



# *Cressi-sub*

## Service Manual



# Balanced Diaphragm First Stage

# Contents

<b>BEFORE STARTING .....</b>	<b>3</b>
<b>DISASSEMBLY .....</b>	<b>3</b>
<b>PARTS CLEANING AND LUBRICATION .....</b>	<b>7</b>
CLEANING METAL PARTS .....	7
CLEANING COMBINATION METAL/PLASTIC PARTS .....	7
CLEANING PLASTIC-ONLY PARTS .....	7
LUBRICATION .....	7
<i>Types of Lubricant .....</i>	<i>7</i>
<i>O-rings .....</i>	<i>8</i>
<i>Threaded parts .....</i>	<i>8</i>
<b>REASSEMBLY .....</b>	<b>8</b>
<b>ADJUSTMENT PROCEDURE .....</b>	<b>12</b>
<b>FINAL ASSEMBLY AND TESTING .....</b>	<b>12</b>
<b>TABLE 1 - TROUBLESHOOTING .....</b>	<b>14</b>
<b>TABLE 2 - REQUIRED TOOLS .....</b>	<b>14</b>
<b>EXPLODED PARTS DIAGRAM.....</b>	<b>15</b>

## BEFORE STARTING

### WARNING



This manual is not a training document. It is meant to be a guide for experienced technicians who have also received factory training at a Cressi-sanctioned repair seminar. Do not attempt to repair this or any regulator without the proper training.

Before starting, Cressi recommends that you read through the entire manual to familiarize yourself with all the required tools and techniques. Use this manual as a guide during the servicing process to avoid missing any critical steps. Make sure the work area is clean and that you work over a cushioned work surface so critical parts do not get damaged.

Pay close attention to all warnings and cautions as they will alert you to any potential hazard that may cause damage or injury. Also, pay attention to the notes as they provide important tips and reminders.

## DISASSEMBLY

### CAUTION



The following steps require that the first stage be secured in a vise. Never secure the first stage directly in the vise as it will damage the body. Instead, thread a vise-mounting tool into one of the HP ports (located closest to the yoke), and tighten the mounting tool in the vise. Vise mounting tools are available from third party accessory companies, or you can use the following homemade tool: Thread a high-pressure adapter (3/8" female to 7/16" male) onto an expired CO<sub>2</sub> cartridge. Screw the cartridge into the HP port on the first stage. Mount the CO<sub>2</sub> cartridge in the vise. DO NOT thread the CO<sub>2</sub> cartridge without the adapter into a LP port. If the threads of the CO<sub>2</sub> cartridge break off, it will ruin the first-stage body.

1. Mount the first stage, adjustment screw facing upward, into a vise as described in the caution above (see figure 1). Using a 6mm hex wrench, unscrew and remove the adjustment screw (1). Remove the main spring (3).



Figure 1. Mount first stage in vise and remove adjustment screw

- Place the two pins of an adjustable face spanner wrench into the two holes in the spring retainer (2) as shown in figure 2. Rotate counter-clockwise and remove. Lift out the spring pad (4)



Figure 2. Remove spring retainer

### CAUTION



**DO NOT attempt to pry out the diaphragm. Doing so will damage the sealing area underneath the diaphragm, causing the regulator to leak when pressurized.**

- Attach an air nozzle to a low pressure source (25 to 30 psig). If any of the first stage ports are open, plug them with spare port plugs, leaving one of the low pressure (LP) ports open. Make sure the dust cap (27) is in place and secured with the yoke screw. While keeping a finger over the diaphragm, insert the air nozzle into the open LP port and add a quick blast of LP air. The diaphragm (5) will partially pop out as shown in figure 3. Completely remove the diaphragm by lifting it out with your fingers.



Figure 3. Remove diaphragm with a short blast of low pressure air

- Lift out the pin support (6) and pin (7) as shown in figures 4 & 5.



Figure 4. Remove the pin support



Figure 5. Remove the pin

5. Loosen the vise and turn the regulator so the yoke screw (25) is facing upward. Tighten the vise so the first stage is secure. Unscrew the yoke screw from the yoke (23) and remove the dust cap (27) from the yoke screw. Remove the O-ring (26) located on the outside of the dust cap.
6. Using a large adjustable wrench or 1 inch wrench, unscrew the yoke retainer (24), as shown in figure 6, and remove the yoke (23). Remove the first stage from the vise and work over the workbench.



Figure 6. Remove yoke retainer

### CAUTION



**The parts underneath the filter are under spring tension. Keep pressure applied to the filter when removing the retaining clip to prevent parts from ejecting from the first stage and causing injury.**

7. Using needlenose pliers, squeeze the inside “legs” of the retaining clip (22) while at the same time keeping downward pressure against the filter (21) as shown in figure 7. Slowly relax the pressure against the filter and remove the retaining clip. Lift out the spring (20) as shown in figure 8.



Figure 7. Remove filter retaining clip and filter

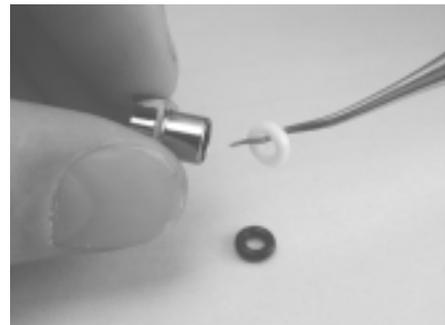


Figure 8. Remove balance chamber spring

8. Turn the first stage over so the balance chamber (19) slides partially out. Grab it with your fingers and remove it from the first stage (figure 9). If the balance chamber stays inside the first stage, you may gently grasp it with needlenose pliers and remove it from the first stage. Using an O-ring tool, remove the O-ring (17) and backup ring (18) located inside the balance chamber (see figure 10).



*Figure 9. Remove balance chamber*

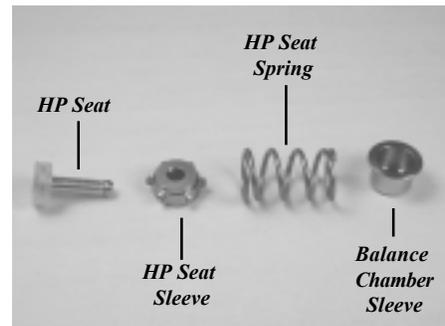


*Figure 10. Remove O-ring and backup ring from balance chamber*

9. Turn over the first stage. The high pressure seat assembly (13/14), spring (15), and balance chamber sleeve (16) will come out as one assembly (see figure 11). Separate the HP seat and balance chamber sleeve from the spring. Remove the seat sleeve (14) from the HP seat (13) as shown in figure 12.



*Figure 11. Remove HP seat assembly*



*Figure 12. Separate parts*

10. Using a 4mm hex wrench, remove all the port plugs (see figure 13). Remove the O-ring from each port plug and discard.



*Figure 13. Remove port plugs with 4mm hex wrench*

# PARTS CLEANING AND LUBRICATION

## CLEANING METAL PARTS

1. Wash all the metal parts in a hot, soapy water solution. Use a soft bristle toothbrush to clean the threads and remove any flaky corrosion.
2. After washing in the hot, soapy water, rinse all the parts in fresh water.
3. Place the metal parts in an ultrasonic cleaner with an appropriate cleaning solution. Avoid using harsh acids such as muriatic acid in ultrasonic cleaners. Clean the parts for 5 to 15 minutes, depending on the amount of corrosion.
4. Remove the parts from the ultrasonic cleaner and rinse them in fresh water. Blow-dry the parts using low-pressure filtered air.

## CLEANING COMBINATION METAL/PLASTIC PARTS

Some parts have plastic and metal molded together, such as the yoke screw (26). In general, avoid cleaning these parts in an ultrasonic cleaner with an acidic cleaning solution. Doing so may chemically attack the plastic. The yoke screw threads may be held in the ultrasonic cleaner, but do not submerge the plastic yoke knob.

1. Wash the parts in a hot, soapy water solution. Use a soft bristle toothbrush to clean the threads and remove any flaky corrosion.
2. After washing in the hot, soapy water, rinse all the parts in fresh water.
3. Blow-dry the parts using low-pressure filtered air.

## CLEANING PLASTIC-ONLY PARTS

Avoid placing plastic parts in an ultrasonic cleaner with an acidic cleaning solution. To properly clean plastic parts, perform the same steps listed above.

## LUBRICATION

### *Types of Lubricant*

Cressi recommends using only food-grade silicone grease or, more preferably, Christo-lube MCG 111.

### CAUTION



**DO NOT use spray silicones as the aerosol propellants may chemically attack the rubber compound.**

### **O-rings**

All O-rings should be treated with a thin film of lubrication. Do not over-lubricate the O-rings with large amounts of grease. Simply place a small amount of grease between your thumb and forefinger and run the O-ring between them.

### **Threaded parts**

You may lightly lubricate first two threads. As you tighten parts together, the lubricant will spread to the other threads.

## **REASSEMBLY**

1. Slide a new HP seat sleeve (14) over a new HP seat (13) as shown in figure 14. Make sure it is pressed all the way onto the seat (figure 15).



*Figure 14. Install sleeve onto HP seat*



*Figure 15. Make sure sleeve captures entire plastic disk*

2. Pass the seat spring (15) over the shaft of the HP seat and press it onto the backside of the seat sleeve (figure 16). Press the balance chamber sleeve (16) into the other end of the spring (figure 17). Insert this assembly into the first stage body, HP seat first, as shown in figure 18.



*Figure 16. Install seat spring*



*Figure 17. Press balance chamber sleeve into spring*



*Figure 18. Install assembly into first stage body*

3. Install a new backup ring (18) and lubricated O-ring (17) into the balance chamber (19) as shown in figures 19 & 20. Insert the balance chamber assembly into the balance chamber sleeve as shown in figure 21.



*Figure 19. Install backup ring*



*Figure 20. Install O-ring*



*Figure 21. Install balance chamber into sleeve.*

4. Place the balance spring (20) onto the balance chamber (figure 22). Set the filter (21) on top of the spring with the cup of the filter facing upward as shown in figure 23.



*Figure 22. Install balance spring on top of balance chamber*



*Figure 23. Place filter, cup facing upward, onto spring*

5. Grasp the inner “legs” of the retaining clip (22) with needlenose pliers and squeeze the legs together. Align the outer edges of the retaining clip and filter. Press down on the filter with the tips of the needlenose pliers to compress the springs (figure 24). It may be necessary to press one side of the retaining clip into the first stage using your finger or a small dowel. When the retaining clip is in place, release the pressure on the needlenose pliers. Inspect the retaining clip to make sure it is properly seated all the way around the groove (figure 25).

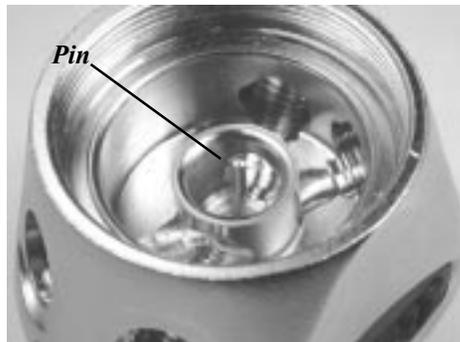


*Figure 24. Install filter retaining clip*



*Figure 25. Inspect retaining clip to make sure it is properly seated*

6. Turn the regulator over. Insert the pin (7) into the small hole located in the center of the first stage body (figure 26). Place the pin support (6) onto the pin (figure 27). Press the pin support a few times. It should have a smooth, springy feel.



*Figure 26. Install pin*



*Figure 27. Install pin support*

7. Press a new diaphragm (5) into the first stage. Using your finger, work the edges of the diaphragm into place so it is evenly seated in the groove below the threads (figure 28). Place the spring pad (4) in the middle of the diaphragm (figure 29) and place the main spring (3) onto the spring pad (figure 30).



*Figure 28. Install diaphragm*



*Figure 29. Place spring pad in center of diaphragm*



*Figure 30. Place main spring onto spring pad*

8. Thread the spring retainer (2) onto the first stage body until handtight (figure 31). Thread the adjustment screw (1) into the spring retainer and tighten using a 6mm hex wrench (figure 32). Tighten the adjustment screw until it is flush with the end of the spring retainer.



*Figure 31. Thread spring retainer onto body until handtight*



*Figure 32. Screw in adjustment screw until flush with spring retainer*

9. Place the yoke (23) over the first stage inlet (figure 33). Thread the retaining nut (24), wrench flats facing upward, onto the first stage inlet until hand tight (figure 34).



*Figure 33. Place yoke onto first stage body*



*Figure 34. Thread yoke retainer onto inlet boss*

10. Thread the vise mounting tool back into one of the high pressure ports. Mount the first stage into a vise with the yoke facing upward. Attach a 1 inch crows-foot to a torque wrench. Tighten the retaining nut to 20 foot-pounds (figure 35).



*Figure 35. Tighten retainer to 20 foot-pounds*

11. Loosen the vise and turn the regulator over so the spring retainer is facing upward. Using the adjustable face spanner wrench, tighten the spring retainer until it stops (figure 36).



*Figure 36. Tighten spring retainer with adjustable face spanner wrench until it stops*

12. Place a new o-ring (26) onto the dust cap (27). Pass the loop of the dust cap over the yoke screw threads. Thread the yoke screw into the yoke.

## **ADJUSTMENT PROCEDURE**

1. Install new O-rings (8 & 11) on the LP and HP port plugs. Install only two LP port plugs and both HP port plugs. Leave the other two LP ports open for the testing procedure to follow.
2. Attach a second stage to one of the open LP ports. This will act as an over pressure valve in case of a high-pressure leak. Attach a LP test gauge (0-400 psi) to the other open LP port. (Note: A test gauge with a relief valve is highly recommended.)
3. Attach the first stage to a fully charged cylinder (2500 to 3000 psi). Crack open the relief valve on the test gauge and slowly open the cylinder valve. After the cylinder valve is fully open, close the test gauge relief valve. The intermediate pressure (IP) should be  $140\pm 5$  psi.
4. If the IP does not fall within this range, use a 6mm hex wrench to turn the adjustment screw (22) and adjust the IP. Turning clockwise increases IP, turning counterclockwise decreases IP. After making an adjustment, cycle the regulator by purging the second stage several times and reread the IP. After IP is set, continue to observe it to make sure IP remains constant.

## **FINAL ASSEMBLY AND TESTING**

1. Close the cylinder valve and purge the air from the regulator system. Remove the first stage from the cylinder and remove the second stage and test pressure gauge, and the port plugs if necessary.
2. Install the customer's second stages, inflator hose(s) and pressure gauge back into the first stage, using the same configuration as when you received the regulator in for service.
3. Reattach the first stage to the cylinder and slowly open the cylinder valve to pressurize the regulator. Dip the entire first stage into a water bath and watch for leaks. Any streaming bubbles means there is a leak somewhere. Note the location of the leak and refer to the troubleshooting guide for possible remedies. If there are no leaks, close the cylinder valve, purge the regulator, and remove from the valve.

4. Dry off the first stage. Blow out any moisture in the dust cap with low-pressure air. Place the dust cap over the inlet fitting and tighten the yoke screw to secure the dust cap in place.

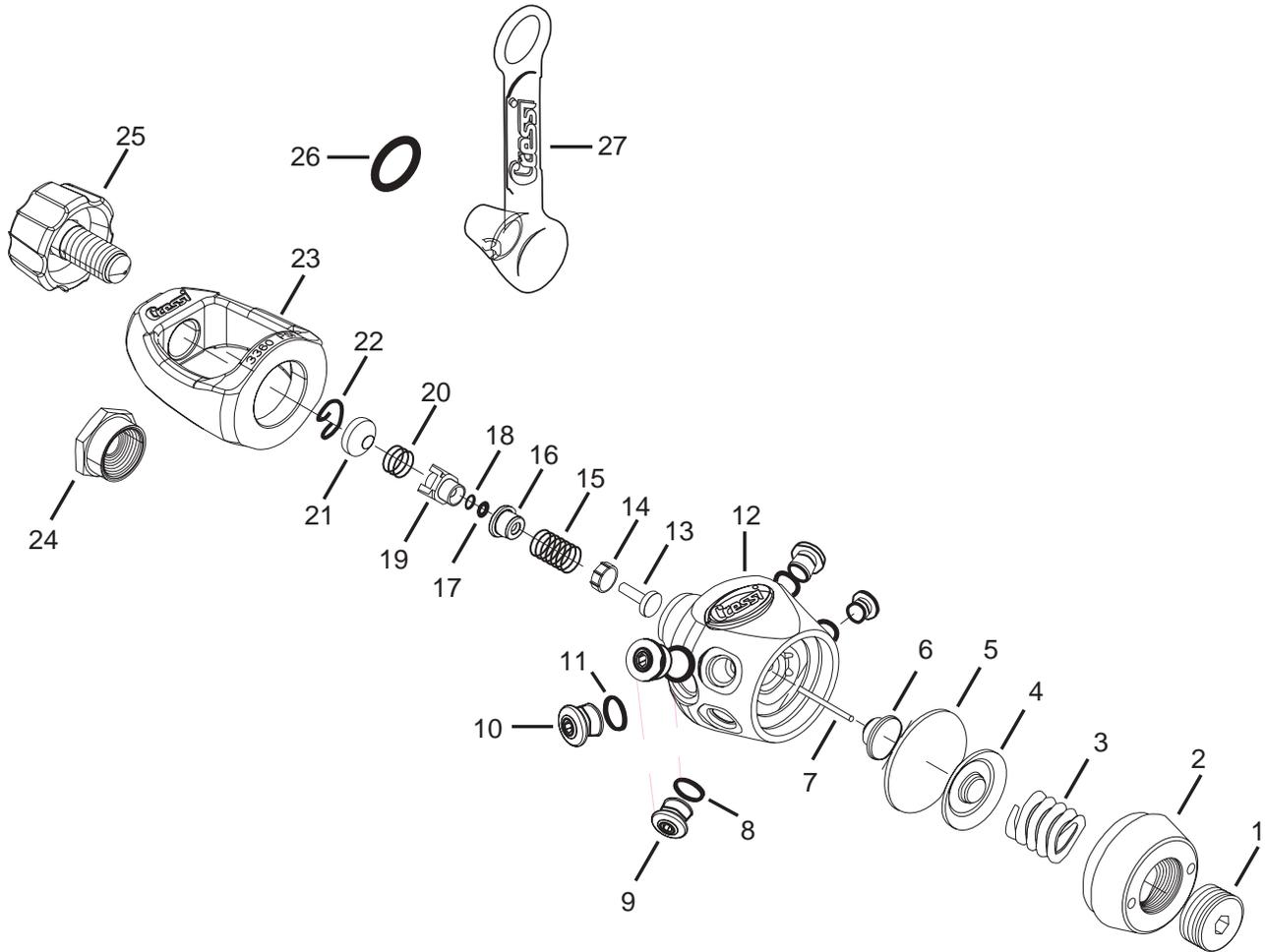
## TABLE 1 - TROUBLESHOOTING

<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Air leak from spring retainer	a. Spring retainer (2) not tight b. Diaphragm sealing area damaged c. Diaphragm (5) worn or damaged	a. Tighten spring retainer b. Replace body (12) c. Replace diaphragm
I.P. Creep	a. HP seat (13) worn or damaged b. HP seat sealing surface damaged c. O-ring (17) worn or damaged d. Backup ring (18) worn or damaged e. Balance chamber scratched internally	a. Replace HP seat b. Replace body (12) c. Replace O-ring d. Replace backup ring e. Replace balance chamber (19)

## TABLE 2 - REQUIRED TOOLS

<i>Tool Description</i>	<i>Used for</i>
1. One inch open end wrench	Removing yoke retainer (24)
2. Needlenose pliers	Removing filter retaining clip (22)
3. O-ring tool	Removing O-rings
4. Adjustable spanner wrench	Removing/installing spring retainer (2)
5. 3/8"-7/16" vise mounting tool	Mounting first stage into vise
6. 4mm hex wrench	Removing/installing all port plugs
7. 6mm hex wrench	Removing/installing adjustment screw (1)
8. Torque Wrench	Tightening yoke retainer (24)
9. 1-inch crows-foot	Used with torque wrench

# EXPLODED PARTS DIAGRAM



Key #	Description
1.	Adjustment Screw
2.	Spring Retainer
3.	Main Spring
4.	Spring Pad
5.	Diaphragm
6.	Pin Support
7.	Pin
<b>8.</b>	<b>O-ring, LP Port (x3)</b>
9.	Port Plug, LP (x3)
10.	Port Plug, HP (x2)
11.	O-ring, HP Port (x2)
12.	Body
<b>13.</b>	<b>HP Seat</b>
14.	Sleeve, HP seat
15.	Spring, HP seat

Key #	Description
16.	Sleeve, Balance Chamber
<b>17.</b>	<b>O-ring</b>
<b>18.</b>	<b>Backup Ring</b>
19.	Balance Chamber
20.	Spring, Balance Chamber
21.	Filter
22.	Retaining Clip
23.	Yoke
24.	Yoke Retainer
25.	Yoke Screw
<b>26.</b>	<b>O-ring</b>
27.	Dust Cap
<b>29.</b>	<b>O-ring</b>
<b>30.</b>	<b>Filter</b>

*Parts in bold are to be replaced during each overhaul*



 ***Cressi-sub***  
**PROFESSIONAL UNDERWATER EQUIPMENT**

1 Charles Street, Westwood, NJ 07675

Tel: 800-338-9143 Fax: 800-493-2680