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BRUT

SERVICE GUIDE

SHERWOOD SCUBA®

www.SherwoodScuba.com

INTRODUCTION

The instructions set forth in this document are intended to guide the experienced scuba equipment repair technician through the standard service procedure for this Sherwood regulator.

It is assumed that the technician possesses basic scuba equipment repair training, proper tools and the skill necessary to perform the service. If you have not received regulator service training provided by Sherwood Scuba specifically for this equipment, do not attempt to perform the service described in this document.

Service parts for Sherwood equipment are sold only to Authorized Sherwood Dealers.

Before attempting to perform service read this manual in its entirety. There are warnings and cautions contained in the manual that may affect your safety or the safety of the regulator user.

If you are uncertain as to whether you are qualified to perform this service contact your regional Sherwood Scuba Distributor for technical assistance.

USE OF WARNINGS, CAUTIONS AND NOTES

WARNING:	**Indicates a potentially hazardous condition or situation which, if not avoided, may result in serious injury or death.**
CAUTION:	**Indicates a potentially hazardous condition or situation which, if not avoided, may result in minor injury. It may also be used to alert against unsafe practices.**
NOTE:	**Indicates an important point or reminder.**

WHEN TO SERVICE

This Sherwood regulator should be **inspected** for service **at least annually**. In most cases a simple inspection, and if needed, minimal adjustment not requiring the replacement of parts will be sufficient for continued use. Guidelines for the Annual Inspection are included in this manual.

Sherwood regulators are designed and tested to perform acceptably under typical recreational diving conditions up to 300 hours of use.

If the regulator has been subjected to **more than 300 hours of use** or it has not received the benefit of careful post-dive cleaning and storage in a clean environment, a **standard service overhaul** is required.

In any case the Sherwood regulator described in this manual should receive a standard service overhaul **at least every two years** to maintain optimal performance. The standard service overhaul includes disassembly, cleaning, inspection, replacement of seals, lubrication, reassembly and adjustments.

Sherwood Scuba offers a standard service kit that contains the parts recommended to be replaced in connection with the standard service overhaul.

ANNUAL INSPECTION GUIDELINES

1. Visually inspect the first and second stage for signs of damage or deterioration. Mouthpieces with tears or other damage should be replaced.

2. Retract hose protectors and inspect the hose over its entire length for signs of damage including blisters, deep cuts or separation at the crimped fittings. If these signs are present the hose must be replaced and standard service overhaul is recommended.

3. Insert a soft probe through the exit port of the exhaust cover and lift the Exhaust Valve to inspect it for cuts, tears or contaminated surfaces. Perform this examination from both sides of the Exhaust Cover to observe the entire perimeter of the Exhaust Valve. If damage to the Exhaust Valve is found a complete overhaul is recommended. If the Exhaust Valve or the sealing surfaces on the Housing are contaminated with debris, the Exhaust Cover must be removed and the surfaces must be cleaned. Instructions for removing and replacing the Exhaust Cover appear in the Second Stage Service Guide. As a final check of the Exhaust Valve apply a moderate suction (approximately minus 5 inches of water, moderate inhalation effort) to the second stage mouthpiece with the air supply closed and the second stage purged. If leakage is detected a complete overhaul is recommended.

4. Inspect the first stage filter for evidence of contamination. Discolored filters indicate previous contact with contaminated air. If evidence of contamination is present it is recommended that a standard service overhaul be performed. In addition you should advise the customer that the regulator has been exposed to contamination and that previously used air cylinders used should be inspected.

5. Install an intermediate pressure gauge into one of the available LP ports.

6. Pressurize the regulator to approximately 500 psi and inspect for leakage. Note intermediate pressure. It should not be greater than 150 psi. If no leakage is detected increase inlet pressure to 3000 psi. Again check intermediate pressure. It should not exceed 150 psi. If intermediate pressure is out of range 140 ± 10 psi or leakage is present a standard service overhaul is recommended.

7. Test the purge function. If there is not a strong surge of air, a standard overhaul is recommended.

8. Gently submerge the entire regulator and look for bubbles that indicate leakage. If leakage is present a standard service overhaul is recommended.

9. If a test bench is available perform an inhalation test. Inhalation effort should not be greater than 2.0 inches of water at opening and less than 5.0 inches of water at 15 SCFM. If a test bench is not available perform a subjective breathing test. When properly adjusted the regulator should provide smooth and easy inhalation. If difficulty with inhalation is suspected a standard overhaul is recommended.

GENERAL COMMENTS

NOTE - Read this section before attempting to perform service.

1. Read the entire set of procedures that follows before starting to service. Steps taken out of sequence or without the knowledge of the proper procedure could damage the regulator or otherwise complicate the service process.

2. Refer to the Illustrated Parts List while performing service. Each part is identified with an item number the first time it appears in the text. Parts that are to be replaced with new parts in conjunction with an overhaul have encircled reference numbers.

3. Do not attempt to reuse parts that are designated for replacement. Retain discarded parts to show to the customer to illustrate that a full overhaul service has been completed.

4. Work in a clean properly equipped area. Cleanliness is essential for all regulator servicing and is critical for regulators that will be exposed to enriched air mixtures (Nitrox). Do not attempt to service if all required tools and a clean work area are not available.

5. Work on one regulator at a time taking care not to mix parts from other regulators. Use only genuine Sherwood parts. Parts that appear similar may have different features that are not easy to detect and may cause poor performance.

6. Be careful to protect the finish on all surfaces of the regulator during the service procedure. When holding parts in a vise use soft or padded jaws to prevent defacing surfaces.

7. O-rings are classified by the service they perform and are identified as either **static** or **dynamic**. **Dynamic** O-rings are those that are subjected to movement and the effects of friction which tend to shorten the useful life of the O-ring. **Static** O-rings are used to create a seal between non-moving parts and are not subject to the same wearing effects. **Static** O-rings have a longer useful life and are not replaced unless they show signs of deterioration or brittleness. Careful inspection of these O-rings is required before they are returned to service.

   Lubrication of O-rings:

   a. General - O-rings in most instances should receive only enough lubricant to ensure they are supple. A light coating of lubricant should present a surface that glistens but without a defined layer of lubricant visible.

   b. Ample – When an ample application of lubricant is specified it generally applies to a dynamic O-ring subject to considerable motion or environmental conditions where a more generous application of lubricant might be beneficial. In this situation there should be a light film or layer of lubricant visible.

8. When removing O-rings use a wooden, plastic or a soft brass tool to lift the O-ring out of its groove. Do not use steel or other hard tools that might scratch sealing surfaces.

9. When instructed to use tools such as a hex key or a wrench, follow the standard convention to rotate clockwise to tighten and counterclockwise to loosen unless otherwise directed.

10. When instructed to tighten a part until snug, it means to apply torque just until the part stops moving freely and the torque requirement to advance it further rises markedly. When specific torque specifications are given there is a necessity to ensure that the part is tightened enough to retain position or to create a seal. Unless you are skilled at accurately estimating torque, a torque wrench should be used. Excessive torque may damage parts and require replacement.

ENRICHED AIR NITROX SERVICE

The Sherwood regulator presented in this manual has been designed and manufactured to allow the use of Enriched Air Nitrox (EAN) gas with an oxygen component not to exceed 40%.

In order to maintain this option the user must ensure that the regulator is protected from the introduction of hydrocarbons. The introduction of hydrocarbons into the regulator may increase the risk of fire when used with EAN.

When servicing the regulator, the technician must be aware of this requirement and exercise caution not to contaminate the regulator with hydrocarbons. This requires a clean workplace, free of oil, grease, debris and other contaminants. Additionally in order to return the regulator to EAN service, the overhaul procedure must have a cleaning provision to remove all hydrocarbons before the regulator is reassembled. Do not substitute parts or use lubricants other than Christo-Lube 111. Silicone lubricants are not acceptable and increase the risk of a fire hazard.

WARNING – The introduction of hydrocarbons, lint, dirt and other contaminants into the areas of the regulator subjected to high pressures (greater than 500 psi) and EAN mixtures containing more than 40% oxygen may constitute a fire hazard and may subject the user to serious injury.

FACILITY REQUIREMENTS

The service facility is perhaps the most important asset of any professional dive store. It should be clean, well lighted, and stocked with a complete inventory of parts and manufacturer's specialty tools for the products your store sells. As a minimum requirement, your service facility should be equipped with the following items:

- **Ultrasonic Cleaner** - Select the right size model that can keep up with the volume of regulators that your store services. A built in timer and heater will help control the cleaning time and temperature of the solution, since most solutions work best when heated.

- **Bench Mounted Vise** - A vise is sometimes needed to hold the regulator secure – especially when removing the first stage yoke retainer. Special care must be taken, however, to avoid damage that can result from improper use of this tool. Be sure to follow the instructions provided in this manual.

- **Magnification Lamp** - Strong lighting and magnification are essential requirements for performing a thorough parts inspection - especially when locating the cause of a small leak.

- **Quality Wrenches & Sockets** - When working with chrome plated brass parts, it is especially critical to use the correct size wrench and to ensure that it fits properly over the part. The use of an adjustable wrench is very likely to cause damage to your customer's regulator, and should be strictly avoided at all times.

- **Calibrated Inch-Pound Torque Wrench** - it is important to follow the manufacturer's torque values whenever they are specified, in order to avoid overtightening or under tightening a part. This is especially important for smaller parts and fittings, when overtightening can easily damage the part.

- **Calibrated Foot-Pound Torque Wrench** - Torque wrenches that can be set for both inch-pound and foot-pound measurements generally tend to be less accurate than wrenches that are designed to measure torque within a specific range.

- **Manufacturer's Specialty Tools** -Specialty tools are critically important to performing each step of disassembly and reassembly according to each manufacturer's procedures. Sherwood specialty tools are required to perform service are listed on the following page.

SECTION 1 BRUT FIRST STAGE

RECOMMENDED TOOLS AND SUPPLIERS

The specialty tools identified below may be purchased from your Sherwood Scuba Distributor. Common tools are available from several sources.

Including:	
Sears Roebuck	www.sears.com/craftsman
Home Depot	www.homedepot.com
Harborfreight Tools	www.harborfreight.com

Common Tools

Open End Wrenches - 9/16", 5/8",1/2"
Box End Wrench – 3/4"
Hex Keys 1/4", 5/32",1/8"
Small Flat Blade Screw Driver
Torque Wrenches 25 ft-lb and 60 in-lb
Flashlight
Compressed Air Gun
1/4" x 6" wooden dowel
O-ring picks, plastic or soft metal
Magnifier

Specialty Tools

First Stage Spanner	20-600-200
Yoke Retainer Socket	20-155-200
Breaker Bar	20-157-500
Snap Ring Pliers	10-101-500
3/8" Drive Extension	20-156-500
Schrader Valve Tool	12-100-500
Intermediate Pressure Gauge (0-300 psi)	20-510-100
Pressure Test Tool w/ Syringe	20-750-500
Blunt Probe	10-120-400
Brass Probe Set	10-102
Back up Ring Installation Tool	20-900-400

SECTION 2 DISASSEMBLY PROCEDURE

1. Record the First Stage and Second Stage serial numbers and an inventory of all attached accessories before beginning disassembly.

2. Perform an inspection of the regulator in accordance with the Annual Inspection Guidelines. This process will give the technician a reference point if the after the overhaul the regulator does not perform as expected.

3. Remove all hoses attached to the first stage with a 9/16" open end wrench for the LP Hose and a 5/8" open end wrench for the HP Hose. BCD Inflator hoses typically require either a 9/16" or 1/2" open end wrench. Tag all hoses that attach accessories such as gauge consoles to ensure they are returned to the appropriate regulator port when reassembled.

4. Remove all port plugs (**5** & **29**) with a 5/32" hex key. Replace if signs of damage or deterioration are present, otherwise set aside for cleaning and reassembly. Remove and discard O-rings (**10** & **27**) from the hose.

△ **NOTE** – In order to avoid the risk of damage to the regulator finish during the disassembly process the preferred method is to secure the first stage body in a bench vise without direct contact between the vise jaws and the regulator. The First Stage Handle (P/N 20-115-00) or similar device is recommended to mount the regulator securely without contact between the vise and the regulator body. An alternative method is to use a woodworking vise with soft jaws to minimize the risk of damage to the regulator finish.

5. With the first stage secured in the vise use the First Stage Spanner Tool (PN 20-600-200) to rotate the End Cap (**2**) counterclockwise to remove it from the First Stage Body (**3**). Set aside End Cap (**2**), Spring (**28**) and Piston (**1**) for further disassembly. Set aside Styling Ring (**6**) for cleaning.

⚠ **CAUTION** – The socket and breaker bar combination provide the best means to prevent damage the Yoke Retainer during disassembly. DO NOT use an adjustable wrench or open end wrench that does not properly fit over the flats on the Yoke Retainer. Doing so may result in permanent damage to the Yoke Retainer or other parts.

6. Loosen the Handwheel (**32**) to create space to fit the 1" Yoke Retainer Socket (PN 20-155-500) over the Yoke Retainer (**4**). Pass the Breaker Bar (PN 20-157-500) through the yoke and engage the socket. Tighten the Handwheel sufficiently to secure the Breaker Bar and rotate the Breaker Bar counterclockwise to loosen the Yoke Retainer. Do not use impact.

7. Remove the Yoke Retainer, Inlet Protector (**16**) and Yoke (**15**).

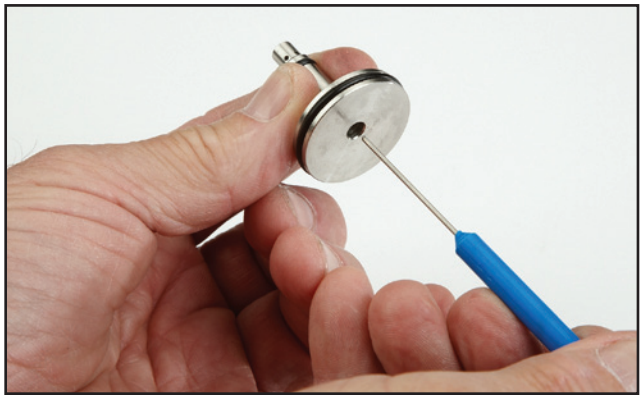
8. Use Snap Ring Pliers (PN 10-101-500) to compress and remove the Retaining Ring (**25**). Tip the Yoke Retainer and the Filter (**8**) and O-ring (**17**) will separate from the Yoke Retainer. Remove O-rings (**13** & **17**). Each of the O-rings in this subassembly will be cleaned and reused unless damaged. Discard Filter.

9. Remove the O-ring (**14**) from the base of the Yoke and O-ring (**19**) from the Body. Set aside for cleaning.

10. Remove the Spring (**28**) from the Piston (**1**) noting whether there are any Spring Isolators (**27**) present. Check the spring cavity in the Body (**3**) also for Spring Isolators. You will need to replace the same number of Spring Isolators in the reassembly process to obtain the correct intermediate pressure. Pull the piston stem to remove the Piston from the End Cap.

11. Remove and discard O-rings (**23** & **24**) from the Piston.

12. Insert a blunt probe through the bore of the piston stem from the large diameter end and push the HP Seat (**10**) to release it from the piston stem. Discard Seat.



13. Grasp the First Stage Body with hand and pull the Saddle (**7**) straight off to expose the Diaphragm (**31**).

14. Peel the lip of the Diaphragm up and remove it from the First Stage Body. Discard the Diaphragm. A new part will be used in reassembly.

15. Use the Schrader Valve Tool (PN 12-100-500) to rotate the Schrader Valve (**18**) counterclockwise to remove it. Discard the valve. Do not reuse.

16. Apply a 5/32″ hex tool to the center of the Orifice Retainer (**9**) and rotate it counterclockwise to remove it from the Body.

17. Remove the O-ring (**20**) from the Orifice Retainer. Set aside for cleaning and reuse.

18. Use a blunt probe to remove the Orifice (**11**) from the Body. Insert the blunt probe through the end of the Body that receives the Piston. A gentle push should release the Orifice. Note the number and orientation of Spring Washers (**12**). Set aside washers for cleaning. Discard O-ring (**21**).

19. Use a brass probe to carefully remove the Back–up Ring (**22**) from the Body. Discard the Back-up Ring. Be careful not to scratch and damage any of the sealing surfaces inside the Body.

SECTION 3 GENERAL CLEANING PROCEDURE

1. Thermoplastic, silicone rubber and anodized aluminum parts, such as diaphragms, accent trim, adjustment knobs, static O-rings, and thermoplastic housings.

    a. Soak in a solution of warm water and ordinary liquid dish detergent. Scrub with a soft nylon bristle brush to remove deposits.

    b. Rinse with fresh water and blow dry with clean low pressure compressed air.

2. Chrome-plated Brass and Stainless Steel parts -

    a. Soak in a solution of warm water and ordinary liquid dish detergent. Scrub with a soft nylon bristle brush to remove deposits.

    b. Thoroughly rinse with fresh water.

    c. If deposits cannot be removed with above process, soak parts in dilute solution of white vinegar (50% water) for approximately 30 minutes and scrub with a nylon brush. Use of an ultrasonic cleaner will accelerate this process. Do not subject thermoplastic or rubber parts to vinegar solution or ultrasonic cleaning.

    d. Rinse first with freshwater and follow up with a final rinse in deionized (distilled) water. Tap water typically contains minerals that will leave undesirable residue on the cleaned parts if final rinse is omitted.

3. Hoses -

    a. Corrosion or mineral deposits on the metallic fittings on hoses may be cleaned using the procedure presented above provided that care is taken to just dip only the metal fittings at each the end of the hose into the cleaning solution. Take care to prevent entrance of the solution into the hose interior.

    b. Rinsing should include flushing the interior of the hose with fresh water followed by drying with compressed air.

SECTION 4 INSPECTION AND LUBRICATION PROCEDURES

- Refer to the Illustrated Parts List (IPL) which provides information regarding which parts should be replaced during the reassembly.

- Before beginning the reassembly process be certain to inspect all parts to be used. Each part must be clean and free of defects. Care to complete a careful inspection may avoid a need to rework the regulator later if unacceptable parts were used in reassembly.

- Maintain cleanliness during the reassembly process. It is important to avoid the introduction of hydrocarbons to the regulator internal parts that may be associated with the deposition of grease and oils and other contaminants. It is recommended that powderless latex gloves be used as a measure to reduce the opportunity of transfer of oils to parts subjected to high pressure.

CAUTION – Silicone grease or aerosols are not compatible with Enriched Air Nitrox (EAN) at high pressures. Do not risk contamination of the regulator rendering it unsuitable for EAN use by using any incompatible lubricants on the regulator assembly.

WARNING – DO NOT attempt to use any other manufacturer's parts regardless of apparent similarity. Use of incorrect parts with even small differences could render the product unsafe with a possibility leading to serious injury or death.

- O-rings are classified by the service they perform and are identified as either **static** or **dynamic**. **Dynamic** O-rings are those that are subjected to movement and the effects of friction which tend to shorten the useful life of the O-ring. **Static** O-rings are used to create a seal between non-moving parts and are not subject to the same wearing effects. **Static** O-rings have a longer useful life and are not replaced unless they show signs of deterioration or brittleness. Careful inspection of these O-rings is required before they are returned to service.

  Lubrication of O-rings:

  a. General - O-rings in most instances should receive only enough lubricant to ensure they are supple. A light coating of lubricant should present a surface that glistens but without a defined layer of lubricant visible.

  b. Ample – When an ample application of lubricant is specified it generally applies to a dynamic O-ring subject to considerable motion or environmental conditions where a more generous application of lubricant might be beneficial. In this situation there should be a light film or layer of lubricant visible.

SECTION 5 REASSEMBLY PROCEDURES

1. Place the Back-up Ring (**22**) over the small end of the installation tool (PN 20-900-400) and insert the Back-up Ring into the First Stage Body (**3**) interior approaching from the end that receives the HP Orifice (**11**). Use the tool to firmly press the Back-up ring into the cavity for retaining it. Verify visually that the Back-up Ring is fully seated.

2. Closely examine the Spring Washers and observe that the shape is slightly convex (curved). Place one Spring Washer onto the Orifice (**11**) with the cupped surface downward. Add another Spring Washer with the curved surface opposite to the Spring Washer already in place. Repeat this procedure so that there are four Spring Washers stacked with the convex surfaces alternating. Apply ample lubrication to O-ring (**21**) and add it to the Spring Washer Stack. Compare the stacking orientation with that of Figure to be certain it is correct.

CAUTION – The correct orientation of the Spring Washers must be verified before proceeding to the next step. Incorrect orientation may impair the regulator's performance.

3. Place the large end of the Orifice onto a blunt probe as a means to hold it for insertion into the First Stage Body. Carefully guide the Orifice into the high pressure side of the Body so that the nose of the Orifice fits into the installed Back-up Ring. Press firmly to be certain the Orifice is fully inserted. Visually inspect for verification.

4. Install the O-ring (**20**) onto the Orifice Retainer (**9**) and then use a 5/32 " hex tool to install the Orifice Retainer into the First Stage Body. Use a torque wrench calibrated for in-lbs torque to tighten to 90 in-lb (±10).

5. Use a Schrader Valve Tool (PN 12-100-500) to install a new Schrader Valve (**18**) into the First Stage Body. Thread the Schrader Valve only until the end of the threaded portion of the valve is flush with the surface of the hole. Tighten until snug. Do not overtighten.

6. Install the Vent Valve (**33**) into the Diaphragm (**31**) by pulling the stem of the Vent Valve through the center of Diaphragm. Be certain that the Vent Valve is oriented in the Diaphragm so that the stem will point toward the interior of the regulator when the Diaphragm is installed.

7. Roll the edges of the Diaphragm back to turn it inside out and position it over the First Stage Body so that the Vent Valve stem is pointing toward the Orifice Retainer. Roll the edges of the Diaphragm over the end of the First Stage Body so that the bead on the inside of the Diaphragm fits into the groove on the First Stage Body. Press on the center of the Diaphragm and test to see if you can feel the Schrader valve operate. There should be a spring back of the Diaphragm when it is pressed and released.

8. Apply Christo-Lube to the piston O-ring (**23**) so that it has ample lubrication and install the O-ring onto the Piston (**1**). Perform the same procedure with O-ring (**24**) and install it onto the piston stem.

9. Install a new High Pressure Seat (**10**) into the cavity at the end of the piston stem. Check to be certain that it fully seats and does not protrude from the piston stem.

10. Set the End Cap (**2**) on a flat surface with the open end facing up and then place the Piston inside the End Cap so that the piston head is above the threads and level with the rim of the End Cap. Gently press the Piston straight into the End Cap taking care to avoid dragging the O-ring over the threads. Press the Piston until it is fully seated. Be certain that the HP Seat in the Piston does not become contaminated with oil, lint or other materials during this process.

CAUTION – Be careful not to allow the Piston to become angled or cocked during insertion. Misalignment may cause the O-ring to become dislodged or metal–to-metal contact between the Piston and End Cap could damage either part.

11. Place the Styling Ring (**6**) over the End Cap so that it rests evenly over the perimeter of the End Cap.

12. Place the Spring Isolator(s) (**27**) inside the First Stage Body. It is important that the same number of Spring Isolators are returned to the regulator as removed during disassembly. If multiple Spring Isolators are required place two inside the First Stage Body and the rest between the Spring and Piston. Do not use more than four Spring Isolators. If more are required to reach the correct Intermediate Pressure (IP), replace the Spring.

13. Apply a light film of lubricant to both ends of the Spring (**28**) and place the Spring into the First Stage Body.

14. Hold the Body stable with the Spring facing upward and guide the End Cap with Piston installed into the Body. The stem of the Piston should travel down through the Spring and center of the Body. Mate the End Cap threads to the threads of the Body and press downward while rotating the End Cap clockwise. The Threads should engage. Tighten until snug and the space between the End Cap and Body is closed.

15. Wet the Saddle (**7**) with clean water and place it over the Diaphragm so that when fully installed the opening for the Yoke Retainer will align with the threaded hole in the body.

16. Using the vise mounting tool secure the First Stage Body in a vise with the inlet port facing straight up.

17. Place the O-ring (**17**) over the conical end of the Filter (**8**) and insert the Filter into the Yoke Retainer. Use Retaining Ring Pliers compress the Retaining Ring (**25**) and install it into the Yoke Retainer.

18. Install the smaller main seal O-ring (**17**) into the groove at the base of the Yoke Retainer and Install the larger O-ring (**13**) onto the Yoke Retainer at the shoulder near the base of the threads.

19. Pass the Yoke Retainer through the Yoke (**15**) and Saddle inserting it into the inlet port of the Body. Hand tighten until snug.

20. Using the 1″ Socket (PN 20-155-500) and Torque wrench with the Socket Drive Extension (PN 20-156-50), tighten the Yoke Retainer to 25 ft-lbs (±1).

21. Place the opening of the Inlet Protector (**16**) over the threads of the Handwheel (**32**) with the dimple in the Inlet Protector facing upward and thread the Handwheel into the Yoke.

22. Place the three-pin spanner of the First Stage Wrench (PN 20-600-200) over the End Cap and tighten the End Cap until the space between the End Cap and Body is closed. Do not overtighten.

23. Replace O-rings (30 & 17) on HP and LP Port Plugs and install Port Plugs into the Body. Install new, lubricated O-rings (**10** & **27**) onto Hose.

24. When coupling the Second Stage to the First Stage be certain that the appropriate LP port is selected and then attach the hose. The torque for tightening the hose should be approximately 40 in-lbs. (Proceed to Final Testing.)

SECTION 6 FINAL TESTING PROCEDURES

CAUTION – If the regulator has been upgraded for use with EAN/NITROX, it is important to pressurize and flow test the regulator using only hydrocarbon-free gas. The regulator will otherwise become contaminated with hydrocarbons if normal compressed air is used.

INTERMEDIATE PRESSURE TEST

1. Connect a calibrated intermediate pressure test gauge to the regulator, either with a quick-disconnect inflator hose or with the female fitting of a second stage LP hose, depending on the connection of the test gauge.

WARNING – To provide a safety relief valve in the event that intermediate pressure exceeds 200 psi, ensure that a fully assembled and properly adjusted second stage is connected to the first stage before pressurizing. Failure to relieve intermediate pressure that exceeds 400 psi may result in damage or rupture of the text gauge or LP hose, and could cause serious personal injury.

2. Initially connect the first stage to a supply of 300 psi filtered test gas, and slowly open the supply valve to pressurize the first stage. Closely monitor the IP test gauge to determine whether the intermediate pressure rises above 150 psi.

CAUTION – If the intermediate pressure continues to rise above 200 psi immediately shut the test gas supply valve. Refer directly to the Table 1, Troubleshooting and remedy as needed before proceeding any further.

3. When the intermediate pressure has been determined to be 150 psi or less, close the supply valve and purge the second stage to depressurize the system. Connect the first stage to a supply of 2,500 - 3,000 psi test gas.

NOTE – Correct intermediate pressure for the first stage is between 130-150 with a supply pressure of 2,500 - 3,000 psi.

4. Open the supply valve again while monitoring the IP test gauge to ensure that the intermediate pressure does not rise above 140 (±10) psi. If the intermediate pressure rises above 150 psi, immediately close the supply valve and purge the system. Refer to Table 1- Troubleshooting, and remedy as needed before proceeding.

5. Repeatedly purge the second stage approximately 15-20 times to cycle the regulator. Then check the test gauge to determine whether the intermediate pressure locks up consistently after each cycle and remains stable at 140 (±10) psi, with no signs of creeping of fluctuation. If the intermediate pressure is not within the specified range, or if it fails to lock up with no creep, refer to Table 1, Troubleshooting to determine the cause of the problem. Repeat this procedure after the problem is corrected.

6. After determining that the intermediate pressure holds stable at 140 (±10) psi, perform the following tests to further ensure the absence of leaks.

EXTERNAL LEAK TEST

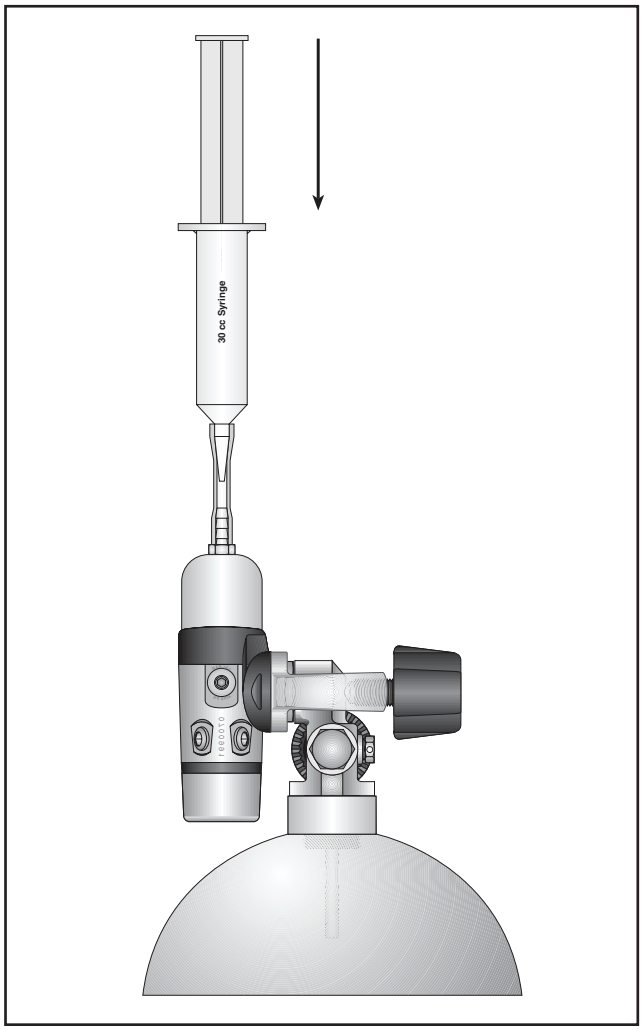
1. After first stage reassembly and final adjustment of the second stage has been completed, submerge the entire regulator in a test tank of clean water while pressurized with 2,500 - 3,000 psi. Observe any bubbles arising from the submerged regulator over a one minute period. The recommended time is necessary due to slower bubble formation that occurs in smaller leaks. Disassemble the regulator at the source of the leak to check sealing surfaces, assembly sequence and component positioning in order to correct the problem(s).

> **NOTE** – The location of extremely small leaks can best be detected by applying a soap solution to the leak area. Before disassembling to correct any leaks, rinse the entire regulator thoroughly with fresh water and blow out all residual moisture with filtered, low-pressure (25 psi) test gas. Refer to Table 1 Troubleshooting.

AMBIENT PRESSURE VALVE TEST

1. After the first stage exhibits a stable intermediate pressure of 140 (±10) psi with no creep, perform the following test check the function of the ambient sensing diaphragm and valve, using the Pressure Tool (PN 20-750-500).

2. Examine the Pressure Tool to ensure that the syringe is securely connected to the sealing cup with a short length of flexible tubing, and that the O-ring seal is intact inside the rim of the cup. Retract the plunger fully inside the top of the syringe.



3. Fit the sealing cup of the Pressure Tool over the end of the saddle, and hold it firmly in place to create a seal. While monitoring the IP text gauge, rapidly depress the plunger to create a surge of pressure against the ambient sensing diaphragm, and check the test gauge to verify that the intermediate pressure increases approximately 10-15 psi.

4. Purge the second stage to cycle the regulator once and check the test gauge to verify that the intermediate pressure returns to its original lockup pressure, with no creep.

5. Repeat Step 3 several times, if necessary, to verify that the intermediate pressure increases when the Pressure Tool is surges, and returns to normal when the regulator is cycled. If the intermediate pressure does not increase or return to a stable lockup pressure, the Schrader valve and sensing diaphragm are either incorrectly installed or not functioning properly. Refer to Table 1 Troubleshooting to determine the cause and the required solution.

NOTE – After completing the overhaul service procedures for the second stage regulator, it is important to test the complete regulator, first and second stage, together as a complete unit, following the final testing procedures outlined in the second stage service guide..

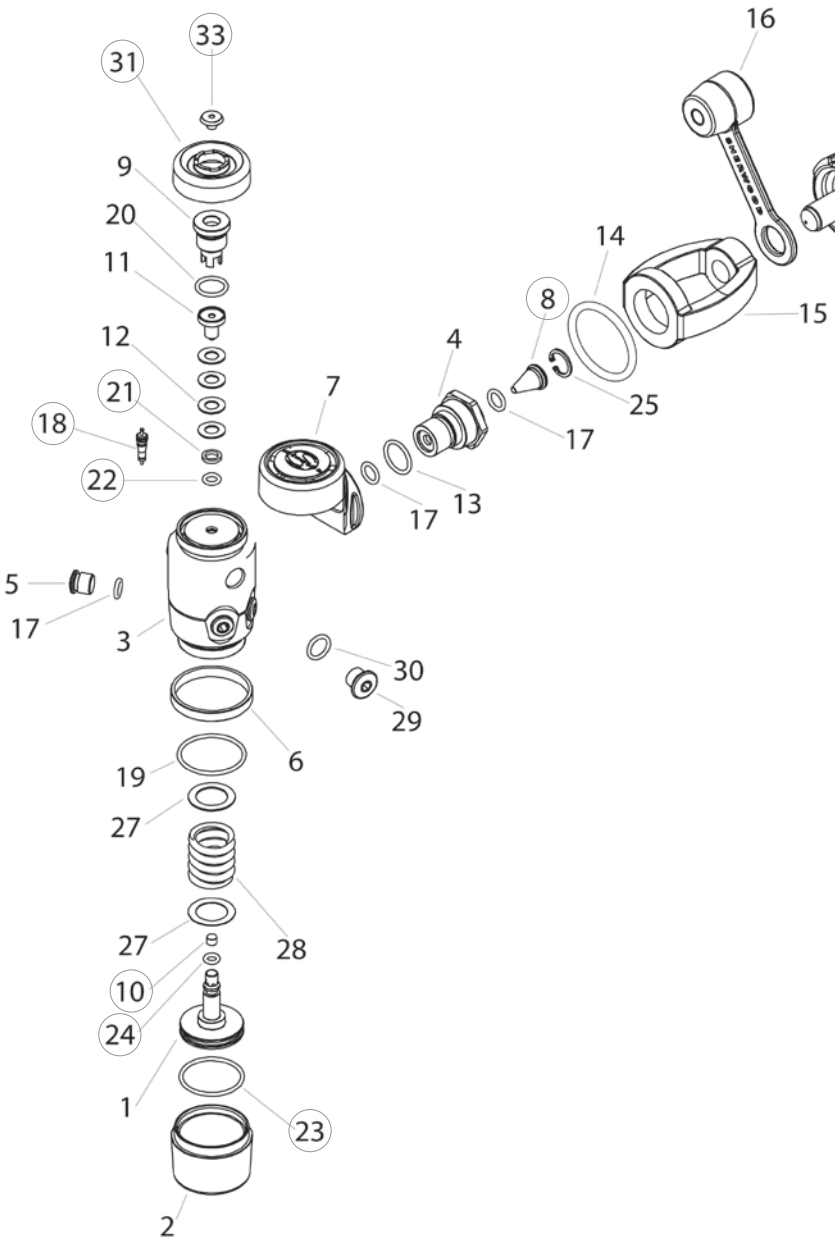
This completes the overhaul service procedures for the First Stage Regulator.

TABLE 1 TROUBELSOOTING GUIDE

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Excessive inhalation resistance from both first & second stages	1. Cylinder valve partially opened. 2. Cylinder valve requires service. 3. Conical filter (**8**) is clogged. 4. Low intermediate pressure.	1. Fully open valve, then turn back ¼ turn. Check fill pressure. 2. Connect to a different cylinder. 3. Replace filter with new. 4. See below.
Low intermediate pressure	1. End cap (**2**) is loose. 2. Spring Washers (**12**) are assembled incorrectly. 3. Main valve spring (**28**) is damaged. 4. Schrader Valve (**18**) is not functioning correctly. 5. Incorrect number of Spring Isolators (**27**) are installed on either side of the Valve Spring.	1. Tighten End Cap until snug. 2. Verify correct orientation. 3. Replace Spring and Spring Isolators. 4. Check condition of Ambient Diaphragm (**31**) and Schrader Valve and replace or reinstall as needed. Preform final test procedure. 5. Add Spring Isolators as needed. Do not exceed four each, if I.P. remains low, replace Spring.
High intermediate pressure	1. HP Seat (**10**) damaged or worn. 2. Piston O-rings (**23** or **24**) damaged or worn. 3. Orifice (**11**) is damaged. 4. First Stage Body (**3**) damaged internally. 5. Incorrect number Isolators (**27**) are installed on either side of Valve Spring.	1. Replace HP Seat. 2. Replace O-rings. 3. Replace Orifice. 4. Replace Body. 5. Remove Spring Isolators as needed.
Leakage from beneath yoke	1. Yoke Retainer O-ring (**17**) damaged or worn.	1. Replace O-ring.
Constant leakage from beneath the end of the saddle	1. Schrader Valve (**18**) is not functioning correctly. 2. Vent Valve (**33**) is incorrectly installed or damaged. 3. Orifice Retainer (**9**) and O-ring (**20**) are incorrectly installed or damaged. 4. Excessively high intermediate pressure.	1. Check condition of Diaphragm (**31**) and Schrader Valve and replace or reinstall as needed. Perform final test procedure. 2. Reinstall or replace vent valve as needed. 3. Reinstall or replace as needed. 4. Remedy as indicated above.

CAUTION – All repairs must be performed with a complete overhaul service, unless the problem is detected immediately after a complete overhaul service has already been performed. Do not attempt to perform partial service if the regulator shows any signs of use.

BRUT FIRST STAGE



ITEM	PART #	DESCRIPTION
1	SHV7035	Piston
2	SHV7036	End Cap
3	SHV7037	Body First Stage
4	SHV7038	Yoke Retainer
5	SHV7039	LP Port Plug
6	SHV7040	Styling Ring
7	SHV7041	Saddle
8	SHV7042	Filter
9	SHV7043	Orifice Retainer
10	SHV7044	HP Seat
11	SHV7048	Orifice
12	SHV7049	Spring Washer
13	SHV7061	O-ring
14	SHV7060	O-ring
15	SHV7051	Yoke
16	SHV7055	Inlet Protector
17	SHV7071	O-ring
18	SHV7065	Shrader Valve
19	SHV7083	O-ring
20	SHV7064	O-ring
21	SHV7066	O-ring
22	SHV7050	Backup Ring
23	SHV7080	O-ring
24	SHV7082	O-ring
25	SHV7034	Retaining Ring
26	SHV7035	Decal Knob
27	SHV7068	Spring Isolator 2-PSI
28	SHV7063	HP Spring
29	SHV7074	HP Port Plug
30	SHV7081	O-ring
31	SHV7067	Diaphragm
32	SHV7062	Handwheel
33	SHV7046	Vent Valve

SECTION 1 BRUT SECOND STAGE

RECOMMENDED TOOLS AND SUPPLIERS

The specialty tools identified below may be purchased from your Sherwood Scuba Distributor. Common tools are available from several sources.

Including:	
Sears Roebuck	www.sears.com/craftsman
Home Depot	www.homedepot.com
Harborfreight Tools	www.harborfreight.com

Common Tools

Open End Wrenches - 9/16", 5/8",1/2", 3/4”
Hex Tool 5/32"
Small Flat Blade Screw Driver
Diagonal Pliers (wire cutters)
Torque Wrenches 25 ft-lb and 60 in-lb
Flashlight
Compressed Air Gun
O-ring picks, plastic or soft metal
Magnifier

Specialty Tools

Poppet/Orifice Installation Tool	20-900-100
Blunt Probe/Pick	10-20-400
Dual Drive Adjustment Tool	20-500-200
Height Gauge	20-900-250

SECTION 2 DISASSEMBLY PROCEDURE

1. Use a 3/4″ open end wrench to stabilize the inlet connector (**9**) and a 5/8″ wrench to rotate the hose fitting nut counterclockwise to separate the hose assembly (**26**) from the inlet connector.

2. Remove the tie wrap (**17**)and mouthpiece (**25**).

CAUTION – When performing the next step to remove the Purge Cover be careful to avoid placement of the probe or screwdriver between the Housing and the Diaphragm Retainer. Incorrect placement of the screwdriver may increase the risk of damage to the Diaphragm requiring replacement of the part.

3. Remove the purge cover (**22**) by inserting a probe at the entry point on the housing and lift the edge of the cover enough to grasp it and lift it from the housing (**12**).

4. Remove diaphragm retainer (**24**) and diaphragm (**23**).

5. With the assistance of a small screwdriver to remove the C-clip (**18**).

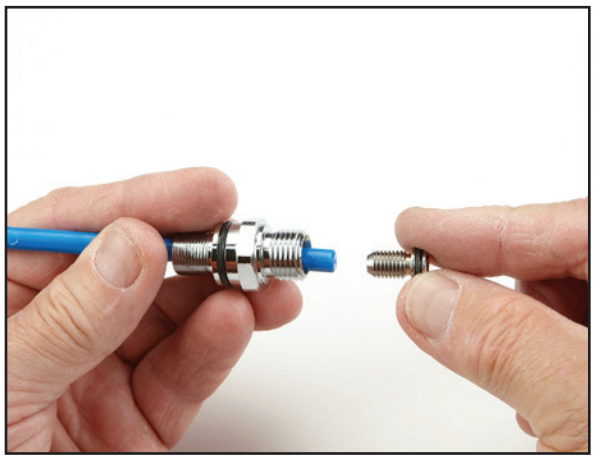
6. Push the access plug (**14**) to remove it from the housing.

7. Remove the O-ring (**11**) from the access plug and set aside for cleaning (it will be reused).

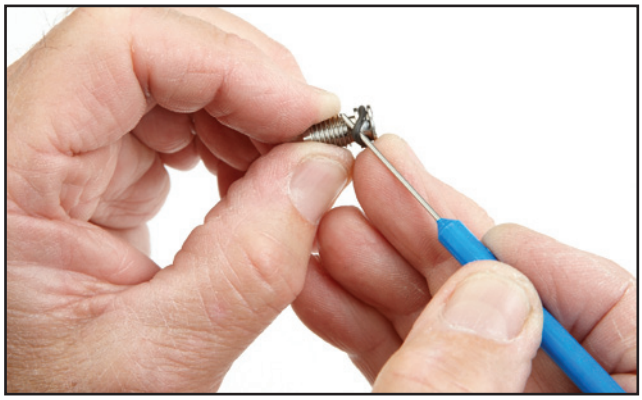
> **CAUTION** – Before performing the next step retract the Poppet (**2**) from the Adjustable Orifice (**4**) by fully depressing the Demand Lever (**5**). Rotation of the Adjustable Orifice without retracting the Poppet may result in damage to the Poppet Seat (**8**) necessitating replacement of the seat.

8. Use a 3/4" wrench to remove the inlet connector from the housing. Remove O-ring (**11**) and set aside for cleaning.

9. Use tool Orifice Installation Tool (20-900-100) to remove the adjustable orifice from the inlet connector. The adjustable orifice is threaded and must be rotated counterclockwise and then pushed with a blunt probe for removal.



10. Remove and discard O-ring (**10**).



11. Slide valve body (**1**) back and lift upward to remove it from the housing.

12. Remove the exhaust tee (**16**) from the housing by removing the two screws (**15**).

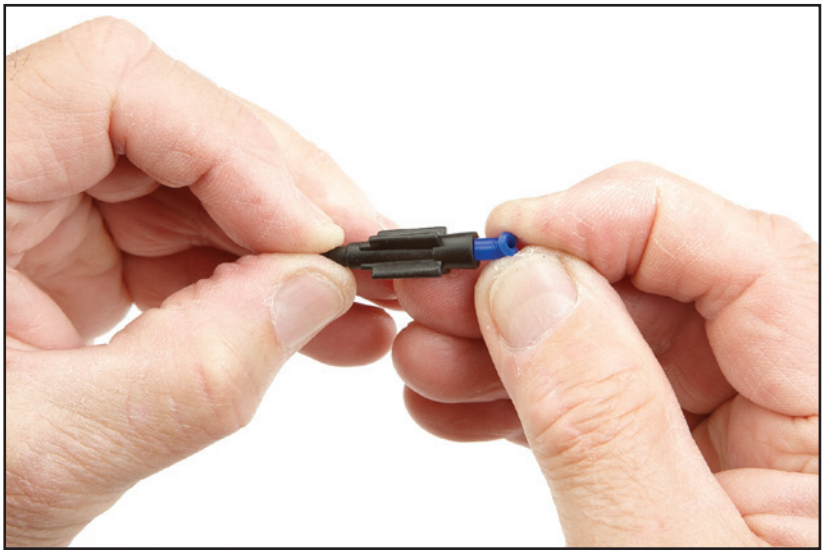
13. Remove the exhaust valve (**13**) from the housing by grasping the valve and stretching the tab to release it from the housing.

14. Rotate the adjuster screw (**3**) counterclockwise to remove it from the valve body.

15. Cover the open end of the Valve Body with your finger to restrain the Poppet and use a probe to push the Cam (**6**) free of the Valve Body.

16. Tilt the Valve Body to allow the Poppet (**2**) and Spring (**7**) to slide out of the Valve Body.

17. Grasp the Poppet Seat (**8**) and pull to separate it form the Poppet. Discard the Seat.



This concludes the disassembly process. Proceed to Cleaning and Inspection before beginning reassembly.

SECTION 3 GENERAL CLEANING PROCEDURE

1. Thermoplastic, silicone rubber and anodized aluminum parts, such as diaphragms, accent trim, adjustment knobs, static O-rings, and thermoplastic housings.

    a. Soak in a solution of warm water and ordinary liquid dish detergent. Scrub with a soft nylon bristle brush to remove deposits.

    b. Rinse with fresh water and blow dry with clean low pressure compressed air.

2. Chrome-plated Brass and Stainless Steel parts -

    a. Soak in a solution of warm water and ordinary liquid dish detergent. Scrub with a soft nylon bristle brush to remove deposits.

    b. Thoroughly rinse with fresh water.

    c. If deposits cannot be removed with above process, soak parts in dilute solution of white vinegar (50% water) for approximately 30 minutes and scrub with a nylon brush. Use of an ultrasonic cleaner will accelerate this process. Do not subject thermoplastic or rubber parts to vinegar solution or ultrasonic cleaning.

    d. Rinse first with freshwater and follow up with a final rinse in deionized (distilled) water. Tap water typically contains minerals that will leave undesirable residue on the cleaned parts if final rinse is omitted.

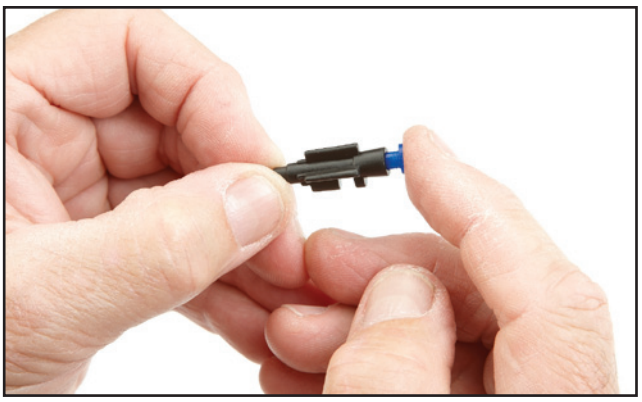
3. Hoses -

    a. Corrosion or mineral deposits on the metallic fittings on hoses may be cleaned using the procedure presented above provided that care is taken to just dip only the metal fittings at each the end of the hose into the cleaning solution. Take care to prevent entrance of the solution into the hose interior.

    b. Rinsing should include flushing the interior of the hose with fresh water followed by drying with compressed air.

SECTION 4 REASSEMBLY PROCEDURES

1. Install a new poppet seat (**8**) into the poppet (**2**).



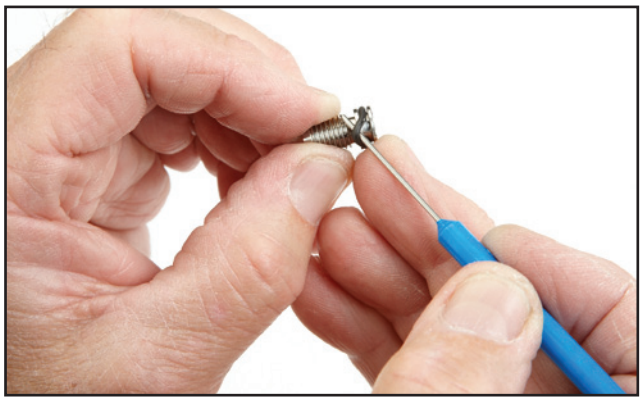
2. Install the adjustment screw (**3**) into the valve body with an initial insertion of only one or two threads.

3. Place spring (**7**) inside valve body (1).

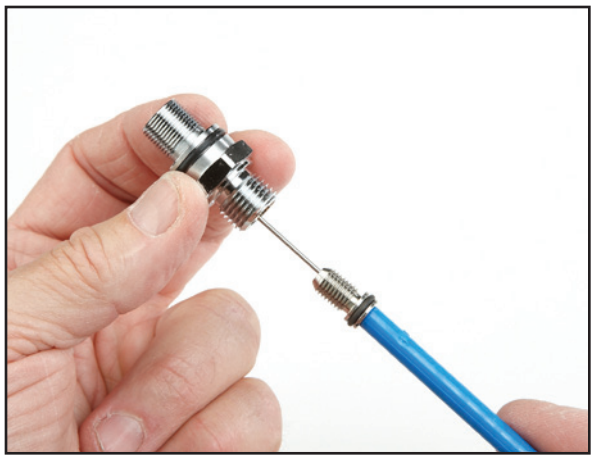
4. Use poppet Poppet Insertion Tool 20-900-100 to guide the poppet into the valve body. Note that notch in the poppet must align with the cross hole in the valve body. After the poppet is aligned, insert the cam (**6**) with the flat side facing toward the spring (**7**) to capture the poppet.

5. Hold the valve body so that the adjustment screw is at the left and the spring is visible though the air jet opening. This should align the valve body so that the cam is below the center line of the valve body. Place the demand lever (**5**) onto the cam by spreading the legs of the demand lever enough to slip it onto the cam. Operate the demand lever to observe that it moves the poppet.

6. Install the cleaned O-ring (**11**) onto the inlet connector. Note the O-ring groove is closest to the end with fine threads.



7. Install a new lubricated O-ring (**10**) onto the Adjustable Orifice (**4**) and then insert the adjustable orifice into the Inlet Connector (**9**). Note that insertion is at the end of the inlet connector with the coarse threads. Use the Orifice Installation Tool 20-900-100 to thread the adjustable orifice rotating it clockwise until it comes to a stop. Then rotate the Adjustable Orifice counterclockwise two full turns. This will establish the approximate correct Demand Lever height after the Inlet Connector is installed.



8. Install the cleaned exhaust valve (**13**) into the housing. Be certain that the tab is captured in the hole in the housing and that the exhaust valve fully closes.

9. Install the exhaust tee (**16**) and secure with the two screws (**15**).

10. Install the valve body into the housing aligning the square feature on the valve body with the indexing feature in the housing.

CAUTION – Before performing the next step retract the Poppet (**2**) from the Adjustable Orifice (**4**) by fully depressing the Demand Lever (**5**). Rotation of the Adjustable Orifice without retracting the Poppet may result in damage to the Poppet Seat (**8**) necessitating replacement of the seat.

11. Install the Inlet Connector (**9**) into the housing taking care to depress the demand lever fully to retract the poppet to prevent contact with the adjustable orifice as the inlet fitting is rotated during insertion. Use a 3/4 " wrench to tighten. (Apply approximately 40 in-lbs torque).

12. Install a cleaned and lubricated O-ring (**11**) onto the access plug (**14**) and insert the access plug into the housing. Secure with the C-clip (18).

13. Remove the port plug (**19**) from the access plug.

14. Insert a 5/32 " hex tool to engage the adjuster screw and rotate clockwise to advance the adjuster screw until it comes to a gentle stop. Reverse the rotation to retract the adjuster screw one and one half turns.

15. Temporarily attach the partially assembled second stage to a fully assembled and adjusted first stage with an intermediate pressure set between 140 and 150 psi. Place the Dual Drive Adjusting Tool 20-500-200 between the hose and the inlet connector.

16. Pressurize the regulator so that intermediate pressure acts on the second stage. There may be air leaking by the poppet until a final adjustment is made. Check the height of the Demand Lever position above the edge of the Housing with the Height Gauge. It should be approximately 3/16". If an adjustment is necessary, engage the blade feature of the Dual Drive Adjusting Tool with the slot in the Adjustable Orifice. Depress the Demand Lever to retract the Poppet and rotate the Adjustable Orifice clockwise to lower the Demand Lever and in the opposite direction to raise it. Release the Demand Lever and check the height. Continue repeating the process until the height is correct.

17. Install the diaphragm (**23**) and diaphragm retainer (**24**).

18. Install purge cover (**22**). If an air leak is detected when the purge cover is installed the demand lever may be set too high. Repeat step 16 if necessary.

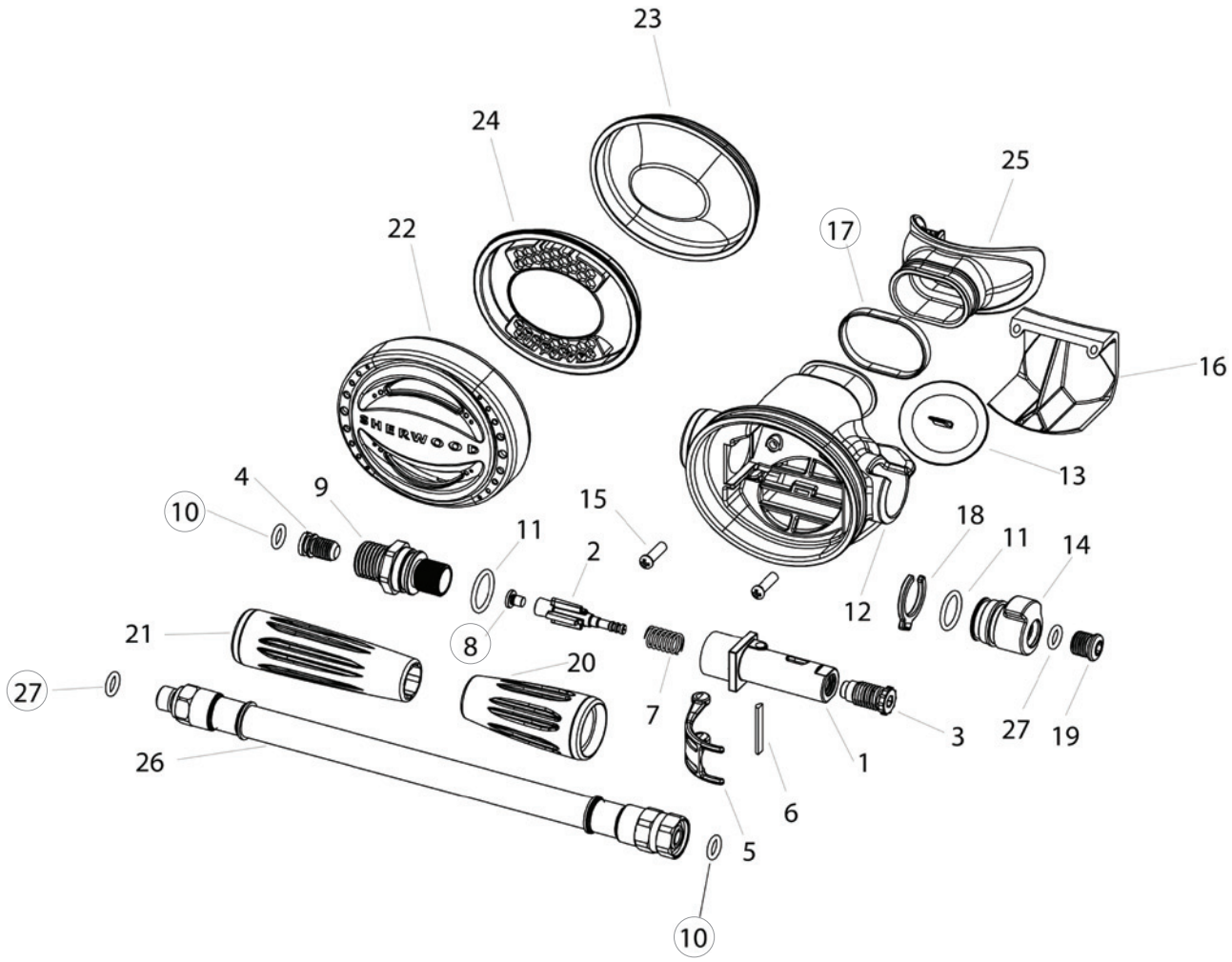
19. Depressurize the regulator assembly and remove the Dual Drive Adjusting tool. Install the hose assembly (**26**) and tighten the swivel nut to approximately 40 in-lbs torque. Push the hose protector (**20**) toward the housing to cover the hose fitting completely.

20. Use a 5/32" Hex Tool to install the LP Port Plug (**19**) into the Access Plug (**14**). Check the opening effort (cracking pressure) of the second stage. It should be between 1.2 and 1.8 inches of water pressure. If it needs to be adjusted, remove the LP Port plug, insert the 5/32" Hex Tool in the Adjustment Screw (**3**) and rotate it clockwise to increase effort and counterclockwise to reduce opening effort.

21. Install the Mouthpiece (**25**) and secure with a tie wrap (**17**).

This concludes the reassembly procedure.

BRUT SECOND STAGE



ITEM	PART #	DESCRIPTION
1	SHV7014	Valve Body
2	SHV7020	Poppet
3	SHV7019	Adjustment Screw
4	SHV7016	Adjustable Orifice
5	SHV7015	Demand Lever
6	SHV7018	Lever Cam
7	SHV7017	Spring
8	SHV7005	Poppet Seat
9	SHV7013	Inlet Connector
10	SHV7071	O-ring
11	SHV7070	O-ring
12	SHV7021	Housing
13	SHV7006	Exhaust Valve
14	SHV7022	Access Plug

ITEM	PART #	DESCRIPTION
15	SHV7027	Screw
16	SHV7024	Exhaust Tee
17	SHV7026	Tie Wrap
18	SHV7025	C Clip
19	SHV7023	Port Plug, LP
20	SHV7032	Hose Protector, Short
21	SHV7031	Hose Protector, Long
22	SHV7095	Purge Cover
23	SHV7090	Diaphragm
24	SHV7012	Diaphragm Retainer
25	SHV7028	Mouthpiece
26	SHV7530	Hose Assembly w/ O-ring
27	SHV7075	O-ring