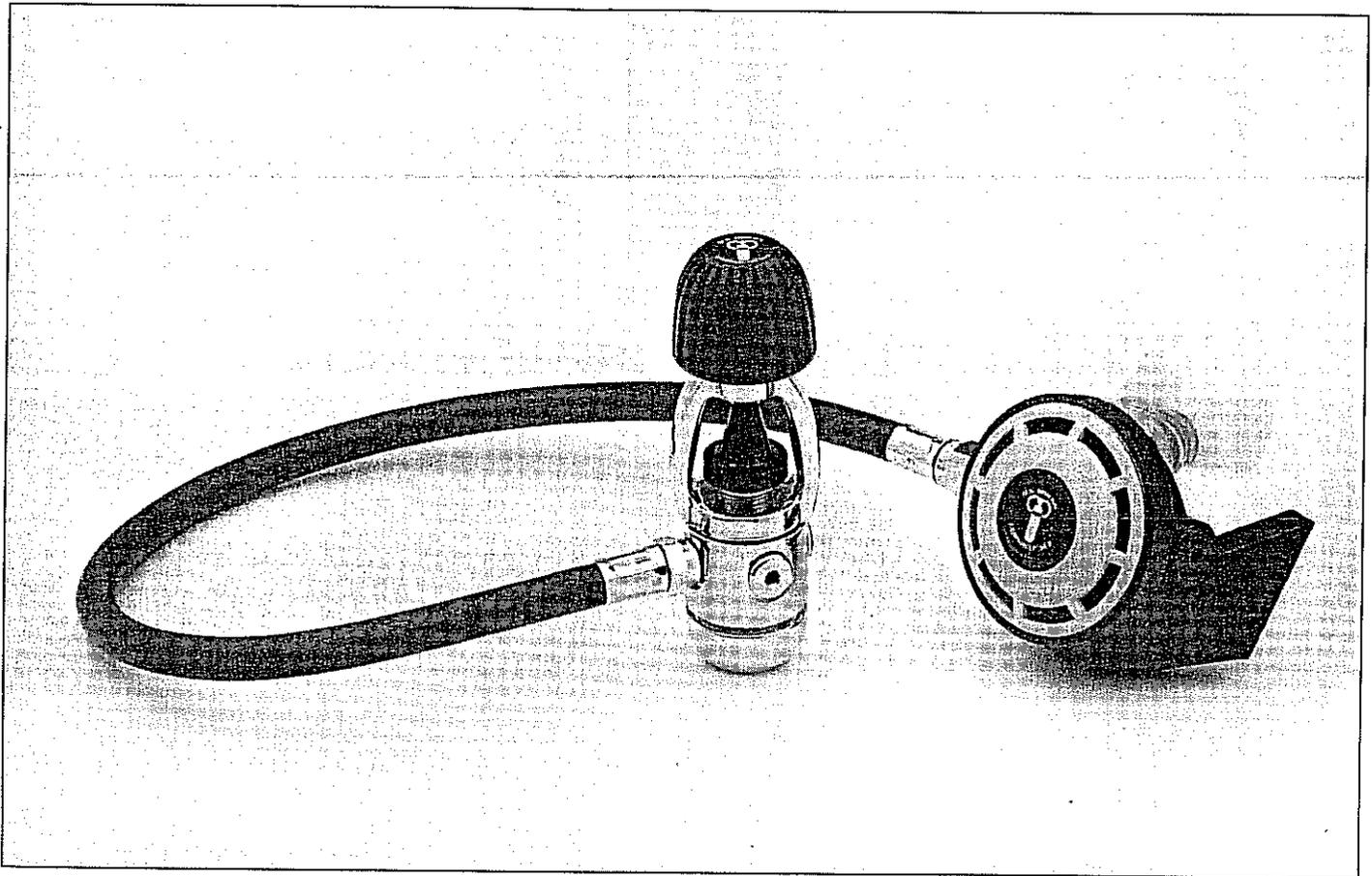


# CONSHELF S.E. SERIES REGULATOR SERVICE MANUAL



## I. INTRODUCTION

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

## II. SAFETY PRECAUTIONS

CAUTIONS and NOTES used in this manual have the following significance.

### CAUTION

Maintenance techniques that will result in damage to parts if not carefully followed.

### NOTE

Maintenance techniques that are considered important enough to emphasize.

## III. GENERAL (PREVENTATIVE) MAINTENANCE

Providing the best possible preventative routine maintenance before and after dives will help to ensure the maximum life of the Consheff S.E. 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."

(Refer customer to the U.S. Divers® Aqua-Lung Regulator Owner's Manual, P/N 1019-97.)

1. After each day of diving, the regulator must be cleaned, inspected, and prepared for the next use or for storage. As soon as the regulator is removed from the SCUBA cylinder(s), install the dust cap (Item 26) over the regulator first-stage inlet port. This cap is normally attached to the regulator yoke (Item 22) and therefore has been underwater. Blow all the water out of the cap first. Failure to do this results in water entering into the first-stage, causing corrosion. Also make sure the O-ring (Item 25) 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.
2. There are two methods of routinely cleaning the Consheff S.E. Series Regulators after each dive. The first (preferred) method is the "pressurized" procedure.
  - a. Remove the dust cap (Item 26). Attach the regulator to a charged SCUBA cylinder.
  - b. Open the cylinder valve slowly to pressurize the regulator.

# CONSHelf S.E. SERIES REGULATORS

- c. Soak the regulator with fresh warm (not over 120°F) tap water to remove salt and mineral deposits, directing water into the mainspring cavity of the first-stage regulator (Item 12) and into the second-stage mouthpiece (Item 39). Also depress the purge button (Item 47) 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.

## NOTE

Soaking regulator parts in warm water will remove more salt and mineral deposits than will conventional rinsing. In cleaning the Conshelf S.E.S. (Supreme Model), a warm water soaking of the mainspring cavity cannot be performed, as this area has been filled with a silicone fluid and sealed with a secondary diaphragm (Item 48). Simply soak entire exterior of the first stage thoroughly, and proceed as above when cleaning the second stage.

- 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 it, lay the regulator flat on a clean towel, away from direct sunlight.
3. 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 allowing water to enter only the mainspring cavity (Supreme Model see NOTE above).
    - 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 the first stage. Blow out excess water from the second stage after soaking.
    - c. To air dry it, lay the regulator flat on a clean towel away from direct sunlight.
  4. After air drying, the regulator should be stored as follows:
    - a. Store in a clean equipment box or, as an alternative, seal inside a plastic bag.
    - b. It is 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.

## CAUTION

Never store the regulator while still connected to the 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 hose; such abuse will eventually damage the regulator or the cylinder valve.

DO NOT loosen or remove the secondary-diaphragm retaining ring (Item 49) or the secondary diaphragm (Item 48) from the first stage of the Conshelf S.E.S. (Supreme Model), because this will result in loss of silicone fluid, making the regulator unfit for cold water use.

## 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. Have your regulator cleaned and adjusted frequently at a competent service facility. The frequency will depend upon the amount of use given the regulator and the conditions of use. However, U.S. Divers® requires inspection, overhaul and scheduled parts replacement at least once a year in order to comply with the Limited Lifetime Warranty for the Conshelf S.E. Regulator Series. Frequent use, however, in comparatively clean, fresh water environments might require cleaning and an overhaul every six months. Use of rental equipment and/or in salt, chlorinated (swimming pool), or polluted water might require cleaning and overhaul of the regulator every three to six months. Remember that chlorinated water is an especially bad environment for regulators because the chlorine chemically deteriorates the neoprene-rubber components.
3. Regularly inspect the sintered filter (Item 20) 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 nonreusable 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 internally inspected and cleaned or hydrostatically tested as required.
4. No other adjustment or maintenance of your regulator is recommended by U.S. Divers. For such adjustments 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 Conshelf S.E.(S) Regulator often — your personal safety and the mechanical integrity of your regulator depend on it

## CONSHOLF S.E. SERIES REGULATORS

### IV. AUTHORIZED REGULATOR DISASSEMBLY

#### A. GENERAL CONSIDERATIONS

1. This section presents step-by-step disassembly procedures for the Consholf S.E. 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 Replacement Parts Listing in Section VII Table 3 — Recommended Lubricants and Cleaners, and Table 5 — Recommended Tool List.
2. Disassembly of the Consholf S.E. Regulator Series 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. Prior to disassembly of the Consholf S.E.(S), a pretest is recommended. By following the test described in Section IX or Table 1 — Testing Procedures and making reference to the Troubleshooting Table 2, pages 17 through 18, you will be able to determine the need for parts replacement.

#### B. FIRST-STAGE DISASSEMBLY (REMOVAL OF HOSES)

1. Using a 11/16-inch open-end wrench, turn the wrench counterclockwise and remove the intermediate-pressure hose (Item 46) from the first-stage body (Item 1). Also remove the high-pressure gauge hose with a 5/8-inch open-end wrench and, if present, the low-pressure inflator hose with a 1/2-inch open-end wrench.
2. While holding the inlet fitting (Item 36) with a 3/4-inch 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 46).
3. Remove and discard the O-rings (Items 44 and 45) from the intermediate-pressure hose.
4. If the low-pressure inflator hose, Octopus Regulator intermediate-pressure hose, or the high-pressure hose of the pressure gauge, requires the use of the special LP. or HP. adapters (Items 52 and 53), remove the adapter(s) by turning them counterclockwise, using a 11/16-inch wrench. Remove and discard the adapter O-rings (Items 2 and 4).
5. Remove and discard all O-rings attached to the hoses of the Octopus Regulator (Item 44 and 45) and those of the low-pressure inflator and/or the high-pressure hose of the pressure gauge.

### FIRST-STAGE DISASSEMBLY

#### C. LOW-PRESSURE SIDE

#### CAUTION

NEVER attempt to secure the first-stage body by direct clamping in a vise. This will result in damage to the regulator body requiring replacement of this part.

#### CAUTION

Empty CO<sub>2</sub> cartridge used for vise mounting should not be an old rusty cartridge from a Buoyancy Control Device. A new cartridge should be placed in a CO<sub>2</sub> firing mechanism and discharged. The adapter (Item 52) should be threaded to the cartridge. The cartridge/adapter should be set aside and used for regulator repair only. Glueing the adapter to the CO<sub>2</sub> cartridge is recommended.

## CONSHOLF S.E. SERIES REGULATORS

6. Screw an empty CO<sub>2</sub> cartridge clockwise into a low-pressure adapter (Item 52). Then screw the adapter and cartridge clockwise into one of the low-pressure ports on the first-stage body (Item 1). Mount the first-stage body in a bench vise, main-spring side facing upward, by means of the CO<sub>2</sub> cartridge. (See Figure 1).
7. Using a large flat-bladed screwdriver, place the blade in the slot on the adjustment screw (Item 12). Turn the screwdriver counterclockwise and remove the adjustment screw. Lift out the mainspring (Item 11). For the Consholf S.E.S. (Supreme Model): Using the slotted tool (U.S.D. P/N O812-45), provided with the environmental conversion kit (U.S.D. P/N 1088-50), turn the tool counterclockwise to remove the secondary diaphragm retaining ring (Item 49). Next, using your fingertips, lift upward on the secondary diaphragm (Item 48) and remove it. Remove the first-stage from the bench vise and pour out and discard the silicone fluid. Finally, remount the first stage in the vise again in its former orientation to complete disassembly of the low-pressure side. Remove the adjustment screw and mainspring (Items 12 and 11) as described above.
8. With a 1-3/8-inch "crow's foot" and breaker bar, turn the wrench counterclockwise and remove the spring retainer (Item 10). Lift out the spring pad (Item 9) and the thrust washer (Item 8).

### CAUTION

DO NOT attempt to "pry" the diaphragm out of the first stage, as the diaphragm seating shoulders in the first stage will be scratched, requiring replacement of the body (Item 1).

9. Secure the dust cap (Item 26) in place by means of the yoke screw (Item 24). Using the low-pressure filtered air directed down through a low-pressure port on the first-stage body (Item 1), blow out the primary diaphragm (Item 7). (See Figure 2). Discard the used diaphragm. (SEE NOTE A →)
10. Remove the first-stage from the bench vise. Lift out the pin pad (Item 6) and the pin (Item 17).

This concludes the disassembly of the Low-Pressure Side of the First-Stage Regulator.

## FIRST-STAGE DISASSEMBLY

### D. HIGH-PRESSURE SIDE

11. Mount the first-stage with the yoke screw facing up in the bench vise by means of the CO<sub>2</sub> cartridge.
12. Unscrew the yoke screw (Item 24) counterclockwise and remove it from the yoke (Item 22).
13. Disengage and remove the dust cap (Item 26). Remove and discard the O-ring (Item 25).
14. Using external retaining ring pliers, remove the yoke retaining ring (Item 23) from the groove on high-pressure inlet boss of the first-stage body. Then, turning the yoke counterclockwise, unscrew and remove it from the first stage.

### CAUTION

The retaining ring (Item 21) must be removed carefully as the components beneath it are under spring tension. Failure to place finger over the sintered filter (Item 20) while removing the retaining ring will cause loss or damage of these parts. (See Figure 3)

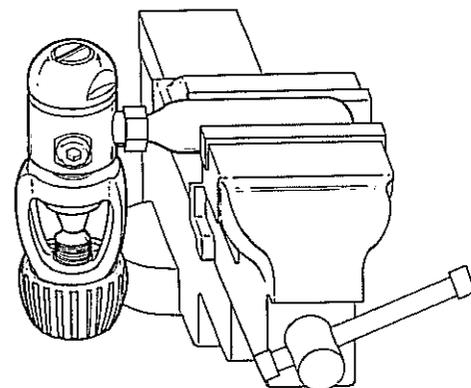


FIGURE 1

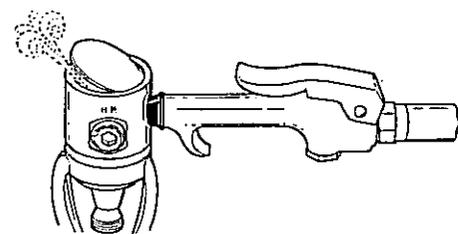


FIGURE 2

### NOTE A

Depending on how firmly the diaphragm is retained on its supporting "seat", the low-pressure port plugs (Item 3) may have to be in place when using low-pressure filtered air to blow out the primary diaphragm.

## CONSHSELF S.E. SERIES REGULATORS

15. With internal retaining-ring pliers, remove the retaining ring (Item 21) from the high-pressure inlet boss. Discard the used retaining ring.
16. The sintered filter (Item 20) will pop out with the retaining ring. Remove and discard the sintered filter.
17. Lift out the spring (Item 19), spring block (Item 15), high-pressure seat spring (Item 18), and the high-pressure seat (Item 16). Discard the used seat.

**CAUTION**

Use **EXTREME** care when removing O-rings from grooves. Even a small scratch across an O-ring sealing surface will result in leakage. Once an O-ring sealing surface has been damaged, the part must be replaced.

18. Located inside the spring block (Item 15) is an O-ring and backup ring (Items 14 and 13). Remove and discard both the O-ring and backup ring.
19. Remove the first-stage body from the vise. Remove the CO<sub>2</sub> cartridge and adapter from the body by turning the adapter counterclockwise.
20. Using a 3/16-inch Allen wrench unscrew any remaining low-pressure port plugs (Item 3). Remove and discard the port-plug O-rings (Item 2).

This concludes the disassembly of the Conshelf S.E. First-Stage Regulator.

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### E. SECOND STAGE DISASSEMBLY

21. Using the box-top wrench (U.S.D. P/N 1021-40), unscrew the box top (Item 43) counterclockwise and remove it.

**CAUTION**

The purge button (Item 47) does not usually need to be removed during normal servicing. Without special care removal of the purge button can result in a fracture of one or more of the four purge-buttons' retaining arms. This would require replacement of the purge button.

22. Carefully lift out the thrust washer (Item 42) and the diaphragm (Item 41).

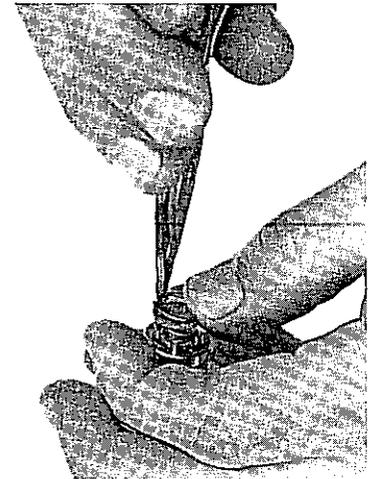
**CAUTION**

During removal of the inlet fitting (Item 36) depress the lever (Item 34). Failure to keep the lever depressed could cause damage to the disc (Item 27) sealing surface.

23. With the lever depressed, use a 3/4-inch wrench to unscrew counterclockwise and remove the inlet fitting (Item 36). Remove and discard the inlet-fitting external O-ring (Item 35).
24. With a 3/16-inch Allen wrench remove the port plug (Item 51) by turning the wrench counterclockwise. Remove and discard the O-ring (Item 50) from the plug.

**CAUTION**

The disc and retainer assembly (Item 27 and 28) is under spring tension. Care should be taken when removing these parts. This will help prevent damage or loss of parts.



**FIGURE 3**

# CONSHOLF S.E. SERIES REGULATORS

25. Fit the disc and retainer wrench (U.S.D. P/N 1100-05) over the disc end of the retainer (Item 28). Then, while holding the locknut (Item 33) with the 1/4-inch nut driver portion of the lever height adjustment tool (U.S.D. P/N 1016-84), through the port-plug hole in the box bottom (Item 30), turn the nut driver counterclockwise and remove the locknut (Item 33). Discard the used locknut.
26. Remove the spacer (Item 32), lever (Item 34) and washer (Item 31) from inside the box bottom.
27. Next, remove the retainer (Item 28) and the spring (Item 29) from the inlet boss of the box bottom. Discard the used disc (Item 27) that is located in the larger end of the retainer.
28. Snip the plastic mouthpiece clamp (Item 40) with pliers or, with care, use wirecutters and remove it. Next, pull off the mouthpiece (Item 39).
29. Pull off the exhaust tee (Item 38) from the box bottom.
30. Snip off the "stem" of the exhalation valve (Item 37) from inside the box bottom. Remove and discard the used valve.

This concludes the disassembly of the Consholf S.E. Second Stage Regulator.

## V. REGULATOR PARTS CLEANING (SEE NOTE B →)

### 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 plastics 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 VII). The other rubber and plastic parts: diaphragm, mouthpiece, exhaust tube, box top, box bottom, port plug, and dust cap, 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. (SEE NOTE C →)

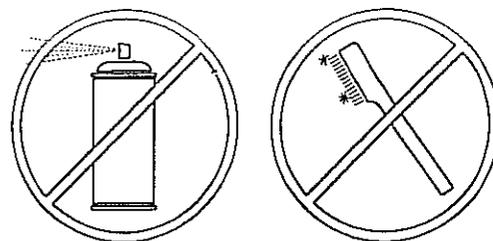
- B. After disassembly, all metallic parts should be given a preliminary cleaning in a warm detergent/water solution. A soft nylon bristle brush may be used if mineral encrustation or corrosion is present. DO NOT use a wire brush! Expendable parts such as the sintered filter (Item 20), retaining ring (Item 21) and the second-stage locknut (Item 33) should be replaced and need not 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 plate parts. After completion of ultrasonic cleaning, all metal parts should be removed, rinsed thoroughly with clean fresh water and blown dry with low-pressure (30 psig) air. Only brass, plated brass, and stainless steel parts should be immersed in acid cleaning solution such as Oaktite # 31.

### NOTE B

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



### NOTE C

The retainer (Item 28) and the inlet fitting (Item 36) should be cleaned 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 Oaktite #31 is used in the ultrasonic cleaner, 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 of acetic acid to one part water.

## CONSHSELF S.E. SERIES REGULATORS

- C. If no ultrasonic cleaner is readily available, then the following, less preferred, chemical procedure for cleaning can be used. First, remove any loose adherent material or flaking, using a soft bristle brush. Place metal parts in a recommended acid bath solution (for example, Oaktite #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.

### VI. REGULATOR PARTS INSPECTION

#### A. GENERAL PROCEDURES

1. All soft seal and nonreusable components in the Conshself S.E. Regulator will be 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 moulding flaws, before installation.
3. All reusable metal components must be thoroughly inspected visually 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, reciporating 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.

#### B. SPECIFIC PROCEDURES

##### FIRST-STAGE ASSEMBLY

9. The high-pressure seat (Item 16) should be replaced during standard annual cleaning and overhaul. Any "wrinkling", "fissuring", "cratering," or other forms of rubber fatigue involving the soft sealing area may result in a first-stage high-pressure leak.
10. Check the machined seating orifice in the first-stage body (Item 1) for evidence of nicks, scratches, excessive wear, or other damage. Replace the body if necessary.
11. The primary diaphragm (Item 7) must be replaced during standard annual cleaning and overhaul.
12. Check the first-stage body for serious dents or nicks. Also inspect the yoke (Item 22) for distortion, bending, and damaged or worn threads. Replace if necessary.

(SEE NOTE D ———>)

##### SECOND-STAGE ASSEMBLY

13. The retainer (Item 28) should be inspected for nicks, pitting, scratches, defective plating, or excessive wear of the screwdriver slot on the threaded end. The through hole located on the seating face of the retainer should be clear and free of debris. Replace if necessary.
14. Examine the retainer orifice seat on the inlet fitting (Item 36) for nicks, pitting, scratches, or defective plating. Replace if necessary.
15. Check the demand lever (Item 34) for bending, distortion, or excessive wear of the nylon button. Replace lever if necessary.

#### NOTE D

For the Conshself S.E.S.: Both the primary and secondary first-stage diaphragms (Items 7 and 48) must be replaced during standard annual cleaning and overhaul. Any cuts, nicks, holes, or combination of mechanical damage and/or chemical deterioration may result in air leakage between regular servicing requiring diaphragm replacement. Also replacement of the silicone fluid is required. Do not try and salvage old silicone fluid for reuse.

## CONSHelf S.E. SERIES REGULATORS

16. Inspect the second-stage diaphragm (Item 41) for cuts, nicks, pinholes, or other evidence of mechanical damage. Check the condition of the rubber itself 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 diaphragm if necessary.
17. Inspect thoroughly the second-stage hose (Item 46) for any signs of general deterioration of the rubber, including crazing or superficial cracking, shrinkage or hardening. Insure that 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 end of the inlet fitting for either stripped or damaged threads. Maximum service time for rental hoses is one year; inspect your personal second-stage hose after each dive. Replace the second-stage hose if necessary.
18. Inspect both low-pressure inflator and high-pressure gauge hoses for crazing or superficial cracking, shrinkage, hardening, and any other signs of general deterioration. Also, check the end fittings for any damage or leakage. Replace hose(s) if necessary.
19. Finally, refer to the Troubleshooting Table for additional problem areas — their causes and recommendations for cleaning and replacement.

## VII. ROUTINE PARTS REPLACEMENT SCHEDULE CONSHelf S.E./S.E.S. REGULATOR SERIES

| Part No. | Description         | Item No. | Qty. Needed |
|----------|---------------------|----------|-------------|
| 9570-25  | O-ring              | 2        | 3           |
| 9570-04  | O-ring              | 4        | 1           |
| 1000-29  | Primary Diaphragm   | 7        | 1           |
| 8280-05  | Backup Ring         | 13       | 1           |
| 8200-06  | O-ring              | 14       | 1           |
| 1053-20  | High-Pressure Seat  | 16       | 1           |
| 1051-06  | Sintered Filter     | 20       | 1           |
| 8630-51  | Retaining Ring      | 21       | 1           |
| 8201-20  | O-ring              | 25       | 1           |
| 1085-10  | Disc                | 27       | 1           |
| 1025-10  | Locknut             | 33       | 1           |
| 1051-39  | Exhaust Valve       | 37       | 1           |
| 1049-40  | Mouthpiece Clamp    | 40       | 1           |
| 8200-14  | O-ring              | 35       | 1           |
| 9570-25  | O-ring              | 44       | 1           |
| 9573-10  | O-ring              | 45       | 1           |
| 9570-25  | O-ring              | 50       | 1           |
| 1088-53* | Secondary Diaphragm | 48       | 1           |
| 1088-55* | Silicone Fluid      |          | 1           |

\*Used only on the Conshelf S.E.S.

### NOTE

U.S. Divers recommends that parts listed under "Routine Parts Replacement Schedule" be replaced every year for regulators used exclusively for recreational diving.

### NOTE

Check for any severe corrosion or pitting of the mainspring; replace only if required.

### NOTE

Second-stage diaphragm need only be replaced only if damaged or if signs of age or chemically-induced deterioration are seen.

# CONSHELF S.E. SERIES REGULATORS

(SEE NOTE E →)

## VIII. AUTHORIZED REGULATOR REASSEMBLY

This subsection presents a detailed, step-by-step reassembly procedure for the Conshelf S.E. and S.E.S. Regulator Series. Unless noted otherwise, this procedure applies to both the Conshelf S.E. and S.E.S. models. Specific references for the Conshelf S.E.S. are indicated when necessary. It is important that the sequence be followed exactly in the order given.

### A. PRELIMINARY PROCEDURES

1. Screw an empty CO<sub>2</sub> cartridge, clockwise into a low-pressure adapter (Item 52). Then screw the adapter and cartridge clockwise into one of the low-pressure ports on the first-stage body (Item 1). Mount the first-stage body in a bench vise, main-spring side facing upward, by means of the CO<sub>2</sub> cartridge. (See Figure 4)
2. Lightly lubricate two of the O-rings (Item 2) and place them on the two low-pressure port plugs (Item 3).
3. Lightly lubricate the O-ring (Item 4) and install it on the high-pressure port plug (Item 5).
4. Install one of the two low-pressure port plugs (Item 3) and the one high-pressure port plug (Item 5) clockwise using a 3/16-inch Allen wrench attached to a torque wrench to 40 inch-pounds into the first-stage body (Item 1). (SEE NOTE F →)

### B. LOW PRESSURE SIDE

5. Insert the pin support (Item 6) into the center hole of the first-stage body.
6. Install a new primary diaphragm (Item 7) into the the first-stage body over the pin support by pushing its edges down into the supporting "seat" of the body. This procedure can be completed by hand, or, if necessary, with the aid of a non-metallic flat-ended tool. The edges of the diaphragm should be evenly and firmly positioned in the support "seat". (SEE NOTE G →)
7. Place the gasket (Item 8) and, then, the spring pad (Item 9) on the diaphragm. Place the spring retainer (Item 10) over these two components and screw it clockwise completely onto the first-stage body to a torque of 25 foot-pounds using a 1-3/8 inch torque wrench.
8. Insert the mainspring (Item 11) into the spring retainer ensuring that the mainspring is centered over the spring pad, and then place the adjustment screw (Item 12) over the protruding end of the mainspring.
9. Next, using a large flat-bladed screwdriver, turn the adjustment screw counterclockwise until it is flush with the end of the spring retainer. (See Figure 5). For the Conshelf S.E.S., the adjustment screw should be turned clockwise until it is flush with the secondary diaphragm supporting shoulder (See Figure 6). For the Conshelf S.E.S. Remember that a new supply of silicone fluid will be poured into the spring retainer (Item 10) after the intermediate pressure adjustment is completed. After the procedure is finished, a new secondary diaphragm (Item 48) and the secondary-diaphragm retaining ring (Item 49) will be reinstalled. Refer to Subsection IX on First-Stage Adjustment if necessary.
10. Now remove the first-stage body from the vise, then remove the empty CO<sub>2</sub> cartridge from the low-pressure port. Set the cartridges aside.

### C. HIGH PRESSURE SIDE

11. Install a new backup ring (Item 13) and lightly lubricated O-ring (Item 14), in this order, into the open end of the spring block (Item 15). Set this assembly aside.

#### NOTE E

All O-rings, except Item 25, should be lightly lubricated with silicone lubricant during reassembly.

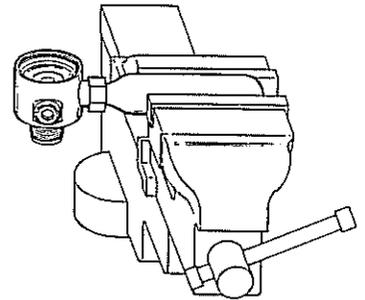


FIGURE 4

#### NOTE F

Do not install remaining low-pressure port plug (Item 3). Set it aside for later installation. Leave the other two low-pressure ports open for connection to a test bench or intermediate-pressure test gauge (U.S.D. P/N 1116-10), and a second-stage hose during subsequent regulator adjustment and testing.

#### NOTE G

If the primary diaphragm (Item 7) displays a rough and smooth side, place the smooth side down against the pin pad.

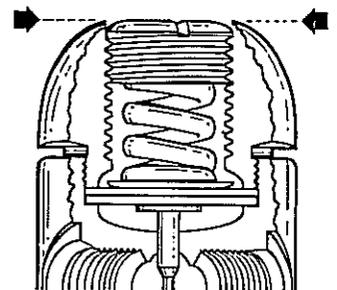


FIGURE 5

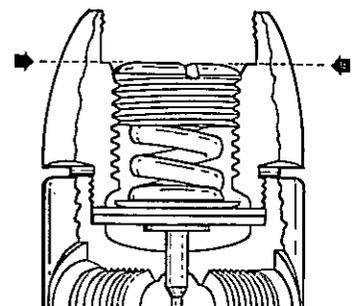


FIGURE 6

**CONSHOLF S.E. SERIES REGULATORS****CAUTION**

Use care when inserting the pin into the first-stage body; do not allow the pin to contact the machined seating orifice of the first-stage body.

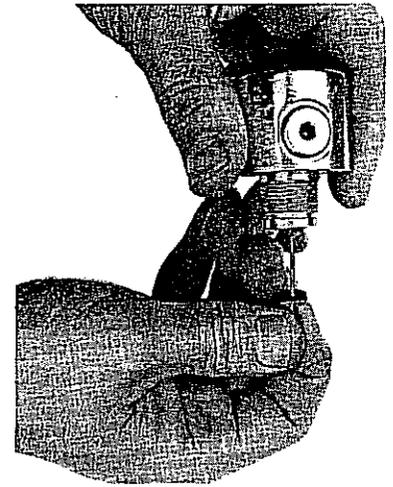
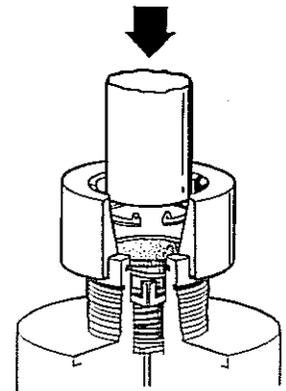
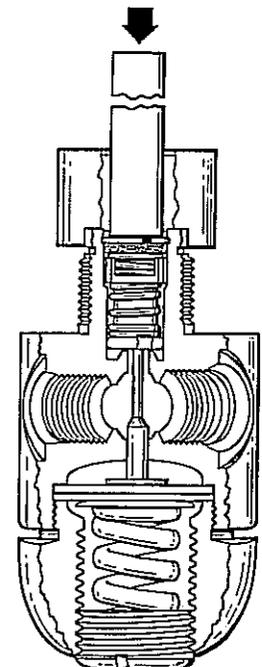
12. While holding the small end of the new high-pressure seat (Item 16) in one hand, insert the end of the pin (Item 17) into the center of the seat. Then carefully insert this subassembly up into the center hole of the first-stage body. (See Figure 7.) Gently "wiggle" this subassembly, if necessary, during this procedure to ensure that the end of the pin is completely seated in the pin support (Item 6).
13. While holding the high-pressure seat and pin assembly in place with one finger, turn the first-stage body over so that it's threaded inlet boss is facing upward.
14. Insert the seat spring (Item 18), spring block assembly (Item 15) and spring (Item 19) into the inlet boss of the first-stage body.
15. Place the special high-pressure block guide (U.S.D. P/N 1110-00), recessed end downward, over the tip of the inlet boss of the first-stage body. Next, drop a new sintered filler (Item 20) with rough side facing upward into the spring block guide. Place a new retaining ring (Item 21), flat side upward, on top of the sintered filler. (See Figure 8).
16. While holding the block guide, with the retaining ring centered over the hole and on top of the filler, apply sufficient pressure downward against the retaining ring, using a 1/2-inch flat-end wood dowel (see Figure 9), to force the retaining ring through the guide until it fully "locks" in its own groove in the inlet boss. At this point, the seat spring, spring block, spring, and sintered filler should be correctly positioned and "locked" in the boss. Check this positioning carefully before proceeding.
17. Next, completely thread the yoke (Item 22) clockwise onto the inlet boss of the first-stage body, then secure by installing the yoke retaining ring (Item 23) flat side facing upwards on the inlet boss using external snap-ring pliers.
18. Lightly lubricate the threads of the yoke screw (Item 24) with D.C. III. Reinstall the yoke screw (Item 24) by turning it clockwise into the yoke (Item 22).
19. Install O-ring (Item 25), unlubricated, into the dust cap (Item 26) to complete the dust-cap assembly.
20. Wrap the nylon cord, tied to the dust cap, around one leg of the yoke and pass the cap through the loop formed, creating a "loose" knot.

This concludes the reassembly of the Consholf SE First-Stage Regulator. Testing of the First-Stage Regulator will follow reassembly of the second-stage regulator.

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**D. SECOND STAGE REASSEMBLY**

21. Insert the new disc (Item 27) into the bore provided for it on the retainer (Item 28).
22. Position the spring (Item 29) over the stem of the retainer (Item 28).
23. Fit the disc and retainer with its spring onto the special disc and retainer wrench (U.S.D. P/N 1100-05), and carefully insert into the second-stage box bottom (Item 30).

**FIGURE 7****FIGURE 8****FIGURE 9**

**CONSHSELF S.E. SERIES REGULATORS**

24. Push inward on the wrench and hold momentarily so that the threaded stem of the retainer protrudes into the interior of the box bottom.
25. Immediately place the washer (Item 31), radiused end up, spacer (Item 32), and a new locknut (Item 33) onto the retainer. Turn the locknut clockwise until first threads are engaged.
26. Still pushing inward on the wrench, compressing the spring, insert the lever (Item 34) between the spacer and the washer (See Figure 10). Assure that the lever is properly aligned in its groove on the box bottom.
27. Holding the locknut with the 1/4-inch nut-driver portion of the lever-height adjustment tool (U.S.D. P/N 1016-84) inserted through the port-plug opening on the box bottom, turn the nut driver clockwise until about three threads of the retainer are visible beyond the head of the locknut. Remove the disc and retainer wrench and nut driver from the box bottom.
28. Next, lightly lubricate the O-ring (Item 35) and place it on the inlet fitting (Item 36), to avoid marring the surface of the disc seat (Item 27), depress the lever and screw the inlet fitting (Item 36) clockwise into the inlet boss of the box bottom using a 3/4-inch torque wrench, tighten the inlet fitting to a torque of 40-inch pounds.
29. If there is excessive "free play" or "flop" in the lever, place the 1/4-inch nut-driver portion of the lever-height adjustment tool (U.S.D. P/N 1016-84) through the port plug opening in the box bottom, and over the locknut (Item 33). Next insert the screwdriver portion of the lever height adjustment tool down through the hollow bore in the nut driver until it engages with the slot on the end of the retainer (Item 28) (See Figure 11.) While holding the screwdriver steady, turn the nut driver clockwise. Adjust only far enough to eliminate excessive "freeplay" or "flop" of the lever.
30. Insert the new exhalation valve (Item 37) into the box bottom (Item 30) and pull on the stem of the valve until its barb passes through the hole into the box bottom. Using the wire cutters, trim the stem end of the valve 1/8" to 1/4" above the barb.
31. Reinstall the exhaust tee (Item 38), by stretching it over the flange of the box bottom.
32. Fit the mouthpiece (Item 39) onto the box bottom, and fasten the mouthpiece in place with a new mouthpiece clamp (Item 40). The lock tab on the mouthpiece clamp should be aligned with the air-inlet boss of the box bottom. (See Figure 12). Tighten with pliers and snip the extra length with wire cutters.
33. Position the second-stage diaphragm (Item 41) on its shoulder in the box bottom. Ensure that the diaphragm is situated on the box bottom so that the two rubber tabs protruding through the metal plate of the diaphragm straddle the lever without interference. (See Figure 13.) Place the thrust washer (Item 42) over the diaphragm.
34. Screw the box top assembly (Item 43) clockwise into the box bottom. Using the box-top wrench tool (U.S.D. P/N 1021-40), tighten the box top firmly handtight.

(SEE NOTE H →)

This concludes the reassembly procedures of the Conshself S.E. Series Second-Stage Regulator.

.....



FIGURE 10

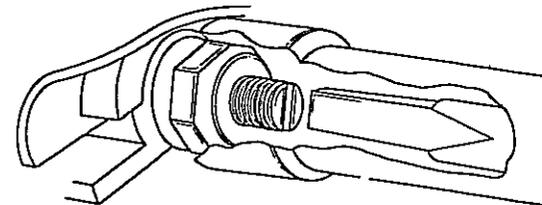


FIGURE 11

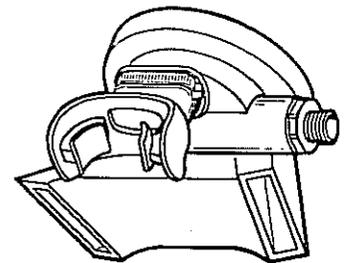


FIGURE 12

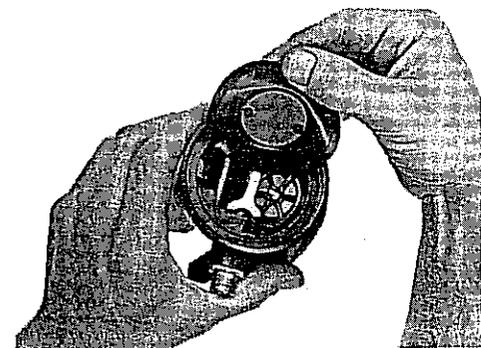


FIGURE 13

**NOTE H**

Do not reinstall the port-plug assembly (Item 51) until final adjustment of second-stage assembly is completed.

**CONSHOLF S.E. SERIES REGULATORS****IX. AUTHORIZED REGULATOR ADJUSTMENT AND TESTING**

(SEE NOTE I →)

**A. PRELIMINARY PROCEDURES****ATTACHMENT OF FIRST-STAGE TO SECOND-STAGE REGULATORS**

1. Install the two lubricated O-rings (Items 44 and 45) on the intermediate-pressure hose (Item 46).
2. Attach the hose (Item 46) to one of the low-pressure ports on the first-stage body (Item 1) using a 11/16-inch torque wrench. Tighten the hose clockwise to a torque of 40-inch pounds.  
(SEE NOTE J →)
3. Connect the first-stage regulator to a source of low-pressure (500 psig) breathing air. While firmly holding the free end(s) of the second-stage hose(s), carefully open the air source control valve allowing a small quantity of air to flow through the open hose(s). This will flush any dust or debris from the interior of the hose(s).
4. Close the air source control valve and attach the second-stage regulator(s) to the free end of the second-stage hose(s). While holding the inlet fitting (Item 36) with a 3/4-inch wrench, use an 11/16-inch torque wrench to tighten the swivel nut clockwise to a torque of 40-inch pounds.

**B. FIRST-STAGE ADJUSTMENT AND TESTING**

(SEE NOTE K →)

1. With the first-stage regulator mounted on the test bench high-pressure valve block adapter, attach a spare intermediate-pressure hose to the open low-pressure port on the first-stage regulator. Attach the free end of this hose to the male fitting provided for it on the test bench. (If the Octopus regulator is attached to the first-stage regulator, removal of the port plug (Item 3) will be required).
2. While watching the intermediate-pressure gauge on the test bench, slowly pressurize the bench and regulator to 500 psig. The intermediate-pressure gauge should indicate a "lockup" pressure of 130 to 160 psig. If the gauge pressure increases beyond 160 psig, turn the air source off immediately. This indicates a failure of the first-stage regulator to achieve "lockup" pressure. Refer to the Troubleshooting Table 2 on page 17 for corrective guidelines and specific procedures. If the intermediate pressure is not greater than 160 psig but there is an audible leak or freeflow from the second-stage regulator(s), adjustment of the lever (Item 34) will be required before final adjustment of the first-stage intermediate pressure can be completed. (See Section VIII, Subsection D, Step 29 and Appendix A for details of lever adjustment).

(SEE NOTE L →)

**CAUTION**

If an adjustment of intermediate pressure is required (not within 130 to 160 psig), be sure to "cycle" the regulator by pushing the purge button (Item 47) at least ten (10) times after turning the adjustment screw (Item 12). Failure to "cycle" the regulator can result in a false reading of the first-stage intermediate-pressure "lock-up".

3. If the "lockup" pressure is below 130 psig, it may be increased by turning the adjustment screw (Item 12) "in" or clockwise. This should be done by using a large flat-bladed screwdriver. Turn the screw no more than 1/8 turn at a time, then purge the second stage several times and observe the adjustment's intermediate-pressure increase. Repeat this process until the desired intermediate pressure has been reached.

**NOTE I**

Before placing the Consholf S.E.(S.) Regulator back in service, the following sequence of adjustments is necessary. The use of a flow test bench is the preferred device to insure the quality of your adjustments. This will enable the service technician to check critical performance requirements of the Regulator series more precisely. If no test bench is available to the service technician, use of a SCUBA cylinder, the less preferred testing procedures will follow this section.

**NOTE J**

If the Consholf S.E. Octopus is to be used, attach the Octopus hose to the first-stage body as described in Steps 1 and 2. Connection of additional hoses, such as the pressure gauge or low-pressure inflator hose, should not be done until after complete testing of the first and second stage(s). This will simplify troubleshooting leakage problems, if they occur.

**NOTE K**

In conjunction with this subsection, the technician should refer to Table 1 on page 17, Test Bench Specifications, for the Consholf S.E., S.E.S., and Octopus Regulators. In addition, all tests described must first be done at low pressure (500 psig) and then again at service pressure (3000 psig).

**NOTE L**

For more detailed information on proper setting of the Intermediate Pressure see Appendix B.

## CONSHelf S.E. SERIES REGULATORS

4. If the "lockup" pressure is above 160 psig, it may be decreased by turning the adjustment screw (Item 12) "out" or counterclockwise. Using the large flat-bladed screwdriver, turn the adjustment screw no more than 1/8 turn at a time, then purge the second stage several times and observe the adjustment's intermediate-pressure decrease. Repeat this process until the desired intermediate pressure has been reached. If the acceptable range cannot be achieved by varying the adjusting screw (Item 12); refer to the Troubleshooting Table 2, page 17, for corrective guidelines and specific procedures.
5. Assuming the correct intermediate pressure has been achieved, depress the purge button (Item 47) several times, release and observe the test bench intermediate-pressure gauge 5 seconds to 15 seconds after purging. The intermediate pressure indicated must not "creep" or slowly increase more than 5 psig within this time. If the intermediate pressure will not stabilize at one pressure setting, refer to the Troubleshooting Table 2, page 17, for corrective guidelines and specific procedures.
6. After stabilizing the intermediate pressure repeat Steps 2 through 5 at 3000 psig, service pressure.
 

(SEE NOTE M →)

  - A. Pour silicone fluid into the spring retainer until the level reaches within 1/8-inch below the top of the retainer.
  - B. Insert the secondary diaphragm (Item 48) into the spring retainer with the outer, raised lip pointing up. The diaphragm must be covered with silicone to function properly.
  - C. Air bubbles underneath the secondary diaphragm must be removed by smoothing the diaphragm with the fingernail.
  - D. Using the square, slotted tool provided with the conversion kit, screw the secondary-diaphragm retaining ring (Item 49) clockwise into the spring retainer. Hand tighten firmly.
  - E. Verify that the intermediate pressure has not changed after the conversion or reinstallation procedure. Refer to the subsection on the first-stage adjustment as required.

### C. SECOND-STAGE ADJUSTMENT AND TESTING

#### SECOND-STAGE AIR FLOW TEST

(SEE NOTE N →)

1. With the regulator still attached to the flow test bench and pressurized 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 litres per minute). The reading on the Magnehelic gauge (Inhalation/Exhalation Effort Gauge) should indicate no more than +6.0" H<sub>2</sub>O. If the reading is over +6.0" H<sub>2</sub>O, refer to Troubleshooting Table 2 on page 18, for corrective guidelines and specific procedures.

#### SECOND-STAGE OPENING EFFORT TEST

2. Next, shut off the flowmeter control knob. Slowly turn the flowmeter control knob back on while watching both the Magnehelic gauge and the intermediate pressure gauge. When the intermediate pressure gauge begins to drop below the intermediate pressure "lock up", the Magnehelic gauge should indicate an opening effort of +0.6" of H<sub>2</sub>O to +1.5" of H<sub>2</sub>O. If the opening effort is not within this range, refer to the Troubleshooting Table 2, page 18, for corrective guidelines and specific procedures.

#### NOTE M

For the Conshelf S.E.S.: After completing the adjustment of the intermediate-pressure setting depressurize and remove the regulator from the test bench or cylinder valve. Then remount the first-stage body, using an empty CO<sub>2</sub> cartridge and adapter again, in the bench vise with the low-pressure side facing upward. The following procedure covers either the completion of the environmental conversion of a standard Conshelf S.E. or reinstallation of environmental components on the Supreme Model (S.E.S.).

#### NOTE N

Prior to performing the second-stage adjustments and testing, installation of the O-ring and port plug (Items 50 and 51) must be done. Place the lubricated O-ring (Item 50) on the port plug (Item 51). Next, using a 3/16-inch Allen torque wrench, insert the wrench in the port plug and screw the plug clockwise into the box bottom (Item 30) to a torque of 5 to 8 inch-pounds.

# CONSHelf S.E. SERIES REGULATORS

## SECOND-STAGE PURGE FLOW TEST

- Turn off flowmeter control knob. Next, while the second-stage regulator 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 18, for corrective guidelines and specific procedures. When purge flow is correct, remove the second stage from the mouthpiece adapter on the flow test bench.

## CONSHelf S.E. OCTOPUS FLOW TEST (SEE NOTE O →)

- Mount the octopus second-stage regulator on the mouthpiece adapter of the flow test bench. Slowly turn the flowmeter control knob until the flow reaches a minimum of 15 SCFM (425 L.P.M.) The reading on the Magnehelic gauge should indicate no more than + 6.5" H<sub>2</sub>O. If the reading is over + 6.5" H<sub>2</sub>O, refer to Troubleshooting Table 2, on page 18, for corrective guidelines and specific procedures.

## OCTOPUS OPENING EFFORT TEST

- Shut off the flowmeter control knob. Slowly turn the flowmeter control knob back on while watching the Magnehelic gauge. The Magnehelic gauge should indicate an opening of +1.2" to +2.1" of H<sub>2</sub>O. If the opening effort is not within this range, refer to the Troubleshooting Table 2, page 18, for corrective guidelines and specific procedures.

## OCTOPUS PURGE FLOW TEST

(See Step 3 above, same as second-stage purge flow test.)

## LEAKAGE TEST

After final reassembly and adjustment of the Conshelf S.E. Regulator, the following simple test for external leakage is recommended.

(SEE NOTE P →)

- With the first and second stages attached to a high-pressure air supply, submerge the entire system in a test tank of clean water.
- Turn on the high-pressure supply.
- Observe any bubbles arising from the submerged regulator over a one-minute period. This recommended time is necessary due to the lower bubble formation that occurs in cases of smaller leaks. Any bubbles noted indicate leakage with the need to disassemble and check all sealing areas, assembly sequence and component positioning in order to correct the problem(s).

(SEE NOTE Q →)

## SUBJECTIVE BREATHING TESTING

- In general, the properly overhauled and adjusted Conshelf S.E. Regulator, upon breathing in and out of the mouthpiece slowly and deeply four or five times, should deliver air to the user without excessive inhalation effort, freeflow, or "fluttering" of the second-stage diaphragm. In addition, when exhaling there should be no fluttering or sticking of the exhalation valve. If any of these problems occur, again refer to the Troubleshooting Table for corrective guidelines and specific procedures. Also, conduct a purge flow test; depress the purge button fully, an adequate volume of air should flow from the mouthpiece.

This concludes the adjustment and testing procedures for the Conshelf S.E. Regulator Series.

### NOTE O

If the Conshelf S.E. Octopus regulator is attached to the first-stage regulator, the following are the test procedures for this regulator.

### NOTE P

The mouthpiece of the regulator must point straight down or freeflow may result when submerged in water.

### NOTE Q

An alternative method for visually detecting regulator leakage is to apply soap solution to possible leakage areas using a small, clean brush. Bubble streams will pinpoint the source of the leakage.

Before disassembling to correct any leakage problems, 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.

**CONSHSELF S.E. SERIES REGULATORS**

1. After following the preliminary procedures in Section IX, Steps 1 through 4, use a spare intermediate-pressure hose (Item 46). Attach this hose to one of the open low-pressure ports on the first-stage body (Item 1). (If the Octopus regulator is attached to the first-stage regulator, removal of the port plug (Item 3) will be required.) (SEE NOTE R →)
2. Thread the intermediate test pressure gauge (U.S.D. P/N 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.
3. Connect the first-stage regulator to a low-pressure air source (partially filled SCUBA cylinder — 500 psig). Slowly turn on the air source control knob and pressurize the regulator. Once the regulator is pressurized, slowly close the gauge bleeder valve while watching the test gauge. The gauge should indicate a "lockup" pressure of 130 to 160 psig. If the gauge pressure continues beyond 160 psig, immediately open the gauge bleeder valve and close the air-source control valve. Such a steadily increasing gauge pressure beyond 160 psig indicates failure of the first-stage regulator to achieve "lockup" pressure. Refer to the Troubleshooting Table 2, page 17, for corrective guidelines and specific procedures.
4. If there is any detectable leakage through the second-stage regulator when the intermediate pressure is 160 psig or less, unscrew counterclockwise the disc and retainer locknut (Item 33) 1/2 turn at a time just until the leakage stops. (SEE NOTE S →)

**CAUTION**

If an adjustment of intermediate pressure is required be sure to "cycle" (10 times) the regulator by pushing the purge button (Item 47) after turning the adjustment screw (Item 12). Failure to "cycle" the regulator can result in a false reading of the first-stage intermediate-pressure "lock-up".

5. If the "lockup" pressure is below 130 psig, it may be increased by turning the adjustment screw (Item 12) "in" or clockwise. Turn the screw no more than 1/8 turn at a time, then purge the second stage several times and observe the adjustment's intermediate-pressure increase. Repeat this process until the desired intermediate pressure has been reached.
6. If the "lockup" pressure is above 160 psig, it may be decreased by turning the adjustment screw (Item 12) "out" or counterclockwise. Using the large flat-bladed screwdriver, turn the adjustment screw no more than 1/8 turn at a time, then purge the second-stage several times and observe the adjustment's intermediate-pressure decrease. Repeat this process until the desired intermediate pressure of 130 to 160 psig has been reached. If an acceptable range cannot be achieved by varying the adjusting screw (Item 12), refer to the Troubleshooting Table 2 on page 17 for corrective guidelines and specific procedures.
7. Assuming the correct intermediate pressure has been achieved, depress the purge button (Item 47) several times, release and observe the intermediate-pressure gauge 5 seconds to 15 seconds after purging. The intermediate pressure indicated must not "creep" or slowly increase more than 5 psig within this time. If the intermediate pressure will not stabilize at one pressure setting, refer to the Troubleshooting Table 2, page 17, for corrective guidelines and specific procedures.
8. After stabilizing the intermediate pressure repeat Steps 3 through 7 at 3000 psig, service pressure. (SEE NOTE T →)

**NOTE R**

If no test bench is available for testing the Conshself S.E. Regulator, the following adjustment and testing procedures should be followed. For more detailed information on proper setting of the Intermediate Pressure see Appendix B.

**NOTE S**

For detailed lever-height adjustment, see Section VIII, subsection D, Step 29.

**NOTE T**

For the Conshself S.E.S.: See Note page 13, below Step 6 for environmental conversion or reinstallation of environmental components on the Supreme Model (S.E.S.)

## CONSHLF S.E. SERIES REGULATORS

### C. SECOND-STAGE ADJUSTMENT AND TESTING

Before final reassembly of the second-stage regulator and after preliminary adjustment of the lever, the following procedures are recommended. The first is a general purge flow test; the second provides an approximate performance evaluation of opening effort.

(SEE NOTE U →)

#### A. SECOND-STAGE AIR FLOW

1. With the Conshlf S.E. Regulator connected to a high-pressure air supply of 3,000 psig, turn on the air supply. If the sudden leakage or free flow into the second stage occurs, turn off the air supply immediately, and adjust the locknut outward (counter-clockwise), lowering the lever height, until the leakage stops.
2. Assuming there is no leakage, reinstall the port plug (Item 51), with its new lubricated O-ring (Item 50) to the box bottom. Tighten the port plug with a 3/16 Allen wrench to 5 to 8 inch-pounds torque.
3. Fully depress the purge button. This should result in a moderate flowrate of air exiting from the mouthpiece.
4. Repeat this procedure several times. Refer to the Troubleshooting Table to correct any air flow problems.

#### B. OPENING EFFORT CHECK

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

#### CAUTION

Do not allow water to enter the mouthpiece (Item 39) as the water will spray over the test area.

6. While holding the mouthpiece or exhaust tube (Item 38), 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.
7. This submersion should cause the second-stage to free flow, indicating an acceptable, but approximate, opening effort of one inch of water column.

#### LEAKAGE TESTING

(See Page 14 for this procedure).

#### SUBJECTIVE BREATHING TESTING

(See Page 14 for this procedure).

This concludes the adjustment and testing procedures for the Conshlf S.E. Regulator Series.

#### NOTE U

For detailed lever-height adjustment, see Section VIII, subsection D, Step 29.

# CONSHelf S.E. SERIES REGULATORS

**TABLE 1**  
**TEST BENCH SPECIFICATIONS**  
**CONSHelf S.E., S.E.S. and OCTOPUS REGULATORS®**

| Test                        | Condition(s)   | Acceptable Range   |
|-----------------------------|--|--|
| Leak Test                   | 3,000 ± 100 psig inlet pressure                                | No leaks allowed   |
| Intermediate Pressure       | 3,000 ± 100 psig inlet pressure                                | 130 to 160 psig<br>(Optimum 140 ± 5 psig)                              |
| Intermediate-Pressure Creep | 3,000 ± 100 psig inlet pressure                                | 5 psig max. between 5 to 15 seconds<br>After cycling regulator (purge) |
| Opening Effort              |  | + 0.6 - + 1.5 in. H <sub>2</sub> O                                     |
| Opening Effort (Octopus)    | Supply Pressure 140 ± 5  | + 12 - + 21 in. H <sub>2</sub> O                                       |
| Flow Effort                 | 140 ± 5 psig inlet pressure at 15 SCFM                         | + 6 in. H <sub>2</sub> O or less                                       |
| Flow Effort (Octopus)       |  | + 6.5 in. H <sub>2</sub> O or less                                     |
| Purge Flow                  | Supply Pressure 140 ± 5 psig<br>(purge button fully depressed) | 5.0 SCFM flowrate (minimum)  |

**TABLE 2**  
**TROUBLESHOOTING GUIDE**  
**CONSHelf S.E., S.E.S., and OCTOPUS REGULATORS®**  
**FIRST-STAGE REGULATOR**

| Problem  | Probable Cause  | Recommendation   |
|--|---|--|
| High-Intermediate Pressure<br>(above 160 psig) | 1. Adjustment screw (Item 12) improperly set<br>(See Appendix B)  | 1. Turn adjustment screw (Item 12) counterclockwise until optimum 140 ± 5 psig intermediate pressure is reached  |
| Low Intermediate Pressure<br>(below 130 psig)  | 1. Adjustment screw (Item 12) improperly set<br>(See Appendix B)<br>2. Main spring (Item 11) maybe too weak   | 1. Turn adjustment screw (Item 12) clockwise until optimum 140 ± 5 intermediate pressure psig is reached.<br>2. Replace main spring (Item 11).   |
| Intermediate Pressure<br>"Creep"               | 1. High-Pressure Seat (Item 16) dirty, damaged or worn<br>2. Machined seat orifice in first-stage body (Item 1) dirty, damaged or worn.<br>3. O-ring (Item 14) dirty, damaged or worn   | 1. Examine and/or replace high-pressure seat (Item 16)<br>2. Examine and/or clean machined seat in ultrasonic cleaner or replace first-stage body (Item 1) if orifice is damaged, dirty or worn.<br>3. Examine and/or replace O-ring (Item 14).  |
| <b>SECOND STAGE REGULATORS</b>                 |   |  |
| Free-Flow or Hissing Sound from Second Stage   | 1. Lever (Item 34) set too high<br>2. Purge button (Item 47) jammed open<br>3. Lever (Item 34) bent<br>4. Disc (Item 27) dirty, damaged or worn<br>5. Retainer (Item 28) dirty, damaged or worn<br>6. Inlet fitting (Item 36) dirty, damaged or worn<br>7. Pure adjustment screw (Item 56) set too low<br>8. Spring (Item 29) worn or weak<br>9. Intermediate-pressure set too high | 1. Turn locknut (Item 33) counterclockwise to readjust lever down<br>2. Clean or replace purge button (Item 47)<br>3. Examine and/or replace lever (Item 34)<br>4. Replace disc (Item 27)<br>5. Clean and/or replace retainer (Item 28)<br>6. Examine and clean or replace inlet fitting (Item 36)<br>7. Back purge adjustment screw out (counterclockwise 1/2 turn at a time and retest. (See Note below)<br>8. Replace spring<br>9. See First-Stage Troubleshooting Guide. |

# CONSELF S.E. SERIES REGULATORS

**TABLE 2**  
**TROUBLESHOOTING GUIDE**  
**CONSELF S.E., S.E.S., and OCTOPUS REGULATORS®**  
**SECOND STAGE REGULATORS**

| Problem  | Probable Cause   | Recommendation  |
|--|--|---|
| Hard-to-Breathe  | <ol style="list-style-type: none"> <li>Lever (Item 34) bent</li> <li>Lever (Item 34) set too low</li> <li>Intermediate pressure set too low</li> <li>Sintered filter (Item 20) clogged</li> <li>Intermediate-pressure hose (Item 46) clogged</li> </ol>  | <ol style="list-style-type: none"> <li>Examine and/or replace lever (Item 34)</li> <li>Turn locknut (Item 33) inward (clockwise) to adjust lever (Item 34) upward</li> <li>See First-Stage Troubleshooting Guide</li> <li>Check flow according to Table 1 and Testing Procedure page 17. If flow is too low replace sintered filter (Item 20)</li> <li>Clean or replace hose (Item 46)</li> </ol>   |
| Low Purge Flowrate   | <ol style="list-style-type: none"> <li>Adjustment screw (Item 56) improperly adjusted</li> </ol>   | <ol style="list-style-type: none"> <li>Turn purge adjustment screw (Item 56) clockwise 1/2 turn at a time and reset. <b>NOTE:</b> Ensure opening effort adjustments have been completed before attempting to adjust purge screw.</li> </ol>   |
| Water Entering Second Stage  | <ol style="list-style-type: none"> <li>Hole in mouthpiece (Item 39)</li> <li>Hole in diaphragm (Item 41)</li> <li>Exhalation valve (Item 37) dirty or damaged</li> <li>Exhalation valve seat on box bottom (Item 30) dirty, damaged or worn</li> <li>Diaphragm (Item 41) improperly seated between box top and box bottom (Items 43 &amp; 30)</li> <li>O-ring (Item 50) dirty, damaged or worn</li> <li>Cracked or damaged box bottom or box top (Items 30 &amp; 43)</li> </ol>                                      | <ol style="list-style-type: none"> <li>Examine and/or replace mouthpiece (Item 39)</li> <li>Examine and/or replace diaphragm (Item 41)</li> <li>Examine and/or replace exhalation valve (Item 37)</li> <li>Clean and/or replace box bottom (Item 30)</li> <li>Disassemble and reassemble properly. (Be sure thrust washer (Item 42) is present and in place on top of the diaphragm (Item 41))</li> <li>Replace O-ring (Item 50)</li> <li>Examine and/or replace box bottom or box top (Items 30 &amp; 43)</li> </ol> |
| External Air Leakage (See Footnote Table 4)  | <p align="center"><b>(Immerse pressurized regulator in water to locate the source of the leak. If leaks are detected depressurize system prior to tightening loose fitting plugs or hose.)</b></p> <ol style="list-style-type: none"> <li>Inlet fitting (Item 36) loose</li> <li>Plugs (Items 3, 5 or 51) loose</li> <li>Intermediate pressure hose (Item 46) loose</li> <li>Retainer (Item 10) loose</li> <li>Adapters (Item 52 or 53) loose</li> <li>O-rings (Items 2, 4, 35, 44, 45 or 50) not seating</li> </ol> | <ol style="list-style-type: none"> <li>Tighten inlet fitting (Item 36)</li> <li>Tighten plugs (Items 3, 5 or 51)</li> <li>Tighten intermediate pressure hose (Item 46)</li> <li>Tighten retainer (Item 10)</li> <li>Tighten adapters (Items 52 or 53)</li> <li>Replace O-rings (Items 2, 4, 35, 44, 45 or 50) as needed or examine O-ring seating surfaces.</li> </ol>  |
| <p><b>NOTE:</b> This is only a partial list of failure modes. For solutions to other troubleshooting problems or malfunctions not included in the above table, contact U.S. Divers Technical Services Department for assistance.</p> |  |   |

**TABLE 3**  
**RECOMMENDED LUBRICANTS AND CLEANERS**  
**CONSELF S.E., S.E.S and OCTOPUS REGULATORS®**

| Lubricant / Cleaner  | Application | Source(s)   |
|--|-------------|---|
| D.C. III<br>(Pure Silicone Grease)   | All O-rings | Dow Corning Corporation<br>P.O. Box 1767-T<br>Midland, MI 48640 |
| <p><b>NOTE:</b> When applying silicone grease, use only a light film. Also, application of spray silicone lubricant is not recommended. This is because (1) only a slight amount of residual silicone remains after the solvent evaporates, and (2) the aerosol propellant may adversely affect rubber and plastic components.</p> |             |   |

# CONSHLF S.E. SERIES REGULATORS

**TABLE 3  
RECOMMENDED LUBRICANTS AND CLEANERS  
CONSHLF S.E., S.E.S and OCTOPUS REGULATORS®**

| Lubricant / Cleaner   | Application  | Source(s)  |
|---|--|--|
| Ultrasonic Cleaner 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 cleaner 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.<br>50 Valley Road<br>Berkeley Heights, NJ 07922  |
| Vinegar (100 gr.) white distilled<br>M.C. Cleaner No. 2044<br><br>Snoop   | Brass and Stainless Steel Parts<br><br>All reuseable metal parts<br><br>Leak testing | "Household" grade<br><br>Zip Aerosol Products<br>Canoga Park, CA 92304<br><br>Nupro Company<br>400 E. 345th Street<br>Willoughby, OH 44094 |
| NOTE: Both agents listed above are suitable for cleaning, especially heavy corrosion, verdigris, and mineral deposits.  |  |  |
| CAUTION: Do not expose plastic or rubber parts to solvents or caustic cleaning solutions. Also, when using acidic solutions, wear appropriate eye, hand, and clothing protection. Baking soda should be kept readily available for neutralizing any spilled acidic solutions. |  |  |

**TABLE 4  
TORQUE SPECIFICATIONS  
CONSHLF S.E., S.E.S and OCTOPUS REGULATORS®**

| Part Number   | Description / Key Number                        | Torque Value                         |
|---|---|--------------------------------------|
| 1020-04<br>1020-03  | Low Press. and High Press. / 3 and 5 Port Plugs | 40 inch-pounds                       |
| 1053-26<br>1088-51  | Spring Retainer/10                              | 25 foot-pounds                       |
| 1020-82   | Low Press. and High Press. Adapters / 52 and 53 | 40 inch-pounds                       |
| 1020-25<br>1020-28  | Hose (end fittings) /46                         | 40 inch-pounds                       |
| 1049-02<br>1019-24  | Inlet Fitting/36<br>Port Plug/51                | 40 inch-pounds<br>5 to 8 inch-pounds |
| NOTE: If LP. Inflator hose or Pressure Gauge hose are attached to Regulator torque hoses to 40 inch-pounds. In addition these torque valves must be attained before attempting any leakage testing. |   |                                      |

# CONSHOLF S.E. SERIES REGULATORS

**TABLE 5  
RECOMMENDED TOOL LIST  
CONSHOLF S.E., S.E.S., and OCTOPUS REGULATORS®**

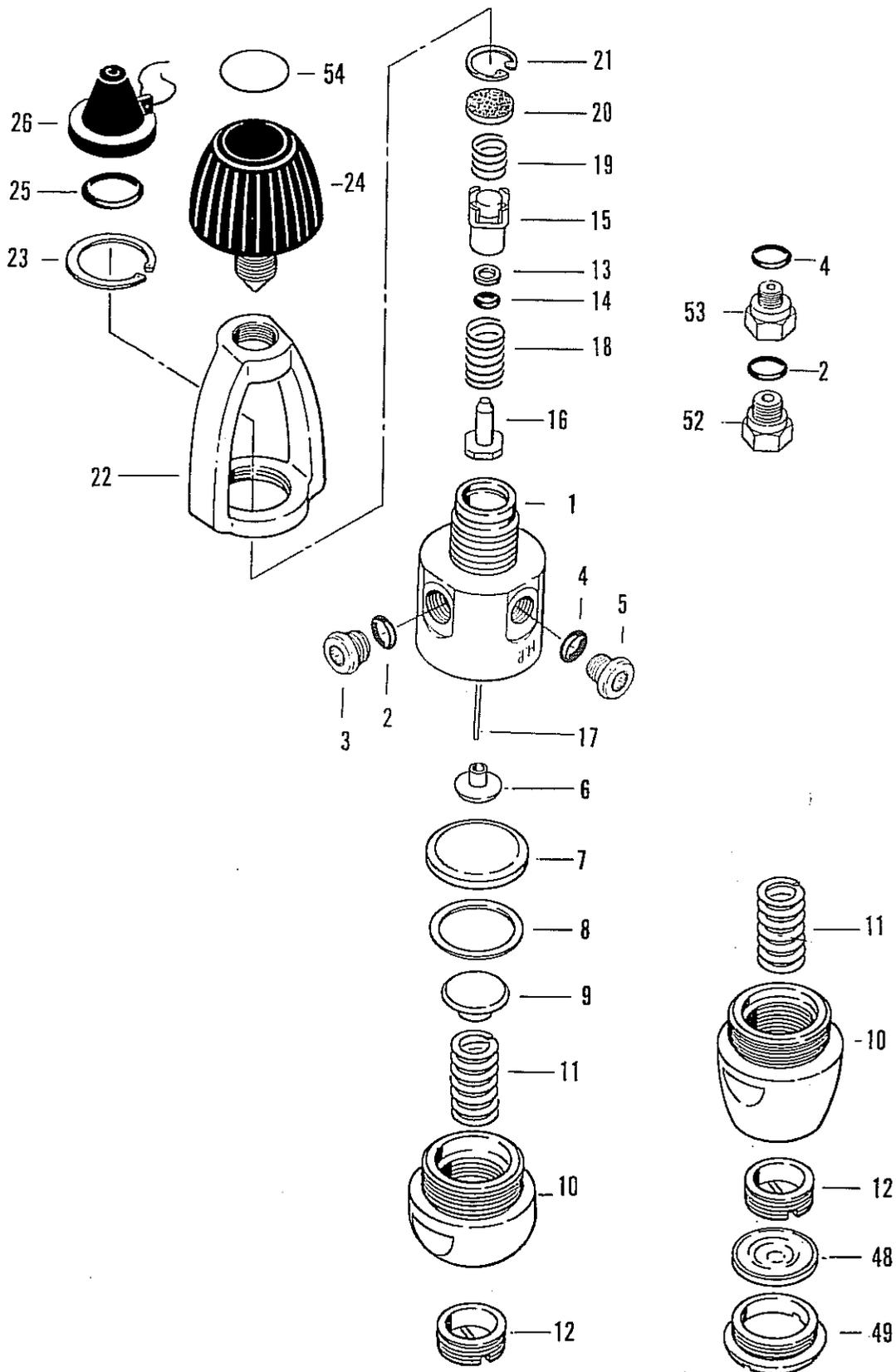
| Part Number  | Description  | Application  |
|--|--|--|
| 7803-00  | Aqua-Lung Repair Manual  | All Aqua-Lung Regulators   |
| 1110-00  | Block Guide  | Assembly of components for High Pressure seat  |
| 1019-40  | Box Top Wrench   | Box Top  |
| 1016-10  | Test Pressure Gauge  | Intermediate Pressure Testing  |
| 1110-05  | Disc and Retainer Wrench   | Disc and Retainer  |
| 1016-84  | Lever Height Adjustment Tool   | Disc and Retainer Locknut  |
|  | Open End/Box End Wrenches<br>11/16-inch<br><br>3/4-inch<br><br>1-3/8-inch (crows foot) | LP./HP. Adapter<br>Hose End Fittings<br><br>Inlet Fitting<br><br>Spring Retainer                   |
|  | Allen Wrenches<br>3/16-inch<br><br>5/64-inch   | LP./HP. Port Plugs, Second Stage Port Plug<br><br>Purge Adjustment Screw                           |
|  | Screw Driver<br>Large Flat Blade   | First Stage Adjustment Screw   |
|  | Pliers<br>Standard and Wire Cutter   | Mouthpiece Clamp<br>Exhalation Valve Stem  |
|  | Retaining Ring Pliers  | First Stage Retaining Rings  |
|  | Torque Wrenches<br>0 to 120 inch-pounds<br>10 to 40 foot-pounds                        | Inlet fittings, High/Low port plugs, adapters, hoses, Second Stage port plugs and spring retainers |
| <p><b>NOTE:</b> An empty CO<sub>2</sub> cartridge used for vice mounting should not be an old, rusty cartridge from a Buoyancy Control device. A new cartridge should be placed in a CO<sub>2</sub> firing mechanism and discharged. The adapter (Item 52) should be threaded to the cartridge. The cartridge/adapter should be set aside and used for regulator repair only. Gluing the adapter to the CO<sub>2</sub> cartridge is recommended.</p> |  |  |

# CONSHLF S.E. SERIES REGULATORS

| Item — Part No. | Description      | Qty. | Item — Part No. | Description           | Qty. |
|-----------------|------------------|------|-----------------|-----------------------|------|
| 1 — 1020-01     | Body             | 1    | 15 — 1053-24    | Spring Block          | 1    |
| 2 — 9570-25     | O-ring           | 3    | 16 — 1053-20    | Seat                  | 1    |
| 3 — 1020-04     | LP. Port Plug    | 1-2  | 17 — 1020-02    | Pin                   | 1    |
| 4 — 9570-04     | O-ring           | 2    | 18 — 1015-04    | Spring                | 1    |
| 5 — 1020-03     | H.P. Port Plug   | 1    | 19 — 1046-13    | Spring                | 1    |
| 6 — 1015-69     | Pin Support      | 1    | 20 — 1051-06    | Sintered Filter       | 1    |
| 7 — 1000-29     | Diaphragm        | 1    | 21 — 8630-51    | Retaining Ring        | 1    |
| 8 — 8210-26     | Thrust Washer    | 1    | 22 — 7004-11    | Yoke                  | 1    |
| 9 — 1017-28     | Spring Pad       | 1    | 23 — 8610-68    | Retaining Ring        | 1    |
| 10 — 1053-26    | Spring Retainer  | 1    | 24 — 1075-06    | Yoke Screw            | 1    |
| * 1088-51       | Spring Retainer  | 1    | 25 — 8201-20    | O-ring                | 1    |
| 11 — 1053-27    | Spring           | 1    | 26 — 1010-12    | Dust Cap              | 1    |
| * 1020-40       | Spring           | 1    | *48 — 1088-53   | Diaphragm             | 1    |
| 12 — 1015-49    | Adjustment Screw | 1    | *49 — 1088-54   | Diaphragm Retainer    | 1    |
| 13 — 8280-05    | Backup Ring      | 1    | 52 — 1020-82    | LP. Threaded Adapter  | 1    |
| 14 — 8200-06    | O-ring           | 1    | 53 — 1020-85    | H.P. Threaded Adapter | 1    |

NOTE: Item Number sequence is in order of reassembly procedure.  
 \* Used on Supreme Model only.

# CONSHOLF S.E. SERIES REGULATORS

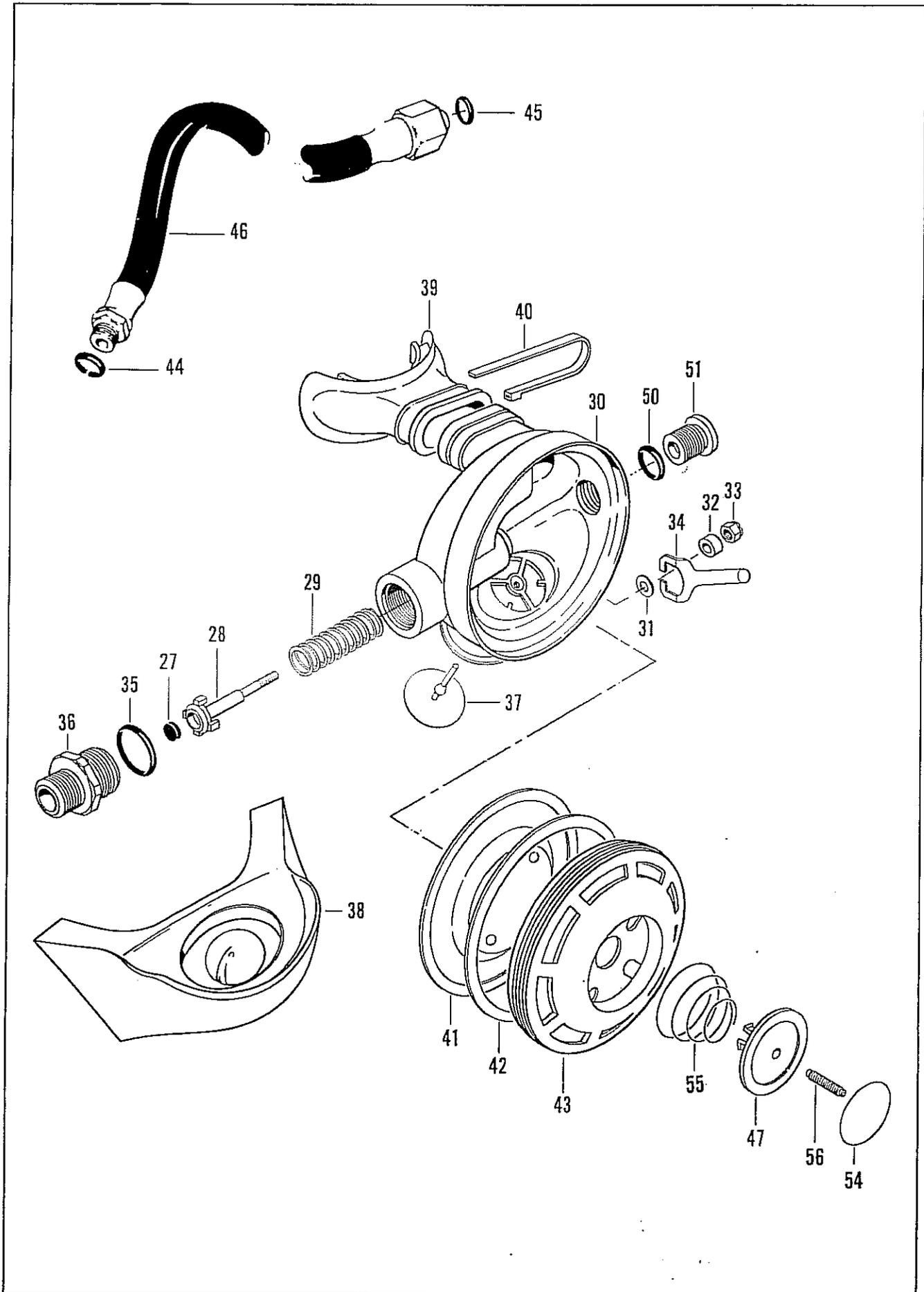


# CONSHLF S.E. SERIES REGULATORS

| Item — Part No. | Description           | Qty. | Item — Part No. | Description                   | Qty. |
|-----------------|-----------------------|------|-----------------|-------------------------------|------|
| 27 — 1085-10    | Disc                  | 1    | 42 — 8210-27    | Thrust Washer                 | 1    |
| 28 — 1049-03    | Retainer              | 1    | 43 — 1019-05    | Box Top (Black)               | 1    |
| 29 — 1085-10    | Spring                | 1    | 1019-06         | Box Top (Blue)                | 1    |
| 1085-14         | Spring (Octopus)      | 1    | 1019-07         | Box Top (Yellow)              | 1    |
| 30 — 1019-45    | Box Bottom            | 1    | 44 — 9570-25    | O-ring                        | 1    |
| 1019-46         | Box Bottom (Octopus)  | 1    | 45 — 9573-10    | O-ring                        | 1    |
| 31 — 8450-22    | Washer                | 1    | 46 — 1015-25    | Hose                          | 1    |
| 32 — 1025-17    | Spacer                | 1    | 1020-28         | Hose (Octopus)                | 1    |
| 33 — 1025-10    | Locknut               | 1    | 47 — 1014-45    | Purge Button                  | 1    |
| 34 — 1085-13    | Lever                 | 1    | 50 — 9570-25    | O-ring                        | 1    |
| 35 — 8200-14    | O-ring                | 1    | 51 — 1019-24    | Port Plug                     | 1    |
| 36 — 1049-02    | Inlet Fitting         | 1    | 54 — 1074-81    | Decal (Yellow/Black)          | 2    |
| 37 — 1051-39    | Exhalation Valve      | 1    | 1074-82         | Decal (Blue/Black)            | 2    |
| 38 — 1019-19    | Exhaust Tee           | 1    | 1074-83         | Decal (SES Model)             | 2    |
| 1019-24         | Exhaust Tee (Octopus) | 1    | 1074-84         | Decal (Octopus)               | 1    |
| 39 — 1058-89    | Mouthpiece            | 1    | 55 — 1014-36    | Spring                        | 1    |
| 40 — 1049-40    | Clamp                 | 1    | 56 — 1016-32    | Adjustment Screw              | 1    |
| 41 — 1016-32    | Diaphragm             | 1    | 1020-43         | Hose Protector<br>(not shown) | 1    |

NOTE: Item Number sequence is in order of reassembly procedure.

# CONSHLF S.E. SERIES REGULATORS



# CONSHelf S.E. SERIES REGULATORS

## APPENDIX A

### U.S. DIVER'S AQUA-LUNG CONSHelf S.E., CONSHelf 20 and AQUARIUS 2 SECOND-STAGE LEVER HEIGHT ADJUSTMENT TOOL — P.N. 1016-84

#### INSTRUCTION SHEET

The following instructions will help you to use this tool and improve your efficiency in adjusting the opening effort of the Conshelf S.E., Conshelf 20 and Aquarius Second Stage Regulator Series.

#### NOTE

Regulators for use on S.C.U.B.A. are Life Support Apparatus. Only personnel with factory maintenance and repair training certification should attempt disassembly, reassembly or adjustment of this Life Support Apparatus.

#### INSTRUCTIONS

After the First-Stage has passed all test requirements according to the service manual (Conshelf S.E. see Manual P.N. 7802-08, Page 17, Table 1, Conshelf 20 see Manual P.N. 7802-06, Page 10, Table 1, Aquarius 2 see Manual P.N. 7802-05, Page 9, Table 1). Assuming the Second-Stage Regulator is properly assembled according to the service manuals proceed as follows:

1. Remove access port plug (P.N. 1019-24 or 1016-12). This can be done by using a 3/16 inch Allen wrench, turning the wrench counterclockwise and removing the port plug.
2. Place the 1/4 inch nut driver portion of the tool (P.N. 1016-84) over the locknut (P.N. 1025-10), located inside the second-stage regulator. Next, insert the screwdriver portion of the tool down through the center of the nut driver. Once the screwdriver is installed in the nut driver, insert the blade of the screwdriver into the slot on the end of the retainer (P.N. 1049-03) (Figure A).
3. Holding the screwdriver portion and retainer steady, turn the nut driver portion and locknut clockwise to reduce opening effort. (Figure B).
4. To set the opening effort at its minimum level, turn the nut driver portion and locknut clockwise until a freeflow condition just begins. Then turn the nut driver and locknut counterclockwise, just until the freeflow stops. Back the tool (P.N. 1016-84) out of the regulator and replace the access plug (P.N. 1019-24 or 1016-12) with its O-ring (P.N. 9570-25).
5. Test the regulator's breathing effort first subjectively and then on a test bench. Insure that the bench results match the requirements in the service manual (Conshelf S.E. see Manual P/N 7802-08, for Conshelf 20 see manual P.N. 7802-06. For Aquarius 2 see Manual P.N. 7802-05).

For further reference, consult your Aqua-Lung Technical Services Department (714) 540-8010.

FIGURE A

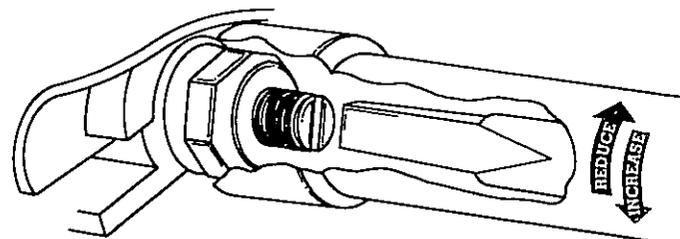
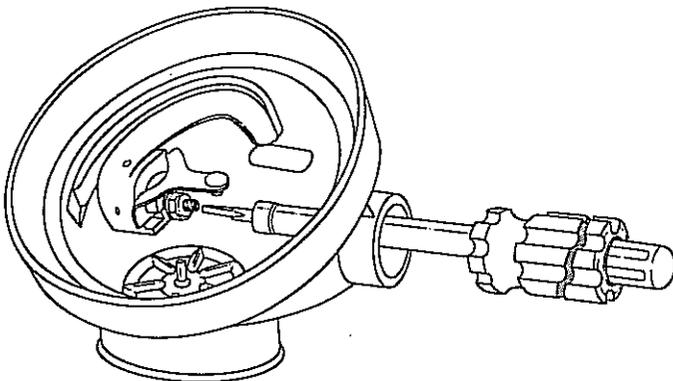


FIGURE B

# CONSHELF S.E. SERIES REGULATORS

## APPENDIX B

INTERMEDIATE PRESSURE of U.S. DIVER'S AQUA-LUNG REGULATORS  
(Royal S.L., P/N 1047 & 1048; J.M. Coustearu Royal, P/N 1014 & 1015;  
CONSHELF S.E., P/N 1019 & 1020; CONSHELF 30, P/N 1011 & 1012 or 1028 & 1029;  
CONSHELF 20, P/N 1016 & 1017 or 1035 & 1036;  
CONSHELF XIV, P/N 1081 & 1088

Repair manual (P/N 7803-00) now shows varying intermediate-pressure ranges on these diaphragm-operated first-stage regulators.

This product notice is to inform, all certified Aqua-Lung repair technicians of the recommended acceptable range for intermediate-pressure setting when adjusting or during annual warranty servicing of the regulator.

In conjunction with this product notice, the repair technicians should refer to the Aqua-Lung Service Manual (P/N 7803-00). The following table shows the part numbers for each regulator manual and the page number where this information is located.

| Regulator Part Number                 | Manual Part Number   | Page Number |
|---------------------------------------|--|-------------|
| 1047, 1048, 1014 & 1015               | 1014-86 Rev. B   | 110         |
| 1019 & 1020, 1016 & 1017, 1035 & 1036 | 7802-06  | 10          |
| 1081 & 1088                           | 7802-06  | 14          |
| 1011 & 1012<br>1028 & 1029            | 1014-86 Rev. B (For First Stage)<br>7802-06 (For Second Stage) | 110<br>10   |

The recommended acceptable intermediate pressure for diaphragm-operated, first-stage regulators is 130 to 160 psig. All Test Bench Specifications (Table 1 on reference pages above) can be accomplished within this 130 to 160 psig pressure range. Minor second-stage adjustments may be required when using lower intermediate-pressure and planning deep dives.

Intermediate pressure directly affects the flow characteristics of the regulator at depth (in excess of 100 feet). Therefore, U.S.D. has established an optimum window for the intermediate pressure of its factory-made and adjusted regulators to be  $140 \pm 5$  psig. This intermediate-pressure range gives optimum regulator performance for the standard sport diving environment.

Field repair technicians are to incorporate these changes of intermediate-pressure range into the P/N 7803-00 service manual. These changes are effective immediately.

For further information, contact the Aqua-Lung Technical Service Department at (714) 540-8010.



## U.S. DIVERS®

A DIVISION OF U.S.D. CORP

3323 WEST WARNER AVENUE  
P.O. BOX 25018  
SANTA ANA, CA 92799-25018