SHERWOOD SCUBA® REGULATORS

MINIMUS® (SRB3108)

SHADOW™ (SRB3209)



Assembly & Maintenance Guide

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IMPORTANT

Read all instructions and procedures in this manual carefully **before** servicing the regulator. Parts have changed cosmetically over the years, but newer style parts can usually be used in place of older parts. The most current part numbers can be obtained by calling your authorized Sherwood Distributor. If you have any questions, contact your Sherwood Sales Representative or authorized Sherwood Distributor.

INTRODUCTION

This manual is a guide for the annual servicing and maintenance of the Sherwood SR3108 Minimus and SR3209 Shadow+ regulators. It gives breakdowns of regulator parts, equipment specifications, servicing instructions, troubleshooting recommendations, and guidelines for proper care of these regulators. This manual is intended for use **only** by persons specially trained and authorized to service Sherwood Scuba equipment.

Because of the many unique features found only in Sherwood regulators, Sherwood conducts seminars on a regular basis throughout North America to train technicians in proper service and repair procedures for all current Sherwood regulators. In addition, all Sherwood dealers and their staff members are encouraged to attend the seminars to gain an in-depth understanding of the construction, special features and operation of Sherwood regulators.

NOTE: You **must** be authorized by Sherwood to work on Sherwood Scuba equipment. You can obtain proper authorization by attending all appropriate seminars given in your area. This is the **only** way you can become an authorized Sherwood technician.

For information on the dates and locations of upcoming Sherwood service seminars near you, contact your Sherwood Distributor or Sherwood Sales Representative.

IMPORTANT

Anyone attempting to service or repair Sherwood Scuba regulators **must** have a thorough understanding of the principles of operation of scuba regulators and valves, as well as the appropriate mechanical ability. The technician must also be properly trained in the safe use of compressed air and the various tools and cleaning solutions involved in the procedures outlined in this manual.

SPECIFICATIONS

REGULATOR MODEL	Sherwood SR3108 Minimus & SR3209 Shadow+
AIR FLOW	29 cu. ft. / min. @ 1 atmosphere
INHALATION RESISTANCE	1.5" w.c @ 1 atmosphere
EXHALATION RESISTANCE	0.8" w.c. max. @ 1 atm.
RECOMMENDED LUBRICANTS	LTI Christo-Lube #1110, Dow Corning 111 Compound®, Parker Super O-Lube®, or equivalent
TYPE	Downstream valve, diaphragm, with Variable Fulcrum **U.S. Pat. #3,991,785**
WEIGHT	4.2 oz. (octopus w/o main hose 8.1 oz. (Shadow+ w/o main hose)
HOSE LENGTH	36 in.
MATERIALS	Cover - Thermoplastic Triax Case - Thermoplastic Triax® Poppet Seat - Liquid Silicone Tm Rubber 0-rings - Buna-N® Diaphragm - Tufel® (Blue) Exhaust Valve - Thermoplastic Elastomer Mouthpiece - C-Flex®

TOOLS REQUIRED FOR MINIMUS & SHADOW+ SERVICING

— # 10 Torx Screwdriver (Sherwood Tool TL117)
— Phillips screwdriver
— 3/4" wrench
— 5/8" wrench
— 9/16" wrench
— Side cutting pliers
— Sherwood In-line Adjusting Tool (p/n TL102)
— Sherwood Plastic Probe (p/n TL111) to push out orifice
— Sherwood Lever Height Adjusting Tool (TL123)
— Sherwood Stem Socket Tool (p/n TL124)

DISASSEMBLY

To view the complete parts list of the second stage, fold out the front cover of this manual.

(1) Pull back the hose protector (Item 21) from the inlet end ferrule. Remove the hose assembly (Item 20) from the orifice housing (Item 16) using a 3/4" and a 5/8" wrench. Inspect the hose assembly for any cuts or cracks, especially on the hose at the metal ferrules. Replace the hose assembly if any cuts or cracks are found.

(2) Remove the mouthpiece (Item 15) by cutting the mouthpiece tie (Item 14) with side cutting pliers. Discard the old mouthpiece tie. Examine the condition of the mouthpiece. Pay particular attention to the area on top just behind where the old tie tightened. This is a prime area for small holes to develop. If the mouthpiece is in good condition, it can be reused.

(3) Pry out the exhaust grid (Item 10) with a small screwdriver.

(4) Use a #10 Torx (or small slot) screwdriver to remove the four screws (Item 12) holding the front cover (Item 1) in place.

(5) Gently remove the diaphragm (Item 2) from the cover. Hold the diaphragm up to a light source. **Gently** stretch the diaphragm and look for tears or pinholes. If any are found, replace the diaphragm. Otherwise, the diaphragm can be reused.

Note: If the unit is a SR3209 Shadow+, at this point you should pull off the swivel (Item 26, Fig. 1) from the orifice housing (Item 23). Inspect the inner bore of the swivel for any scratches that may have caused air leakage. Remove and inspect the O-rings (Items 24 & 25) from the orifice housing. Replace them if any wear or deformation of the O-rings is found. Remove the short hose assembly (Item 27) from the swivel using a 9/16" wrench. Inspect the hose for kinks and bulges.

(6) Hold the case in one hand and use a 3/4" wrench to loosen and remove the orifice housing from the lever assembly. The case is strengthened at the lever support area to withstand the turning forces of the lever support when this is done.

(7) Use the Sherwood in-line adjusting tool (p/n TL102) to, back the adjusting orifice (Item 18) out of the orifice housing until the threads disengage. Remove the in-line adjusting tool, and push the adjusting orifice the rest of the way out of the orifice housing with the Sherwood plastic probe (p/n TL111).

(8) Remove the O-ring (Item 19) from the adjustable orifice.

(9) Before removing the exhaust valve (Item 12) from the case, bend it over as far as it will go from the top, bottom, left and right sides. If it fails to snap back quickly, and does not lie perfectly flat against the case, the valve should be replaced. If it does snap back satisfactorily, remove it and inspect the sealing edges. If they appear smooth, and the locking tab on the nipple is good, the valve can be reused.

(10) Remove the lever support from the inside of the case (Item 13).

(11) Normally, you will simply need to change the poppet stem seat insert (Item 9) to restore the second stage to maximum performance. To change the stem seat insert (Item 9), leave the lever assembly together. With a penknife or similar object, carefully remove the old seat insert. Put the new seat insert on a clean flat surface and lower the poppet cavity (from which the old seat insert was removed) over the new seat insert.

(12) If parts of the lever assembly (stem, spring, lever, etc.) need to be replaced, take apart the assembly with the Sherwood stem socket tool (p/n TL124). Clamp the stem socket tool in a bench vice. Insert the square head of the poppet stem into the tool. With a Phillips screwdriver, loosen the screw (Item 3) that holds the assembly together **two turns only.**

(13) Re-install the orifice housing onto the lever support (without the case) turning the two parts together firmly by hand. This will cause the poppet (Item 8) to be pushed out farther than normal by the orifice. This in turn will cause the lever to go limp.

NOTE: If only the lever (Item 5) is to be replaced, do not totally remove the screw. You can now remove the lever from under the washer and replace it with a new lever. If other parts such as the spring (Item 7) are to be replaced, remove the screw (Item 3) fully. Then remove the orifice housing from the lever assembly to get these parts out.

(14) Rinse all plastic and silicone parts in clean fresh water, and then blow the parts dry with compressed air to remove any sand and dust particles.

(15) **If necessary,** clean all metal parts of the second stage in an ultrasonic cleaner or cleaning solution. Remove the O-rings before cleaning any metal parts; most cleaning solutions are damaging to the O-ring material. See page 7 for recommendations on cleaning solutions.

NOTE: If you use an ultrasonic cleaner to clean the adjustable orifice (Item 18), use a plastic container to prevent the orifice from vibrating against other metal parts which could damage the orifice seal.

(16) Inspect the case (Item 13) for any cracks. Look particularly closely at the area where the orifice housing and the lever support clamp down. Replace the case if any cracks are found.

(17) Inspect the orifice's (Item 18) sealing cone (where the poppet insert seals) for any nicks, scratches, or corrosion. Corrosion or minor scratches can be polished out using a fine-grit rubberized polishing stick or a clean new pencil eraser.

Do not apply heavy pressure when rotating the polishing stick. Stop polishing immediately after the corrosion or scratch disappears. Blow all dust and debris out of the orifice housing with clean compressed air.

NOTE: Prior to this point, you should have cleaned and inspected all parts, following proper servicing procedures. **Do not continue until this has been done.**

ASSEMBLY

(1) Re-install the cleaned and lubricated O-ring (Item 19) onto the adjustable orifice (Item 18). Install the adjustable orifice back into the orifice housing. Push it in with your finger as far as it will go.

(2) Install the exhaust valve (Item 12) into the case by inserting the nipple into the small hole from the outside of the case. Reach inside the case and pull the nipple firmly with the fingers until you hear or feel it "click" into place. Inspect the exhaust valve to see that it is properly seated.

(3) Snap the exhaust grid (Item 10) back into its slots. Make sure it is properly seated.

(4) Install the lever assembly into the case.

(5) Screw the orifice housing (Item 16) onto the threads of the lever assembly. Hold the case (Item 13) in one hand. Use a 3/4" wrench on the orifice housing. Tighten the orifice housing and the lever assembly together snugly (70 in. lbs.).

Note: Do not allow lubrication (grease on fingers, or silicone over-spray) to get on the case (Item 13), the diaphragm (Item 2), or the exhaust valve (Item 11) as it may cause slippage or deterioration of these parts.

Note: If the unit is a SR3209 Shadow+, the O-rings (Items 24 & 25) should now be lubricated and replaced onto the orifice housing (Item 23). The larger of the two O-rings goes on closest to the case (Item 13). Install the short hose assembly onto the swivel (Item 26). Lubricate the inner bore of the swivel. Re-install the swivel back onto the orifice housing.

Note: The following steps (5-8) are included here for continuity. They must be performed after the regulator second stage is adjusted (see "Set-Up of Second Stage," page 4).

(6) Install the diaphragm (Item 2) into the case so that it sits evenly on the ledge.

(7) Install the cover (Item 1) onto the case by sliding it carefully and firmly into place.

(8) Install the four screws (Item 12) that hold the cover onto the case using a # 10 Torx screwdriver (Sherwood Tool TL117) or a small slotted screwdriver.

CAUTION! DO NOT OVER-TIGHTEN. These screws are threading into plastic, which will hold well in service but can be stripped if over-tightened.

(9) Install the mouthpiece (Item 15) and mouthpiece tie (Item 14).

SET- UP

NOTE: For the following adjustments, remove the cover and diaphragm.

(1) Install Sherwood's in-line adjusting tool (p/n TL102) between the orifice housing (Item 16) and the hose assembly (Item 20). Use the tool to screw the adjustable orifice (Item 18) clockwise. Watch the end of the lever (Item 5) as you do this. As soon as the tip of the lever begins to drop, stop turning the tool.

NOTE: The slight amount of friction this operation produces between the orifice and the stem seat will not harm the stem seat.

(2) Attach the second stage to its accompanying overhauled and properly adjusted first stage, and mount on an air tank filled to between 2700 and 3500 psig.

(3) **Slowly** turn on the tank valve. If you hear any leaks, determine the location of the leak, shut the air off, and repair the leak as necessary.

(4) Turn on the air. Use the in-line adjusting tool to turn the adjusting orifice (Item 18) counter-clockwise until you hear a slight hissing. Then turn the adjusting orifice clockwise just enough to stop the hissing.

NOTE: A slight clockwise turn past the point where the hissing just stops will reduce wear and tear on regulators used heavily in rental or training situations.

(5) Depress the lever assembly in the second stage five or six times to get the internal parts seated in their proper positions. Listen for any hissing. Adjust if necessary.

(6) After setting the adjusting orifice, check the relationship between the diaphragm wear plate and the tip of the lever assembly. If you are reusing the same major parts of the regulator, this measurement will most likely be correct, and no adjustment will be needed. To check this relationship, temporarily install the diaphragm (Item 2). With the diaphragm properly seated along its edges, use the finger to tap the wear plate against the tip of the lever. If a slight gap between the wear plate and the lever tip is detected, the lever is too low. If no gap is felt, and no air begins hissing when the cover is installed the height of the lever is OK. If air does begin to hiss only when the cover is installed, the lever is too high.

(7) If no adjustment to the lever height is needed, proceed to step (8). If adjustment either up or down on the lever is needed, use Sherwood's lever height adjusting tool p/n TL123. Install the lever in the slot of the tool. Refer to Sherwood's Tools, Repair Kits and Accessories Manual, page 8, for instructions on the use of the TL-123 tool.

Holding the tool in one hand, with the tip of the lever toward the fingers, bend the lever carefully. Do not hold on to the case when making this adjustment, as this can result in the lever bending at the wrong area (near the lever support instead of at the mid-point of the lever). If necessary, bend the lever upward using the same holding method.

Replace the diaphragm. Continue to test the gap between the lever and the diaphragm after each bending until the lever is in the correct position.

TESTING

INHALATION EFFORT:

Check the inhalation effort of the second stage with a pan of water about five inches deep.

(1) Slowly immerse the second stage with the inlet hose pointed straight up. Since this is an octopus regulator, no air should flow before the water floods into the mouthpiece. This type of setting assures that the regulator will not be prone to free flowing while it is out of the mouth during the dive.

(2) If you use a water column or water manometer to check inhalation effort, it should not be **less than** 1.5" - 2" w.c. at cracking. You can alter the inhalation effort within a certain range.,

(3) You can increase the inhalation effort by turning the adjusting orifice (Item 18) clockwise. Discontinue clockwise adjusting when the lever assembly (Item 5) becomes loose against the lever support (Item 6).

(4) You can decrease the inhalation effort by turning the adjusting orifice counter-clockwise. Discontinue counter-clockwise adjusting when air begins to hiss past the second stage orifice.

EXHALATION EFFORT:

If you do not use instruments to check the exhalation effort, the flow should feel smooth and unrestricted. If you use a water column, it should not exceed 1/2" w.c. at one atmosphere. Brand new exhaust valves will sometimes adhere slightly to the case, causing a slight increase in exhalation effort. This condition will disappear with use.

LEAK TEST:

(1) Disconnect the air supply. Purge the regulator of all positive air pressure.

(2) Slowly immerse the second stage in a pan of water with the mouthpiece pointing straight up.

(3) Immerse the regulator until the water is 1/4" to 1/8" from the lip of the mouthpiece.

(4) Hold the regulator in this position for one minute and then slowly raise it out of the water.

(5) Tip the regulator mouthpiece downward and watch the inside of the mouthpiece tube. If any water escapes from the mouthpiece tube, check for source of leakage.

EXTERNAL AIR LEAKS:

(1) Attach the regulator first stage to a tank short enough to totally submerge the first and second stage in your filling station cooling water.

(2) With the tank valve still turned off, flood the second stage completely with water, and then position it mouthpiece up.

(3) Turn the tank air valve on slowly and then watch for any leaks in the first or second stage (except for the normal flow of air from the one-way bleed valve on the first stage).

(4) Repair any leaks.

TROUBLESHOOTING

POSSIBLE CAUSE	RECOMMENDED ACTION
HIGH INHALATION EFFORT <u>AT DEPTH</u>:	
1. Interstage pressure too low	First stage should be putting out 130 psig minimum.
2. Second stage improperly adjusted	Repeat Steps 1 through 4 in the section of this manual entitled "Set-Up".
FREE FLOWING:	
1. Intermediate pressure too high	First stage should be putting out 150 psig maximum.
2. Damaged or worn L.P. poppet stem seat	Replace seat (p/n 978-9S).
3. Nicked or corroded orifice sealing	Dress the orifice with a polishing stick, or replace the orifice ice.
4. Demand lever bent too high	Adjust or replace the lever.
5. Weak spring in second stage	Replace the spring.
6. Second stage improperly adjusted	Repeat Steps 1 through 4 in the section of this manual entitled "Set-Up".
7. Parts in the second stage have been severely chilled due to repeated purging and have shrunk, allowing air to flow.	Allow the second stage to warm back up to room temperature (this chilling will not occur in normal diving).

WET BREATHING:

1. Improper clearing, or diver diving in total down position. . . . . .Instruct the diver on proper clearing head-technique.

2. Diaphragm improperly installed . . . . . .Check position of diaphragm visually.

3. Hole in the mouthpiece at tie area . . . . . .Replace the mouthpiece.

4. Hole in the diaphragm . . . . . .Replace the diaphragm.

5. Damaged exhaust valve, or edges of the exhaust valve not firmly seated on the case. . . . . .Replace exhaust valve.

6. Crack in case . . . . . .Replace case.

PARTS CLEANING RECOMMENDATIONS

Regulators which see heavy use, particularly those used in salt water, often require extra effort to remove dirt and corrosion from the parts of the regulator. Some suggested cleaning solutions are listed at the end of this section, and there are probably many others being used successfully. Here are a few general suggestions we can make:

First, don't expect your cleaning solution to do all the work in a matter of seconds. If the solution cleans extremely rapidly, it is probably too strong and may be etching the finish on the parts. Use a wooden or plastic stick or a soft bristle brush to help get rid of the thickest deposits. Take special care not to damage orifice sealing areas. Dress the orifice sealing areas with a fine grit polishing stick or pencil eraser after drying the parts.

Immerse only those parts which really need cleaning. With Sherwood's Dry Air Bleed System, the interior of the first stage is always clean and dry, so the piston and spring should never need cleaning. Immersing the clean Sherwood piston in contaminated cleaning solution can plug the flow control element in the face of the piston, which could slow or stop the flow through the positive air purge system.

Many of the solutions used for cleaning metal parts can damage the nitrile compounds found in O-rings. For this reason, remove all O-rings before placing parts in a cleaning bath.

SOME EXAMPLES OF COMMONLY USED CLEANING SOLUTIONS

SOLUTION	COMMENTS
Soapy water	Good for plastic and silicone parts.
Vinegar and water (equal part solution)	Ingredients easily available. Approx. 15 min. cleaning time.
1000 cc water 60 gr. sulfuric acid 60 gr. potassium dichromate	Fast-acting solution that must be made and used with care. Use gloves and safety glasses.
Cleaning solutions recommended by ultrasonic cleaner manufacturers	The preferred choice. Check with the manufacturer for strengths and recommended uses for their cleaners.

CUSTOMER MAINTENANCE & HANDLING TIPS

How your customers treat their regulators will directly influence the unit's function and durability. Here are a few tips that you can pass on to your customers to help ensure the durability of their new Sherwood octopus:

PRE-DIVE CHECKS:

(1) Check the hoses and hose connections for cuts, abrasions or other signs of damage before mounting the regulator on the tank valve. Slide the hose protectors back to inspect the areas of the hose normally covered. Be sure all hose connections are tight.

(2) Before turning on the tank air valve, check to make sure that the yoke nut or DIN connection is tight and the regulator body is aligned properly, with no kinks in the hoses.

(3) Turn the tank valve on **slowly** and listen for leaks. If any leaks are found, replace or repair parts as recommended.

(4) **Never** lift the tank/BCD assembly by the regulator or hoses.

(5) Surface-test the regulator by breathing lightly through the mouthpiece. Depressing the purge button above the water's surface is **not** an appropriate method for testing the function of the regulator.

POST-DIVE CARE:

(1) After the dive, blow all water out of the dust cap with clean dry air and place the cap securely on the regulator inlet. On multiple tank dives, keep salt water out of the regulator inlet when changing tanks. Neglecting these simple procedures is the greatest cause of corrosion and wear in scuba regulators. When used properly, Sherwood's exclusive Dry Air Bleed System keeps all other water-borne contamination out of the first stage body.

NOTE: A tiny stream of air bubbles escaping from a small black valve on the first stage indicates that the Dry Air Bleed System is working. The amount of air used is negligible (13 - 27 cc/min.). Check the system periodically, particularly after servicing, to ensure that there is some air escaping from the black one-way bleed valve. If no air is escaping from the valve when you apply air pressure to the first stage, have the regulator inspected.

(2) With the dust cap securely in place, rinse the first and second stages in **clean fresh water. DO NOT** depress the purge button before or during rinsing since this may introduce water 'into the second stage and the low pressure hose. Shake or blow all excess water from the second stage and allow the entire regulator to air-dry before storing.

(3) Store the regulator in a clean bag or storage box, away from sunlight, excessive heat and humidity.

SCHEDULED MAINTENANCE:

To keep the owner warranty in effect, your customers **must** have their regulators inspected and serviced annually (within 30 days before or after the anniversary of the date of purchase) by an authorized Sherwood Dealer. **Failure to do so invalidates the warranty.** Even with infrequent use, the regulator **must** be serviced annually to ensure proper performance and satisfy warranty requirements.

Companion instructional VHS videotapes to this and other Sherwood repair manuals are available from your authorized Sherwood distributor at a nominal cost. Ask your Sherwood sales representative or authorized Sherwood distributor for details.

NOTE: Part numbers and specifications are subject to change without notice. Changes will be announced by technical bulletins. You, the repair technician, should have ready access to these bulletins. Your authorized Sherwood distributor is your most current source of correct part numbers and information.

MINIMUS (SR3108) AND SHADOW+ (SR3209)

ITEM#	CATALOG#	DESCRIPTION
1	3108R-6	Cover (right hand version)
1	3108L-6	Cover (left hand & Shadow+ version)
2	3108-13	Diaphragm (blue Tufel®)
3	J12CO4045B	Screw (combination Phillips/ square drive)
4	19-4006-17	Washer
5	3108-3	Lever
6	9-3108R-9	Lever Support (right hand version)
6	9-3108L-9	Lever Support (left hand version & Shadow+)
7	19-3602-29	Spring
8	9-3108-18	Stem (no seat insert installed)
9	978-9BN	Seat Insert (for stem)
10	3801-8	Exhaust Grill
11	4006-15	Exhaust Valve
12	3702-5	Screw for Cover (4 required)
13	3108R-5	Case (right hand version)
13	3108L-5	Case (left hand & Shadow+ version)
14	3786-9W	Mouthpiece Tie
15	3602-3	Mouthpiece
16	1-3108-7	Orifice Housing (for Minimus version
17	G01 OA	O-ring (for adjustable orifice)
18	43-4006-20	Adjustable Orifice (no O-ring)
19	G01 OA	O-ring (for hose outlet end)
20	3809-50-36	Hose Assembly with hose protector (36")
21	3602-27	Hose Protector
22	G011B	O-ring (hose inlet end)

Note: The following parts are unique to the Shadow+. See Fig. 1

23	1-3209-7	Orifice Housing (for Shadow+ version)
24	G01 5C	O-ring (larger of the two for the swivel)
25	G014C	O-ring (smaller of the two for the swivel)
26	2-3209-12	Swivel fitting
27	3208-30-38	Hose assembly with quick disconnect

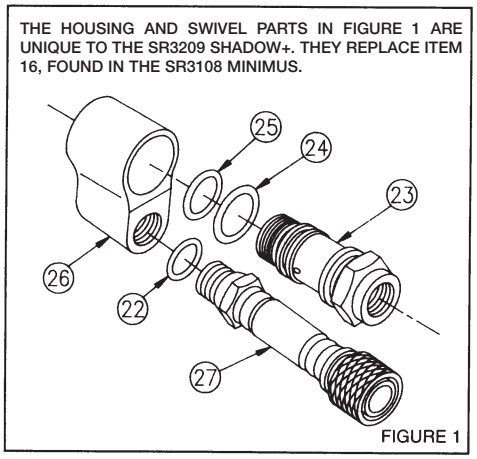


FIGURE 1



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