SP4

(UNBALANCED PISTON)

SERVICE PROCEDURE

This SP4 Product Service Procedure conveys a list of components and service procedures that reflect the SP4 as it was configured at the time of this writing (3/26/02).

It also contains Supplemental Information intended to assist the Authorized Oceanic Regulator Service Technician who is servicing an SP4 configured with older components.

SP4 FIRST STAGE

CONTENTS

GENERAL PROCEDURES

REFER TO ..... DOC. 12-2202

SPECIFICATIONS

Torques

Yoke Retainer (p/n 6564)	23 to 25 ft-lbs
DIN Filter Retainer (p/n 4544-300)	120 to 140 in-lbs
*If the DIN Filter Housing has a hex machined into the Inner Bore, increase DIN Filter Retainer torque to 16 to 18 ft-lbs.	
DIN Filter Housing (p/n 6565)	16 to 18 ft-lbs
HP Port Plug (p/n 3462)	35 to 40 in-lbs
LP Port Plug (p/n 3463)	35 to 40 in-lbs
HP Hose into First Stage Body	35 to 40 in-lbs
LP Hose into First Stage Body	35 to 40 in-lbs
Inflator Hose into First Stage Body	35 to 40 in-lbs
Piston Cap (p/n 6627)	120 to 140 in-lbs

Intermediate Pressure

Preferred	140 to 145 psi at 3,000 psi supply
Acceptable	137 to 148 psi at 3,000 psi supply
Preferred	130 to 136 psi at 500 psi supply
Acceptable	127 to 139 psi at 500 psi supply

TOOLS REQUIRED

Standard Tools

1/2" Open End Wrench
9/16" Open End Wrench
5/8" Open End Wrench
13/16" Open End Wrench
1" Open End Wrench
5/32" Hex Key
1/4" Hex Key
Low Pressure Test Gauge
CO2 Cartridge (discharged) or HP Hose End Fitting

Specialty Tools

P/N 40.2302	Christo-Lube MCG111 - 2 oz
P/N 40.6536	DX Spanner
P/N 40.9315	Intermediate Pressure Gauge
P/N 40.9412	1/4" Drift Pin Punch
P/N 40.9520	O-ring Tool Kit
P/N 40.9518	Circlip Pliers

TROUBLE SHOOTING

SYMPTOM	POSSIBLE CAUSE	TREATMENT
* **Restricted airflow and inhalation resistance through complete system.**	1. Cylinder valve not completely opened. 2. Cylinder valve requires service. 3. CONE FILTER (4, 12) is contaminated.	1. Open valve completely. 2. Connect Regulator to a different cylinder. 3. Replace with new and perform a complete service.
* **Air leakage detected from inlet openings of First Stage.**	1. PISTON HEAD O-RING (27) is damaged or worn. 2. PISTON SHAFT O-RING (25) is damaged or worn.	1. Replace with new. 2. Replace with new.
* **Insufficient intermediate pressure.**	1. PISTON CAP (29) loose. 2. VALVE SPRING (23) is weakened.	1. Tighten PISTON CAP (29) onto BODY (21). 2. Replace with new.
* **Excessive intermediate pressure.**	1. Contamination under SHIM (22). 2. HP SEAT (24) damaged or worn. 3. Internal damage to Orifice Cone inside BODY (21).	1. Clean seating surface and replace SHIM (22) with new. 2. Replace with new. 3. Replace BODY (21).

DISASSEMBLY PROCEDURE

⚠ **NOTE: Be sure to check and record the intermediate pressure and perform the Leak Detection Test outlined in the Initial Inspection Procedures prior to disassembling the Regulator. Review the Troubleshooting Section on page 3 to gain a better idea of which internal parts may be worn, and to better advise your customer of the service that is needed.**

1. Before disassembling the First Stage, remove the low pressure second stage Hoses with a 9/16" open end wrench, the high pressure Hose with a 5/8" open end wrench, and the low pressure inflator Hose with either a 9/16" or 1/2" open end wrench. Remove all remaining PORT PLUGS (17, 19) with a 5/32" hex key.

2. Remove and inspect the O-rings now visible on all these items for any signs of decay. Discard if found.

3. Install one of the following items into the HP PORT (17) of the BODY (21), using a HP Port Adaptor if necessary, before proceeding to the next step. (Fig. 1)

a. A discharged CO2 cartridge which has been set aside for this purpose.

⚠ **CAUTION: DO NOT use a CO2 cartridge which has not been discharged.**

b. A discarded high pressure Hose (the First Stage end hose fitting alone will suffice) which has been set aside for this purpose.

⚠ **NOTE: For units received with Yoke Connectors perform step 4Y, for units received with DIN Connectors perform step 4D.**

4Y. Yoke Connector disassembly:

A. Remove the YOKE SCREW (1) from the YOKE (2). (Fig. 2)

B. With the CO2 cartridge, or HP hose fitting facing to the right, lower the First Stage BODY (21) into a soft-jawed or well padded vise with the YOKE (2) facing straight up. Turn the BODY counterclockwise to ensure the CO2 cartridge, or the HP fitting, is making contact with the jaw of the vise, prohibiting further movement of the BODY. Secure the BODY in the vise and apply a thin-wall, or modified, 1" open end wrench to the YOKE RETAINER (6). Using firm steady force, turn the YOKE RETAINER counterclockwise to remove. DO NOT use impact to loosen.

⚠ **NOTE: It is important that the wrench is properly seated over the entire hex portion of the YOKE RETAINER (6) to prevent any damage to the part. (Fig. 3)**

⚠ **CAUTION: Tighten the vise only as needed to hold the First Stage secure, and DO NOT overtighten. Doing so will result in permanent damage, rendering it inoperable.**

Fig. 1

Fig. 2

Fig. 3

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C. After removing the YOKE RETAINER (6), remove the YOKE (2) and PROTECTOR CAP (16) and set these aside. Remove and discard the RETAINER O-RING (7) and DO NOT attempt to reuse.

D. Using Internal Circlip Pliers, remove the RETAINING CLIP (3) that retains the CONE FILTER (4). The FILTER should drop out freely in your hand. Discard, and DO NOT attempt to reuse. Remove the FILTER O-RING (5) and inspect for any signs of decay. Discard if found.

4D. DIN Connector disassembly:

A. With the CO2 cartridge, or HP hose fitting, facing to the right, lower the First Stage Body into a soft-jawed or well padded vise with the DIN Connector facing straight up. Turn the BODY (21) counter-clockwise to ensure the CO2 cartridge, or the HP fitting, is making contact with the jaw of the vise, prohibiting further movement of the body. Secure the First Stage BODY in the vise and apply a 1/4" hex key to the DIN FILTER RETAINER (9). Using firm steady force, turn the DIN FILTER RETAINER counterclockwise to remove. DO NOT use impact to loosen (Fig. 4).

* Refer to Supplemental information on page 12.

Fig. 4

⚠ CAUTION: Tighten the vise only as needed to hold the First Stage secure, and DO NOT overtighten. Doing so will result in permanent damage, rendering it inoperable.

B. Remove the DIN FACE O-RING (8) and RETAINER O-RING (10) from the DIN FILTER RETAINER (9) and inspect for any signs of decay. Discard if found.

C. Lift the DIN COUPLER WHEEL (11), then the PROTECTOR CAP (16), straight off the DIN FILTER HOUSING (14) and set aside. Apply a 13/16" open-end wrench to the Flange at the base of the DIN FILTER HOUSING (Fig. 5). Using firm, steady force, loosen in a counter clockwise direction to remove. DO NOT use impact to loosen.

Fig. 5

△ NOTE: It is important that the wrench is deep enough to seat entirely over the Flange to avoid any damage to the seating surface.

D. After removing the DIN FILTER HOUSING (14) from the BODY (21), turn it over and tap lightly to drop out the DIN CONE FILTER (12). Discard the FILTER, and DO NOT attempt to reuse. Remove and inspect the FILTER O-RING (13) for any signs of decay. Discard if found. Remove and discard the FILTER HOUSING (15) and DO NOT attempt to reuse.

5. Invert the First Stage Body in the vise and secure as detailed in steps 4Y-A, or 4D-A, with the PISTON CAP (29) facing up. Using Piston Body Spanner, loosen the PISTON CAP (29) by applying firm steady pressure in a counter-clockwise rotation (Fig. 6). DO NOT use impact to loosen.

(see CAUTION on next page)

Fig. 6

⚠ **CAUTION: Tighten the vise only as needed to hold the First Stage secure, and DO NOT overtighten. Doing so will result in permanent damage, rendering it inoperable.**

6. Remove the PISTON CAP (29) from the BODY (21) by lifting it straight up. Remove and inspect the STYLING BAND (28) for any signs of decay. Discard if found. Remove the VALVE PISTON (26) and VALVE SPRING (23) from the main BODY (21).

7. Remove the SHIMS (22), found either inside the cavity of the main body or on the end of the VALVE SPRING (23), and inspect for signs of wear or distortion. Discard if found. (Fig. 7)

⚠ **NOTE: Before discarding, it is very important to make a note of the quantity of SHIMS (22) that were removed, and identify their correct thickness. Pink is thick and blue is thin.**

8. With the use of a pen light and a magnifier, closely examine the seating surface of the Orifice Cone inside the BODY (21) for any signs of damage. If found, discard the BODY and DO NOT attempt to repair or reuse (Fig. 8).

⚠ **CAUTION: It is very important to prevent the entrance of any metallic objects into the Cavity of the BODY (21) while it is exposed.**

9. Closely examine the VALVE SPRING (23) with the use of a magnifier, checking for any signs of corrosion. Discard if found.

⚠ **CAUTION: If the initial intermediate pressure was lower than 135 PSI, indicating that the VALVE SPRING (23) has weakened, replace the SPRING and DO NOT attempt to reuse.**

10. Remove and discard the PISTON HEAD O-RING (27) and the PISTON SHAFT O-RING (25). DO NOT attempt to reuse.

11. Carefully remove the HP SEAT (24) from the end of the VALVE PISTON Shaft (26) by carefully inserting a 1/16" in diameter drift pin, or a blank drill bit, through the opening in the center of the Piston's Head (Fig. 9). Using firm, steady force, press the pin through the VALVE PISTON until the HP SEAT exits the end of the Shaft. DO NOT use impact to “drive” out the HP SEAT. Discard the HP SEAT and DO NOT attempt to reuse.

12. Using the broad flat end of the brass o-ring tool, press gently between the edge of the PISTON CAP INSERT (30) and the PISTON CAP (29) to lift and remove the PISTON CAP INSERT. Inspect for signs of decay or distortion. Discard if found.

13. Remove the CO2 cartridge, or HP hose fitting, from the BODY (21) prior to cleaning.

Fig. 7

Fig. 8

Fig. 9

REASSEMBLY PROCEDURE

NOTE: Prior to reassembly, it is necessary to inspect all parts, both new and those that are being reused. Check to ensure that O-RINGS are clean and supple, and that every part and component has been thoroughly cleaned.

WARNING: Use only genuine Oceanic parts, subassemblies, and components whenever assembling Oceanic products. DO NOT attempt to substitute an Oceanic part with another manufacturer's, regardless of any similarity in shape, size, or appearance. Doing so may render the product unsafe, and could result in serious injury or death of the user.

1. Lubricate and install the PISTON SHAFT O-RING (25) onto the Shaft of the VALVE PISTON (26), and the PISTON HEAD O-RING (27) onto the Head of the VALVE PISTON. Set the piston aside, standing on the flat surface of its head.

2. Install the HP SEAT (24) into the end of the VALVE PISTON Shaft (26), ensuring that it seats completely flush with the outer edge (Fig. 10).

3. Stand the BODY (21) on end with the threaded end, large opening, facing up. Lightly lubricate and install the required SHIMS (22) over the Stem inside the Cavity of the BODY and one only onto the Head of the VALVE PISTON (26) at the Base of the Shaft.

NOTE: It is very important to replace the SHIMS (22) with type that were removed from each side of the VALVE SPRING (23) during the disassembly procedure.

4. Ensuring proper alignment, install the END CAP INSERT (30) and the STYLING BAND (28) onto the PISTON CAP (29).

5. While holding the PISTON CAP (29) secure, carefully insert the VALVE PISTON (26), Head first into the PISTON CAP (29) until the Base of the VALVE PISTON Head is flatly seated against the Bottom of the PISTON CAP (29). (Fig. 11)

CAUTION: It is very important to insert the VALVE PISTON (26) into the PISTON CAP (29) evenly so as not to pinch or damage the PISTON HEAD O-RING (27), VALVE PISTON Head (26), or the interior wall of the PISTON CAP (29).

6. Apply a very light film of lubricant to both ends of the VALVE SPRING (23) and place the VALVE SPRING over the Stem inside the Cavity of the BODY (21).

7. While holding the BODY (21) secure, lower the PISTON CAP/ VALVE PISTON Assembly down onto the BODY, guiding the VALVE PISTON Shaft, Seat first, directly through the center of the VALVE SPRING (23) and into the BODY (Fig. 12). Firmly press straight down while turning clockwise to engage the Threads. Continue to tighten by hand until secure.

Fig. 10

Fig. 11

Fig. 12

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7. Install either a discharged CO2 cartridge or HP hose fitting, which has been set aside for this purpose, into the HP Port (of the BODY (21).

⚠ **CAUTION: DO NOT use a CO2 cartridge which has not been discharged.**

8. With the CO2 cartridge, or HP hose fitting, facing to the right, lower the First Stage BODY (21) into a soft-jawed or well padded vise with the piston cap facing straight up. Turn the BODY clockwise to ensure the CO2 cartridge, or the HP fitting, is making contact with the jaw of the vise, prohibiting further movement of the BODY. Secure the First Stage BODY into a soft-jawed or well padded vise with the PISTON CAP (29) facing up. Using a DX Spanner and a foot pounds torque wrench, tighten the PISTON CAP (29) by applying firm steady pressure in a clockwise rotation **to a torque of 120-140 in/lbs**. DO NOT use impact to tighten. (Fig. 13)

Fig. 13

⚠ **CAUTION: Tighten the vise only as needed to hold the First Stage secure, and DO NOT overtighten. Doing so will result in permanent damage, rendering it inoperable.**

9. Invert the First Stage BODY (21) in the vise with the HP Inlet Bore facing straight up. Align the CO2 cartridge, or the HP fitting, as in step 8 and secure the First Stage in the vise.

⚠ **CAUTION: Tighten the vise only as needed to hold the First Stage secure, and DO NOT overtighten. Doing so will result in permanent damage, rendering it inoperable.**

△ **NOTE: For units received with Yoke Connectors perform step 10Y, for units received with DIN Connectors perform step 10D.**

10Y. Yoke Connector reassembly:

A. Place the loop end of the PROTECTOR CAP (16) over the Yoke Retainer Neck of the BODY (21).

B. Lubricate and install the FILTER O-RING (5) into the YOKE RETAINER (6), at the base of the CONE FILTER Cavity of the BODY (21). (Fig. 14)

Fig. 14

C. Install the CONE FILTER (4) into the YOKE RETAINER (6), and install the RETAINING CLIP (3) into the groove above it, using Internal Circlip Pliers (Fig. 15).

△ **NOTE: Close examination of the RETAINING CLIP (3) will show that one side is slightly rounded and the other is flat. Install with the flat side facing out of the YOKE RETAINER (6) to ensure greater holding strength.**

D. Lubricate and install the RETAINER O-RING (7) into the Groove on the end of the YOKE RETAINER (6).

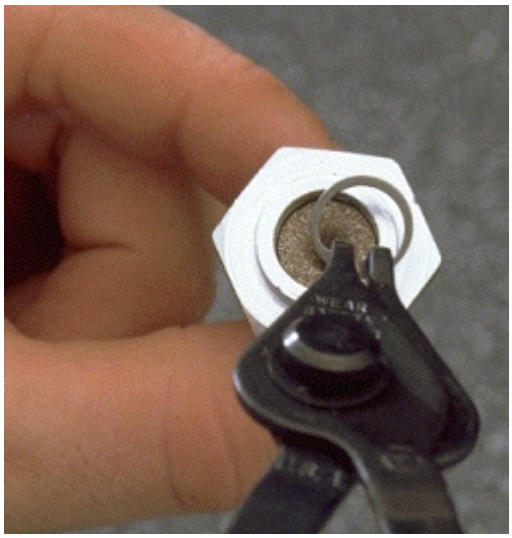

Fig. 15

E. Insert the threaded end of the YOKE RETAINER (6) through the YOKE (2), facing opposite the end that holds the YOKE SCREW (1).

F. Holding the YOKE RETAINER (6) and YOKE (2) together between your thumb and forefinger, insert the YOKE RETAINER (6) into the BODY (21), so that the threads seat properly. Hand tighten in a clockwise direction until secure. Using a thin wall, or modified, 1" open end wrench that is properly seated over the entire hex portion of the YOKE RETAINER, tighten it **to a torque of 16-18 ft/lbs** (Fig. 16).

G. Install the YOKE SCREW (1) into the YOKE (2).

Fig. 16

10D. DIN Connector reassembly:

A. Lubricate and install the FILTER HOUSING O-RING (15) into the Groove on the end.

B. Hold the DIN FILTER HOUSING (14) between your thumb and forefinger and insert the DIN FILTER HOUSING into the BODY (21), so that the threads seat properly. Hand tighten in a clockwise direction until secure. Using a 13/16" open end wrench that is properly seated over the entire seating surface of the DIN FILTER HOUSING Flange, tighten **to a torque of 16-18 ft/lbs** (Fig. 17).

C. Lubricate and install the FILTER O-RING (13) into the DIN FILTER HOUSING (14), at the Base of the CONE FILTER Cavity. Install the DIN CONE FILTER (12) into the DIN FILTER HOUSING.

D. Place the loop end of the PROTECTOR CAP (16) over the Yoke Retainer Neck of BODY (21).

E. Install the DIN COUPLER WHEEL (11) down over the Stem of the DIN FILTER HOUSING (14) with the threaded, smaller end facing up.

Fig. 17

F. Lubricate and install the DIN FACE O-RING (8) and RETAINER O-RING (10) onto the DIN FILTER RETAINER (9).

G. Insert the threaded end of the DIN FILTER RETAINER (9) through the DIN COUPLER WHEEL (11), into the DIN FILTER HOUSING (14), and hand tighten until secure. Apply a 1/4" hex key socket and tighten **to a torque of 16 to 18 ft-/lbs (if the DIN FILTER HOUSING has a hex machined into its Inner Bore) or 120 to 140 in/lbs (if it does not have the hex)** (Fig. 18).

Fig. 18

11. Lubricate and install all O-RINGS onto all Hoses and PORT PLUGS (17, 19). Install all LP Hoses and PORT PLUGS (19) into the BODY (21), and the HP Hose or PORT PLUG (17) into the BODY, tightening clockwise with a 5/32" hex key socket **to a torque of 35-40 in/lbs**.

⚠ **CAUTION: Be certain not to install any low pressure Hose into the High Pressure Port via an Adaptor.**

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TUNING AND TESTING

1. Connect a recently calibrated Low Pressure Test Gauge to a low pressure Hose, and connect the First Stage with Second Stage and Low Pressure Test Gauge to a pure breathing gas source of 3000 PSI. Slowly open the supply valve to pressurize the Regulator, and purge the Second Stage several times.

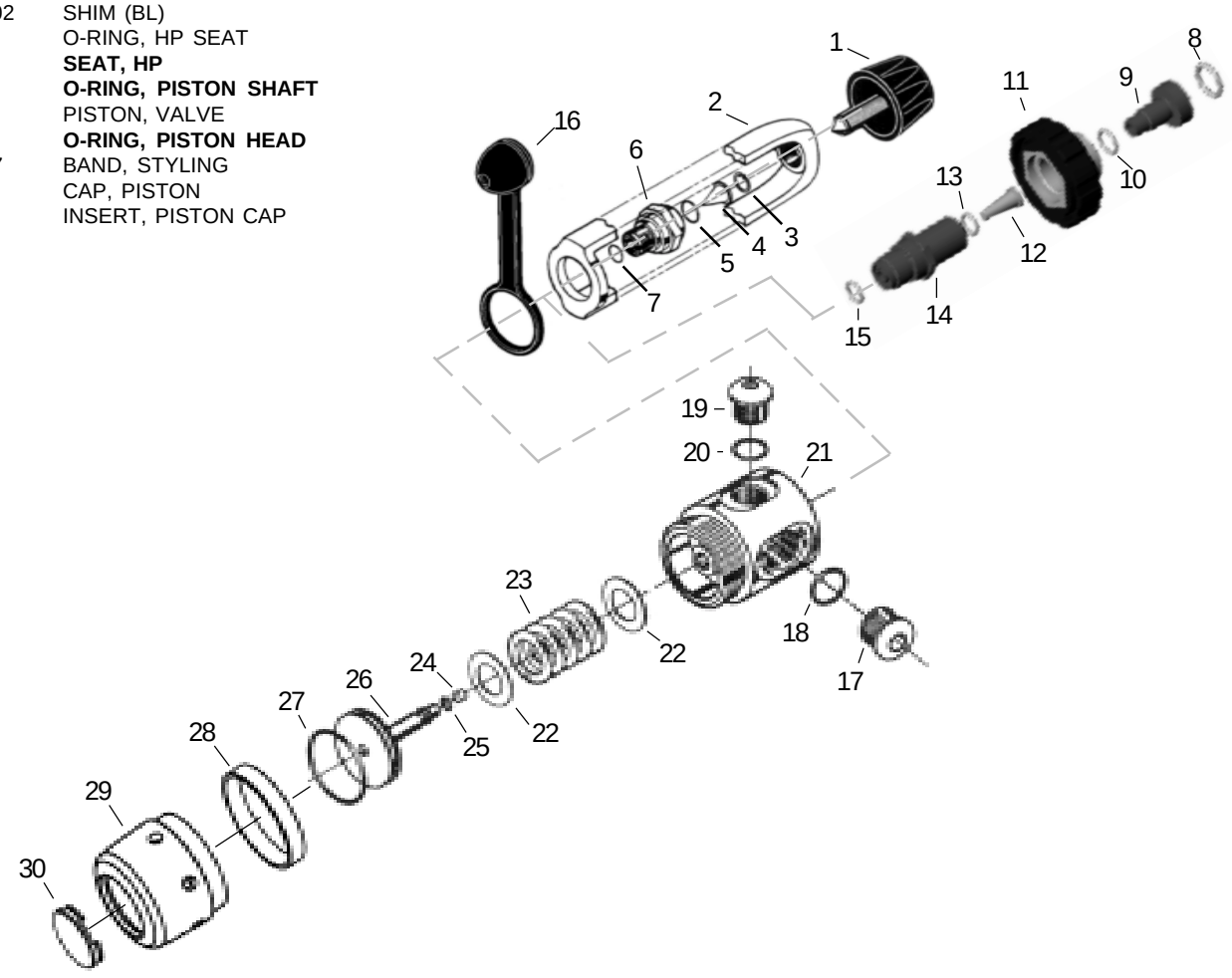
2. Adjust the intermediate pressure, if necessary, to read 140-145 PSI by adding and/or substituting SHIMS (22) to increase or decrease the pressure.

△ **NOTE: Ensure that the intermediate pressure holds stable at 140-145 PSI, and does not creep or fluctuate after the Second Stage has been purged several times. If creeping is detected, refer to the Troubleshooting Section on page 3 to determine possible cause and treatment.**

SP4 FIRST STAGE

Dia. No.	Part #	Description
YOKE VERSION		
1c	6307.07	SCREW, YOKE (BK)
2c	6562	YOKE
3c	3530	CLIP, RETAINING
4a	**3545**	**FILTER, CONE**
5a	**2.013**	**O-RING, FILTER**
6c	6564	RETAINER, YOKE
7a	**2.011**	**O-RING, RETAINER**
DIN VERSION		
8a•	6374	O-RING, DIN FACE
9c	4544-300	RETAINER, DIN FILTER
10a•	2.012	O-RING, RETAINER
11c	6559	WHEEL, DIN COUPLER
12a•	4546	FILTER, DIN CONE
13a•	2.011	O-RING, FILTER
14c	6565	HOUSING, DIN FILTER
15a•	2.011	O-RING, FILTER HOUSING
YOKE and DIN VERSIONS		
16c	6560	CAP, PROTECTOR (BK)
17c	3462	PLUG, HP PORT
18b	3.904	O-RING, HP PORT PLUG
19c	3463	PLUG, LP PORT
20b	3.903	O-RING, LP PORT PLUG
21c	6626	BODY
22b	85091.01	SHIM (PK)
	85091.02	SHIM (BL)
23c	85084	O-RING, HP SEAT
24a•	**85085**	**SEAT, HP**
25a•	**2.008**	**O-RING, PISTON SHAFT**
26c	85083	PISTON, VALVE
27a•	**2.023**	**O-RING, PISTON HEAD**
28c	6628.07	BAND, STYLING
29c	6627	CAP, PISTON
30c	6596	INSERT, PISTON CAP

Part #	Description
ANNUAL SERVICE PARTS KITS	
40.6155	KIT, YOKE CONNECTION SERVICE PARTS (Includes all **Bold** items)
40.6156	KIT, DIN CONNECTION SERVICE PARTS (includes all • items)



SUPPLEMENTAL INFORMATION

Due to design enhancements that have been made since the SP4 was originally released, the unit being serviced may not have the same components previously described.

The intent of this Supplemental Information is to assist the Oceanic Regulator Service Technician with identification of previous component parts and provide guidelines for their reuse or replacement.

The exploded view diagram on page 11 can be used as a reference for older units.

DIN FITTING

In the event that the complete DIN Fitting comes off the First Stage when the DIN FILTER RETAINER is being removed during Disassembly (step 4D, page 5), it will be necessary to disassemble the Fitting to replace the FILTER.

If the DIN FILTER HOUSING has a hex machined into the end opening of the Inner Barrel, hold the HOUSING with a 7/32" hex key and remove the DIN FILTER RETAINER using a 1/4" hex key.

If the DIN FILTER HOUSING does not have a hex machined into the end opening of the Inner Barrel, insert a flat blade screwdriver into the opening to hold the HOUSING and remove the DIN FILTER RETAINER using a 1/4" hex key. If the HOUSING becomes damaged, it must be replaced.