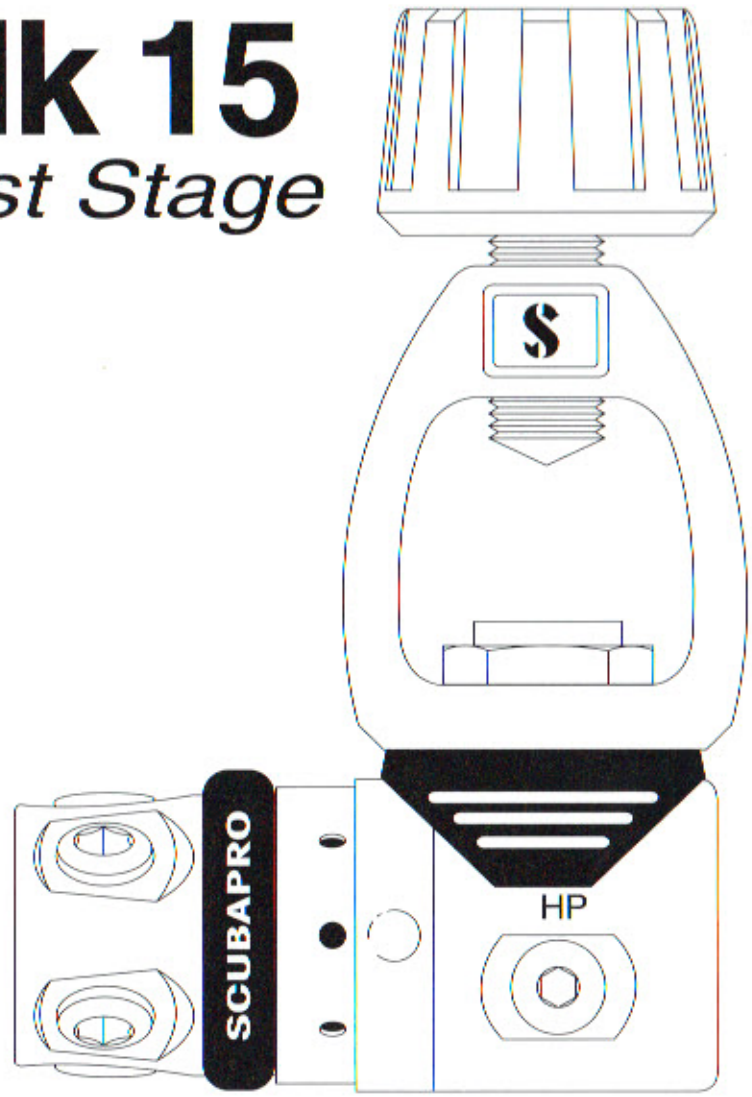
Figure #1

SCUBAPRO®

Technical Service Reference & Repair Guide

Mk 15 *First Stage*



Contents:

Technical Service Upgrade:

Important Note: The following information "is not" designed to be a complete training guide for infield servicing of the Mark 15 first stage. All Scubapro technicians are required to attend an annual repair clinic to insure safe handling and servicing of Scubapro products.

Figure #1

General Information:

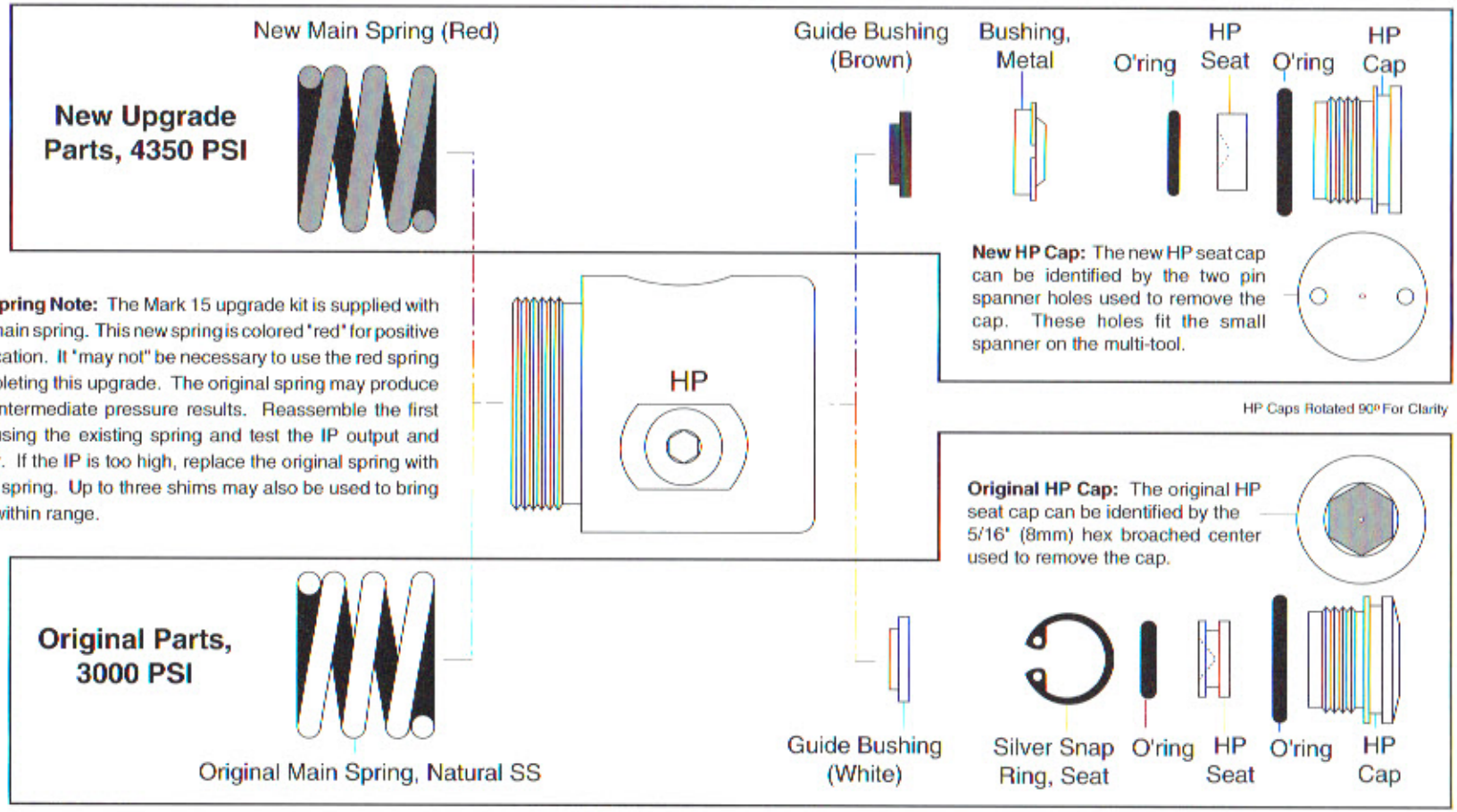
Figure #1 illustrates the parts included in the Mark 15 upgrade kit (#10-600-051) and the parts removed from the original configuration. The purpose of this technical service update is to establish the procedure for retrofitting the new parts into the Mark 15 and increasing the working pressure to 4350 psi (300 bar). The existing Mark15 was rated to 3000 psi and should not be used beyond this pressure. This high pressure upgrade is not a required procedure and can be done when the first stage is rebuilt during the required annual service. The original configuration can be used until this time provided that the 3000 psi threshold is not exceeded. The upgrade kit does not include the parts required for completing annual service. The Mark15 annual service kit (#10-600-041) can be ordered as needed. Be sure to read the complete procedure before attempting this upgrade. Improper installation of the upgrade parts may result in unstable first stage performance.

SCUBAPRO®

Technical Service Update

Mark 15 Upgrade

Parts Identification

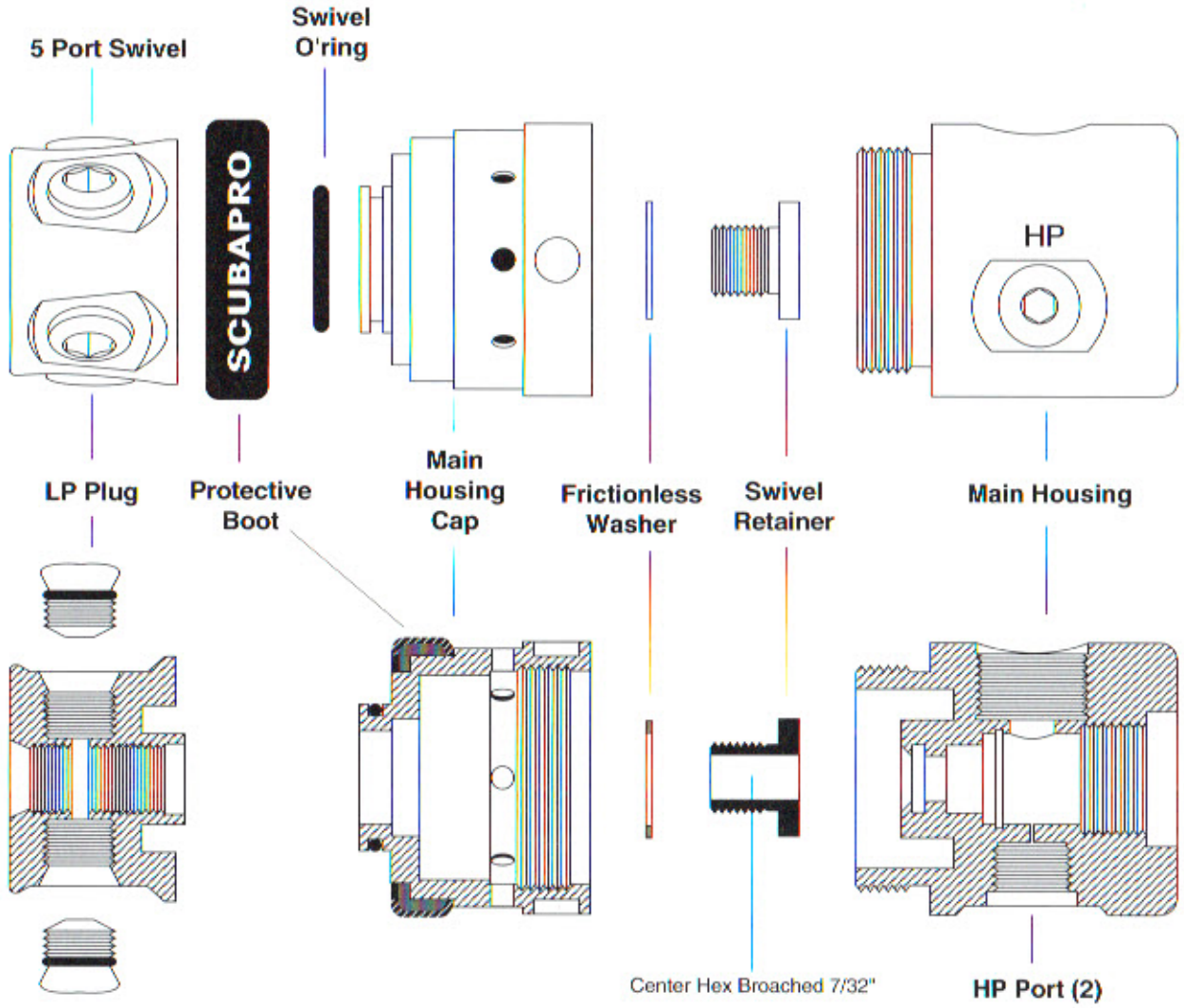


Pete Wolfinger, Scubapro Dealer Support

Figure #2

SCUBAPRO® Mark 15 First Stage

Main Housing & Swivel Assembly



Notes:

The Mark 15 main housing and swivel parts are detailed to the left in both the external and cut-away views. The assembly of these components is reasonably straight forward. Observe the following procedures when doing the final assembly.

- Torque the swivel retainer to 55-70 inch lbs. via the 7/32" center hex broach.
- Replace and lubricate the swivel port o'ring.
- Tighten the main housing and main housing cap using the multi-tool. The tension should be secure enough to prevent disassembly by hand.
- The SPEC boot may be installed after the Mark 15 is completely assembled.

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Figure #2

SCUBAPRO®

Technical Service Update

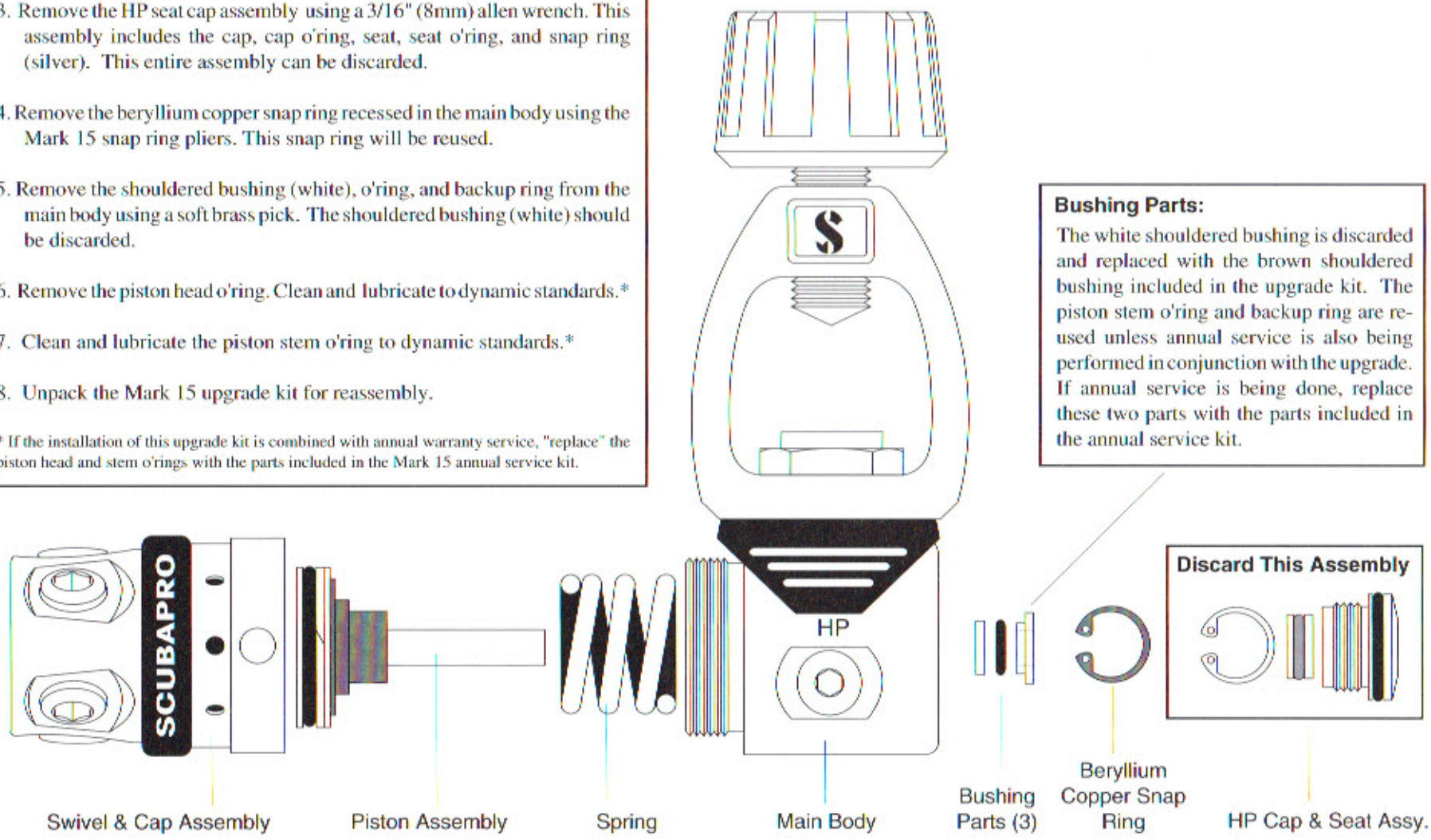
Mark 15 Upgrade

Disassembly

Disassembly Procedure:

1. Remove the swivel and cap assembly using the multi-tool.
2. Slide the piston and spring out of the main body.
3. Remove the HP seat cap assembly using a 3/16" (8mm) allen wrench. This assembly includes the cap, cap o'ring, seat, seat o'ring, and snap ring (silver). This entire assembly can be discarded.
4. Remove the beryllium copper snap ring recessed in the main body using the Mark 15 snap ring pliers. This snap ring will be reused.
5. Remove the shouldered bushing (white), o'ring, and backup ring from the main body using a soft brass pick. The shouldered bushing (white) should be discarded.
6. Remove the piston head o'ring. Clean and lubricate to dynamic standards.*
7. Clean and lubricate the piston stem o'ring to dynamic standards.*
8. Unpack the Mark 15 upgrade kit for reassembly.

* If the installation of this upgrade kit is combined with annual warranty service, "replace" the piston head and stem o'rings with the parts included in the Mark 15 annual service kit.



Bushing Parts:

The white shouldered bushing is discarded and replaced with the brown shouldered bushing included in the upgrade kit. The piston stem o'ring and backup ring are re-used unless annual service is also being performed in conjunction with the upgrade. If annual service is being done, replace these two parts with the parts included in the annual service kit.

Pete Wolfinger, Scubapro Dealer Support

Figure #3

SCUBAPRO®
Technical Service Update

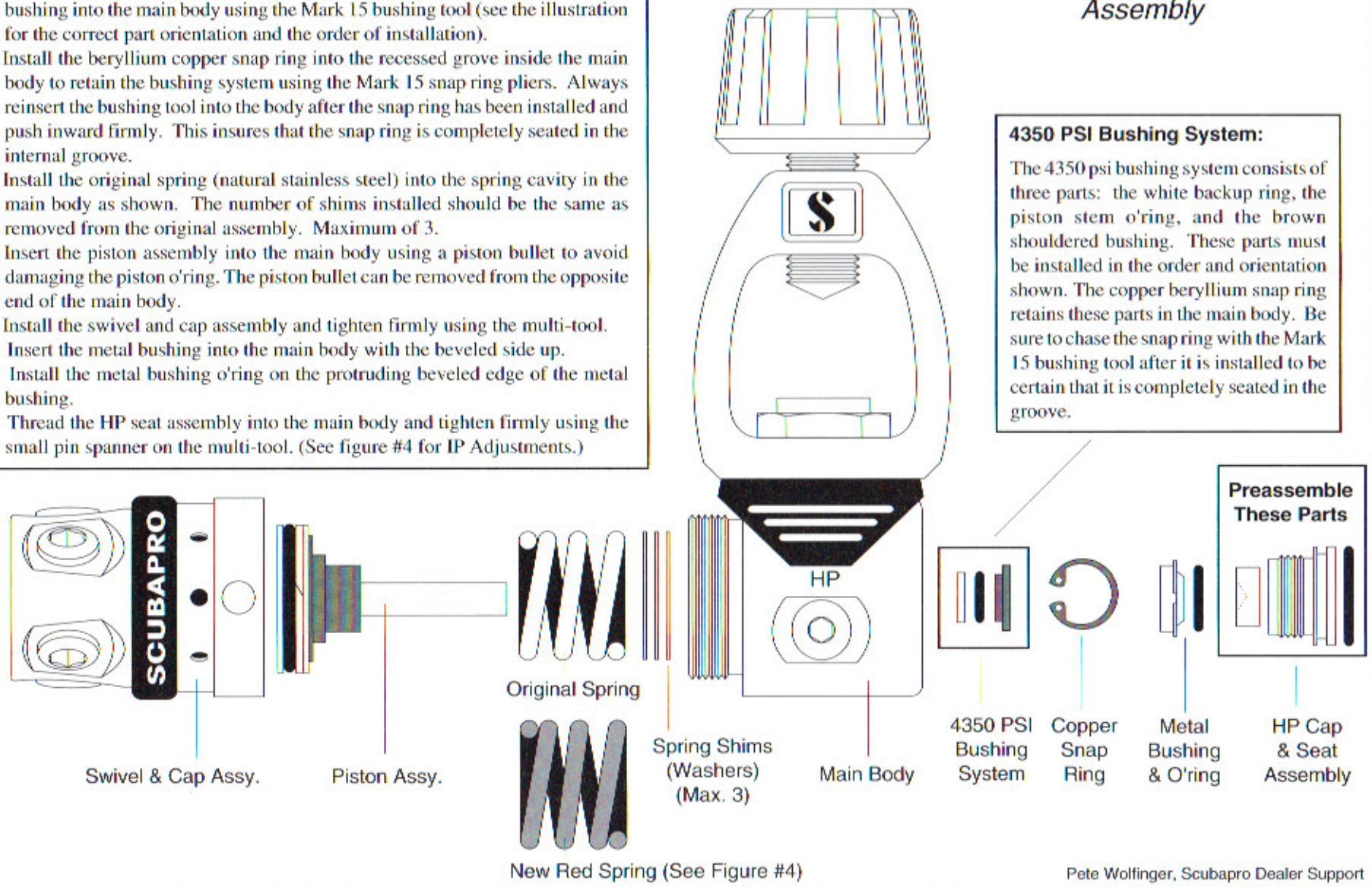
Mark 15 Upgrade
Assembly

Assembly Procedure:

1. Preassemble the HP cap, HP cap o'ring, and HP seat. Be sure that the cave cone recess in the HP seat is facing out (see illustration).
2. Press the white backup ring, piston stem o'ring, and brown shouldered guide bushing into the main body using the Mark 15 bushing tool (see the illustration for the correct part orientation and the order of installation).
3. Install the beryllium copper snap ring into the recessed grove inside the main body to retain the bushing system using the Mark 15 snap ring pliers. Always reinsert the bushing tool into the body after the snap ring has been installed and push inward firmly. This insures that the snap ring is completely seated in the internal groove.
4. Install the original spring (natural stainless steel) into the spring cavity in the main body as shown. The number of shims installed should be the same as removed from the original assembly. Maximum of 3.
5. Insert the piston assembly into the main body using a piston bullet to avoid damaging the piston o'ring. The piston bullet can be removed from the opposite end of the main body.
6. Install the swivel and cap assembly and tighten firmly using the multi-tool.
7. Insert the metal bushing into the main body with the beveled side up.
8. Install the metal bushing o'ring on the protruding beveled edge of the metal bushing.
9. Thread the HP seat assembly into the main body and tighten firmly using the small pin spanner on the multi-tool. (See figure #4 for IP Adjustments.)

4350 PSI Bushing System:

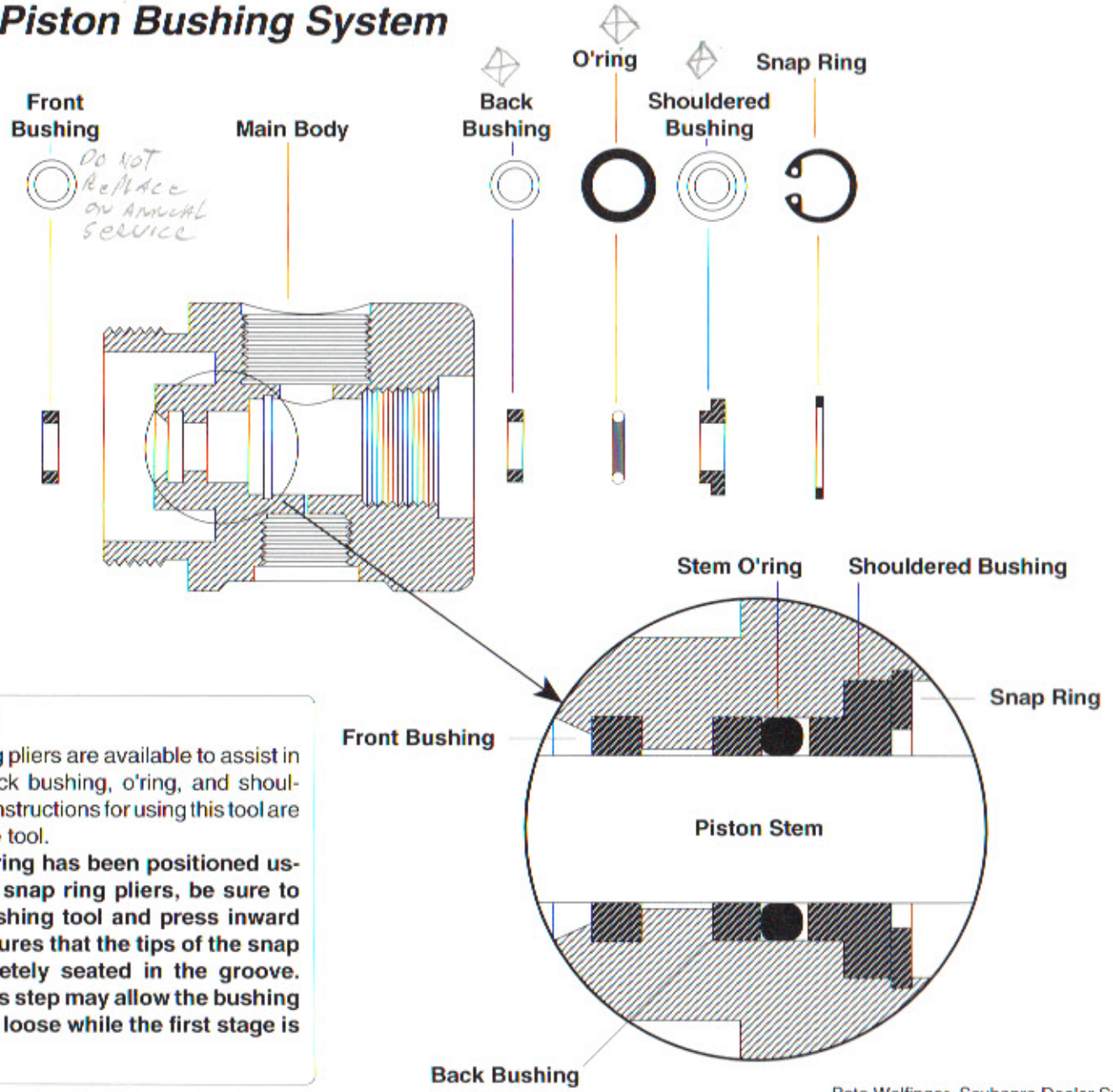
The 4350 psi bushing system consists of three parts: the white backup ring, the piston stem o'ring, and the brown shouldered bushing. These parts must be installed in the order and orientation shown. The copper beryllium snap ring retains these parts in the main body. Be sure to chase the snap ring with the Mark 15 bushing tool after it is installed to be certain that it is completely seated in the groove.



Pete Wolfinger, Scubapro Dealer Support

Figure #3

SCUBAPRO® Mark 15 First Stage
Piston Bushing System



Notes:
The Mark 15 first stage utilizes a replaceable piston bushing system. This special guide system minimizes o'ring pinch and provides an ultra smooth surface that reduces friction. The front bushing is "not" replaced during service. The back bushing, o'ring, and shouldered bushing are replaced to renew the system each time the first stage is repaired. A beryllium copper snap ring retains the bushing system in the main body. Due to its recessed location, special snap ring pliers are required to remove & install this snap ring. See important note below.

Important Note:
Special snap ring pliers are available to assist in installing the back bushing, o'ring, and shouldered bushing. Instructions for using this tool are included with the tool.
After the snap ring has been positioned using the special snap ring pliers, be sure to reinsert the bushing tool and press inward firmly. This insures that the tips of the snap ring are completely seated in the groove. Failure to do this step may allow the bushing system to work loose while the first stage is in use.

Pete Wolfinger, Scubapro Dealer Support

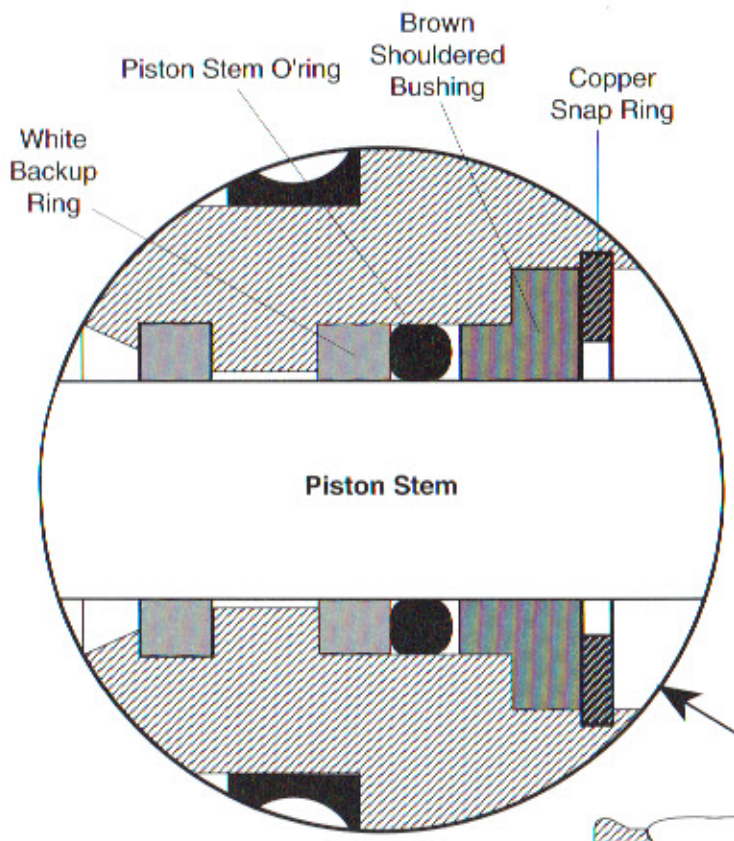
Figure #4

SCUBAPRO®

Technical Service Update

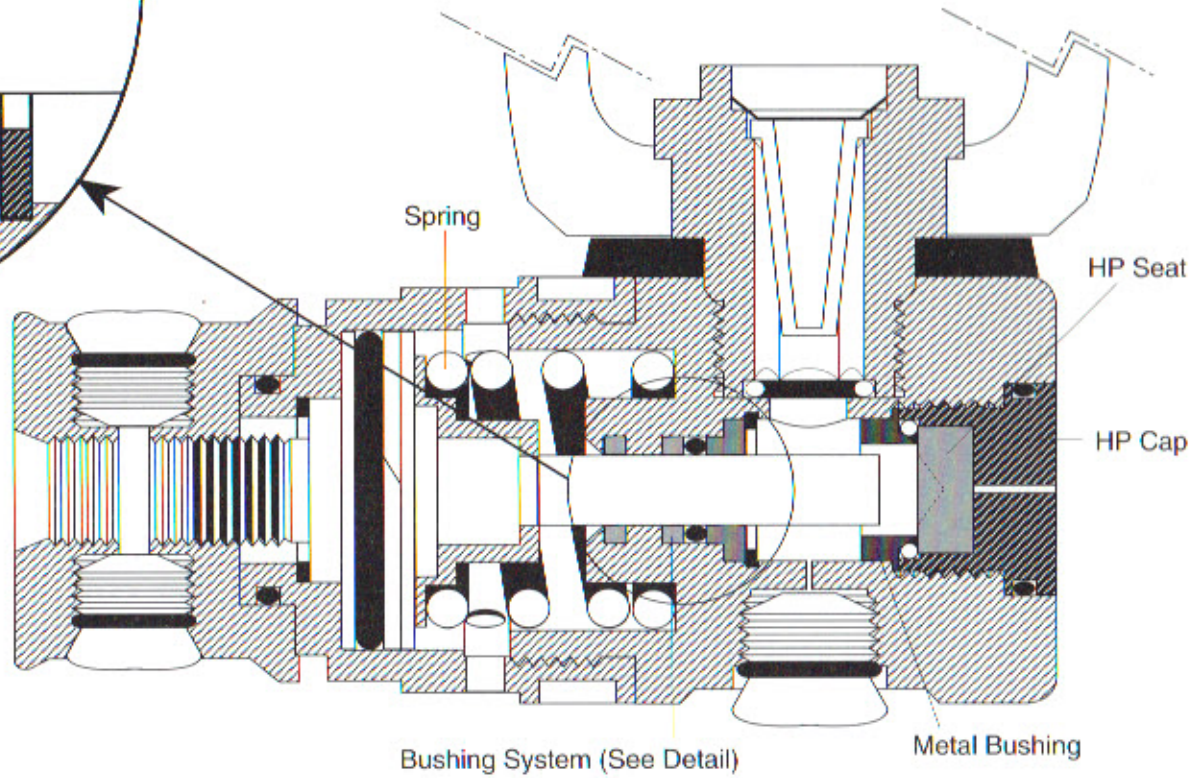
Mark 15 Upgrade

Intermediate Pressure Adjustments:



Intermediate Pressure Standards And Adjustments:

The Mark 15 first stage will produce intermediate pressures from 125 psi -145 psi over the supply pressure range of 4350 psi - 300 psi. This pressure gradient can be adjusted by two methods. The red spring, included in the upgrade kit, is slightly softer and will decreases IP output. Shims washers) can also be used, upto a maximum of three, to modify the IP. Cycle the first stage 8-10 times after installing the kit and then check to be sure that the IP is "locked up" and does not creep upward. If IP problems are encountered beyond the scope of these standards, please contact Scubapro Technical Service Department.



Bushing System Detail:

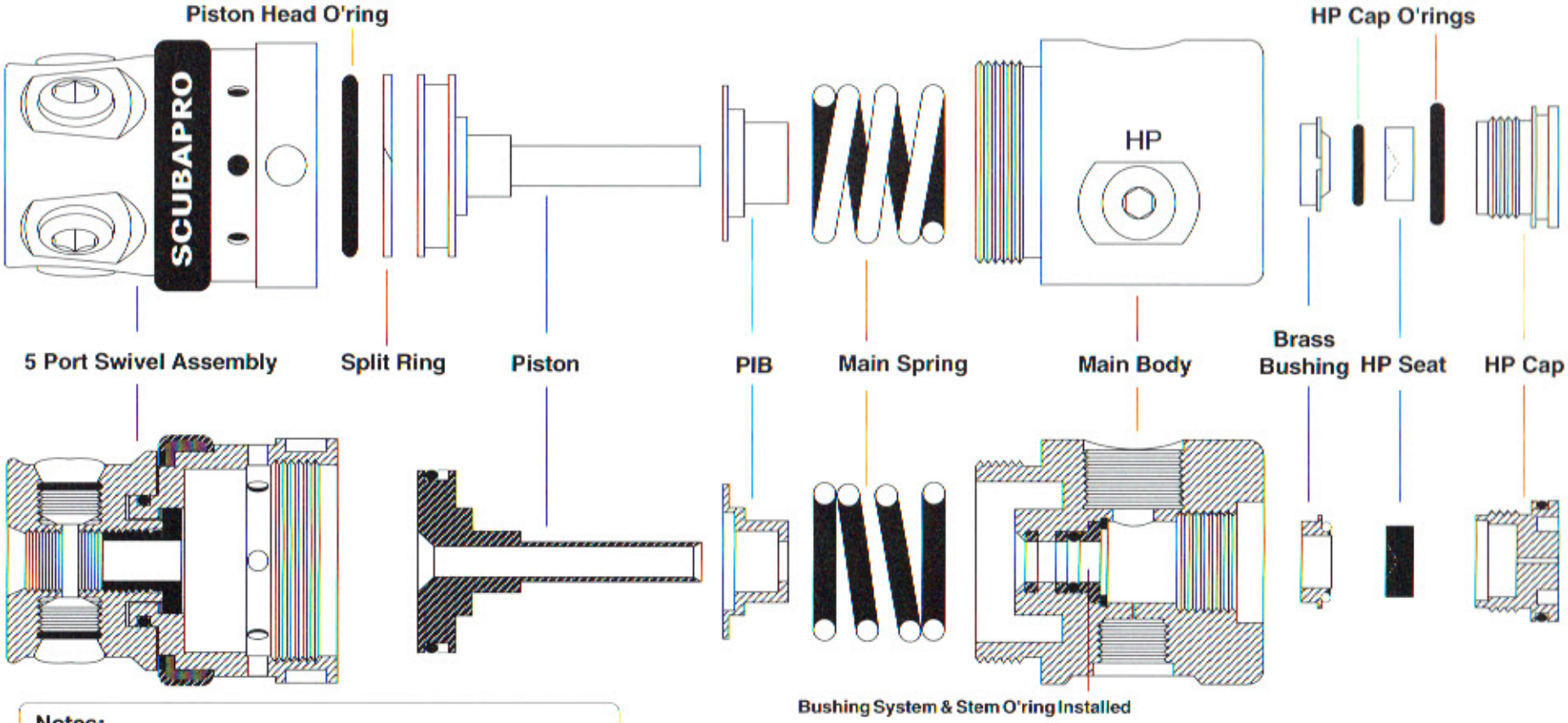
The detail above shows the Mark 15 bushing system installed inside the main body. Be sure that the piston stem o'ring is adequately lubricated to dynamic standards and the snap ring is fully seated in the main body groove. Always use a piston bullet when installing the piston into the main body to avoid damaging the piston stem o'ring.

Pete Wolfinger, Scubapro Dealer Support

Figure #4

SCUBAPRO® Mark 15 First Stage

Piston & HP Seat Components

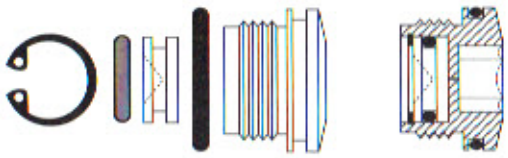


Notes:

The illustration above shows the piston and high pressure seat components. The swivel o'ring, piston head o'ring, piston stem o'ring, HP seat, and rear bushing system should be replaced during annual service. The PIB should be packed to the piston with silicone grease to prevent water exchange in this area. Lubricate all dynamic o'rings using the proper procedure. Be sure to stay up-to-date on the latest engineering information regarding HP seats available as replacement parts.

The components to the right are the original HP seat components used in the Mark 15 first stage. These were downgraded to 3000 psi. Replace with the components shown in the main illustration at the service interval.

Original 3000 psi HP Seat Parts



Pete Wolfinger, Scubapro Dealer Support

Figure #5

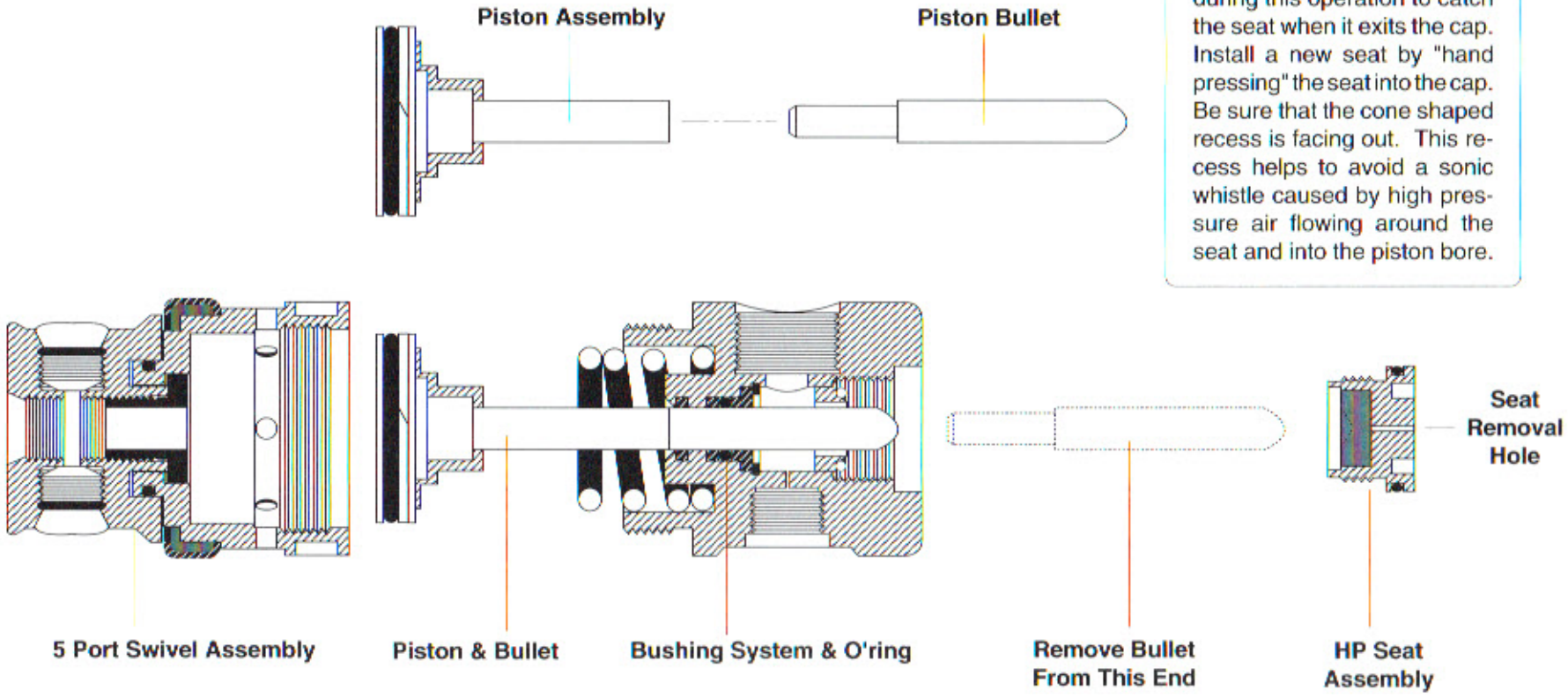
SCUBAPRO® Mark 15 First Stage

Piston & Seat Installation

Note:
Be sure to use a piston bullet when installing the piston into the main housing. The bullet slides into the piston bore and allows the sharp piston knife edge to slide through the internal stem o'ring and bushing system without damaging the parts. The bullet can be removed from the far end of the main body after the piston is in place. After the bullet has been removed, the HP seat assembly can be threaded into the main housing. Tighten the HP cap using the pin spanner on the multi tool (not shown).

HP Seat Removal/Installation

To remove the HP seat from the cap, hold an air blow gun over the small hole in the cap and pressurize. The air will get behind the seat and blow it forward out of the cap. Position your hand over the seat during this operation to catch the seat when it exits the cap. Install a new seat by "hand pressing" the seat into the cap. Be sure that the cone shaped recess is facing out. This recess helps to avoid a sonic whistle caused by high pressure air flowing around the seat and into the piston bore.

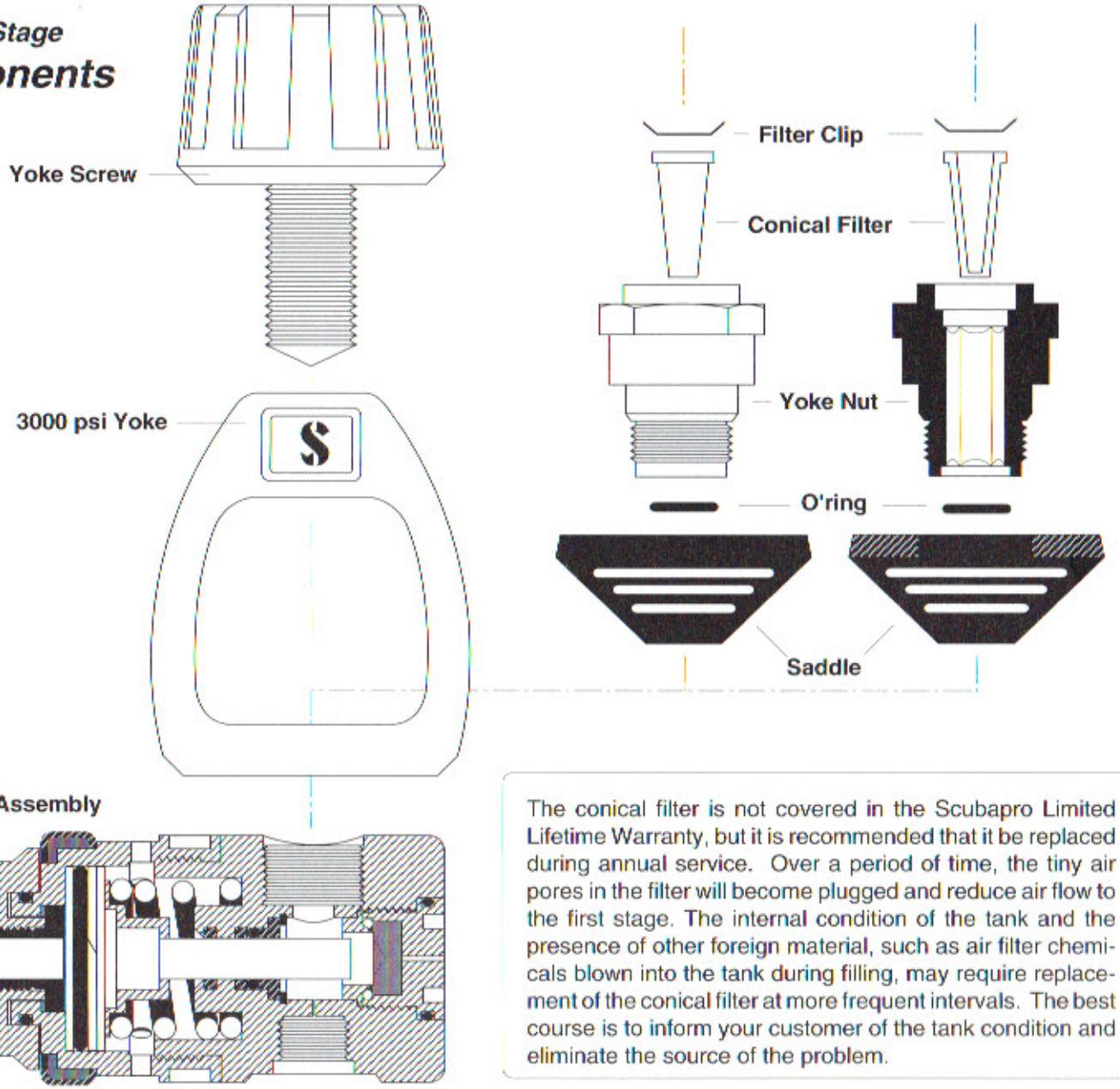


Pete Wolfinger, Scubapro Dealer Support

Figure #6

SCUBAPRO® Mark 15 First Stage
3000 PSI Yoke Components

Note:
All Scubapro first stages are shipped with a 3000 psi yoke system for connecting the first stage to a standard o'ring sealed valve. A Din connecting system is also available. The strength of the yoke has been increased several times over the last 25 years. It is highly recommended that all older yoke systems be replaced with the current 3000 psi yoke. This recommendation is based on the availability of 3000 psi air cylinders and the likelihood of the first stage being exposed to this higher pressure. In the interest of safety, please pass this suggestion along to your customers.



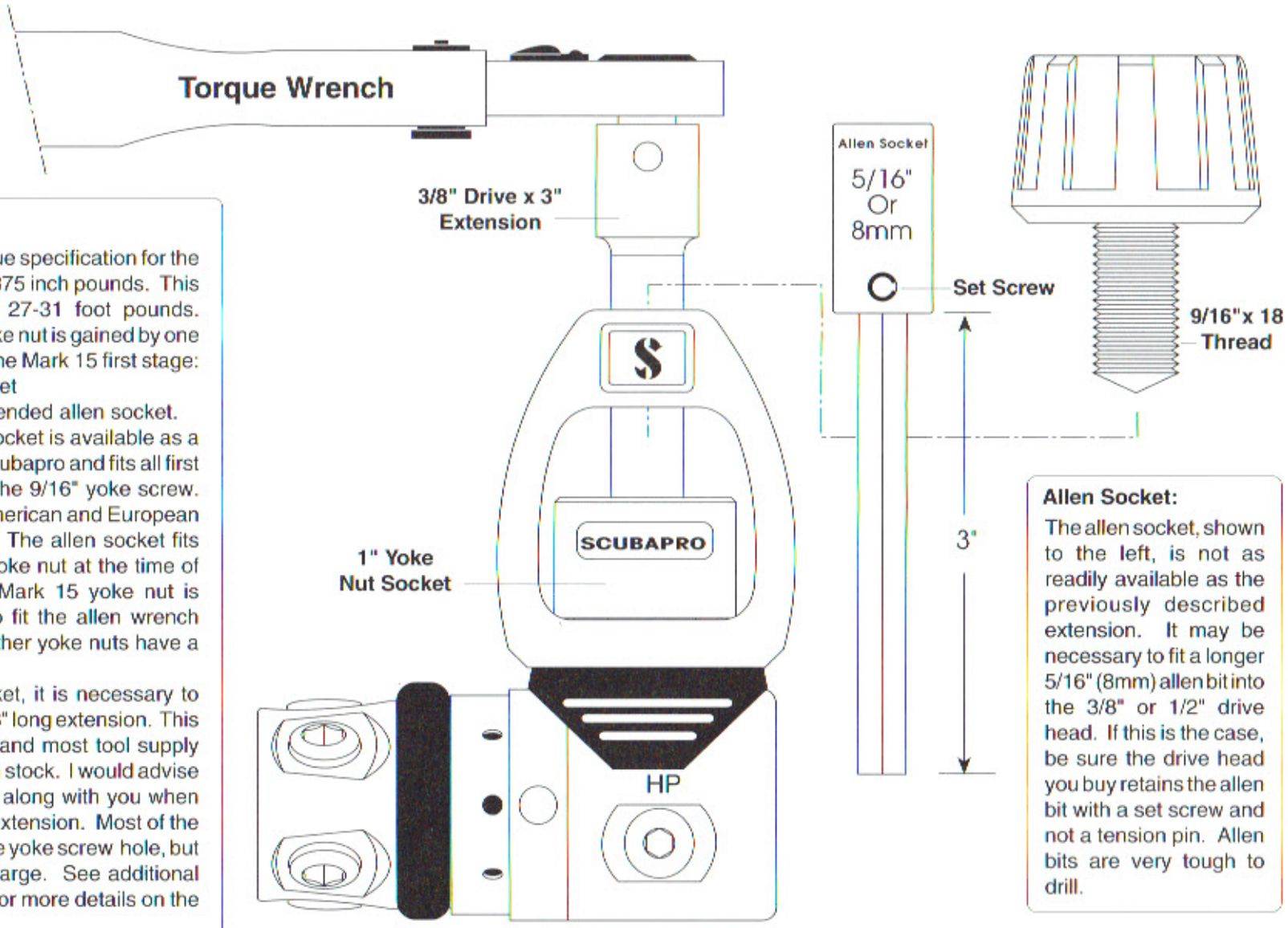
The conical filter is not covered in the Scubapro Limited Lifetime Warranty, but it is recommended that it be replaced during annual service. Over a period of time, the tiny air pores in the filter will become plugged and reduce air flow to the first stage. The internal condition of the tank and the presence of other foreign material, such as air filter chemicals blown into the tank during filling, may require replacement of the conical filter at more frequent intervals. The best course is to inform your customer of the tank condition and eliminate the source of the problem.

Pete Wolfinger, Scubapro Dealer Support

Figure #7

SCUBAPRO® Mark 15 First Stage

Applying Torque To The 1" Yoke Nut



Notes:

The Scubapro torque specification for the 1" yoke nut is 325-375 inch pounds. This figure converts to 27-31 foot pounds. Access to the 1" yoke nut is gained by one of two methods in the Mark 15 first stage:

- 1" Yoke Nut Socket
- 5/16" or 8mm extended allen socket.

The 1" Yoke Nut Socket is available as a special tool from Scubapro and fits all first stages that utilize the 9/16" yoke screw. This includes all American and European yokes since 1982. The allen socket fits only the Mark 15 yoke nut at the time of this writing. The Mark 15 yoke nut is center broached to fit the allen wrench configuration. All other yoke nuts have a round filter cavity.

To use the 1" socket, it is necessary to have a 3/8" drive x 3" long extension. This is a standard item and most tool supply outlets will carry it in stock. I would advise you to take a yoke along with you when you purchase this extension. Most of the ones I tried will fit the yoke screw hole, but some may be too large. See additional notes, to the right, for more details on the allen socket.

Allen Socket:

The allen socket, shown to the left, is not as readily available as the previously described extension. It may be necessary to fit a longer 5/16" (8mm) allen bit into the 3/8" or 1/2" drive head. If this is the case, be sure the drive head you buy retains the allen bit with a set screw and not a tension pin. Allen bits are very tough to drill.

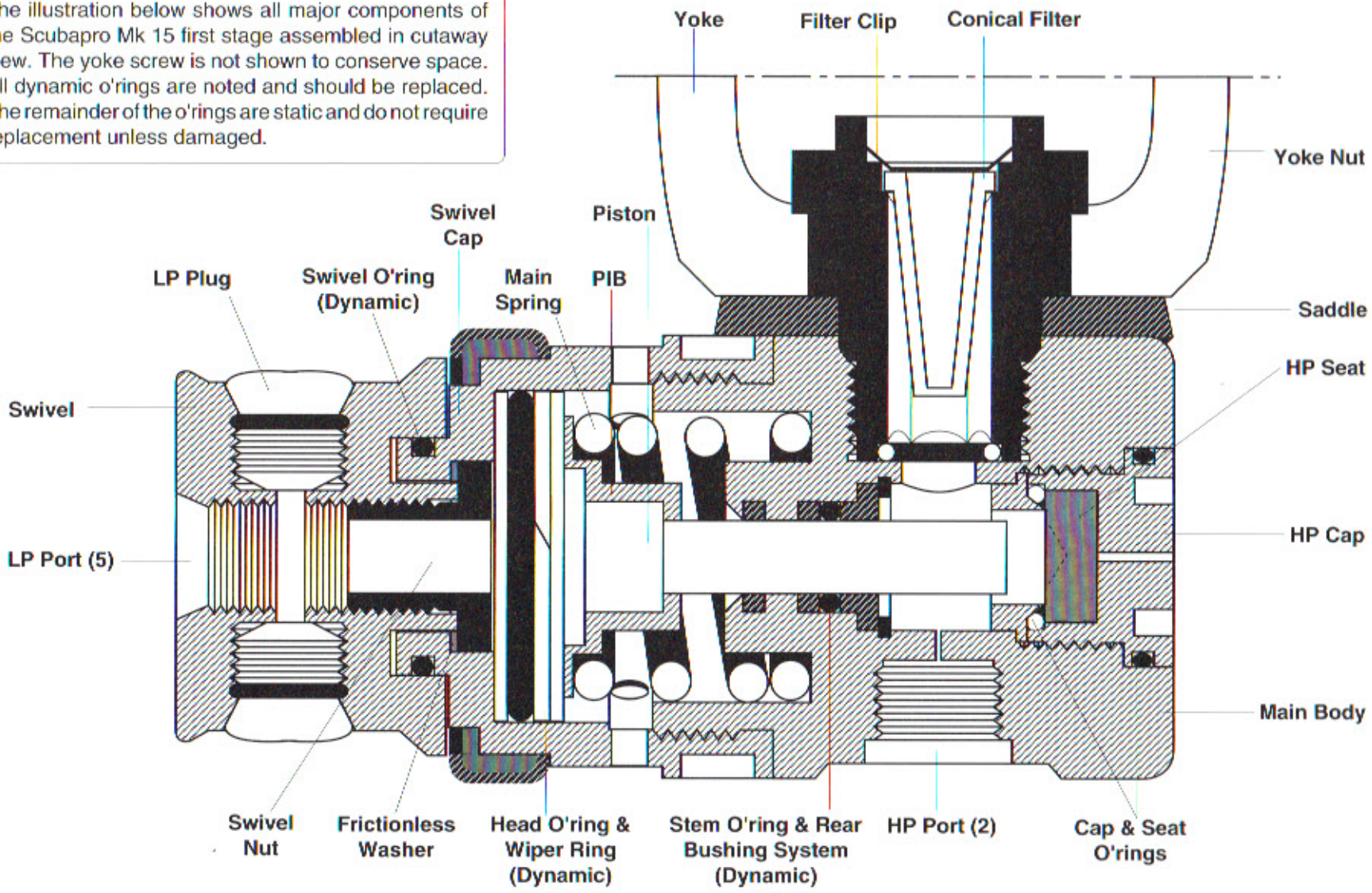
Pete Wolfinger, Scubapro Dealer Support

Figure #8

SCUBAPRO® Mark 15 First Stage
Full Cutaway

Notes:

The illustration below shows all major components of the Scubapro Mk 15 first stage assembled in cutaway view. The yoke screw is not shown to conserve space. All dynamic o'rings are noted and should be replaced. The remainder of the o'rings are static and do not require replacement unless damaged.



Pete Wolfinger, Scubapro Dealer Support

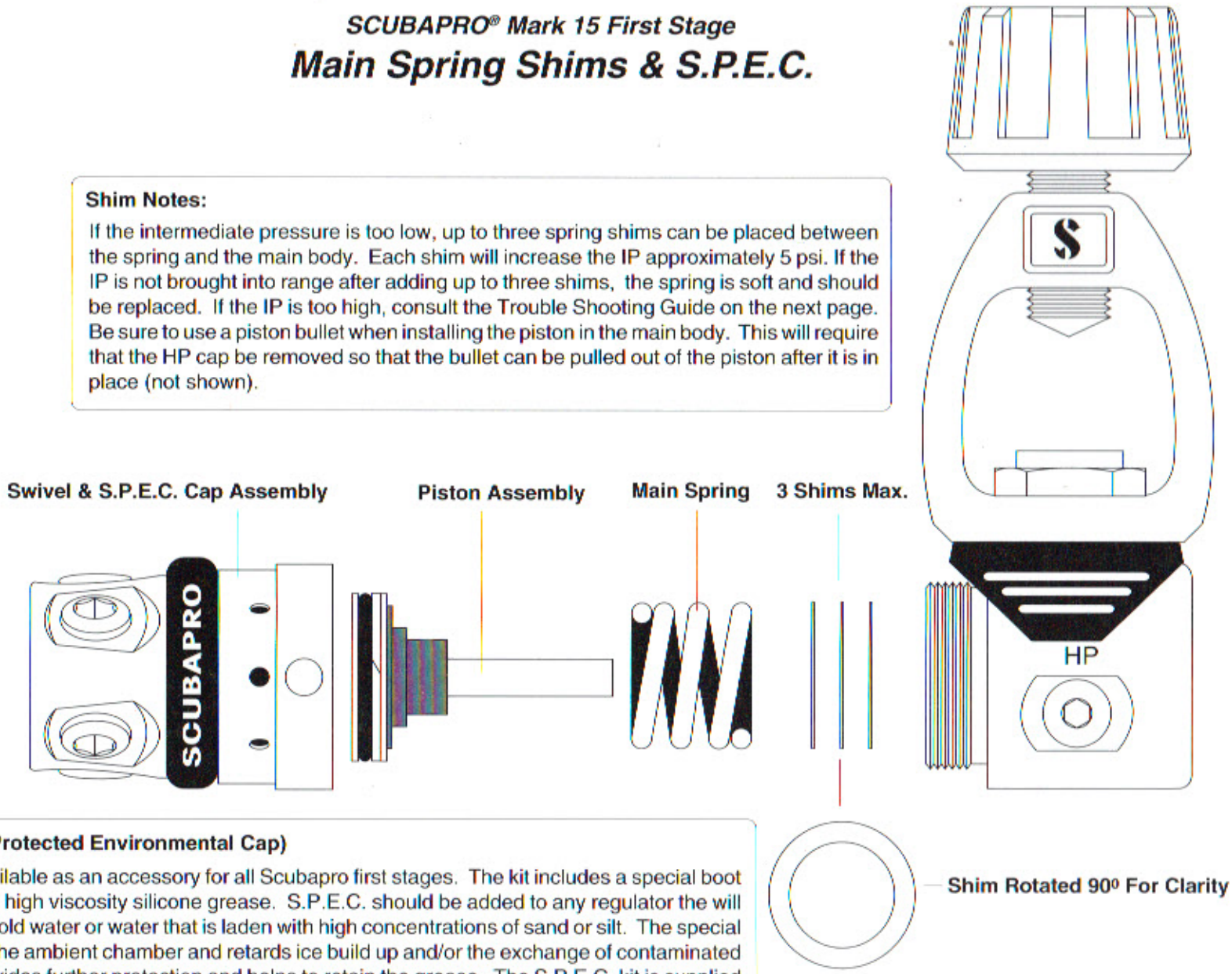
Figure #9

SCUBAPRO® Mark 15 First Stage

Main Spring Shims & S.P.E.C.

Shim Notes:

If the intermediate pressure is too low, up to three spring shims can be placed between the spring and the main body. Each shim will increase the IP approximately 5 psi. If the IP is not brought into range after adding up to three shims, the spring is soft and should be replaced. If the IP is too high, consult the Trouble Shooting Guide on the next page. Be sure to use a piston bullet when installing the piston in the main body. This will require that the HP cap be removed so that the bullet can be pulled out of the piston after it is in place (not shown).



S.P.E.C. (Silicone Protected Environmental Cap)

S.P.E.C. kits are available as an accessory for all Scubapro first stages. The kit includes a special boot and a 7 gram tube of high viscosity silicone grease. S.P.E.C. should be added to any regulator the will be exposed to very cold water or water that is laden with high concentrations of sand or silt. The special grease is packed in the ambient chamber and retards ice build up and/or the exchange of contaminated water. The boot provides further protection and helps to retain the grease. The S.P.E.C. kit is supplied with complete instruction for installation. **Important Note: The boot should never be used unless the ambient chamber is packed with silicone.**

Pete Wolfinger, Scubapro Dealer Support

Figure #10

SCUBAPRO® Mark 15 First Stage
General Procedures & Trouble Shooting

General Procedures, All First Stages

- Precheck intermediate pressure before disassembly
- Precheck for any external air leaks before disassembly
- Disassemble using proper tools
- Inspect all parts for defects
- Degrease where necessary
- Clean all parts
- Replace all dynamic O'rings
- Replace the HP seat
- Replace the HP filter and filter retainer
- Reassemble all components
- Check intermediate pressure with new parts installed
- See Trouble Shooting Guide to analyze results

Mk 15 Schematic Notation:

Intermediate Pressure Limits

Intermediate pressure limits must be between 125-145 psig at both supply pressures of 3000 (yoke system), 4350 (Din system) and 300 psig. 0 psig intermediate pressure creepage allowed after seating of a new seat.

Never exceed 160 psig IP.

First stage mechanical principles are covered in Chapters 1-3 in the front of this manual. If you need additional information concerning this data, please refer to these three chapters or call Scubapro Technical Service Department or your regional representitive.

Symptom	Probable Cause	Solution
• Audible air leaks at porting	Loose plugs or hoses Damaged static o'rings O'ring not properly seated	Tighten where necessary Relube & replace o'rings Adjust o'ring alignment
• Air leaks through ambient ports	Defective piston stem o'ring Defective piston head o'ring	Relube & replace o'ring Relube & replace o'ring
• Low IP@ 3000 psi	Weak main spring	Replace or shim main spring
• High IP@ 3000 psi	Poor seating result Stiff main spring HP stem o'ring pinch	Replace HP seat Replace piston or main housing Replace spring or remove shims Check IP @ 300 psi
• Low IP @ 300 psi	Weak spring	Replace or shim spring
• High IP @ 300 psi	Stiff spring	Replace spring or remove shims
• Initial IP creep on gauge	New seat taking a set	Cycle regulator 20-25 times
• Continuous IP creep on gauge	Poor seating result	Replace HP seat Replace piston or body
• High IP @ 3000, Norm. IP @300 (balanced piston only)	HP stem o'ring pinch	Replace & relube stem o'ring Replace piston Replace body

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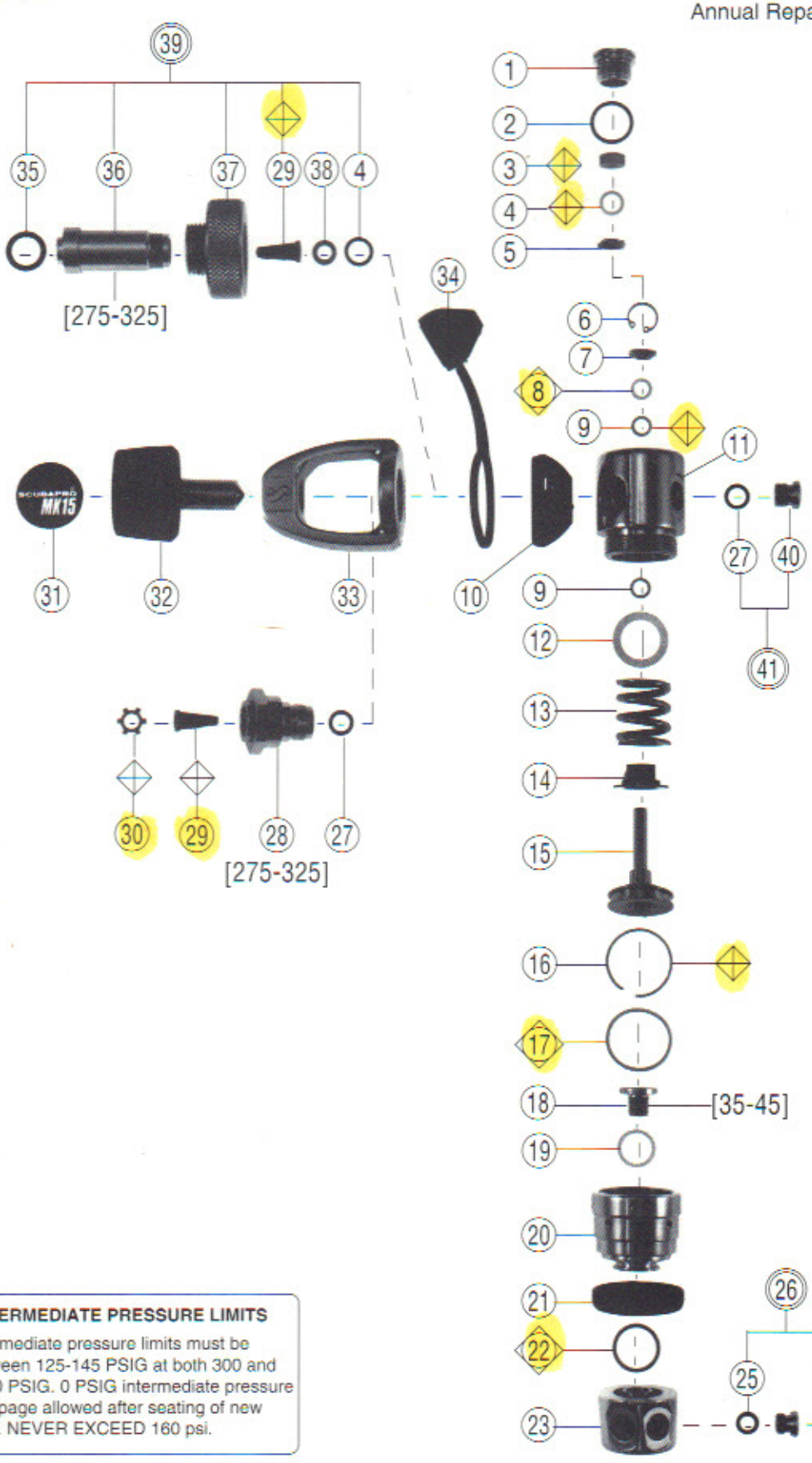
SCUBAPRO

Technical Service Schematic

MK 15 FIRST STAGE #10-600-000

Date 12/97 Revison B

Annual Repair Parts Kit #10-600-041



INTERMEDIATE PRESSURE LIMITS

Intermediate pressure limits must be between 125-145 PSIG at both 300 and 3000 PSIG. 0 PSIG intermediate pressure creepage allowed after seating of new seat. NEVER EXCEED 160 psi.

SCUBAPRO

Technical Service Schematic

MK 15 FIRST STAGE 10-600-000

Date 12/97 Revison B
Annual Repair Parts Kit #10-600-041

Parts

	#	QTY	PART #	DESCRIPTION	COST
*	1	1	10-600-125	RETAINER, SEAT, HP	
	2	1	01-050-398	O-RING, SEAT RETAINER, BLACK	
*	3	1	10-600-123	SEAT, HP	
*	4	1	01-050-401	O-RING, SEAT, AMBER	
	5	1	10-600-124	INSERT BUSHING, CHROME	
	6	1	01-073-112	RETAINING RING, O-RING, COPPER	
	7	1	10-600-129	WASHER, RING, RETAINING	
	8	1	01-050-137	O-RING, PISTON, SHAFT, AMBER	
*	9	2	01-060-600	WASHER, O-RING	
	10	1	10-600-111	SADDLE, MK15	
	11	1	10-600-101	BODY, MK15	
*	12	1	01-060-218	WASHER, SHIM, MK15	
	13	1	01-020-600	SPRING, MK15	
	14	1	10-600-115	SLEEVE, PLASTIC, MK15	
	15	1	10-600-103	PISTON, MK15	
	16	1	01-051-222	RING, BACK-UP	
	17	1	01-050-179	O-RING, PISTON, LARGE, AMBER	
	18	1	10-500-103	RETAINER, SWIVEL	
	19	1	01-060-500	WASHER, SWIVEL	
	20	1	10-600-102	CAP, SWIVEL, MK15	
	21	1	10-600-114	TRIM BUMPER, SWIVEL, MK15	
	22	1	01-050-161	O-RING, SWIVEL	
	23	1	10-600-118	SWIVEL, MK 15	
	24	4	10-101-104	PLUG, LP, (3/8-24)	
	25	4	01-050-132	O-RING, LP PLUG, BLUE	
	26	4	10-101-006	PLUG, LP, (3/8-24) WITH O-RING	
	27	1	01-050-138	O-RING, HP PLUG & YOKE RTNR, BLUE	
	28	1	10-600-104	RETAINER, YOKE, MK15	
	29	1	01-028-109	FILTER	
	30	1	01-073-101	RETAINER	
	31	1	01-006-623	DECAL, YOKE SCREW, MK15	
	32	1	10-200-008	YOKE SCREW ASSEMBLY	
	33	1	10-101-157	YOKE, MACHINED, SATIN FINISH	
	34	1	10-101-211	HP, PROTECTOR, COMBO YOKE/DIN	
	35	1	01-050-193	O-RING, DIN, BLACK	
	36	1	10-400-107	RETAINER, DIN, 300 BAR	
	37	1	10-105-118	KNOB, DIN, 300 BAR	
	38	1	01-060-501	WASHER, DIN	
○	39	1	10-400-030	KIT, DIN, 300 BAR	
	40	1	10-101-139	PLUG, HP, (7/16-20)	
	41	1	10-101-039	HP PLUG WITH O-RING (7/16-20)	
○	●	1	10-600-119	SPEC BOOT, MK15	
○	●	1	10-600-020	SPEC KIT, W/BOOT & SILICONE GREASE	
*	●	1	10-600-051	MK15 UPGRADE KIT	

Technical Information:

ALLEN WRENCH SIZES:
#28 yoke retainer 5/16 or 8mm
#24 LP Plug 5/32
#40 HP Plug 5/32
#36 Din retainer 15/32 or 6mm

Item #13 note: 01-020-601 spring (red) may be used if lower intermediate pressures are required.

Special Engineering Notes:

Flow through piston designs will under some conditions make a whistling noise during flow. To alleviate, heavily lubricate Item #8, 01-050-137 and/or replace item #3, 10-600-123 HP seat.

Reference Item #1 If MK15 HP seat retainer has the Allen Hex 8mm inset, install Upgrade Kit #10-600-051. (See Engineering Bulletins #234).

Reference Item #12: A maximum of 3 washers (#10-060-218) may be used to adjust intermediate pressure to specified limits.

Legend

(prices subject to change without notice)

● Not Shown
◇ Dynamic O'Ring Replace Annually
○ Optional Item
◈ Annual Replacement
▲ Limited Warranty
[ ] Torque In Inch Pounds
❑ Older Configuration
* See Note