

SCUBAPRO[®]

Technical Service Reference & Repair Guide

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Special Lubrication Information: The Mark 10Plus and Mark 20 first stages utilize special lubricants that improve intermediate pressure stability and maximize performance. The primary product used for internal dynamic o'ring lubrication is called Christo-Lube and is packaged under the Scubapro label. Be sure to use this special lubricant as directed when servicing these two first stages.

Christo-Lube Available 3/1/96 PN 41-047-000

Important Note: The following information "is not" designed to be a complete training guide for infield servicing of the Mark 20 first stage. All Scubapro technicians are required to attend an annual repair clinic to insure safe handling and servicing of Scubapro products.

Mark 20 First Stage

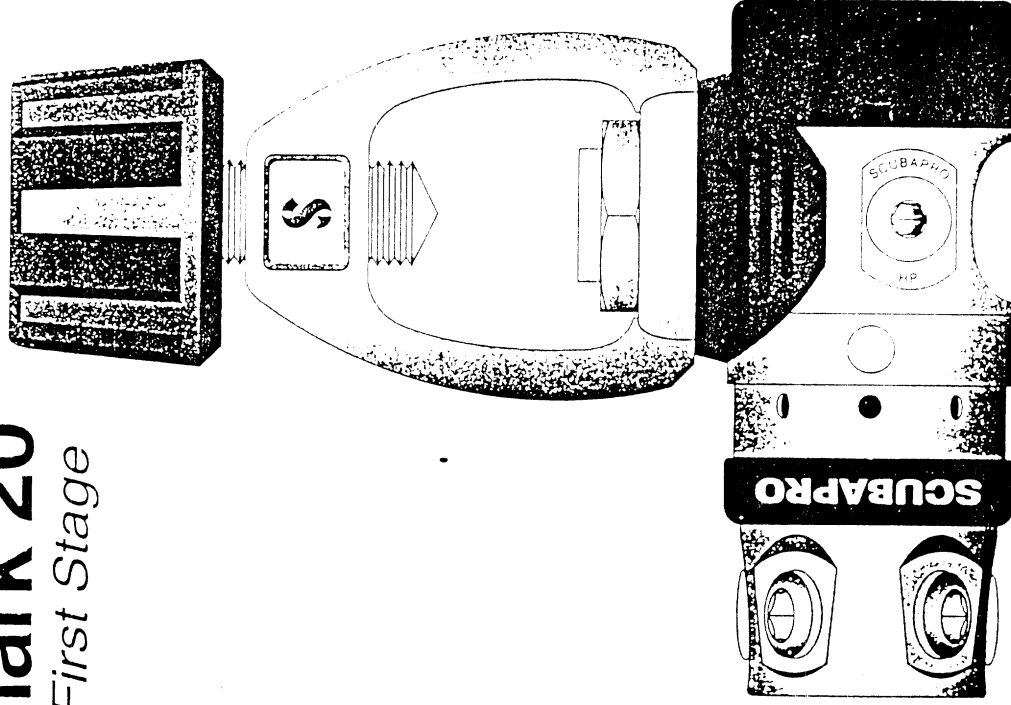
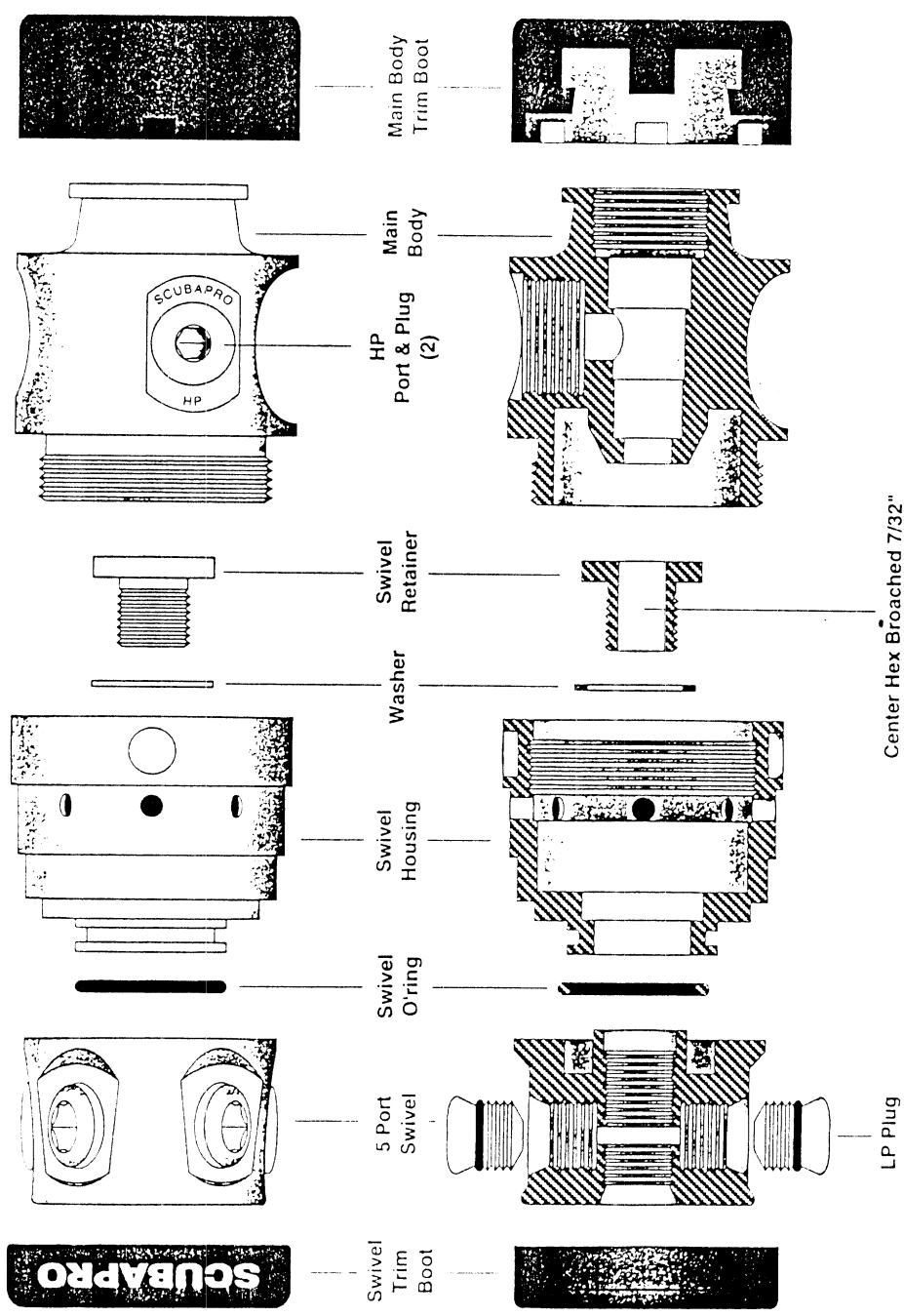


Figure #2

SCUBAPRO® Mark 20 First Stage Main Body & Swivel Assembly



Notes:

The Mark 20 main body and 5 port swivel parts are detailed to the left in both the external and cutaway views. The assembly of these components is reasonably straight forward. Observe the following procedures when doing the final assembly:

- Replace and lubricate the swivel port o-ring.
- Torque the swivel retainer to 55-70 inch lbs. via the 7/32" center hex broach.
- Tighten the main body and swivel housing using the multi-tool. The tension should be secure enough to prevent disassembly by hand.
- The swivel & main body trim boots may be installed after the Mark 20 is completely assembled.

Figure #3

SCUBAPRO® Mark 20 First Stage Piston & HP Seat Components

Notes:

The illustration below shows the piston and high pressure seat components. Both the piston head and piston stem o-rings should be replaced and properly lubricated with Christo-Lube. The HP seat and guide bushings are also replaced during annual service. The Mark 20 bushing system is vital to the high pressure performance. By replacing it at regular intervals, the piston-to-seat alignment is preserved and remains the same as a new first stage.

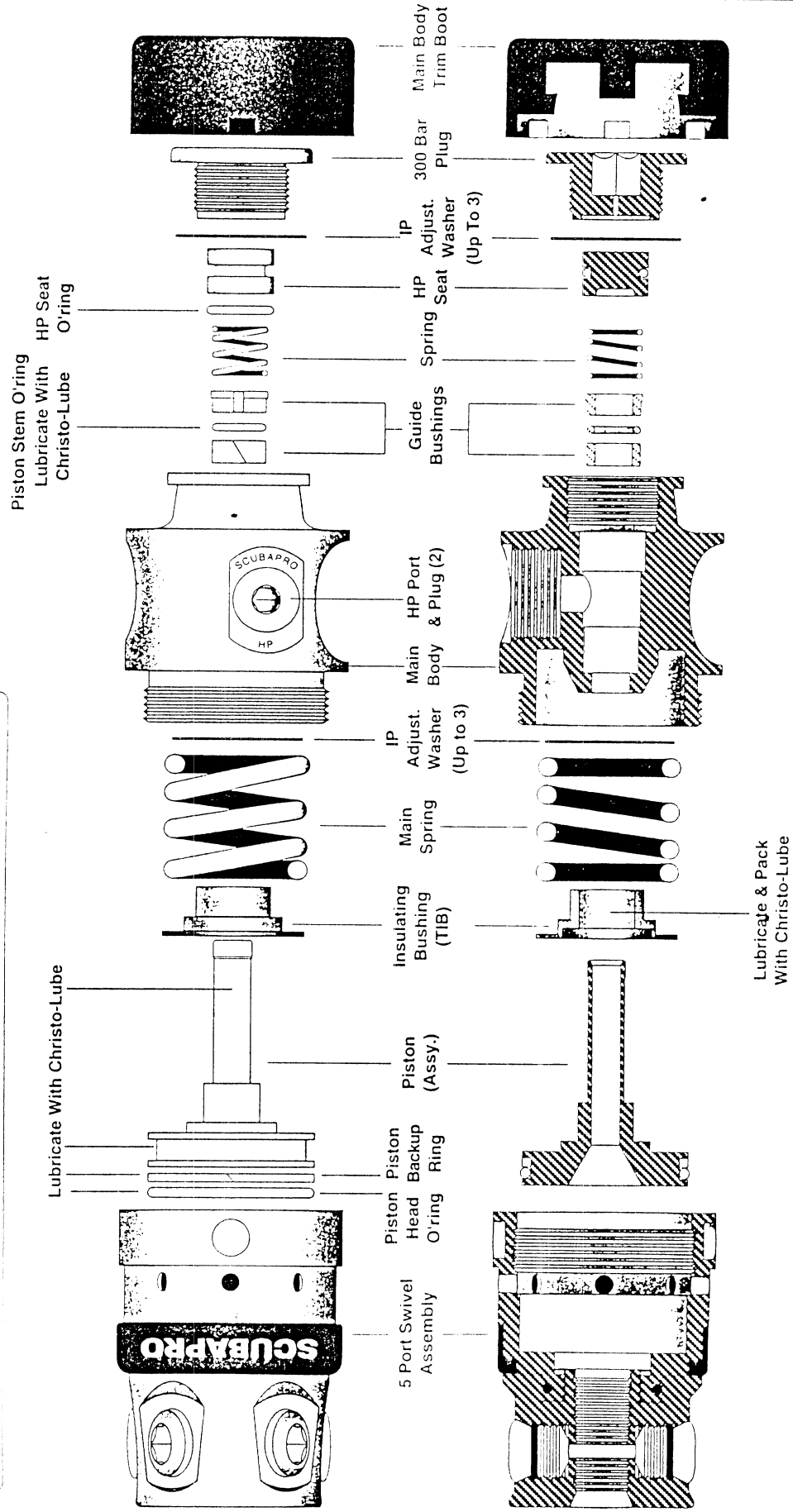


Figure #4

Important Assembly Notes:

The Mark 20 piston and bushing assembly requires a different assembly procedure than previous Scubapro first stages. These changes in assembly sequencing involve all of the in-line parts that are installed into the main body. The following order of installation must be followed to assemble the Mark 20 correctly:

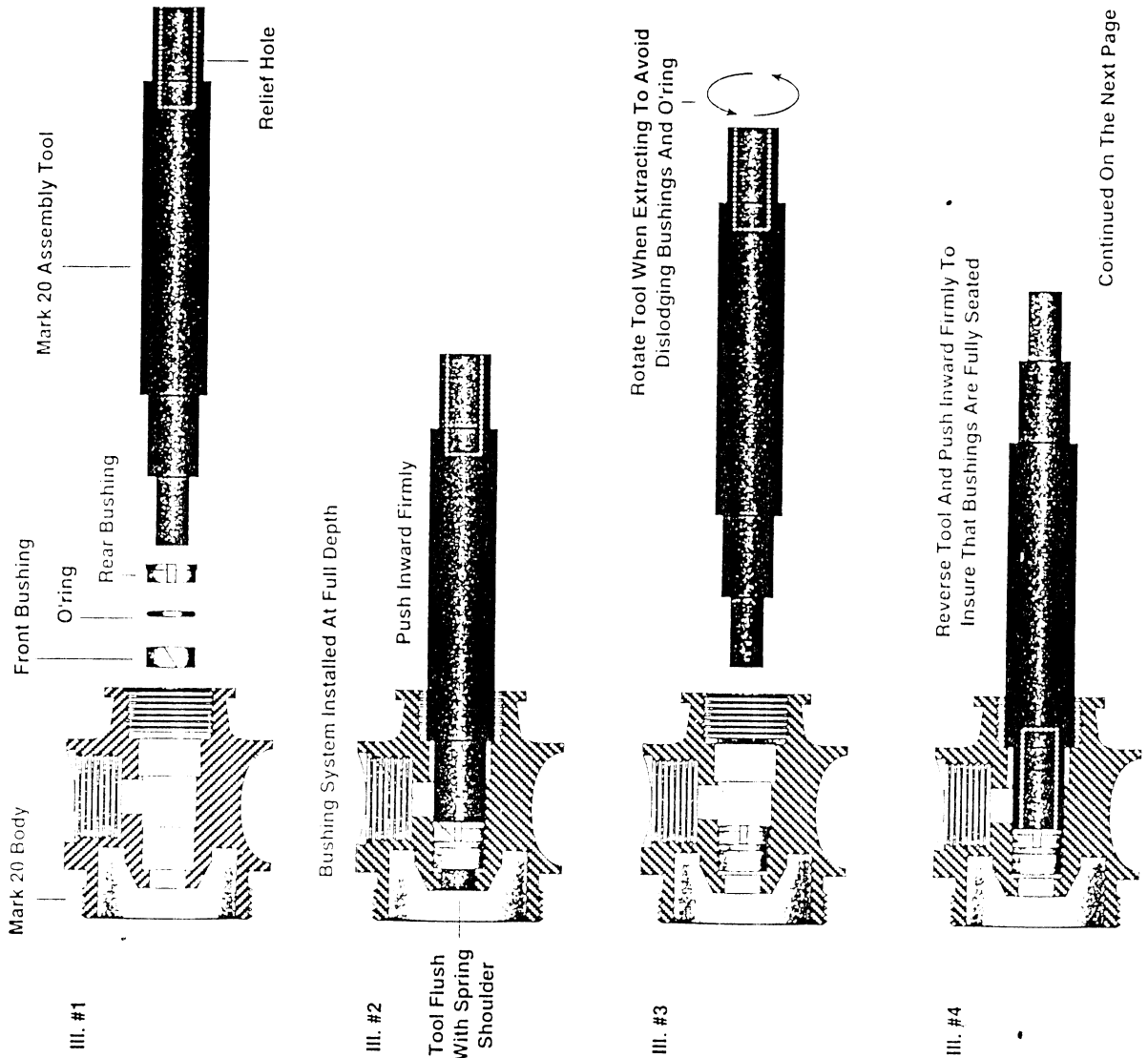
Bushing System Installation: The Mark 20 bushing system is installed first in the main body. A special tool, called the Mark 20 Assembly Tool, is required to complete this task. The tool has two different functions that deal with inserting the bushings and o-ring initially, and then holding these parts in place while the spring, piston assembly, and swivel assembly are installed. The end of the tool that has "two" machined ledges is used to install the bushing system into the body. The front bushing, o-ring, and rear (shouldered) bushing are placed on the tool in the order shown in illustration #1. Be sure that the o-ring is lubricated to dynamic standards with Christo-Lube. A light coating of lubricant on the tool end itself will assist in removing the tool after the bushings and o-ring are in place.

With the bushings and o-ring stacked on the tool, install the bushing system by pushing inward firmly. When the bushings are completely seated on the internal ledge, the end of the tool will be flush with the spring shoulder on the opposite end of the body (see illustration #2).

Remove the tool with a twisting motion to help release the tool from the bushing system and o-ring (see illustration #3).

To insure that the bushings did not move when extracting the tool, turn the tool over and press inward firmly (illustration #4). This end of the tool is center drilled to receive the piston when it is inserted from the other side of the body. For a continuation of this assembly procedure, see the next page (figure #5).

**SCUBAPRO® Mark 20 First Stage
Piston & Bushing Installation**



Continued On The Next Page

Figure #5

Continued from figure #4

Piston and Spring Installation: With the tool still in place, install the spring and piston assembly through the bushing system and into the relief hole drilled into the end of the tool. The rounded sealing edge on the piston will not damage the o-ring and the use of a piston bullet is not required when inserting the piston into the Mark 20 first stage. A light coating of lubricant on the tip of the piston will help the piston slide through the bushing and o-ring easily (illustration #5).

Swivel Assembly Installation: The swivel assembly is threaded onto the main body with the tool in place. This action will compress the spring and position the piston at its fully installed depth. Before removing the tool, push inward firmly to be sure that the bushing system has remained fully seated during assembly (illustration #6).

HP Seat Component Installation: The HP seat components can now be installed. The spring is designed to hold the bushing system in place. The seat is positioned with the concave side facing toward the piston and the seat retainer is threaded into the body as a final step (see illustration #7). It is recommended that two shim washers be installed for the initial set up. Shim washers may be added or removed to modify IP output (see figure #10).

Alternate Method: If the Mark 20 Assembly tool is not available, the bushings can be installed with any soft blunt tool that will fit the recessed area of the body. After the bushings and o-ring are in place, completely install the HP seat components. The spring will help to hold the bushing system in position while the piston is inserted. Be extremely careful not to disturb the location of the bushings and o-ring while inserting the piston. Extra care must be taken to insure proper assembly using this method (not shown).

SCUBAPRO® Mark 20 First Stage Piston & Bushing Installation Continued

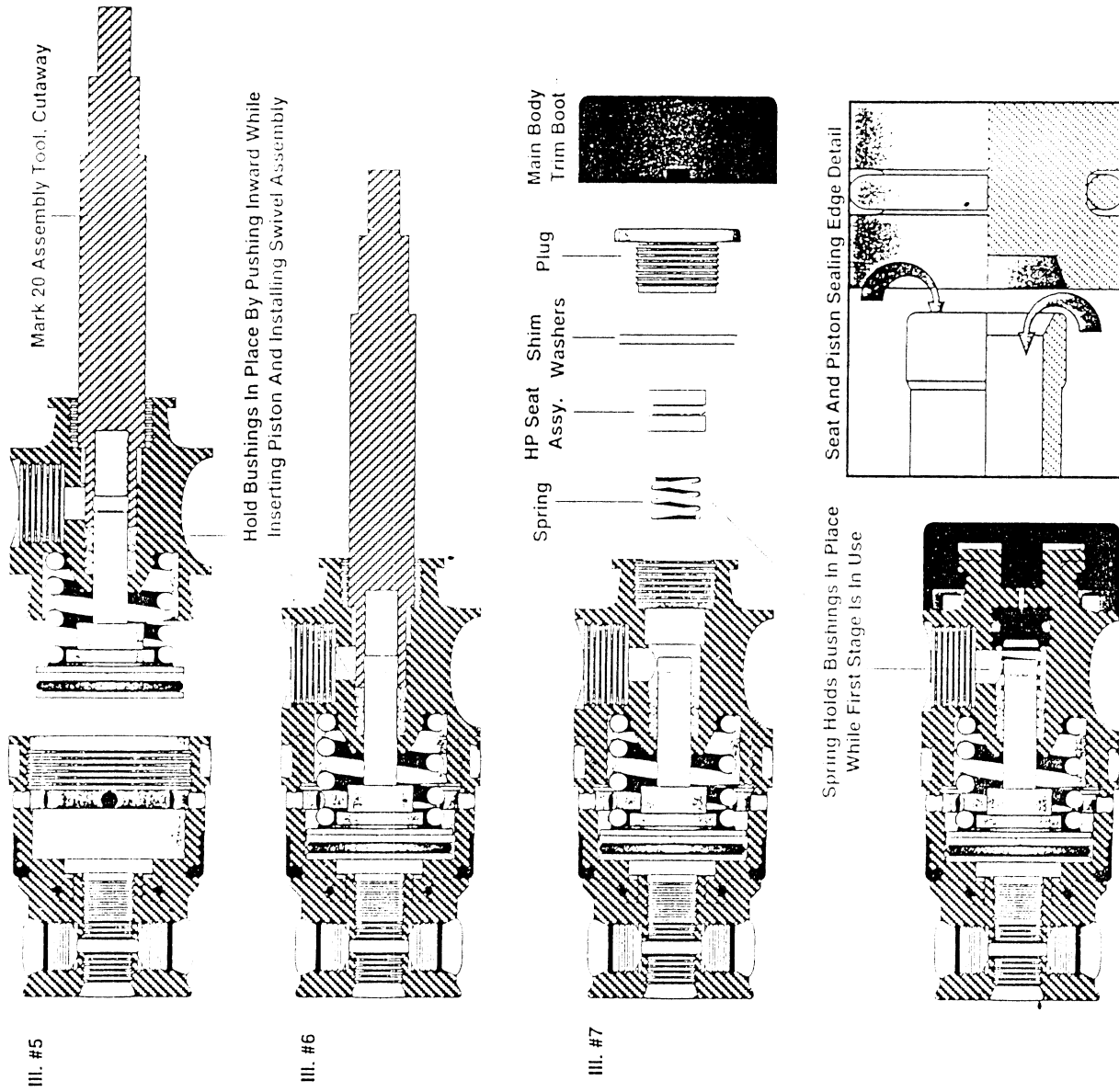
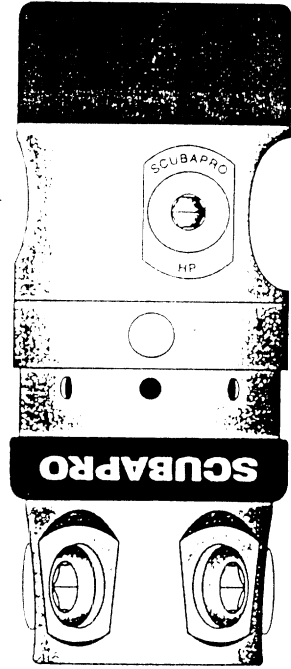
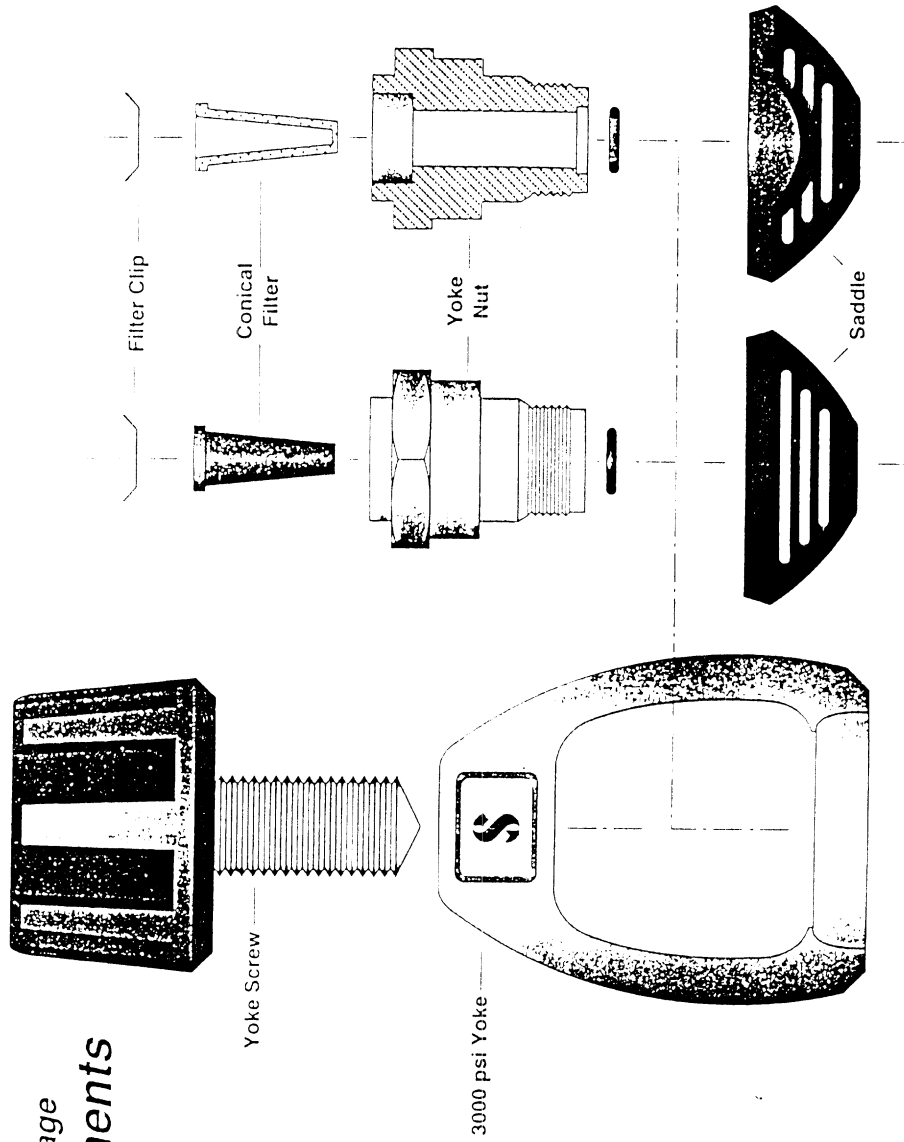


Figure #6

SCUBAPRO® Mark 20 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.



Mark 20 Main Assembly

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.

Figure #7

SCUBAPRO® Mark 20 First Stage 300 Bar DIN Components

Note: The Scubapro 300 Bar Din Systems are shown in these illustrations in exploded view.

There are two configurations detailed on this page. Configuration #1 is the original unit used prior to March, 1996. Configuration #2 was being introduced when this copy was written.

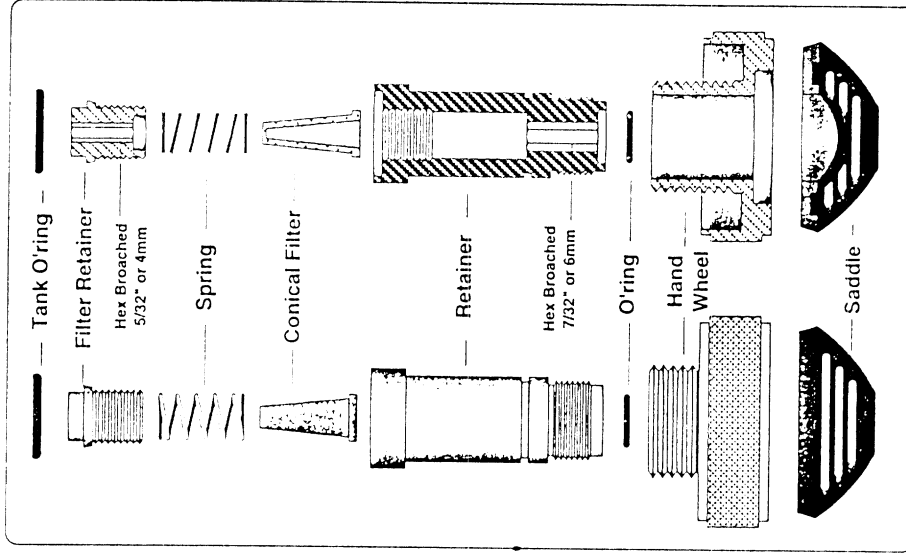
The primary difference is in the method of holding the conical filter in the retainer.

In configuration #1, the filter is inserted into the bottom of the retainer and backed up by a ring spacer and an o-ring. These parts are held in position when the retainer is installed in the first stage body using a 7/32" or 6mm allen socket.

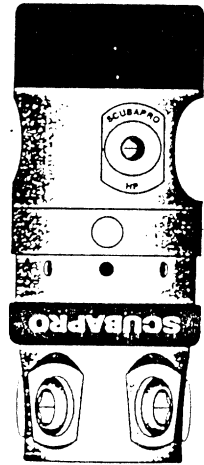
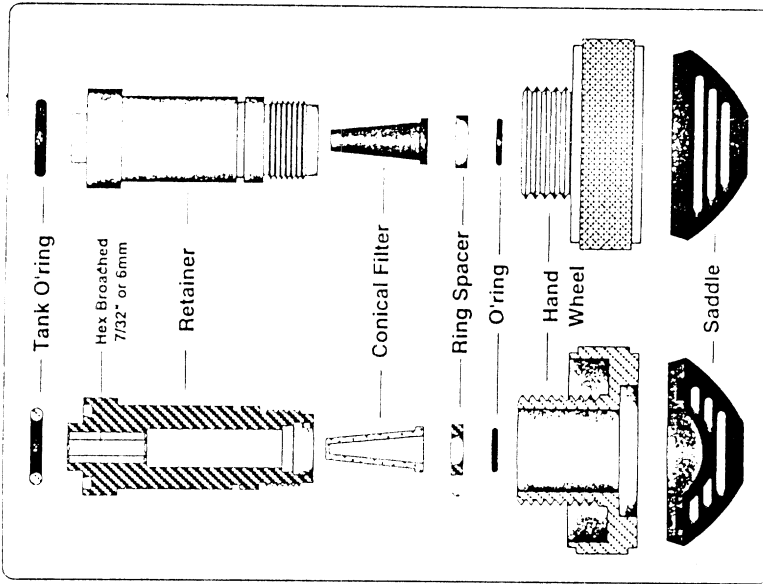
In configuration #2, the filter can be removed without unthreading the retainer from the first stage body. This is accomplished by removing the filter retainer and spring from the top of the retainer using a 5/32" or 4mm allen socket. The retainer can then be removed by using a long 7/32" or 6mm allen socket.

Caution should be taken not to overtighten the filter retainer. For specific torque requirements, see figure #8.

Configuration #2



Configuration #1



Assembled First Stage

Figure #8

SCUBAPRO® Mark 20 First Stage Applying Torque To The DIN Connector

Correct installation of the Scubapro Din connectors requires applying the proper torque to the components.

Configuration #1 utilizes a 7/32" or 6mm allen socket to torque the retainer into the first stage body. The upper hole in the retainer is hex broached to fit the allen drive bit. Torque the retainer 265-350 inch pounds (22-29 foot pounds). See configuration #1.

Configuration #2 requires the application of torque in "two" different locations. The retainer is torqued into the first stage body using a long 7/32" or 6mm allen socket. The broached hole for this installation is located in the "bottom" of the retainer (see configuration #2). Torque the retainer 265-350 inch pounds (22-29 foot pounds). The conical filter, spring, and filter retainer are installed "after" the retainer has been torqued in place. Torque the filter retainer to 35-44 inch pounds using a 5/32" or 4mm allen socket.

Do not attempt to apply the retainer torque (265-350 inch pounds) to the filter retainer. This may cause permanent damage to the filter retainer and prevent it from being removed in the future.

Disassembly of configuration #2 is in the reverse order described above. For further torque requirements, see figure #9

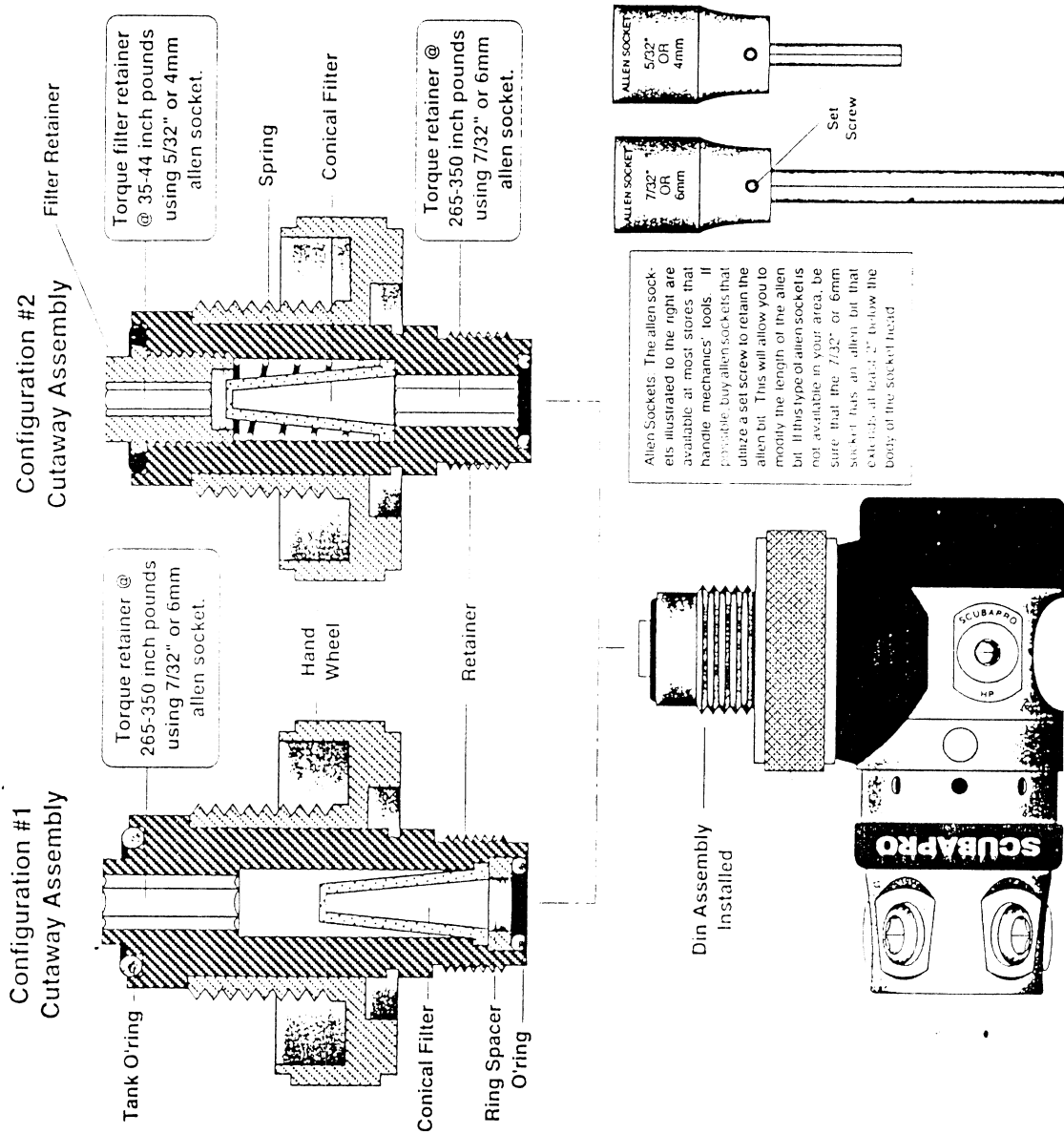


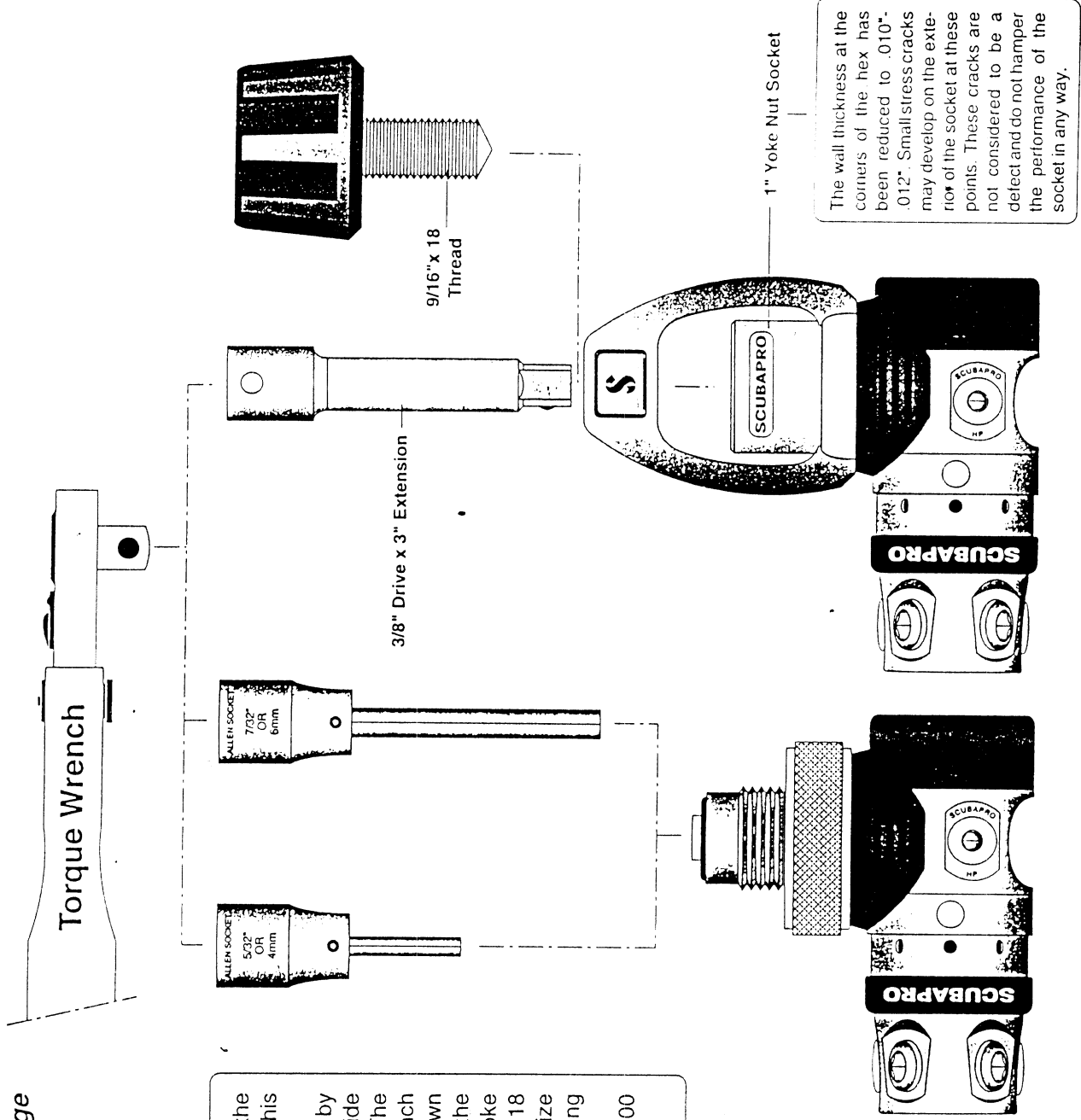
Figure #9

SCUBAPRO® Mark 20 First Stage Applying Torque To The 1" Yoke Nut & Din Connector

The Scubapro torque specification for the 1" yoke nut is 265-350 inch pounds. This figure converts to 22-29 foot pounds.

The yoke retaining nut can be torqued by using a special 3/8" drive socket that fits inside the yoke (see Scubapro special tools). The socket is then connected to the torque wrench by inserting a 3" x 3/8" drive extension down through the yoke screw hole in the top of the yoke. This method requires that the yoke screw hole is the current size of 9/16" x 18 thread. (Older yokes, prior to 1982, that utilize a smaller yoke screw can not be torqued using this method.)

For torque information regarding the 300 bar Din connectors, see figure #8.



The wall thickness at the corners of the hex has been reduced to .010". 012". Small stress cracks may develop on the exterior of the socket at these points. These cracks are not considered to be a defect and do not hamper the performance of the socket in any way.

Figure #10 SCUBAPRO® Mark 20 First Stage
Full Cutaway

Notes:

The illustration below shows all major components of the Scubapro Mark 20 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.

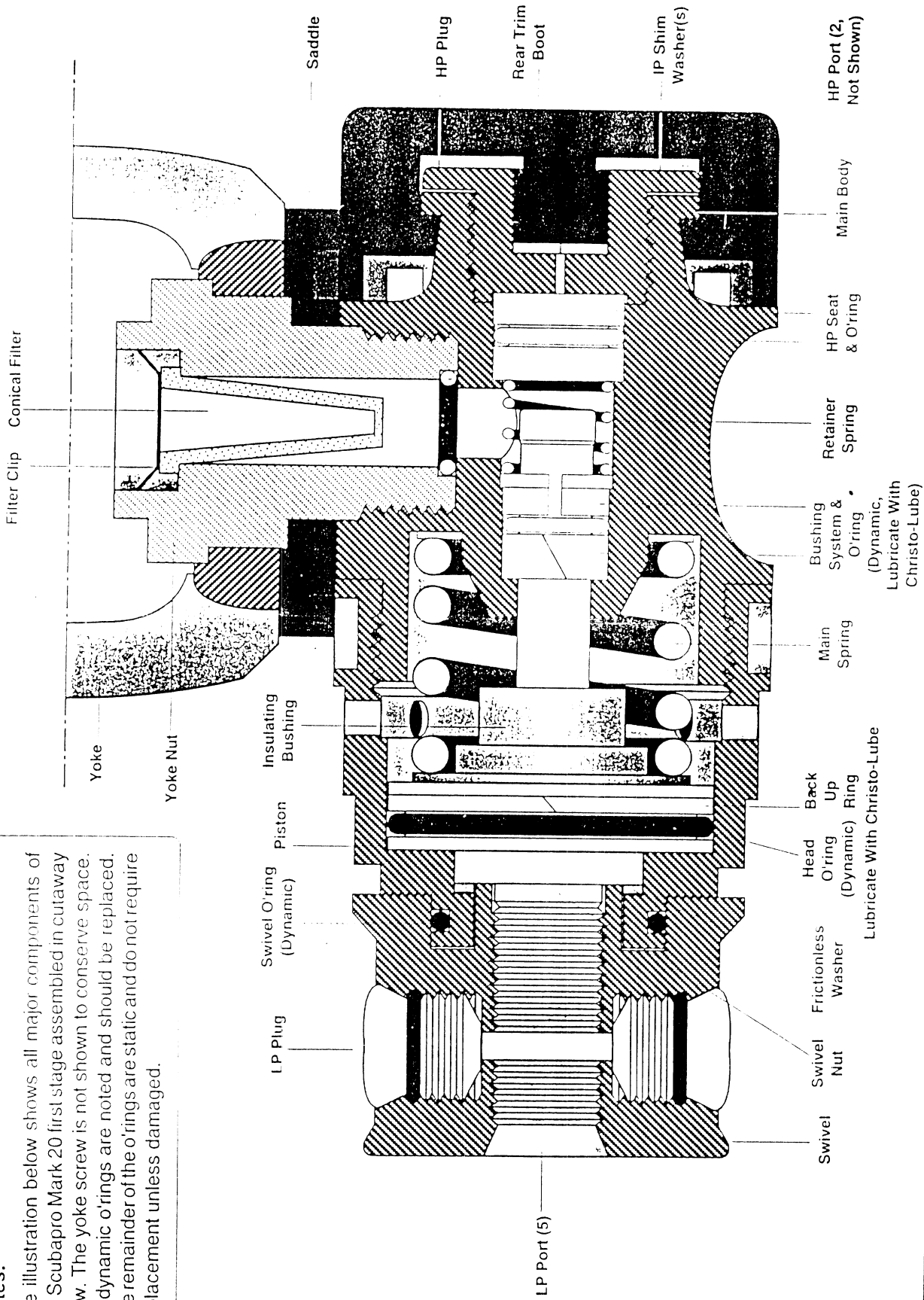


Figure #11

SCUBAPRO® Mark 20 First Stage Intermediate Pressure Adjustment

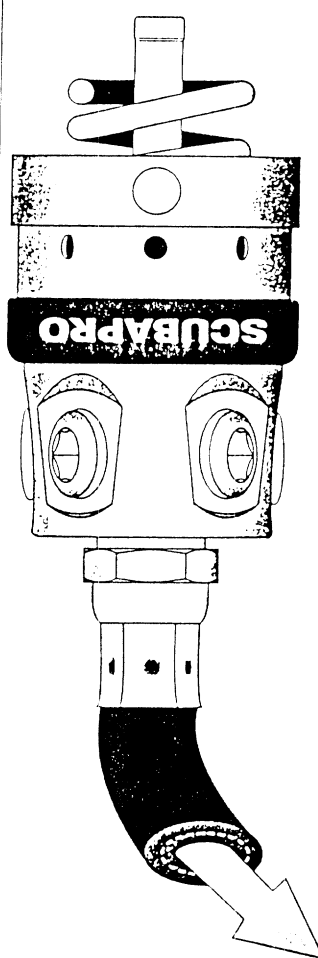
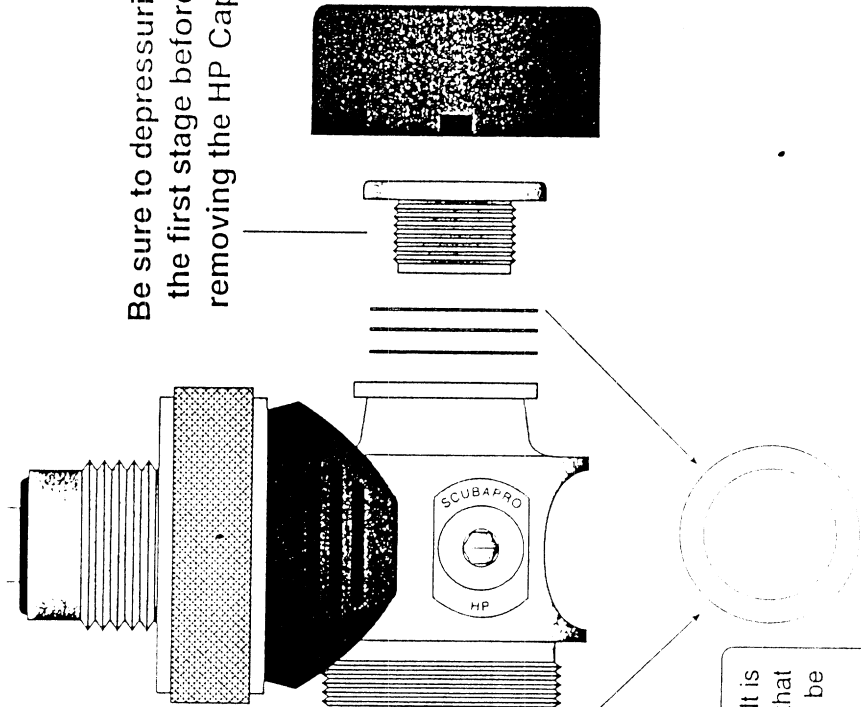
The intermediate pressure of the Mark 20 can be adjusted by installing/removing a series of washers/shims. These shims are located in two places. One set is positioned between the main spring and the body and the other set is located between the HP plug and the main body (see illustration below).

The shims between the main spring and the body are installed first during the primary assembly. Replace the same number of shims that were removed during disassembly and use the set between the HP plug and body for adjusting the IP.

When the IP requires alteration, depressurize the regulator and remove the rear trim boot and HP plug. Check the number of shims already in use (3 max.). Removing a shim decreases IP approximately 5 psi and adding a shim increases the IP approximately 5 psi. If the IP can not be brought into range by this procedure, remove/add shims between the main spring the body.

If problems still exist with the IP range, replace the HP seat first and the piston second to determine the source of the problem. The maximum number of shims in each location is "3" as shown in the illustration. Do not exceed this number of shims in an attempt to bring the IP into range.

Be sure to depressurize
the first stage before
removing the HP Cap!



IP output is measured
at the second stage
using the Pneumatic
Adjusting Tool.

The Mark 20 IP washer/shim is made from a hard resilient plastic. It is translucent, amber in color, and is approximately .012" thick. Be sure that the rear shims are installed correctly to insure that the plug can be tightened securely.

Figure #12

SCUBAPRO® Mark 20 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

Important Note

See Schematics regarding the Mark 10plus and Mark 20 first stage IP requirements.

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 representative.

| Symptom | Probable Cause | Solution |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Audible air leaks at porting | <ul style="list-style-type: none"> Loose plugs or hoses Damaged o-rings O-ring not properly seated | <ul style="list-style-type: none"> Tighten where necessary Relube & replace o-rings Adjust o-ring alignment |
| <ul style="list-style-type: none"> • Air leaks through ambient ports | <ul style="list-style-type: none"> Defective piston stem o-ring Defective piston head o-ring | <ul style="list-style-type: none"> Relube & replace o-ring Relube & replace o-ring |
| <ul style="list-style-type: none"> • Low IP @ 3000 psi | <ul style="list-style-type: none"> Incorrect number of shims Weak main spring | <ul style="list-style-type: none"> Add shim(s) maximum of three Replace spring |
| <ul style="list-style-type: none"> • High IP @ 3000 psi | <ul style="list-style-type: none"> Incorrect number of shims Poor seating result Stiff main spring HP stem o-ring pinch | <ul style="list-style-type: none"> Remove shim(s) Replace HP seat Replace piston Replace spring Check IP @ 300 psi |
| <ul style="list-style-type: none"> • Low IP @ 300 psi | <ul style="list-style-type: none"> Weak spring | <ul style="list-style-type: none"> Replace spring or add shims |
| <ul style="list-style-type: none"> • High IP @ 300 psi | <ul style="list-style-type: none"> Stiff spring | <ul style="list-style-type: none"> Replace spring or remove shims |
| <ul style="list-style-type: none"> • Initial IP creep on gauge | <ul style="list-style-type: none"> New seat taking a set | <ul style="list-style-type: none"> Cycle regulator 20-25 times |
| <ul style="list-style-type: none"> • Continuous IP creep on gauge | <ul style="list-style-type: none"> Poor seating result | <ul style="list-style-type: none"> Replace HP seat Replace piston Replace body |
| <ul style="list-style-type: none"> • High IP @ 3000, Norm. IP @300 | <ul style="list-style-type: none"> HP stem o-ring pinch | <ul style="list-style-type: none"> Replace & relube stem o-ring Replace bushing system |

SCUBAPRO

Technical Service Schematic

MK20 FIRST STAGE 10-750-000

Date 5/96

Revision A

Annual Repair Parts Kit - 10-750-041

