems, check the opening effort.

Before proceeding, read the following caution that pertains to step a.



CAUTION: Do not allow water to enter the mouthpiece as the water will spray over the test area.

- a. While holding the mouthpiece or exhaust tee, slowly submerge the second stage regulator, box top facing downward and level, into a pan of clean water to a depth of about one inch above the diaphragm.
 - b. This submersion should cause the second-stage to leak, indicating an acceptable, but approximate, opening effort of one inch of water column.
7. **Leakage Test**

See page 11 for this procedure.
8. **Subjective Breathing**

See page 12 for this procedure.

This concludes the adjustment and testing procedures for the Arctic regulator.

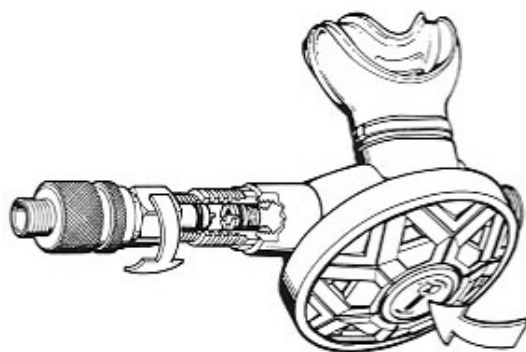


Figure 14

Table 1
Test Bench Specifications
Arctic Regulator

Test	Condition	Acceptable Range
Leak test	3500 or 3000±100 psig	No leaks allowed
Intermediate-pressure	3500 or 3000±100 psig	135±5 psig
Intermediate-pressure creep	3500 or 3000±100 psig	5 psig max between 5 to 15 seconds after cycling regulator (purge)
Opening effort	Supply pressure 135±5	+6 to 1.5 inch H ₂ O
Flow effort	135±5 psig inlet pressure at 15 SCFM	6 inches H ₂ O or less
Purge flow	Supply pressure 135±5	5.0 SCFM flow rate minimum

Table 2

Troubleshooting Guide

Arctic Regulator

Problem	Probable Cause	Recommendation
Leak or hissing sound from second-stage	<ol style="list-style-type: none"> 1. Intermediate-pressure set too high. Should be 135±5 psig. 2. Lever (item 7) set too high. 3. Purge button (item 23) jammed open. 4. Lever (item 7) bent. 5. Disc (item 15) dirty, damaged, or worn. 6. Retainer (item 16) dirty, damaged, or worn. 7. Crown (item 19) seating surface or O-ring groove dirty, damaged, or worn. 8. O-ring (item 18) dirty, damaged, or worn. 9. Spring (item 17) worn or weak. 	<ol style="list-style-type: none"> 1. See first-stage troubleshooting guide in SEA Service Manual (PN 7802-12). 2. Turn crown (item 19) clockwise to readjust lever. 3. Clean purge button (item 23) area. 4. Examine and/or replace lever (item 7). 5. Replace disc (item 15). 6. Clean and/or replace retainer (item 16). 7. Examine and clean, or replace crown (item 19). 8. Replace O-ring (item 18). 9. Replace spring (item 17).
Hard to breathe	<ol style="list-style-type: none"> 1. Intermediate-pressure set too low. Should be 135±5 psig. 2. Lever (item 7) set too low. 3. Lever (item 7) bent. 4. Retainer (item 16) not tightened to intermediate nut (item 12). 5. Intermediate nut (item 12) not tightened to sheath (item 9). 6. Ribbed plug (item 14) not tightened to box bottom (item 2). 7. Box top (item 24) not tightened to box bottom (item 2). 8. First-stage sintered filter (item 22 in SEA Service Manual) clogged. 9. Intermediate-pressure hose (item 30) clogged. 	<ol style="list-style-type: none"> 1. See first-stage troubleshooting guide in SEA Service Manual (PN 7802-12). 2. Turn crown (item 19) counterclockwise to readjust lever. 3. Replace lever (item 7). 4. Thread retainer (item 16) hand tight to intermediate nut (item 12). 5. Thread intermediate nut (item 12) hand tight to sheath (item 9). 6. Thread ribbed plug (item 14) to box bottom (22±3 inch-pounds). 7. Thread box top (item 24) hand tight to box bottom (item 2). 8. Check flow according to Table 1 and test procedures on page 11 in SEA Service Manual (PN 7802-12). If flow is too low, replace filter. 9. Clean or replace intermediate-pressure hose (item 30).
Low purge flow	<ol style="list-style-type: none"> 1. Lever (item 7) set too low. 2. Box top (item 24) not tightened to box bottom (item 2). 3. Purge button (item 23) jammed. 	<ol style="list-style-type: none"> 1. Turn crown (item 19) clockwise to adjust lever upward. 2. Thread box top (item 24) hand tight to box bottom (item 2). 3. Clean purge button (item 23) area.

Troubleshooting continued



Problem	Probable Cause	Recommendation
Water entering second-stage	1. Hole in mouthpiece (item 1).	1. Examine and/or replace mouthpiece (item 1).
	2. Hole in diaphragm (item 25).	2. Examine and/or replace diaphragm (item 25).
	3. Diaphragm (item 25) improperly seated between box bottom and thrust washer (items 2 & 26).	3. Disassemble and properly reassemble.
	4. Exhalation valve seat on box bottom (item 2) dirty, damaged, or worn.	4. Clean and/or replace box bottom (item 2).
	5. Hole in exhalation valve (item 4).	5. Replace exhalation valve (item 4).
	6. O-ring (item 13) dirty, damaged, or worn.	6. Replace O-ring (item 13).
	7. Cracked or damaged box bottom (item 2)	7. Examine and/or replace box bottom (item 2).
External air leaks	 NOTE: Immerse pressurized regulator in water to locate the source of the leak. If you detect leaks, depressurize system before tightening loose fittings, plugs, or hoses.	
	1. Intermediate-pressure hose (item 30) loose.	1. Tighten intermediate pressure hose.
	2. O-rings (items 21, 28 and/or 29), or O-ring sealing surface dirty, damaged, or worn.	2. Examine and/or replace O-rings (items 21, 28 & 29) or fittings.
	3. First-stage fittings too loose.	3. See first-stage SEA Service Manual (PN 7802-12).
 NOTE: This is only a partial list of possible failure modes. For solutions to problems not found in this troubleshooting guide, contact U.S. Divers Technical Services Department for assistance.		

Table 3

Recommended Lubricants and Cleaners

Arctic Regulator





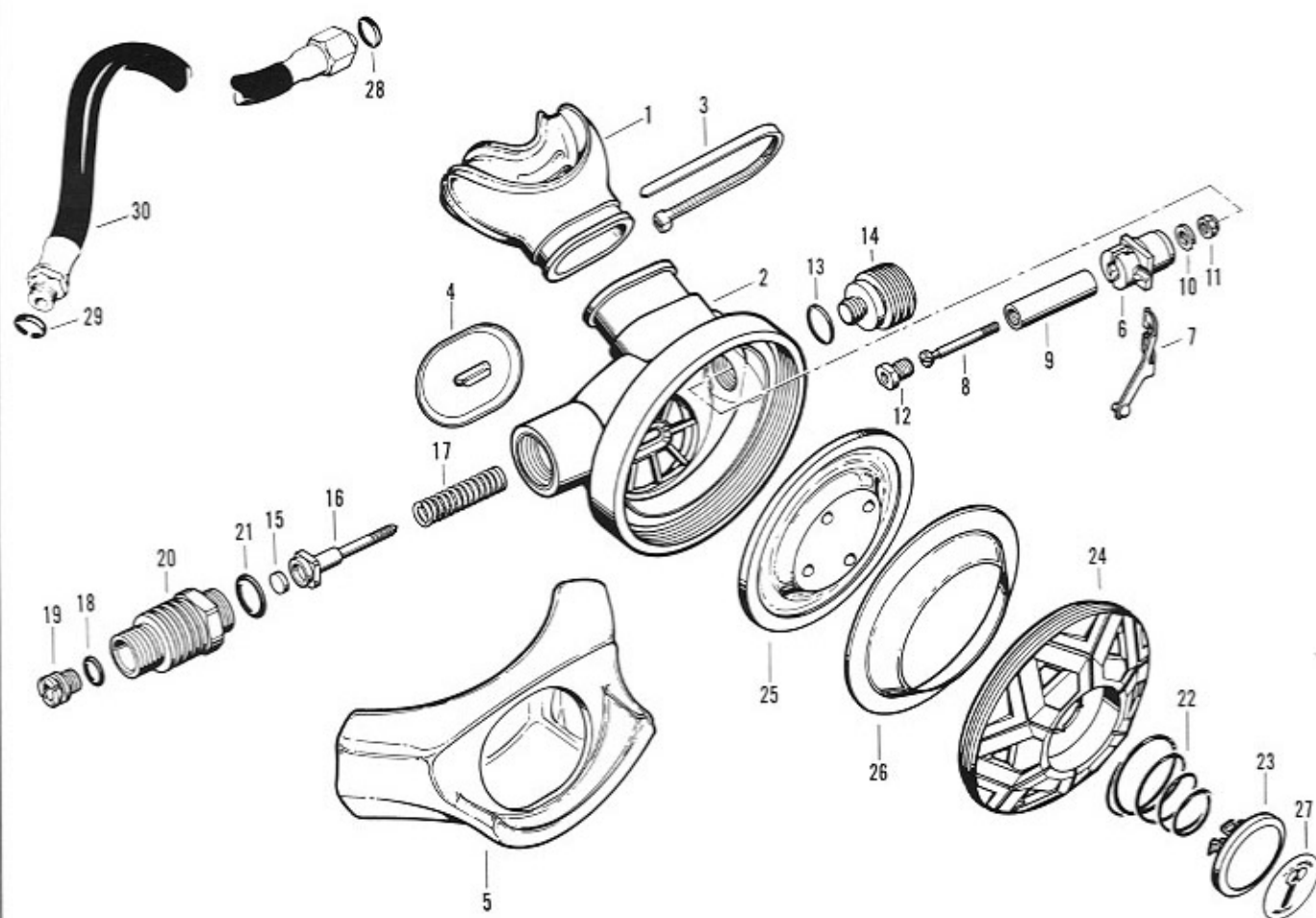
Lubricant	Application	Source(s)
Dow Corning 111 (Pure silicone grease)	All O-rings; threaded metal parts	U.S. Divers Co., PN 0501-16. Dow Corning Corporation P.O. Box 1767-T Midland, MI 48640 1-800-248-2481
 Note: When applying silicone grease, use only a light film. Also, application of spray lubricants is not recommended because (1) only a slight amount of silicone remains after the solvent evaporates, and (2) the aerosol propellant may adversely affect rubber and plastic components.		
Ultrasonic cleaning tank with ultrasonic detergent	Metal, reusable plastic and rubber parts	Various. List of suppliers available from U.S. Divers Technical Services Department
 Note: Use of an ultrasonic cleaning tank with an ultrasonic detergent is the preferred and recommended method of cleaning Aqua-Lung® regulator parts.		
Oakite #31	Brass and stainless steel parts.	Oakite Products, Inc. 50 Valley Road Berkeley Heights, NJ 07922
White distilled vinegar (100 gr.)	Brass and stainless steel parts	"Household" grade
 NOTE: Both Oakite #31 and vinegar are suitable for cleaning, especially heavy corrosion, verdigris and mineral deposits.		
Liquid dishwashing detergent	All reusable parts.	"Household" grade
Snoop	Leak testing.	Nupro Company 400 E. 345th Street Willoughby, OH 44094
 CAUTION: Do not expose plastic or rubber parts to solvents or caustic cleaning solutions. When using acidic solutions wear appropriate eye, hand and clothing protection. Keep baking soda readily available for neutralizing any spilled acidic solutions.		

Table 4
Torque Specifications
Arctic Regulator

Part Number	Description/Key Number	Torque Value
1094-96	Inlet fitting/20	55 inch-pounds
1094-97	Ribbed plug/14	22±3 inch-pounds
1022-36	Hose/30	40 inch-pounds

Table 5
Tool List
Arctic Regulator

Part Number	Description	Application
7803-00	Aqua-Lung® Service Manual (Includes this manual)	All Aqua-Lung Regulators
1019-40	Box Top Wrench	Box top
1094-48	Arctic 5.5mm Nut Driver	Lever support assembly
1094-46	Arctic In-line Adjustment Tool	Adjustable crown
1094-36	Seat Extractor	Adjustable crown
1094-44	Disc and Retainer Wrench	Disc and Retainer
	11/16 inch open end wrench	Hose end fitting
	19mm open end wrench	Inlet fitting
	7mm open end wrench	Intermediate nut
	5mm Allen wrench	Ribbed nut (heat exchanger)
	Small screwdriver (1016-84) screwdriver)	Connector rod
	Small padded jaw pliers	Sheath
	Wire cutters	Mouthpiece clamp
	Torque wrench - 0 to 120 inch-pounds	Inlet fitting; Ribbed nut



Item	Part Number	Description	Qty.
1	1058-85	Mouthpiece	1
2	1094-79	Box bottom	1
3	1049-13	Clamp	1
4	1082-77	Exhalation valve	1
5	1082-56	Exhaust tee	1
6	1094-53	Lever support	1
7	1094-55	Lever	1
8	1094-56	Connector rod	1
9	1094-93	Sheath	1
10	1067-46	Washer	1
11	1067-22	Locknut	1
12	1094-92	Intermediate nut	1
13	8200-45	O-ring	1
14	1094-97	Ribbed plug	1
15	1067-38	Disc	1

Item	Part Number	Description	Qty.
16	1094-68	Retainer	1
17	1067-08	Spring	1
18	8200-10	O-ring	1
19	1094-94	Crown	1
20	1094-96	Inlet fitting	1
21	8200-14	O-ring	1
22	1067-39	Spring, Purge button	1
23	1067-29	Purge button	1
24	1094-86	Box top	1
25	1016-32	Diaphragm	1
26	1094-97	Thrust washer	1
27	1094-84	Decal	1
28	9573-10	O-ring	1
29	9570-25	O-ring	1
30	1020-35	Hose	1