DEEP SIX
EXPEDITION DIVE GEAR

SERVICE MANUAL©

Version 3.2

DEEP SIX

SIGNATURE SERIES SCUBA REGULATORS

DEDICATION

This manual is dedicated to those who choose to go the extra distance and take responsibility for themselves.

Servicing your own gear is not rocket science. It does take patience, attention to detail, a bit of training and the right tools.

For those explorers who choose to take this path, Deep6 salutes you. We thank you for your loyalty and support.

Deep Six Expedition Dive Gear is proud to provide you with the tools you need to explore a world most never see.

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Manual Version 2.1 Revisions:
Vise handle added to required tools, picture updated, page 7
OSHA standard for hazardous gas pressure updated, page 10
Thread lubrication warning supplemented, page 11
Frozen thread penetrating oil added, page 20
New discussion of thread lubrication, page 24
Pages renumbered

Introduction

Deep6 has introduced a regulator set that is built with precision manufactured components designed to the highest standards in the industry. In our first stage, computer controlled CNC milling machinery enables precise component production. Our specifications are exacting, yielding consistent performance.

In our Signature Series, additional manufacturing requirements include Teflon-impregnated o-rings for critical components, a durable PVD coating and second stage bodies made with high-impact material.
Our regulators have proven themselves on the most demanding, deep technical dives. But our business model empowers you to take command of your own service, should you desire. This can significantly lower the cost of ownership, placing this extraordinary equipment within the reach of the weekend recreational diver.

Our first stage offers five low pressure ports on a swivel that will accommodate virtually any desired hose routing. Two opposed high pressure ports make both sidemount and backmounted double tank diving easy to configure. The regulator's environmentally sealed and precisely balanced diaphragm construction yields a low Intermediate Pressure change from full to empty tank. Of special benefit to both the vacation diver and technical diver, it requires only a quick external rinse for post-dive maintenance.

Our balanced second stage design includes both an adjustable orifice and adjustable poppet spring tension, allowing easy tuning and on-the-fly accommodation of differing breathing requirements between primary and auxiliary second stages. A precision adjustment of Venturi flow augmentation provides smooth breathing at depth, while allowing a quick and easy way to prevent freeflow on giant stride from a boat, even while wearing heavy gloves.

Unique in the industry, our specially-designed "Turbine Piston" ensures laminar flow of breathing gas down the second stage barrel on its way to the mouthpiece, greatly improving air delivery. The poppet's design does not require special alignment during assembly, increasing safety by ensuring complete lever engagement in any poppet orientation.

By offering in-person scuba regulator service training courses as well as factory service, Deep6 allows you to control an unknown that arises with every service interval. Servicing your own equipment can substantially decrease the cost of ownership. This service manual is your link between your Deep6 service training and your regulator, helping to ensure that you can maintain your regulators at the same level of performance as on the day you bought them. Additionally, this document can assist you in diagnosing problems and making on-site adjustments should problems arise in a remote location.

* * *

NOTE: This manual is designed for use ONLY by those divers trained in regulator service by Deep6, or by professional technicians already trained, experienced and active in the service of sealed, balanced diaphragm first stages and adjustable, balanced, barrel-design second stages.

This manual is organized into broad chapters devoted to:

- General Considerations, covering safety and tool-handling as covered in your Deep6 training course
- First Stage Service, further divided into Inspection, Disassembly, Cleaning, Reassembly and Tuning
- Hose and SPG service
- Second Stage Service, further divided as above
- Troubleshooting
- Quick Reference Appendices and Schematics

Cleaning for oxygen service is discussed in each component section (1st, 2nd, Hose/SPG) for those who desire to maintain the regulator's suitability for oxygen use above 40%.

The Quick Reference chapter contains all critical steps from both 1st and 2nd stage service chapters without additional discussion, providing the experienced technician with an easily used guide to the proper order of critical service steps, required tools, o-ring sizes and torque values.

Service Interval

Deep6 Signature Series regulators have a service interval of 2 years or 200 dives, whichever comes first. Additionally, an Inspection as described on pages 12-13 must be performed annually. Intermediate Pressure and second stage cracking effort should be checked regularly, and adjusted as required. The second stage cover and diaphragm should be removed and the interior rinsed well whenever retained sand or debris is suspected.

Cautions, Safety Warnings and Service Training Reminders

Throughout the manual you will see symbols prompting caution, warning you of issues which may affect your safety, or reminding you of tips you received during service training that may help prevent damage to your equipment during service.

A CAUTION should prompt you to reread the accompanying or referenced statement and follow its steps or advice carefully, to avoid making a critical mistake during service that may result in component damage or out-of-specification performance. Caution statements are not repeated in the Quick Reference Appendices, and the manual should be consulted whenever a step is encountered that is not completely familiar to you.

A WARNING alerts you to a safety consideration which may endanger you either during service or during subsequent use of the equipment during a dive, if all steps are not followed exactly. WARNINGS are of such importance that they are repeated in the Quick Reference Appendices.

SPECIFICATION A SPECIFICATION is a value range or limiting value attached to a service step that must be adhered to, to ensure proper performance. Deviation from a SPECIFICATION may result in damage during service, equipment failure, or inadequate performance during a dive which may result in death.

A TRAINING REMINDER is noted in the body of the manual where an important piece of information conveyed in training is worth repeating, to ensure best performance. With experience, these reminders should be well known to an experienced technician, and are not repeated in the Quick Reference Appendices.

Schematics

Included at the end of this manual are schematics for the Signature Series regulators. Parts are numbered on the schematic and are used throughout the text of this manual to guide you to a specific part on the schematic. When identical parts are used in both DIN and Yoke versions of the first stage, the same schematic number is used in both DIN and Yoke sections of the manual. Where a part is found only in a DIN or Yoke first stage, the schematic number in the text of this manual applies only to the DIN or yoke schematic respectively, and the item number is grayed out on the other schematic. Note also that these item numbers are not the part numbers used in replacement part ordering. Those manufacturing part numbers which correspond to a given schematic item number are separately listed on each schematic.

How to Use This Manual

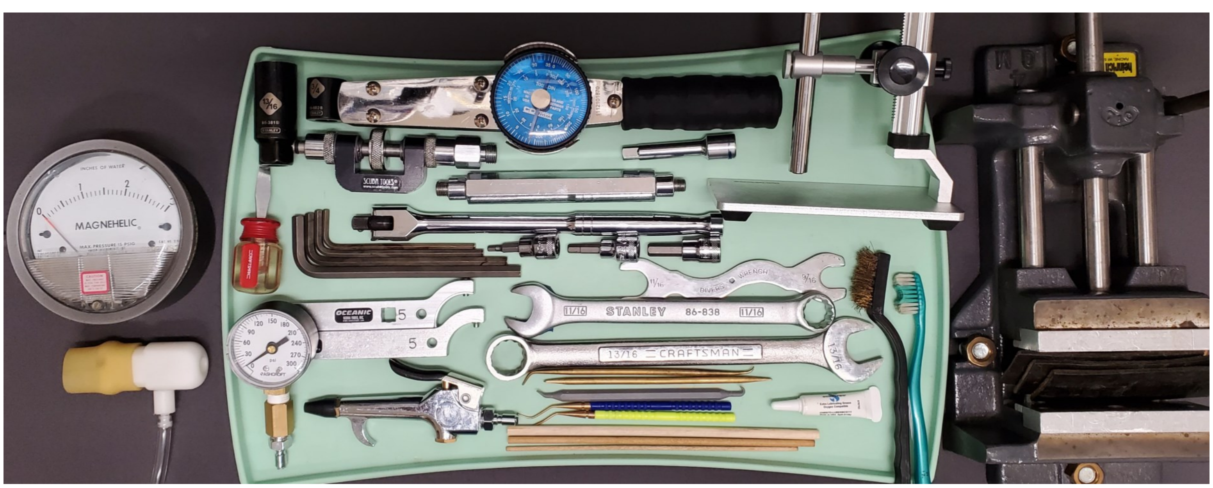
Print out pages 55-59 to use during service, as well as whichever of the schematics on pages 60-64 apply to your particular regulators. The remainder of the manual can be viewed on an electronic device, but it is extremely useful to have paper copies of reassembly parts layout photos and schematics, to avoid moving back and forth inside an electronic document. In this fashion, you can proceed methodically through the steps of the manual, while having references to the parts, tools and torque values close at hand.

Once you are well versed in service, it may be easiest to also print out the Quick Reference Service Steps on pages 53 and 54, referring to the complete manual as questions arise.

Recommended Tools

The following list contains all tools recommended for service of Signature Series Regulators. On page 8, where certain of the more expensive tools have an acceptable alternative, the alternative is listed adjacent to that tool, with accompanying notes. While listed distributors are possible sources for some items, they are not the only source, and are included as a convenience, rather than a specific recommendation of any particular vendor.

1. Torque Wrench (0-300 in-lb)
2. 3/8" drive sockets (3/4" for Yoke; 13/16" deep socket for DIN) (see text, pages 16 & 17)
3. In-line Second Stage Adjuster
4. 3" extension (3/8" drive) for Yoke - special thin profile Scubatools 20-156-500
5. Vise handle with 3/8" and 7/16" threaded connections
6. USB microscope for inspection
7. Stubby flat-bladed screwdriver (not pictured)
8. Standard L-shaped or T-shaped hex wrenches (4mm, 5mm, 6mm, 8mm)
9. 3/8" drive handle
10. 3/8" drive socket hex keys (4mm, 6mm, 8mm) (straight-shaft, NOT ball-end)
11. Intermediate Pressure Gauge with BCD hose adapter
12. #5 Hook spanners (two) with 0.156" pins, one with a 3/8" square broach for a torque wrench
13. 11/16" Thin-profile open end wrench (or thin adjustable wrench)
14. 11/16" Open-end wrench (or adjustable wrench)
15. 13/16" open end wrench (or crowfoot attachment) (in lieu of 13/16" deep socket above)
16. Soft bristle brushes for cleaning (toothbrush, soft brass bristle)
17. Air gun with rubber tip (gas pressure limiter recommended)
18. Parker brass spade and blunt brass pick
19. Sharp heavy duty plastic pick, or Apeks tool RG911233
20. Thin Brass Picks (curved and ball-end)
21. 1/8", 3/16" & 1/4" wooden dowels
22. Oxygen-safe lubricant (Tribolube-71, Christolube MCG-111 or equivalent)
23. Padded Vise
24. Lipped, padded tray to contain small parts during disassembly and reassembly
25. Apparatus for testing cracking effort (see page 49)
26. Pressurized breathing gas (Modified Grade E to maintain usability with pure oxygen), 500 & 3000 psi



See tool table with alternatives, next page.

ITEM	BEST PRACTICE	ALTERNATIVES	NOTES
Torque Wrench 0-300 in-lb	CDI Dial Type High quality digital wrench	"Click" type, if calibrated. A breaker bar, to which is tied an inexpensive digital luggage scale, can be used if funds are limited	Click wrenches are often inaccurate at low torque values. Pull on a luggage scale must be at right angles to the breaker bar. Surprisingly high accuracy.
In-line Second Stage Adjuster	Scubatools.com PN 20-500-200, or equivalent. Mounted IP gauge not recommended.	Simple orifice adjuster (must have 5mm hex end) 5mm Hex Key	Second stage tuning by sequential hose disassembly and orifice adjustment is slow, and slightly less accurate.
Padded Vise	Bench Mounted to accept 22 ft-lb torque	Temporary mount vises can work if well secured	Padding can include short lengths of heavy leather cut from a wide belt, or thin strips of wood.
Vise Handle	Scubatools 20-114-100	3/8"-24 and 7/16"-20 bolts with threads deburred	Machine shop dies for thread cutting will debur threads
3/8" drive ratchet handle or 3/8" breaker bar	3/8" Breaker Bar generally provides longer lever arm	3/8" drive ratchet handle	Local hardware store item
3" reduced diameter extension to ratchet handle or breaker bar	Scubatools 20-156-500	15" adjustable wrench if extension can't be obtained	For Yoke 1st stage only
3/8" drive socket - 3/4"		15" adjustable wrench (Digital luggage scale will be needed for accurate torque)	For Yoke 1st stage only Adjustable wrench jaws must be large enough to span yoke.
3/8" drive socket - 13/16"	"Spark Plug Socket" with chamfer ground flat	13/16" crowfoot attachment	Local hardware store item For DIN 1st stage only
13/16" crowfoot attachment (3/8" drive)		13/16" deep socket	Alternative to socket above For DIN 1st stage only
Hex key set, 4, 5, 6, 8mm			Local hardware store item Straight shaft (not ball end)
3/8" drive socket hex key 4mm - straight shaft			Do not use ball-end hex SEE WARNING on page 28.
3/8" drive socket hex key 6mm - straight shaft			Hardware store item DO NOT USE ball-end hex
3/8" drive socket hex key 8mm			Hardware store item
11/16" open end wrench		Adjustable wrench	Hardware store item
11/16" thin open end wrench	Divers Wrench Set	Thin adjustable wrench Channellock #6SWCB	
Thin Brass Picks	Scubatools PN 10-126-400	Trident #SA75	
Stiff heavy duty plastic pick	Kinetic Wares 30% Glass Filled Nylon O-ring Pick	Curved sharp brass pick	SEE WARNING on page 19
Parker brass spade and blunt pick	Scubatools PN 10-102-100		No better value elsewhere
Wooden Dowels	1/8", 3/16", 1/4"		Home Depot/Lowe's

List continued on next page

ITEM	BEST PRACTICE	ALTERNATIVES	NOTES
Intermediate Pressure Gauge with BCD connection	Scubatools PN 20-165-111	Leisurepro and others	Other BCD connector types available at Scubatools
Air Gun with rubber tip	Neiko 31112 Air Blow Gun Trident AA04 BCD adapter	1/8” wooden or plastic dowel. Clean cotton rags.	See pages 15 & 18 for further discussion
Oxygen-safe lubricant	Tribolube-71 Scubatools PN 15-810-171	Christolube MCG-111 Scubatools PN 15-710-111	
#5 Hook Spanner with 0.156” pin	Scubatools PN 20-405-200	Hinged hook spanner with appropriate pin	Hinged spanner must be padded so that pin stays at right angle to the hole
#5 Hook Spanner with 0.156 pin and torque broach	Scubatools PN 20-405-300	Digital luggage scale attached to hole in spanner to torque	Pull on a luggage scale must be at right angles to the spanner.
Cleaning brushes - Nylon bristle and brass	Toothbrush Trident #SA28 brass brush		
Inspection microscope	Binocular inspection microscope - $150-400	USB scope attached to cellphone or laptop - $30	Google “USB microscope”
Padded work tray Non-porous for oxygen cleaning	silicone rubber mat 2mm thick; cut to fit small plastic cafeteria tray	Small baking tray from kitchen with silicone pad added	Raised edges keep small parts from rolling away
Cracking effort tool	Magnehelic 0-3” WC with tubing and mouthpiece adapter	1) U-tube manometer with mouthpiece adapter ($2 tubing and $20 for adapter) 2) Bowl of water and ruler $0 cost 3) “Feel” $0 cost	1) A water manometer is just as accurate, but with a slower response rate (which may create inaccuracies) 2) A bowl of water is almost as accurate, but depends upon proper estimation of diaphragm position 3) Tuning by “Feel” is generally very inaccurate See pgs. 49-50 for discussion
Pressurized Modified Grade E air	Regulated gas manifold attached to EAN	Two EAN scuba tanks at 500 and 3000 psi	

General Considerations for Servicing Scuba Equipment

The discussion that follows is **not** instruction in scuba regulator repair. Together with the TRAINING REMINDERS in the body of the manual, this section is intended as a set of operational steps that must be followed to safely and properly service your regulators. Prior to servicing Deep6 equipment, you must have received formal training by Deep6 or an equivalent scuba equipment manufacturer, and must have fully reviewed this manual.

1. The Deep6 Signature regulator set is delivered oxygen clean and ready for pure oxygen use up to 2400 psi. In order to maintain that capability, it is essential that hydrocarbons not be introduced onto regulator components or tools during servicing. This also means that only hydrocarbon-free air be used in drying parts and testing. Gas with a hydrocarbon content that meets scuba standards for oxygen use is known as "Modified Grade E". Compressed breathing air from your local scuba shop <u>may not meet</u> modified Grade E standards, specifically, the less than 0.1 mg/cu meter oil mist requirement. The easiest way to ensure modified Grade E gas is to use Nitrox in the course of your service. The lowest available oxygen concentration available economically (EAN32 or EAN21) is generally the best choice. Whenever the term "clean air" is used in this manual, it refers to Modified Grade E gas as might be obtained from a scuba tank filled with EAN.
WARNING: Use of a hardware store air compressor to provide pressurized air for disassembly, drying or testing is never acceptable. It will render the regulator set suitable <u>only</u> for use with compressed air.

2. All tools and work surfaces should be maintained clean and free of hydrocarbon contaminants. If cleaning for oxygen service is anticipated, tools should be specifically oxygen cleaned as well. The best work surfaces are non-porous, as they are most easily cleaned.

3. It is important to maintain a dirt and dust-free shop environment as far as possible. Airborne lint or microfibers can not only serve as fuel in case of ignition, but may land on a sealing surface, resulting in a difficult-to-diagnose air leak. Lint-free cloth is best for mopping up excess water on newly-cleaned parts. Specifically, "microfiber" towels are a poor choice. Cotton single-layer dish towels with a flat weave (no loops), which have been machine washed prior to use are much better.

4. Pressurized air used to dry parts prior to assembly carries two risks: loss of parts as they are blown out of sight, and subcutaneous gas injection. To prevent the first, grasp all parts firmly when drying with pressurized air. Use a maximum of 40 psi whenever possible. Work on a surface with raised edges, such as a cafeteria tray or baking pan.
WARNING: Prevention of physical injury due to accidental subcutaneous gas injection is extremely important! OSHA defines as a "hazard" any compressed gas exceeding 29 psi. The consequences of carrying skin bacteria into tissues by accidental injection of high pressure gas can be catastrophic. When using an air gun, use a device that limits delivered air pressure to 40 psi, or has a bypass vent that limits overpressurization.

5. TR TRAINING REMINDER: Whether this manual is viewed in printed format or on an electronic device, it is strongly recommended that the Schematic and Quick Reference picture be separately printed out and kept adjacent to your work area. This will save flipping back and forth between the exploded diagram and the text as the manual is followed during service.

6. After disassembly of all components, the corresponding replacement part from the service kit should be laid out immediately adjacent to the old part until all parts removed have been matched to the corresponding service kit part. All old replacement parts should then be removed from the work area. Thus, at the end of reassembly, no parts should remain on the work surface, serving as a cross-check that no part has been omitted.

7. **SPECIFICATION** It is mandatory that all components which have a required torque value are reattached with measured torque. Over-torquing can result in thread failure or component fracture. Under-torquing can result in loosening and detachment under pressure and over time. Either failure can be life-threatening during a dive. Do not rely on estimates of proper torque.

WARNING: Do not lubricate threaded components unless specifically indicated in the manual. Lubrication of threads can result in a doubling of the axial load on the threads for a given torque, and may result in component failure if lubrication has not been engineered into the torque value. See page 24 for further discussion of this critical warning.

8. Three components: the first stage high pressure seat (#12), the first stage volcano orifice inside the regulator body (#8) and the knife edge of the second stage orifice (#12) have zero tolerance for mishandling and resultant surface damage.

Treat the HP seat extremely gently, and do not allow the polymer face to come in contact with any metal part or tool during handling. Similarly, the shaft of the HP seat must not be scratched. It is recommended that this part be kept in its plastic envelope until use, and carefully segregated from other parts and tools when it is placed on a work surface.

The volcano deep inside the first stage body must not be allowed to come in contact with any metal part or tool. Do not insert any metal tool inside the bore of the first stage body to retrieve a part.

The second stage orifice can be easily damaged during removal. Pay particular attention to the steps outlined in the manual during disassembly, and protect the second stage orifice by cleaning and storing it separately from other metal components.

9. With any imperfection at the interface between the volcano orifice and the high pressure seat, you will have an air leak from the high pressure compartment (from the tank) into the intermediate pressure compartment (to the second stages). This leak can be temporary, followed by a complete seal, or continuous. A temporary leak is known as "IP drift", in which the initial IP reading gradually increases a few psi, until the intermediate pressure stabilizes, or "locks up". This often occurs even with a perfect volcano, as the new HP seat molds to the volcano knife edge. It may take several hundred cycles of valve opening and closing before IP lockup is crisp with no drift.

Conversely, an IP leak which is continuous (the gauge IP pressure does not stop rising), is known as "IP creep." IP creep is an out-of-specification condition, and requires close inspection of both the seat and the volcano inside the regulator body. Note that IP creep can also occur due to a leak past certain o-rings, or a scratch on the o-ring lands that seal the balance chamber. This was covered in your training.

10. It is critical to inspect and test the regulator set prior to disassembly and service. It does little good to replace all the required parts only to find after reassembly that an unrecognized problem prevented effective service from the outset. Out-of-specification performance at testing can guide you toward the proper diagnosis of a problem by triggering a closer inspection of the relevant parts upon disassembly.

11. Use common sense. Do not service your regulator set at the last minute before an important dive trip. Give yourself an opportunity to test your equipment during a dive that you can abort with minimal inconvenience. Always remember that scuba diving is unforgiving of mistakes. Use your gear conservatively on its first dive after service, and test it again afterward, following the steps in the next chapter.

PRE-SERVICE INSPECTION AND TESTING

1. **Examine the exterior** of the regulator set. Look for signs of obvious damage, including cracks in either the first stage body or the case of the second. Grasping the first stage body in one hand, attempt to unscrew the IP cap by hand where it joins the regulator body. If looseness is found, do not pressurize the regulator set in step #7 below until the IP cap (#24) has been tightened. See pages 28 & 29. In this case, test the second stage on a different first stage regulator.

2. **Pull back all hose guards** (if any), and determine the degree of corrosion beneath the guard. Determine that all hoses are at least hand tight, and that no o-ring extrusions are visible at port plugs or hose connections.

3. **Examine the sintered metal filter** at the first stage intake, looking for green verdigris corrosion or rust staining. This is evidence of salt water entry or tank oxide deposition.

4. **Examine all hoses**, bending them adjacent to their regulator connections while looking for cracks in the outer layer. Confirm that all hose ends are rigid, and the hose does not rotate beneath the swaged end (SPG hose end excepted). If defects are noted, ensure that the hose in question will be controlled during pressurization, and that you can immediately depressurize the system.

5. **Gently inhale from the second stage** with the dust cap firmly occluding the air intake of the first stage. It should not be possible to inhale gently. Attempt to determine the source of any leak. While a loose second stage diaphragm or ineffective exhaust valve are prime culprits, leaks can also occur due to o-ring failure in the second stage case seals, loose or defective hoses or a cracked case.

6. **Examine the exterior of the SPG** (if any). Confirm that the dial face is intact. Slide the gauge from any console boot (which may require softening the boot in warm water), and confirm that the gauge rotates with minimal resistance on the hose.

7. Attach an Intermediate Pressure Gauge to the BCD hose, and with one finger pressing lightly on a second stage purge button, **pressurize the reg set** (using eye protection). Release the purge button, allowing the intermediate pressure (IP) to rise.

8. **Watch the Intermediate Pressure** gauge carefully, looking for a crisp lockup at a pressure within specification. Note the IP. Watch for IP "drift", a small gradual pressure increase which subsequently locks up. Watch for IP "creep", a slow (or fast) intermediate pressure increase which continues to rise above specification, necessitating depressurization of the reg set. Be prepared to immediately depress the purge button to reduce pressure sent to the second stage while you are turning the tank off, if there is any evidence of a <u>rapid</u> rise in intermediate pressure above limits.

9. **Gently attempt to rotate the pressurized first stage on the tank**, looking for a loose yoke or DIN housing bolt. Do not firmly try to unscrew the regulator body from its yoke or DIN mount when pressurized - you may succeed!

10. **Look, listen and feel for leaks**, noting the location.

11. **Measure second stage cracking effort**, using your choice of measurement method. See discussion on page 49 below.

12. Breathe gently from the second stage, and **watch the IP fluctuation**. It should drop 5-10 psi and return crisply to its lockup pressure.

13. Purge the second stage and **watch the IP drop during purge**. Intermediate pressure should drop less than 20 psi during a brisk purge with a full (3000 psi) tank. Excessive dynamic IP drop is caused by a) a tank valve not fully open, b) a partially occluded metal intake filter in the first stage due to accumulated debris or corrosion, c) excess friction among the internal first stage components, likely caused by internal corrosion, or d) low tank supply pressure.

14. **Immerse the pressurized reg set** in water by inverting the tank. Look for evidence of slow leaks from any connection. With the second stage mouthpiece facing up when submerged, look for any bubbling. This may take time to appear, as small bubbles may initially collect in a corner of the case interior before leaking out of the mouthpiece. Examine the HP hose for a line of tiny bubbles along its length, indicating deterioration. Rotate the SPG underwater on its swivel connection to the HP hose, looking for a leak.

15. After removal of the reg set from the water, **examine the SPG face for water intrusion**.

16. **Make a list** of all defects found, to be addressed in the appropriate service steps that follow.

DEEP6 SIGNATURE FIRST STAGE SERVICE

Before beginning service, take photographs or make a diagram of the regulator set to keep track of the desired hose mounting positions at reassembly.

DISASSEMBLY

1. Remove all hoses together with their second stages and SPG. Remove the yoke knob (if applicable). In preparation for diaphragm removal, fill all ports with port plugs except for one high pressure port (for placement of a vise holder) and <u>one low pressure port</u> on the side of the turret.

2. Attempt to remove the environmental cap by hand, perhaps using a rubberized sheet for extra “grab.” If it is not possible to loosen the cap by hand, take a #5 hook spanner and adjust the 0.156” pin length to the exact depth of the shallow dimple in the environmental cap (Fig. 1). Ensure that the hook spanner chosen matches the arc of the environmental cap precisely, so that the pin engages the shallow dimple at a right angle to the cap. Any angle in the pin orientation due to an over- or undersized hook spanner risks it slipping during removal, marring the regulator finish.

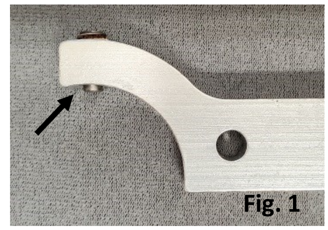


Fig. 1

Always maintain pressure on the hook where the pin enters the recess on the part to be removed, to avoid having the spanner “skip out of the hole” and scratch your finish (Fig. 2).

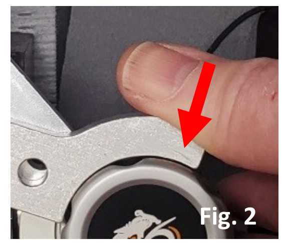


Fig. 2

Whenever removing the environmental cap (#39), remember to use a <u>second</u> #5 hook spanner to maintain clockwise pressure on the diaphragm clamp to prevent inadvertent loosening of the diaphragm (Fig. 3).

Hold the spanners and regulator in a manner similar to the photo at right to follow both recommendations above.

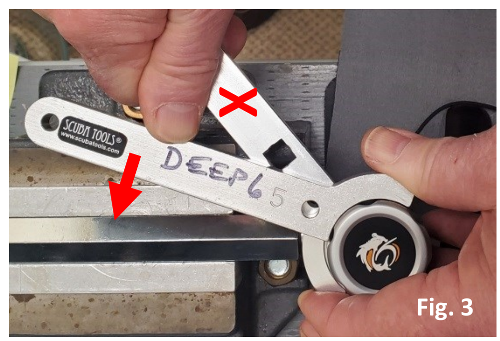


Fig. 3

Following the training reminders above, remove the environmental cap (#39) by twisting counterclockwise until the cap is loose enough to be removed by hand.

3. Set the environmental cap aside and carefully peel off the environmental seal (Silicone Disc #38). Do not use a sharp instrument to remove this part.

Invert the first stage, allowing the plastic Transpiston (#37) to fall into your hand (Fig. 4). Set these parts aside.


Fig. 4

4. Mount the regulator body in a vise by screwing the large (7/16”) end of a vise tool into a high pressure port, with the adjustment cap and diaphragm clamp facing up.

Using a 6mm hex key, unscrew the adjustment cap (#35) at least three turns (Fig. 5), until it is loose and rotates easily, to remove mainspring pressure from the diaphragm clamp (#36).


Fig. 5

NOTE: Failure to remove all mainspring pressure on the diaphragm clamp may result in the clamp springing free during removal, damaging the last thread.

5. Attach a #5 hook spanner to the diaphragm clamp, with the 0.156” pin extended to the depth of the recess in the clamp. Applying counterclockwise force, loosen the diaphragm clamp using even, increasing pressure (Fig. 6). If loosening the clamp requires excessive force, refer to the section “Frozen Threads” below. Once the diaphragm clamp is loose, remove the regulator from the vise and invert it so the clamp is lowermost prior to unscrewing it by hand. This will prevent several parts from falling out unexpectedly.

Carefully separate the diaphragm clamp and several loose pieces (below) from the regulator body above (Fig. 7). You should have a collection of six pieces (Fig. 8) which includes,

- the diaphragm clamp (#36)
- the spring adjuster (#35)
- an antifriction washer (#33)
- the mainspring (#34)
- a second antifriction washer (#33)
- the spring pad (#32)

Set these parts aside. The diaphragm (#31) normally stays behind in the regulator body after clamp removal.


Fig. 6


Fig. 7


Fig. 8

Diaphragm Removal

Do not use any metal tool to remove the diaphragm.

6. The safest way to remove the diaphragm (#31) is to use air pressure to pop it out of the regulator body.
Attempting to dig a stiffened older diaphragm out of the regulator risks scratching the sealing land, permanently damaging the body.

To remove the diaphragm, place a vise tool in one HP port using the 7/16” thread end of the vise tool, and mount the regulator body in a vise with the diaphragm uppermost. Cupping your hand over the diaphragm to retain dislodged parts, place the rubber tip of an air gun supplied with 40psi clean air firmly against the sole open LP port in the turret below (Fig. 9). Using a quick pulse of pressurized air, pop the diaphragm free of the regulator body (Fig. 10), making sure to keep control of the parts. Lift the diaphragm free of the body (Fig. 11).

If low pressure clean air is not available, do not use any metal tool to remove the diaphragm. Instead, leave the diaphragm in place and wait until Step 13 below, after the IP cap is removed. Once the IP cap is removed, use a 1/8” wooden dowel to push the diaphragm free by passing it through one of the three bores that pass from the IP side of the body to the diaphragm side.

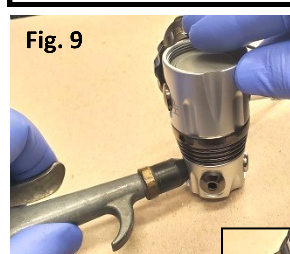


Fig. 9


Fig. 10

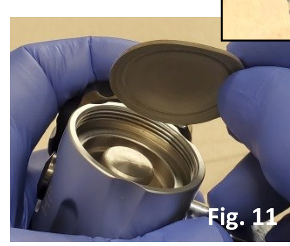


Fig. 11

7. Then, removing the regulator from the vise, invert it to collect the valve lifter (#30) as it falls free (Fig.12). Resist the temptation to remove the valve lifter as it sits in place. You risk bending the shaft of the lifter during manual extraction. If it is stuck in the HP seat (#17), it will come loose in step 18 below.

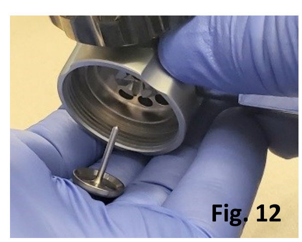


Fig. 12

8. Using a 4mm or 5/32" hex key, together with a vise tool with the small end inserted in an LP port as needed, remove all remaining LP and HP port plugs.

Yoke or DIN Retainer Removal

During a two-year service interval of salt water diving, the threads connecting the regulator body to the yoke or DIN retainer become impregnated with salt crystals from water which is forced along the threads under repeated exposure to several atmospheres of pressure. It can be extremely difficult to unscrew the retainer from the regulator body. Using a vise tool in an HP port for retainer removal can damage the threads of the port if significant force is required to separate the parts.

9. Secure the regulator body in a padded vise with the vise clamps gently holding the cylindrical sides of the regulator body (with both HP port plugs removed). Wood strips or 4-6" strips of heavy leather cut from an old plain belt work well to protect the finish of the regulator body (Fig. 13).

Do not clamp the regulator body in the vise! Instead, use the vise only as a rigid container for manipulation.

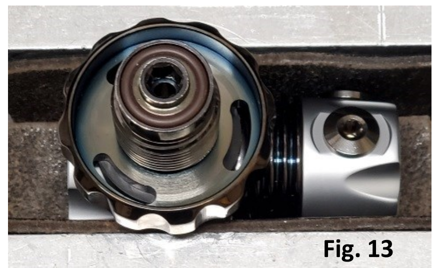


Fig. 13

10 - Yoke: Attach a 3/4" socket to the yoke retainer, and engage it with the Scubatools 20-156-500 extension passed through the threaded hole in the yoke. Connect a 3/8" drive ratchet handle or (better) a 12" breaker bar to the extension, and apply slowly increasing counterclockwise force until the retainer loosens (Fig. 14).

If a Scubatools 20-156-500 extension is not available, use a large (15") adjustable wrench to span the yoke and grasp both sides of the yoke retainer (Fig. 15).

If the retainer will not come free with significant application of force (> 30 ft-lb), see the section "Frozen Threads" below.

Fig. 14

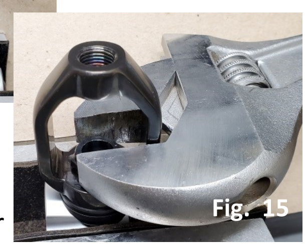



Fig. 15

Unscrew the yoke retainer until it is free of the body, and lift the yoke (#3), retainer (#10) and saddle (#12) from the body. If the o-ring (#11) remains behind, carefully lift it out of the body with a <u>plastic</u> pick.

Do not use a metal pick to remove o-ring (#11). Any scratch on the high pressure lands in the yoke retainer or the regulator body may result in an irreparable leak.

11 - Yoke: Using a thin wooden dowel, push the filter (#10) out of the yoke retainer, together with o-ring (#11), if it is still in place (Fig. 16).

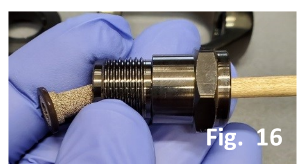


Fig. 16

For continued Yoke Disassembly, skip to step 12 below.

10 - DIN: Place a straight shaft 6mm hex key in the broach of the DIN retainer (#7) and unscrewing counterclockwise (Fig. 17), remove it from the DIN housing (#9). **Do not use a ball-end hex key** in the DIN Retainer. If the retainer will not come free with significant application of force (> 20 ft-lb), see the section "Frozen Threads" below.

Remove the 2-012 D90 o-ring (#15) from the DIN Retainer.


Fig. 17

11 - DIN: After removing the DIN retainer, lift the DIN Wheel (#8) off the DIN Housing (#9) and set both parts aside.

The DIN Housing is then removed with a 13/16” wrench.

NOTE: If a 13/16” deep socket is your desired tool for removing the DIN housing, custom modification of the socket may be required to avoid damaging the DIN Housing. The flats on the Deep6 DIN Housing are low profile to allow free rotation of the DIN Wheel (Fig. 18). Most large sockets are manufactured with a chamfer at the end (Fig. 19) to ease placement onto a large nut. A chamfer may prevent the socket from fully engaging the flat (Fig. 20), markedly increasing the shear force applied to the corners of the flats on the housing during disassembly. You may fracture a point of the hex on the DIN housing if significant force is required.


Fig. 18

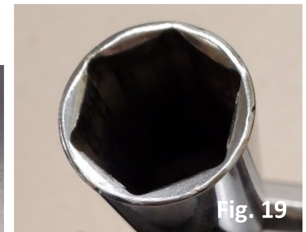


Fig. 19


Fig. 20

An excellent option is to prepare a custom tool by grinding the chamfer off the end of the socket so it fully engages the flats of the DIN Housing (Fig. 21).


Fig. 21

Absent the ability to customize your socket, an open end wrench that lies flush against the saddle and fully engages the DIN Housing wrench flats may be a better choice (Fig. 22). Similarly, for reassembly and torquing, a crowfoot attachment to your torque wrench may be a safer tool. Nonetheless, it should be noted that an open end wrench or crowfoot applies force to only two of the six flats on the hex fitting, which may make removal risky if there is significant corrosion.

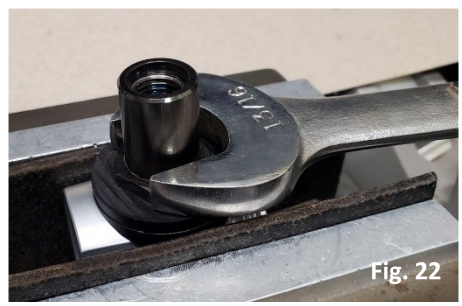


Fig. 22

To disassemble: attach a 13/16” open end wrench or a deep 13/16” socket attached to a ratchet handle or breaker bar (Fig. 23), and rotate counterclockwise with gradually increasing force until the DIN Housing loosens. **Maintain firm downward pressure on the wrench or socket, so that it does not slip off the flats and spall the part.** If the housing resists removal, see the section “Frozen Threads” below.

Fig. 23

After removing the DIN Housing and Saddle (#12), insert a thin dowel into the housing and push out the filter (#10) and o-ring (Fig. 24).


Fig. 24

12. Once again, mount the regulator in a vise, using a vise tool placed in a high pressure port. Attach a #5 hook spanner with the pin extended to the full depth of the recess on the IP cap (#24), and hold the hook firmly against the cap (Fig. 25). Rotating counterclockwise, loosen the IP cap with the handle of the spanner. If loosening the cap requires excessive force, refer to the section "Frozen Threads" below.
Then complete removal, unscrewing the IP cap by hand.

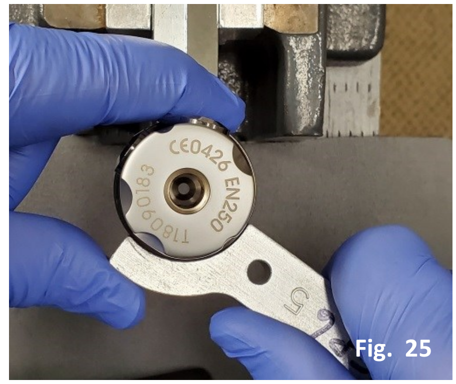


Fig. 25

13. At this point, if diaphragm removal has not been possible, use a 1/8" dowel to push the diaphragm free through one of the three bores in the regulator body (Fig. 26). Then remove the valve lifter. If the valve lifter does not fall out, wait until Step 18 below.

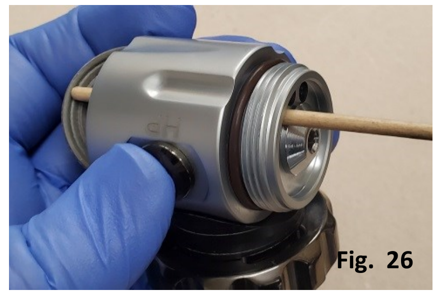


Fig. 26

14. Using a thin pick, remove the 2-024 o-ring (#16) from the regulator body.

Disassembly of the IP Cap

15. Screw the small end (3/8" thread) of a vise tool into the open LP port on the side of the turret. Mounting the IP cap (#24) in a vise with the threaded end up, place an 8mm hex key in the Swivel Retainer (#22) and using even, increasing counter-clockwise force, loosen the swivel retainer and remove it (Fig. 27). If loosening the retainer requires excessive force, refer to the section "Frozen Threads" below.

Beneath the swivel retainer is a thrust washer. Do not lose this part as you separate the swivel turret from the IP cap. Set the swivel turret aside briefly.

If the thrust washer does not fall into your hand, carefully push it out of the IP cap with a fingertip from the turret side, rather than using a tool (Fig. 28). Set the IP cap and washer aside. Retrieving the swivel turret, and using a sharp brass or plastic pick (Fig. 29), carefully remove the two o-rings (#25 and #26).


Fig. 27

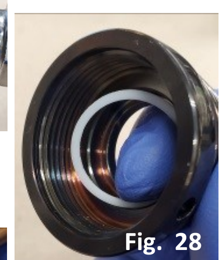


Fig. 28


Fig. 29

16. Returning to the regulator body, and using a straight-shaft 4mm hex key, loosen <u>but do not remove</u> the balance plug (#21) (Fig. 30).

⚠ **Do not use a ball-end 4mm hex key!** Most ball-end hex keys will naturally rest on the HP seat shaft with the waist of the key crossing the broach. Irreparable damage to the balance plug may occur if force is applied to the hex broach with the key flats only partially engaged (Fig. 31). **Always use a straight shaft 4mm hex!** If loosening the balance plug requires excessive force, refer to the section "Frozen Threads" below.


Fig. 30

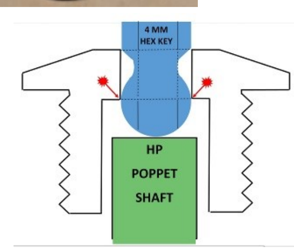


Fig. 31

17. With the balance plug loosened, turn the regulator body <u>balance plug down</u> and unscrew the plug from below (Fig. 32). Maintain slight upward pressure on the plug as it is unscrewed, as there is a spring which will otherwise cause it to pop free, potentially losing critical parts.

Fig. 32

18. Carefully lower the balance plug assembly out of the regulator body. You will have a spring (#19) and HP seat (#17) protruding from the balance plug (Fig. 33). If the HP seat is retained in the regulator body, carefully tap the body into the palm of your hand until the seat falls free. Resist the temptation to retrieve the HP seat with a tool. Any scratch on the shaft of the HP seat will render it useless. If it will not fall free, <u>carefully</u> extract the valve lifter (#30) from the other side of the regulator body, which will release the seat. Set the HP seat and spring aside, storing the seat separately from other parts to avoid damage.

Fig. 33

19. Using a thin brass pick, remove o-ring #20 from the cap of the balance chamber.

Carefully inserting a heavy nylon PLASTIC pick into the balance chamber, hook the outside of the HP o-ring #18 and push it toward the center (Fig. 34). With the o-ring dislodged, hook the o-ring with the pick and extract it.

DO NOT USE A METAL PICK TO DISLODGE THE HP O-RING! Any scratch on the inner land of the balance chamber will create an irreparable high pressure leak that will require replacement of the balance chamber.

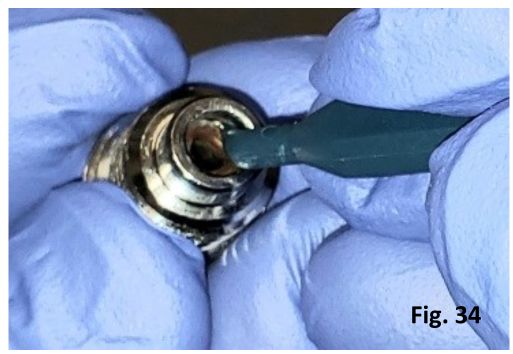


Fig. 34

If it is impossible to remove a hardened old HP o-ring with the plastic pick, <u>carefully</u> spear the visible portion of the o-ring with a sharp brass pick (Fig. 35) in as near a vertical manner as possible, so that the sharp tip of the pick <u>never</u> contacts the land on the inside of the balance chamber. Then pry the o-ring inward until it can be removed and discarded. This may bend your brass pick, but may be the price of removing a hardened o-ring. Resist the temptation to use a steel pick.

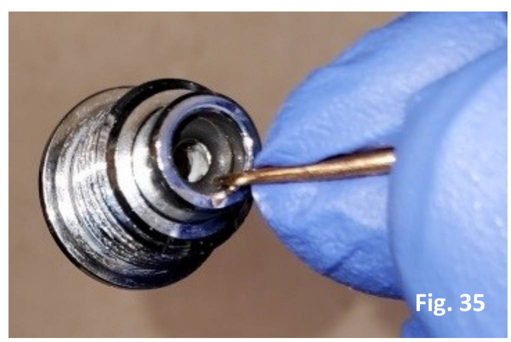


Fig. 35

Set the balance chamber aside.

This completes disassembly of the Signature first stage.

FROZEN THREADS

Threaded parts which have been repeatedly exposed to salt water at several atmospheres pressure admit water and salt molecules along the threads which are impossible to rinse out. When the salt crystallizes, it may cause verdigris corrosion which may "lock" the two parts together requiring a disassembly force far larger than the installation torque. Brass components risk deformation if disassembly forces are excessive. The following section discusses five disassembly techniques (of increasing risk to your equipment) to separate frozen threaded parts. Although it may be counterintuitive, before trying any of these methods, **first try tightening your connection slightly**, and then unscrewing. This may break up corrosion crystals.

A) **Ultrasonic cleaning**, with or without an acid bath, is the most reliable method for loosening frozen parts. However, plastic parts that are bound up in a frozen assembly may be damaged by ultrasonic cleaning. Additionally, effective ultrasonic cleaners with a basin large enough for scuba regulators are expensive and not commonly available. "Jewelry ultrasonics" often operate on a higher, less vigorous frequency than necessary for corrosion removal, and may have only tiny basins.
B) **Soaking in an acid bath** is not as effective as ultrasonic vibration, but is possible for all owners. Acetic acid, as a warm solution of vinegar and water in a 1:1 ratio may dissolve the verdigris corrosion and the salt crystals, allowing a subsequent disassembly attempt to succeed. Extended immersion in acetic acid may remove a tiny amount of chrome, and soaking should be limited to a maximum of 10 minutes at a time before the parts are re-examined for possible damage to the finish.
C) **Cold-soaking** metal equipment causes all metal parts to individually contract. A 30-minute soak in ice-water, or two hours in your freezer may (surprisingly) allow disassembly that was not possible before.

CAUTION: A cold soak will make the metal more brittle. Do not use anything but slowly increasing force to disassemble parts after a cold soak. Specifically, avoid tapping on a wrench handle with a hammer to begin the loosening process.

D) As crystal formation is at the heart of the process that locks threaded parts together, forces that break up the crystals may allow disassembly. That is why ultrasonic treatment works so well. As a "last ditch" step to separate frozen parts, you can use **percussive force** to shatter the crystals.

Place the parts to be separated on a metal base, such as the closed jaws of a vise. Do not pad the surface, but choose a smooth, flat area on which to set your parts. Allow to warm after a cold soak trial.

Place a flat piece of metal on the top of the pieces to be separated, again choosing as flat a surface as possible on the parts to accept percussion. Taking a small hammer, strike briskly straight down on the metal covering piece. The cover will accept the small dent that the hammer creates, while distributing the force to the parts beneath. Use only a medium strike force. It is not the force of the hammer strike that shatters the crystals, but the sudden shock wave traveling through the locked pieces that does the job.

Examine the parts for cosmetic damage, and if none, repeat the strike once more.

Then secure the parts as outlined elsewhere in the manual and again attempt to unscrew them. You may be surprised at the ease with which they separate.

NOTE: Your parts may sustain slight cosmetic damage from this action. If the only alternative is buying new parts, this may have to be acceptable.

E) One final suggestion for separating frozen threads is to use **penetrating oil and time**. If the parts are small enough, you can "waste" an entire can of WD-40® aerosol to fill a small cup and immerse the parts in question. A better alternative to WD-40® is Kroil® Penetrating Oil (Aerokroil) from Kano Industries. Alternatively, heavily spray the joint and come back repeatedly to add new lubricant. Allow at least four days for capillary action to draw the oil completely into the threads, and then reattempt separation.

These five possible methods have all been used successfully, with varying risk of damage to the equipment. After having to do this once, one sees the value of regular disassembly and service, even when performance is good and the IP of the first stage is stable and locks up well over several years. One cannot undo the effects of neglected service after repeated immersion in salt water under pressure. Visible verdigris corrosion along the joint lines of your regulators is a sign that a) better rinsing after dives should have been done, and b) service may be due.

FIRST STAGE PARTS CLEANING

After disassembly of the first stage, lay out all components in a logical manner. Matching the picture in the Reassembly Parts Layout Photo (pp. 54-56) is a good way to ensure that no parts will be omitted.

Before cleaning, match all replacement parts to their old equivalent that came from the regulator. Once each new part has been matched, remove the old part from the work area. That way, no duplicate items (e.g., old o-rings) will remain in the work area to cause confusion upon reassembly.

Once all replaceable parts have been exchanged with the corresponding item in the service kit, it is time to segregate parts for cleaning.

The HP seat (#17) must not come in contact with any metal part during the cleaning process. Scratching the plastic face or the shaft of the HP seat will create an irreparable leak.

The o-ring lands inside the balance plug (#21) must be protected from contact with any other metal part. Finally, the volcano cone deep inside the regulator body (#13) must not come in contact with any metal parts during cleaning. A scratch on the volcano may create an irreparable leak.

Cleaning can be divided into two main types: standard cleaning, and cleaning for oxygen service. While both endeavor to remove corrosion and contaminants from the internal surfaces of the equipment, that process is performed to a much higher standard of cleanliness when cleaning for oxygen service. **This manual is <u>not</u> a textbook on oxygen cleaning**! It is strongly recommended that you take a formal course in cleaning for oxygen service if you contemplate service of these regulators for continued use of oxygen above 40%. The steps outlined in this section should be regarded as <u>minimum</u> required steps to maintain your regulators in the condition in which they were delivered. Furthermore, servicing your regulators without using (at a minimum) **every step** listed below will render your equipment unsuitable for use with EAN above 40% until such cleaning has been accomplished and verified.

To service your regulators for continued use with oxygen above 40%, several steps are mandatory:

a) in order to prevent deposition of skin oils on internal surfaces, nitrile powder-free gloves should be worn at <u>all</u> times during cleaning and reassembly;

b) only oxygen-compatible lubricants should be used (Tribolube 71 or Christo-Lube MCG-111); silicone lubricants such as Molykote 111 are not oxygen compatible, are extraordinarily difficult to remove completely and may permanently disqualify a regulator from oxygen service if used;

c) your work area must be capable of being cleaned of all hydrocarbons; work surfaces should be non-porous, and be thoroughly cleaned and tested before use;

d) your tools should be cleaned and segregated from other tools during this process;

e) air for drying and testing must be at least Modified Grade E air (EAN will meet this standard);

f) the work environment should be maintained as dust and fiber-free as possible; only clean, lint-free cloth should be used in drying parts.

If these requirements cannot be met throughout the service process, the regulator should be regarded as suitable only for air or EAN at or below 40%.

The oxygen cleaning process consists of the following steps:

1) detergent wash (with or without ultrasonic cleaning) and rinse (may be combined with step 2, depending upon agent used);

2) alkaline degreasing and rinse;

3) acid bath with or without ultrasonic cleaning;

4) alkaline neutralization and rinse;

5) inspection and testing for hydrocarbons;

6) repetition of steps 1, 2, 3 and 4 as needed;

7) drying and bagging in a hydrocarbon-free container until reassembly.

Detergent Wash: While wearing gloves, immerse all parts in a warm solution of detergent and agitate to remove deposits. Use a soft toothbrush to remove gross contaminants. Use an ultrasonic cleaner as needed for stubborn deposits. Segregate delicate parts from other metal parts to avoid damage to sealing surfaces during vibration.

A gentle detergent wash of service kit parts is also recommended if you are attempting to clean your regulator for oxygen service. Although the kit parts are supplied clean, they are in an open plastic envelope and exposure to hydrocarbons is theoretically possible. When washing the HP seat, ensure that it is not scratched by any adjacent parts, but is kept segregated and protected. Service kit parts need only a gentle detergent wash and thorough rinse. Alkaline degreasing and an acid wash are not required.

Rinse all parts with clean water and inspect. Repeat as necessary until all visible contamination is removed (note: verdigris corrosion will likely not be removed with this step).

Alkaline Degreasing: If "oxygen clean" equipment is desired, this step should be considered mandatory, and in addition to the detergent wash above. Immerse all metal parts in the chosen solution and ultrasonically clean for ten minutes. Segregate delicate parts from other metal parts to avoid damage to sealing surfaces. Inspect and repeat as needed. Rinse with clean water. As above, verdigris corrosion may not be removed until the next step.

Warm Acid Wash: Using a 50:50 mixture of white vinegar and hot water, immerse all metal parts and agitate. Segregate delicate parts from other metal parts to avoid damage to sealing surfaces. Use a soft toothbrush to remove heavy corrosion and re-immerse in the acid bath. A brush with fine brass bristles may be considered for heavily corroded threads, though this may dull the finish. Repeat as needed until all visible corrosion has been removed. Note: heavy corrosion may leave bare brass behind, as the finish has likely been scratched or marred, leading to the degree of corrosion noted. Deep6's PVD coating is very resistant to verdigris corrosion unless scratched down to bare metal.

Note also that a vinegar solution may not be an aggressive enough cleaner for corroded parts that may have absorbed hydrocarbons in a regulator being prepared for oxygen service. A more aggressive phosphoric acid solution with or without ultrasonic cleaning may be needed. See a list of possible products on the following page.

Rinse briefly in clean water and then immerse in a neutralizing solution created by adding 1 tbsp of sodium bicarbonate to one gallon of clean warm water. Rinse thoroughly and repeatedly in clean water.

Inspection: Remove water droplets from all parts with a lint-free clean cotton cloth. Air dry all metal and plastic parts. Inspect each dry part carefully under bright light with magnification for any dust, corrosion (which may have trapped hydrocarbon contaminants) or oils. If any contaminant is noted, return to a previous step as indicated by the type of contamination and repeat.

Taking two absolutely clean containers, add distilled water to both, and let stand for a few minutes in a dust-free area. Carefully examine the surfaces of the distilled water for any areas of rainbow "sheen" from hydrocarbon contaminants that may have been on the internal surface of the container. If no sheen is noted, this solution will be used in the testing process. Combine the water from one container with the other and cover the empty container.

Add all cleaned and dried parts from the last step to the container of clean distilled water, agitate thoroughly and let stand. Examine the surface of the water for any new sheen of hydrocarbons. If none is noted, pour most of the water into the second clean container and retain it for the testing process.

Using a fresh pair of clean gloves, retrieve the parts from the container and once again, air dry them.

Testing: Using a 250-400 nM ultraviolet light in a darkened room, inspect all parts for any fluorescence indicative of residual hydrocarbons. Note: this step should be regarded as the least sensitive of all the tests. If all parts are free of any visible contamination, they should be covered and set aside for reassembly. If any traces of hydrocarbon residue are noted, cleaning must be accomplished again, using at least a detergent wash, alkaline degreasing and thorough rinse, before testing again.

Now take part of the retained rinse water from the second container and splash it across a clean glass surface. At least **5 seconds** should elapse before the water beads up. No sheen should be visible.

Take part of the retained rinse water and put it in a small, absolutely clean glass container. Shake the rinse water vigorously for five seconds. Observe the surface of the water in the container. All surface bubbles should burst immediately, with no surface sheen on them. Any bubbles suggest residual detergent indicating incomplete rinsing; any sheen is indicative of residual hydrocarbon contamination.

If any traces of hydrocarbon residue are noted, cleaning must be accomplished again, using at least a detergent wash, alkaline degreasing and thorough rinse, before testing again.

If all four tests (bright light inspection under magnification, UV inspection, water sheeting and bubble tests) are passed, the regulator parts can be regarded as likely safe for reassembly and use in an oxygen environment, *if oxygen-safe lubricants are used and no hydrocarbons are introduced during reassembly and testing.* As noted above, if oxygen service is anticipated, a formal course in oxygen cleaning is strongly recommended.

Examples of cleaners and equipment

While the following are not the only suitable cleaners and equipment, they are representative examples that are suitable for use with Deep6 regulators.

Detergent wash - Color and scent-free liquid dishwashing detergent, 1 tsp per gallon of hot water; Blue Gold®**,** Simple Green Crystal® or the new Extreme Simple Green® diluted per manufacturer. Note that Extreme Simple Green® is specifically described by the manufacturer as suitable for scuba oxygen cleaning.

Alkaline degreaser - Global Scuba Manufacturing of Texas (GSM) 42100OX Special Cleaner, diluted per manufacturer

Acid wash - Distilled white vinegar, diluted 1:1 in warm water; Lawrence Factor Wash® or GSM 43190 Regulator Cleaner, diluted per manufacturer; food-grade phosphoric acid, diluted to 8-15% (for soaking), or diluted to 3% for use in an ultrasonic cleaner

Alkaline Neutralizer - Sodium Bicarbonate, 1 tbsp per gallon of warm distilled water

Final rinse - distilled water

Drying - lint-free cotton cloths; air dry in dust-free environment, or dry with pressurized air using Modified Grade E air or EAN. NOTE: loop-weave cloth towels should be avoided; use only flat-weave single ply cotton which has been previously washed to remove fabric sizing.

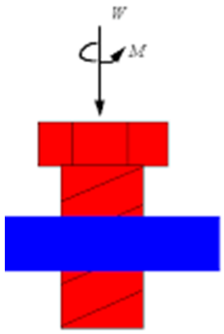
Ultraviolet light - Search Amazon.com for ***365nm*** UV handheld light

Discussion of Thread Lubrication

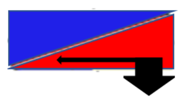
The critical warning on page 11 prohibits thread lubrication except where specifically instructed. The following discussion will show why.

AXIAL THREAD LOAD: Axial load is a tension force locking two components together. That load is maintained by friction between adjacent threads, and by friction between the faces of adjacent components where the threaded items are fully screwed in and butt together. The load disappears as the components unscrew.

When torquing threaded components, applied torque essentially forces two overlapping wedges against each other. The ratio of effective height to base determines the force amplification. See diagram below:



FORCE AMPLIFIER



The ease with which those wedges slide past each other is a major factor in reducing the torque value required to attain a given axial load. In the formula for torque, the contribution of friction is known as "K factor." If you reduce K factor (if you lubricate the threads), you ***increase*** the axial load applied for any given torque.

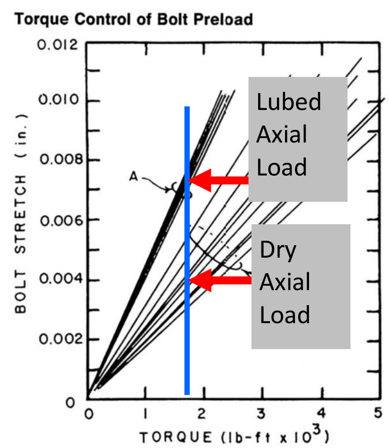


Image 3. Consistency of applied load with a lubricated (A) versus nonlubricated (B) assembly (Image credit: Bickford. (1995). An Introduction to the Design and Behavior of Bolted Joints, New York, NY: Marcel Dekker)

When required loads are engineered into the design of regulator components, they presume a certain K factor for dry, lightly lubricated or heavily lubricated threads. As seen in the graph at right, lubrication may double the axial load on the threads!

LUBRICATION BEFORE APPLYING SPECIFIED TORQUE MAY LEAD TO COMPONENT FAILURE! DO NOT LUBRICATE EXCEPT WHERE SPECIFIED.

Consequence of Improper Thread Lubrication

When lubricated components are joined with a torque specified for dry threads, the load on the threads may double. Over a two year service interval, molecules of lubricant that initially facilitated assembly migrate from between the adjacent flanks of the threads into the microscopic void space in the roots of the threads. The brass components remain under the doubled thread load that was initially applied, but with little or no remaining lubricant. Now add a little verdigris corrosion from salt water molecules that have percolated into the threads at several atmospheres of pressure at depth, and the two components become locked together.

When subsequent disassembly is attempted, the brass may fracture where disassembly torque is applied (see picture at right), because disassembly of the now-poorly-lubricated thread flanks requires greater disassembly torque than assembly torque.

When this DIN retainer was finally disassembled, heavy lubrication was found (that was no longer between the thread flanks).

THE CONCEPT IS COUNTERINTUITIVE! LUBRICATION MAY MAKE SUBSEQUENT DISASSEMBLY HARDER, BECAUSE THE COMPONENT WAS OVERLOADED BY APPLYING TORQUE SPECIFIED FOR A DRY THREAD!

FIRST STAGE REASSEMBLY

Prior to reassembly, arrange the work area to provide ready access to cleaned tools, and use a cleaned assembly surface, preferably with a lip to retain small parts in the immediate area should they roll free during assembly. A metal baking tray with a clean silicone mat provides a suitable surface. Don a clean pair of powder-free nitrile gloves and arrange your cleaned assembly tools nearby. Remove all cleaned and dried parts and arrange them according to the diagram on the Reassembly Parts Layout quick reference page. Arrange all cleaned service kit parts in the appropriate location matching the reassembly quick reference.

Note especially the difference in feel between a duro 70 (medium) and duro 90 (hard) o-ring, as part #11 is identical in size to the four part #29 o-rings. Part #11 is a hard o-ring whose stiff composition seals the yoke retainer or DIN housing to the regulator body, while the part #29 o-rings are softer, as they seal only LP port plugs.

Incorrect placement of a soft #29 at the base of a retainer may allow it to extrude, causing a major gas leak, perhaps during a dive!

In short, pay attention to detail during reassembly! Avoid distractions and follow all reassembly steps as written, as your dive safety depends upon it.

1. With the regulator body held diaphragm side up, install the Valve Lifter (#30) by inserting the pin into the center hole of the body (Fig. 36).

Fig. 36

2. Gently bending the diaphragm (#31) in an arc, convex side up, slide one edge into the groove under the threads (Fig. 37) and work it around the periphery of the body until it is centered above the valve lifter. It is better to gently fold the diaphragm so that it tucks into place, rather than scraping the edge against the threads. Any diaphragm material dislodged from the edge by scraping may interfere with the seal.

DO NOT LUBRICATE THE DIAPHRAGM! Do not use gloves that are slippery with lubricant to handle the diaphragm.

Slide a blunt brass spade around the periphery of the diaphragm <u>below the level of the threads</u> to confirm that the diaphragm edge is fully in its groove, and not caught by any thread of the regulator body (Fig. 38). Set the regulator body aside.

Fig. 37

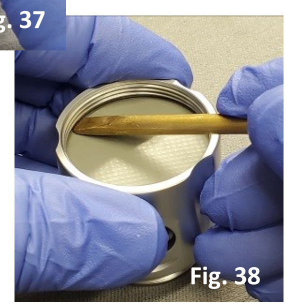


Fig. 38

3. Collect the following items:

- Spring Pad (#32)
- Anti-friction washers (#33) - two
- Main spring (#34)
- Spring adjuster (#35)
- Diaphragm Clamp (#36)

Examine the Diaphragm Clamp (#36). One end has 5-6 threads and the other has 3-4 threads. Orient the Diaphragm Clamp (#36) with the “five thread” end up (Fig. 39).

Fig. 39

4. Lubricate the Spring Adjuster (#34) threads, and screw it into the Diaphragm Clamp on the "five thread" end <u>exactly three turns</u> (Fig. 40).

Fig. 40

5. Now turn the clamp over so that the inside of the adjuster is visible. Place one washer (#33) in the Spring Adjuster and seat it at the bottom by pushing it in with the Main Spring (#34) (Fig. 41) .


Fig. 41

6. Apply two tiny dots of oxygen-safe lube to the top edge of the spring (Fig. 42), and using the lube as a temporary adhesive, tack a second washer to the top end of the spring (Fig. 43).


Fig. 42

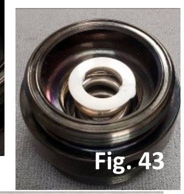


Fig. 43

7. Gently set the Spring Pad (#32) on top of the main spring inside the diaphragm clamp with the smooth side up. Ensure that the centering dimple on the bottom of the spring pad sits inside the washer and spring, and that the anti-friction washer was not dislodged (Figs. 44, 45).


Fig. 44


Fig. 45

8. Grasp the diaphragm clamp assembly with the spring adjuster down and the loose spring pad up. Pick up the regulator body in your other hand with the diaphragm side held down, and hand thread the diaphragm clamp assembly <u>up into the regulator body from below</u> (Fig. 46). **Do not lubricate** the threads of the diaphragm clamp. Continue screwing in the clamp by hand until it meets resistance as the clamp begins to press against the diaphragm.


Fig. 46

9. Mount the regulator in a vise, diaphragm clamp up, using a vise holder screwed into a high pressure port.

10. Take a #5 hook spanner and adjust its 0.156" pin so that it reaches fully into the pin dimple of the diaphragm clamp (Fig. 47) <u>without pushing the hook spanner away from the regulator body</u> (Fig. 48).

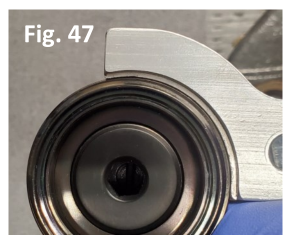


Fig. 47

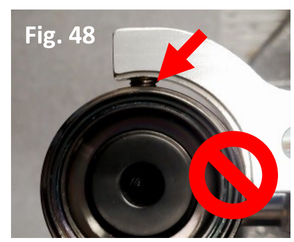


Fig. 48

11. Set the hook spanner in one of the two diaphragm clamp pin dimples and hold it firmly in place with thumb and forefinger. Begin to tighten the diaphragm clamp clockwise, firmly by hand (Fig. 49).
CAUTION: Do not attempt this operation one-handed. If the hook spanner "skips" out of the hole, it will badly scratch the finish of the diaphragm clamp. Always maintain pressure on the pin end of the spanner while tightening.


Fig. 49

Fig. 50


Fig. 51

12. **SPECIFICATION**
Stop tightening the diaphragm clamp when:
a) a torque wrench attached to the broach of the hook spanner (Fig. 50) reads 266 in-lb (30 Nm), ***or***
b) the diaphragm clamp meets the regulator body with firm metal-to-metal contact (Fig. 51), <u>whichever comes first</u>.

⚠

Do not exceed 266 in-lb of torque on the diaphragm clamp to prevent compressive damage to the diaphragm or thread deformation.

13. Invert the regulator body and using a 6mm hex key, add <u>three more turns</u> clockwise to the spring adjuster (Fig. 52). This adds spring counterforce to the diaphragm in preparation for later pressurization. **More important, it centers the lift pin.**

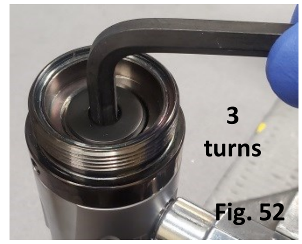


Fig. 52

14. Set the regulator body aside, and collect the following items (Fig. 53):

a) Balance Plug (#21)
b) duro 90 3-905 o-ring (#20)
c) Seat Spring (#19)
d) duro 90 2-006 Teflon o-ring (#18)
e) new High Pressure Seat (#17)

Take care to not scratch the face or shaft of the HP Seat.


Fig. 53

15. Lubricate the 3-905 o-ring (#20) with a thin film of Tribolube 71 or other oxygen-compatible lubricant. Carefully stretching it over the cap of the balance plug, place it in its land just underneath the cap (Fig. 54). Inspect to ensure the o-ring is not twisted. Run a plastic or sharp brass pick under the o-ring if a twist is found. This critical seal is one potential source of IP creep.


Fig. 54

16. Place a thin line of lubricant on the land inside the open end of the balance plug. Generously lubricate the duro 90 2-006 Teflon high pressure o-ring (#18) (Fig. 55). Squeezing it into an oval, carefully insert it into the open end of the balance plug (Fig. 56). Using a 1/8" wooden dowel, carefully rotate and tamp the o-ring until it rests flat inside the balance plug (Fig. 57). Taking the HP Seat in your fingers, carefully insert the shaft into the center hole of the o-ring and slide it back and forth twice to ensure that the o-ring is properly seated, and then remove it (Fig. 58). This critical seal is another potential source of IP creep.


Fig. 55

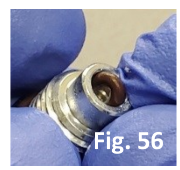


Fig. 56


Fig. 57

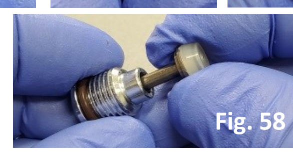


Fig. 58

17. Firmly place the Seat Spring (#18) on the end of the balance plug. Smear a thin film of lubricant on the shaft of the HP Seat (#17), and reinsert the HP Seat so that the shaft end just enters the hole in the o-ring (Fig. 59). <u>Do not lubricate the balance plug threads</u>.


Fig. 59

18. Hold this HP Seat assembly in one hand, with the seat facing up. Holding the regulator body in the other hand, insert the HP Seat assembly <u>by hand</u> into the regulator from below (Fig. 60). Do not use a hex key at this point, or you risk dislodging the HP seat from the Balance Plug (Fig. 61).

Take special care to engage the pin of the valve lifter in the <u>center</u> of the HP Seat face. Off-center insertion may cause the pin of the valve lifter to dent or scratch the HP seat face, causing subsequent IP creep.

Insert the plug with the reg held vertically! Performing this step with the reg body on its side may allow the valve lifter pin to drop slightly to one side, increasing the chance of its striking the HP seat face.

Fig. 60

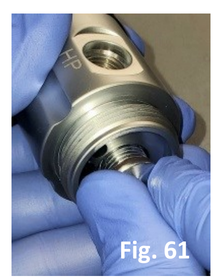


Fig. 61

19. Pressing upward on the balance plug assembly to compress the spring, thread it into the regulator body by hand. Then insert a 4mm straight shaft hex key in the broach in the balance plug, and tighten it finger tight (Fig. 62).

Fig. 62

Do not use a ball-end 4mm hex key! Most ball-end hex keys will naturally rest on the HP seat shaft with the waist of the key crossing the broach. Irreparable damage to the plug may occur if force is applied to the hex broach with the key flats only partially engaged (Fig. 63).

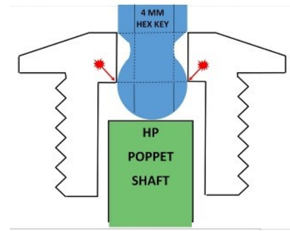


Fig. 63

20. Secure the regulator body in a vise with the vise tool screwed into a HP port, and the balance plug up.

SPECIFICATION Using a 4mm straight shaft socket hex key, torque the balance plug to 80 in-lb.

21. **IMPORTANT: Now unscrew the Spring Adjuster exactly one turn.** This will place initial Intermediate Pressure in a predictable range at the start of tuning.

22. Collect the following parts for turret assembly (Fig. 64):

a) Swivel Retainer (#22)
b) Swivel Thrust Washer (#23)
c) Intermediate Pressure Cap (#24)
d) duro 70 2-016 o-ring (#25)
e) duro 70 2-021 o-ring (#26)
f) Swivel Turret (#27)

Fig. 64

23. Lubricating both o-rings with a light film of oxygen-safe lubricant, stretch the 016 o-ring (#25) over the raised collar of the Swivel Turret (#27) until it seats in its land. Place the 021 o-ring (#26) in its groove (Fig. 65). Do not insert the turret into the cap until after the next step, to make Swivel Retainer insertion easier.

Fig. 65

24. Place the Swivel Thrust Washer (#23) in the recess in the IP Cap (#24). Ensure that it is centered. Drop the Swivel Retainer (#22) into the IP Cap and hold the retainer in place with a forefinger (Fig. 66).

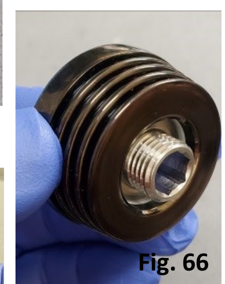


Fig. 66

25. Spin the Swivel Turret (#27) onto the retainer until it is finger tight (Fig. 67). Confirm that o-ring #26 has not been dislodged. Attaching a vise tool to any side LP port in the turret, secure the turret assembly in a vise.

Fig. 67

SPECIFICATION Torque the Swivel Retainer with an 8mm socket hex bit to 150 in-lb (Fig. 68). If a ball end hex key is used, ensure that it is inserted deeply enough into the Swivel Retainer to fully engage the flats of the hex key inside of the retainer.

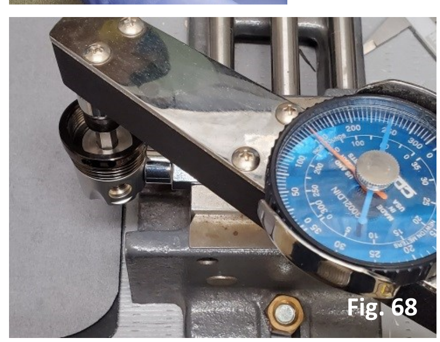


Fig. 68

26. Attach the IP Cap as follows: lubricate the 2-024 duro 70 o-ring (#16) with a thin film of oxygen-safe lubricant and install it. Lightly lubricate the threads of the regulator body, and screw the IP Cap assembly (with turret) firmly by hand onto the body. Mount the regulator body in a vise using a vise tool attached via an HP port, with the IP Cap/Turret facing up.

27. Adjust the 0.156" pin of a #5 hook spanner so that it reaches the full depth of the pin dimple in the IP cap (Fig. 69), but does not push the hook away from the cap (Fig. 70).

Fig. 69

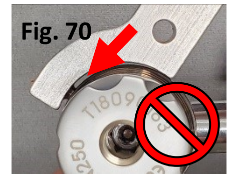


Fig. 70

28. Holding the pin firmly in the IP Cap, turn the IP Cap in a clockwise direction, tightening it onto the regulator body until there is **firm** metal-to-metal contact between the two parts (Fig. 71). Set the assembled regulator body where it can easily be retrieved in the next steps.

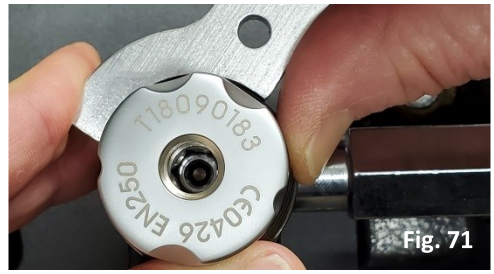


Fig. 71

For DIN assembly steps, see next page.

29 - Yoke: Don a fresh pair of nitrile gloves. Insert the Yoke Retainer (#4) into the Yoke (#3) from the inside of the ring of the yoke. Holding the yoke assembly upside down, and grasping the Filter (#10) by its wide collar, drop the filter into the end of the Yoke Retainer. Carefully press an <u>unlubricated</u> 2-011 D90 o-ring (#11) into the recess in the end of the Yoke Retainer and around the edge of the filter (Fig. 72). Drop the Saddle (#12) over the Yoke Retainer with the flat face toward the yoke.


Fig. 72

30 - Yoke: Continuing to hold the yoke assembly upside down, take the regulator body and place its threaded recess for the Yoke Retainer carefully over the end of the retainer (Fig. 73). DO NOT LUBRICATE THE THREADS. Thread the Yoke Retainer up into the regulator body from below (to avoid dislodging the filter and sealing o-ring) until it is finger tight.


Fig. 73

ONLY when the sealing o-ring (#11) is trapped between the Yoke Retainer and Body is it safe to turn the regulator over.

31 - Yoke: Mount the regulator horizontally in a padded vise, with the Yoke up.

Do not clamp the body in the vise. Instead, use the vise only as a rigid container to contain the body during torquing.

Attach a 3/4" socket to the Yoke Retainer, and slide the Scubatools 20-156-500 extension rod through the hole in the top of the yoke and engage it in the socket (Fig. 74).

Alternatively, tighten the Yoke Retainer with a large (15") adjustable wrench. This will require a digital luggage scale for accurate torquing (Fig. 75).

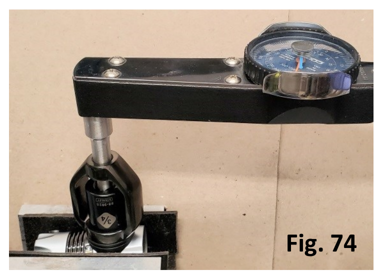


Fig. 74

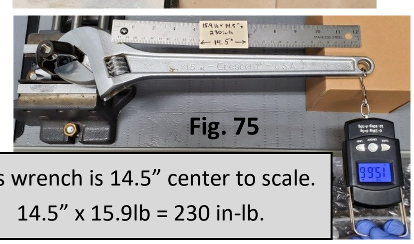


Fig. 75

This wrench is 14.5" center to scale.
14.5" x 15.9lb = 230 in-lb.

SPECIFICATION Attaching a torque wrench to the extension, tighten the Yoke Retainer to 230 in-lb in a single smooth motion. Do not "walk" the retainer in with repeated applications of torque.

32 - Yoke: Thread the Dust Cap (#2) onto the Yoke Knob (#1). Thread the knob into the Yoke.

33 - Yoke: Place new, lightly lubricated o-rings on all port plugs (Fig. 76). Using a 4mm or 5/32" hex key, thread port plugs into one HP port and three LP ports. Tighten barely hand tight (25-40 in-lb).

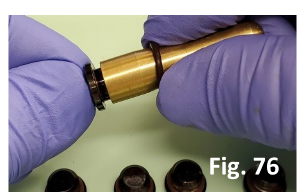


Fig. 76

This completes initial assembly of the Yoke First Stage.

29 - DIN: Don a fresh pair of nitrile gloves. Grasping the Filter (#10) by its wide collar (Fig. 77), drop the filter into the end of the DIN Housing (#9). Carefully press an <u>unlubricated</u> 2-011 D90 o-ring (#11) into the recess in the end of the housing and around the edge of the filter (Fig. 78). Drop the Saddle (#12) onto the housing, flat side down (toward the hex flats). Continue to hold the housing with the filter and o-ring uppermost.


Fig. 77


Fig. 78

30 - DIN: Take the regulator body and place its threaded recess for the DIN Housing carefully over the end of the housing (Fig. 79). DO NOT LUBRICATE THE THREADS. Thread the housing up into the regulator body from below (to avoid dislodging the filter and sealing o-ring) until it is finger tight.

ONLY when the sealing o-ring (#11) is trapped between the DIN Housing and Body is it safe to turn the regulator over.

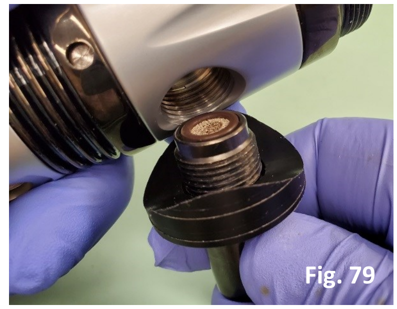


Fig. 79

31 - DIN: Mount the regulator horizontally in a padded vise, with the DIN Housing up (Fig. 80).

Do not clamp the body in the vise. Instead, use the vise only as a rigid container to contain the body during torquing.

Attach a 13/16” deep socket to the Yoke Retainer, and attach the torque wrench. See the discussion of custom modification of a 13/16” deep socket on page 17.

Alternatively, use a 13/16” crowfoot attachment with a flat face with your torque wrench.

SPECIFICATION Tighten the DIN Housing to 230 in-lb in a single smooth motion (Fig. 81). Do not “walk” the housing in with repeated applications of torque.

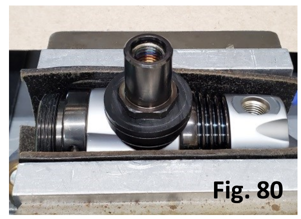


Fig. 80

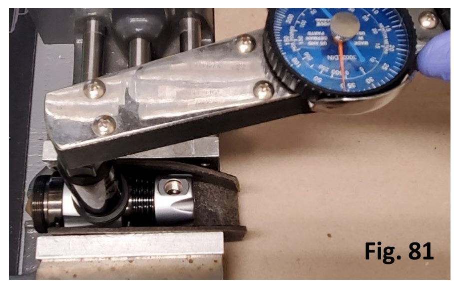


Fig. 81

32 - DIN: Slip the DIN Wheel (#8) onto the spindle of the DIN Housing, thread side up (Fig. 82). Slide the 2-012 D90 o-ring (#15) carefully over the threads of the DIN Retainer (#7) (Fig. 83), and screw the DIN Retainer into the housing. Press the 2-112 o-ring (#6) firmly into the land in the DIN Retainer. Inspect this o-ring to confirm that it is fully seated.


Fig. 82

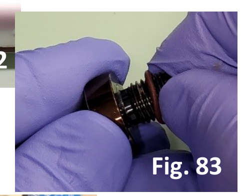


Fig. 83

33 - DIN: **SPECIFICATION** Using a 6mm Hex socket and torque wrench, tighten the DIN Retainer to 80 in-lb (Fig. 84).

Do not use a ball-end hex key in the DIN Retainer. A ball-end hex does not provide a broad enough area for application of 80 in-lb of torque and may dent the brass in this shallow broach.

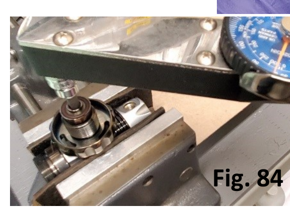


Fig. 84

34 - DIN: Place new, lightly lubricated o-rings on all port plugs (Fig. 85). Using a 4mm or 5/32” hex key, thread port plugs into one HP port and three LP ports. Tighten barely hand tight (25-40 in-lb).

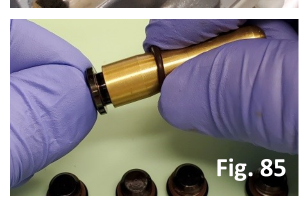


Fig. 85

This completes initial assembly of the DIN First Stage.

FIRST STAGE TUNING

Connect an SPG to one HP port. Connect a working second stage to one LP port and an IP gauge on a BCD hose to a second LP port. **Do not test the first stage without using a relief valve such as a second stage! A HP gas leak into IP compartments from faulty reassembly may exceed design specifications of the regulator and is hazardous.** Mount the first stage on a regulated gas supply set at 500 psi, or on a tank containing 500 psi of Modified Grade E air, with the turret down and Spring Adjuster (#35) facing up.

Tuning Precheck

With the purge button depressed, slowly open the tank/gas valve and watch the IP gauge. If the gauge does not exceed 100 psi, release the purge button. If the gauge does exceed 100 psi, turn off the tank, and purge the second stage. Unscrew the Spring Adjuster (#35) one full turn counterclockwise and try again.

If after releasing the purge button, the gauge does not then exceed 130 psi, nor continue to rise, leave the tank valve on. If the IP gauge continues to rise, shut off the tank and purge via the second stage. IP creep indicates a seal failure at the volcano/HP seat interface, or an o-ring or balance plug leak in the balance chamber. The first stage will require disassembly of the IP cap and balance plug for inspection.

The most likely condition upon turning on the gas supply and releasing the purge button is an IP of 0-50 psi. If this pressure is stable, tuning can begin. If the pressure is low, but continues to drift up slightly, cycle the second stage several dozen times to help the volcano seal against the new HP seat. If IP creep continues, the IP Cap and balance plug will require disassembly for inspection.

Intermediate Pressure Adjustment (low tank)

With a stable, low IP at 500 psi tank pressure, insert a 6mm hex key in the Spring Adjuster and begin turning clockwise in 1/4-1/2 turn increments. Each turn, cycle the second stage once or twice and check IP. Continue turning clockwise in 1/4-1/2 turn increments and purging intermittently or breathing from the second stage, watching the IP rise. Continue advancing the Spring Adjuster until IP reaches ~120 psi. It is common for the IP to jump with small spring turns due to "windup" of the spring coils. Purging the second stage, or depressurizing and repressurizing the first stage will reveal the true Intermediate Pressure.

Now decrease the amount of advancement of the Spring Adjuster to 1/12 turn (or "5 minutes" on a clock face), and carefully continue increasing IP and cycling the second stage until IP reaches **138 psi**.

If a final clockwise advancement of the Spring Adjuster results in an overshoot past the desired IP, simply begin turning counterclockwise in 1/12 turn increments (or less) and breathe from or briefly purge the second stage with each turn. Do not turn the Spring Adjuster counterclockwise more than 1/12 turn without purging, as the new IP will not be seen until after the purge.

Unscrewing the Spring Adjuster adds slight stress to the diaphragm as main spring counterpressure is removed, while a slightly higher IP remains on the other side of the diaphragm until purging. However, the pressure difference is small, and it is NOT necessary to turn off the tank and purge the entire system before turning counterclockwise on the Spring Adjuster, nor is it necessary to purge while turning. Merely cycling the second stage between adjustments is sufficient.

Once the desired IP has been obtained, turn off the tank and purge the system. Then slowly turn the tank back on and confirm that the IP returns to the desired value. It commonly will not, due to mainspring "windup" as noted above. This windup disappears upon depressurization, and the new IP value is the true Intermediate Pressure. Continue small adjustments as above until 138 psi is obtained at 500 psi, both after adjustment and after system depressurization and subsequent repressurization.

Intermediate Pressure Confirmation (high tank)

Connect the first stage to a full tank at 3000 psi, or adjust gas supply pressure to 3000 psi. Slowly open the tank valve while watching IP. Confirm that resulting IP is over 125 psi, or screw in the Spring Adjuster slightly to reach this value. In most cases, high tank IP will be -8 to +2 psi of low tank IP. If an adjustment was made, check IP again at 500 psi tank pressure to confirm that it does not exceed 145 psi.

Confirm that there is no IP Creep at 3000 psi. An IP Drift of up to 5 psi is common with a new HP seat until the seat imprint conforms to the volcano. It may take several hundred cycles of breathing/purging before IP stabilizes. Unlike IP Creep, IP Drift is a slow increase in Intermediate Pressure which then locks up at a higher value, <u>and does not continue to rise</u>. This is acceptable with a new seat as long as the highest IP is within specification.

However, any true IP Creep (continued increase in IP) is an out-of-specification condition which requires disassembly of the IP Cap and Balance Plug assembly, and replacement of component(s).

<u>Late Readjustment</u>

After several thousand breathing cycles, or many hours of pressurization, the HP seat will receive an imprint from the volcano. This is functionally equivalent to slightly screwing in the Spring Adjuster, and your IP at any tank pressure may be slightly higher.

At the same time, a new seat with an imperfect seal may have had several psi of IP Drift upward. As that new seat receives its imprint, it seals both better and earlier, <u>lowering</u> the IP at lockup.

In other words, once your HP seat has "taken a set", your final IP may be slightly different from your initial tuning. If you have become familiar with your IP at a given tank pressure, it is a simple matter to readjust the IP to your desired setting at that tank pressure by screwing or unscrewing the Spring Adjuster a very small amount. This requires removal of the Environmental Seal (see below).

<u>Assembly of the Environmental Seal and Final Testing of the First Stage</u>

With a stable Intermediate Pressure within specification at both low and high tank pressures, it remains only to add the environmental seal.

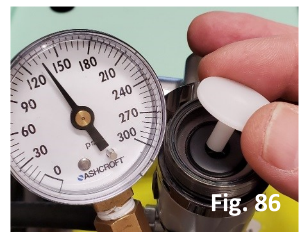


Fig. 86


Fig. 87


Fig. 88


Fig. 89

1. Leave the first stage pressurized on a tank, with the Spring Adjuster facing up. Remove the 6mm hex key.

The Environmental seal <u>must</u> be added with the regulator pressurized, or it will lag in its depth compensation during a dive.

2. Drop the Transpiston (#37) into the 6mm hex broach (Fig. 86).

3. Take the silicone Environmental Seal (#38) and smooth it into place (Fig. 87), centered carefully inside the perimeter of the Diaphragm Clamp (#36). NOTE: The IP may rise slightly if you accidentally press on the Transpiston while adding the seal. This is normal.

4. Lightly lubricate the threads of the Environmental Cap (#39). Screw down the Environmental Cap <u>by hand</u>, tightening it firmly with the aid of a rubberized sheet or "jar opener" pad to increase your grip (Fig. 88). Do not wrench it into place with a hook spanner. The dimple in the cap is only to aid <u>disassembly</u>.

5. Depressurize the regulator, and confirm that the seal has assumed a <u>concave</u> shape (Fig. 89). Again, slowly turn on the tank. Confirm that the static Intermediate Pressure is still within specification. If a concave shape was not noted, remove the cap, repressurize the regulator, and reapply the seal.

6. Breathe from the second stage and confirm that the dynamic IP drops less than 10 psi with a normal breath at any tank pressure. Purge the second stage with a full tank, and confirm that the IP drops less than 20 psi at 3000 psi tank pressure.
If either drop is exceeded, see Troubleshooting, page 51.

SPECIFICATION
Static Intermediate Pressure shall remain between 125 and 145 psi at all tank pressures from 500-3000 psi, with no Intermediate Pressure Creep.

7. Immerse the pressurized first stage in water, looking for leaks. Evaluate leaks using the Troubleshooting section on page 51.

This completes first stage service.

DEEP6 SPG AND HOSE SERVICE

Submersible Pressure Gauge and HP Hose

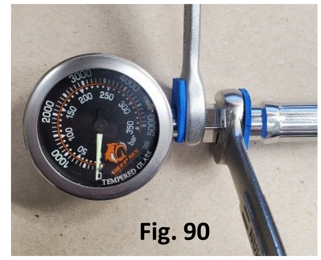


Fig. 90

1. Remove the SPG from any console boot. Soaking the console in hot soapy water may facilitate this. Using two 9/16" open end wrenches, loosen the gauge from the nut, and remove the gauge (Fig. 90).

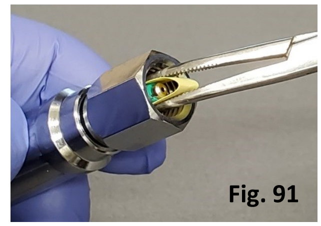


Fig. 91

2. The spool will likely remain either in the end of the gauge, or inside the hose nut. Pulling with a fingernail in the o-ring land, remove the spool. If heavily corroded, spool removal may require a tool (Fig. 91).

When grasping the protruding tip of the spool, pad the serrated edges of your needle nose pliers or forceps with a bit of cloth or paper to avoid marring the sealing surface of the spool.

Fig. 92

3. Remove the spool's two o-rings with a fine brass pick inserted parallel to the o-ring and pushed diagonally under the o-ring to avoid damaging the land.

TR Do not dig at a hardened o-ring with the tip of a pick. It can be helpful to use the gauge as a mount for the spool while using a sharp pick (Fig. 92).

4. Remove verdigris corrosion from the spool by soaking in a 50:50 mixture of hot water and vinegar. NOTE: See pages 21-23 for techniques if the gauge is to be used with high pressure oxygen.

NOTE: If the HP hose has not been used continuously with Modified Grade E air, a new oxygen clean HP hose should be installed before using the regulator set with high-pressure oxygen. <u>It is not possible to oxygen clean a contaminated HP hose</u>, due to the intake restriction.

5. It is not necessary to remove corrosion from the threaded ends of the SPG or high pressure hose. While unsightly, these threads are outside the sealing area. Getting liquid in the end of the hose risks damaging the delicate interior of the SPG upon subsequent pressurization.

If removal of heavy corrosion is necessary to allow reassembly, it is possible to immerse the ends using the following technique.

Fig. 93

Fig. 94

a) Temporarily seal the tiny hole in the <u>first stage end</u> of the HP hose with (non-porous) electrical tape (Fig. 93). This will prevent vinegar from rising more than a few millimeters into the other end of the hose.

b) Using a 50:50 mixture of hot water and white vinegar, immerse the swivel end of the hose <u>only to the end of the metal swage onto the rubber hose</u> (Fig. 94). Do not agitate the hose in the mixture.

c) Remove the hose after 10 minutes and <u>before inverting the end for inspection</u>, remove excess liquid with a cloth. Inspect for adequacy of corrosion removal, and repeat as needed.

d) When corrosion removal is sufficient, immerse the hose end for one minute in a neutralizing solution of 1 tsp baking soda in 1 quart of clean water, and then immerse in clean water. Again, do not immerse deeper than the end of the metal swage.

e) Before inverting the fitting, dry with a cloth. Connect the HP hose to a port of a first stage and open the tank valve. Use 2 min of escaping tank air to thoroughly dry the hose end. If the hose is to be used for oxygen service, only Modified Grade E air or EAN should be used for drying.

6. As with the hose, it is generally not necessary to remove corrosion from the gauge threads. Corrosion in the bore leading to the mechanism stops at the level of the prior o-ring seal. An attempt to clean the bore risks pushing debris into the gauge intake, with damage occurring at the next pressurization.

If removal of heavy corrosion is necessary to allow reassembly, it is possible to immerse the gauge end using the following technique.

a) Temporarily seal the bore in the gauge end with (non-porous) electrical tape (Fig. 95). This will prevent vinegar from getting into the gauge.

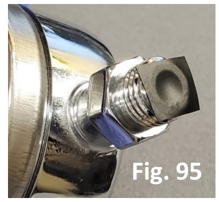


Fig. 95

Fig. 96

b) Using a 50:50 mixture of hot water and white vinegar, immerse the end of the gauge a maximum of 1/2 inch (Fig. 96). Do not agitate the gauge in the mixture.

c) Remove the gauge after 10 minutes and <u>before inverting the end for inspection</u>, remove excess liquid with a cloth. Inspect for adequacy of corrosion removal, and repeat as needed.

d) When corrosion removal is sufficient, immerse the gauge end for one minute in a neutralizing solution of 1 tsp baking soda in 1 quart of clean water, and then immerse in clean water. Again, do not immerse deeper than 1/2”.

e) Before inverting the gauge, dry with a cloth. Only at this stage should the electrical tape be removed. Allow the gauge to air dry. <u>Do not direct pressurized air across the end of the bore</u>!

7. Generously lubricate two 2-003 o-rings with oxygen-safe lubricant. Spools generally are supplied in one of three configurations (Fig. 97), depending upon your hose and gauge. If your spool has full thickness ends, a 70 duro o-ring should be used (Fig. 98), as a 90 duro o-ring is less elastic, and will split during installation (Fig. 99). A 90 duro 2-003 can be installed on a spool with reduced cross-section ends.

Fig. 97

Fig. 98

70 Durometer

Fig. 99

90 Durometer

Setting the o-ring on a firm padded surface (neoprene or silicone mat), firmly press the end of the spool into the center of the o-ring (Fig. 100). The “give” of the padded surface will allow the o-ring to spread around the spool (Fig. 101), and it can be pushed into the land at that point, if necessary, or will pop into place (Fig. 102).

Confirm that you have not occluded the spool ends with lubricant. A rubber tipped air gun supplied with oxygen clean air can be used to clear a lubricant-clogged spool.

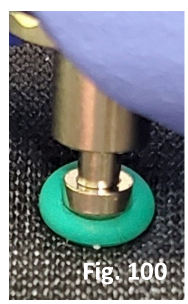


Fig. 100

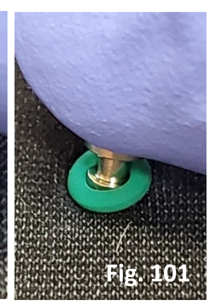


Fig. 101

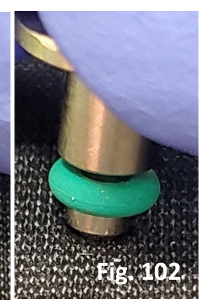


Fig. 102

8. Insert the spool into the gauge end (Fig. 103), and thread the gauge onto the hose. Using two wrenches, tighten the hose nut to the gauge, hand tight (Fig. 104).

TR The dynamic seal is made with the spool o-rings, not the tightness of the threaded connection.

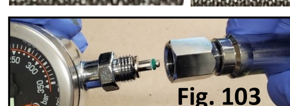


Fig. 103

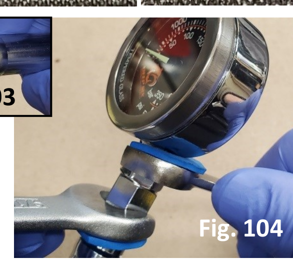


Fig. 104

9. Slide a lubricated 2-012 duro 90 o-ring over the threads on the first stage end of the HP hose.

A 7/16” hose bullet may protect the stiff 90 duro o-ring from damage during installation (Fig. 105).

Fig. 105

This completes SPG and HP hose service.

Low Pressure Hose

1. Using a thin brass or plastic pick, remove the 2-011 o-ring from the first stage end of the hose and discard it.

Always insert the pick parallel to the o-ring and then push the tip diagonally under the o-ring to avoid damaging the land (Fig. 106).

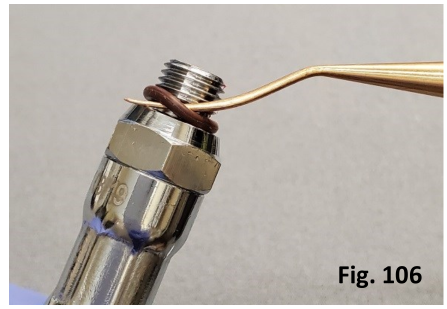


Fig. 106

2. Using a stiff <u>plastic</u> pick, attempt to dig or hook the o-ring from the center post of the second stage end of the hose. If this is not possible, the o-ring can occasionally be removed by <u>carefully</u> sliding a curved thin brass pick underneath (Fig. 107). If your LP hose design has a deep placement of the sealing o-ring, spearing it carefully with the tip of a thin brass pick may be your only alternative. It is important to not damage the sealing land with the tip of the sharp pick.

Alternatively, use of a steel double-hook pick may allow you to safely extract a deep o-ring from a hose end.

Obtain specific training in the use of a steel double hook pick before using it on your own equipment.

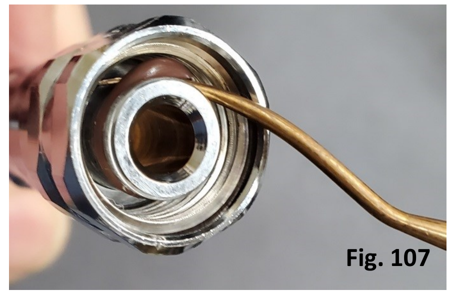


Fig. 107

3. Gently folding the hose into a bow, immerse both hose ends in a container with 2-3" of 50:50 hot water and white vinegar. Soak for 10 minutes, then neutralize by immersing in a solution of 1 tsp baking soda in 1 quart of clean water.

4. For oxygen cleaning, immerse the hoses completely in a solution of dishwashing detergent or Extreme Simple Green. Repeatedly lift one hose end out of the solution, allowing soapy water to drain from the hose. Repeat multiple times.

5. Now immerse the hoses in clean water, and using the same technique of repeated filling and draining, rinse the interior of the hose until no bubbles form on the water surface as the hose drains. This may take several rounds of clean water.

6. Dry the interior of the hose by connecting the hose to an open first stage LP port and blasting intermediate pressure air from the open hose end.

<u>Maintain control of the hose end</u>: prevent physical injury from a flailing hose and metal connector!

7. Inspect for cleanliness by holding a thickly folded clean white cloth over the end of the dry hose. Blast intermediate pressure air from the hose end for several seconds, and inspect the cloth for contamination. If any is noted, repeat steps 3-6 above until the discharge air is clean.

8. Install a new lubricated 2-011 duro 70 o-ring on the first stage end and a new, lubricated 2-010 duro 70 o-ring on the second stage end.

This completes Low Pressure Hose service.

BCD Hose

1. Remove the 2-011 duro 70 o-ring from the first stage end of the hose, and discard it.

2. Using a Schrader valve tool, unscrew the Schrader valve from the other end of the hose. Before attempting to extract the valve, make sure the threads are fully disengaged.
NOTE: With extremely corroded hose ends, the Schrader valve may be extremely resistant to unscrewing. It may be necessary to soak the hose end in 1:1 hot water and vinegar before removal. Alternatively, a two-hour cold soak in your refrigerator freezer may (surprisingly) allow loosening of the parts.

3. Invert the hose end, and the valve should fall or shake out. If not, carefully grasp the valve tip with fine needle-nose pliers or forceps and pull the valve out. Immerse the valve in a mixture of 1:1 hot water and white vinegar for 10 minutes, and then soak in clean water before allowing to dry. Consider replacing a corroded Schrader valve.

4. Removal of the sealing o-ring from the inside of the hose end is now required. While it may be possible to dig the o-ring out of the land with a stiff plastic pick, it is more commonly necessary to use a steel double hook pick. Consider downloading an instructional pamphlet on the use of this tool from
https://scubaboard.com/community/threads/how-to-use-a-double-hook-pick.576600/
Spearing this o-ring with a sharp pick risks damaging the land and creating a leak at the BCD connection.

5. Using the technique described above for low pressure hoses, immerse the hose ends in a warm diluted vinegar solution to remove verdigris corrosion. It is not necessary to disassemble the spring-loaded BCD release mechanism. Now clean the hose as you would any low pressure hose using the instructions on page 35 above, and inspect for residual contamination.

6. Inserting a new lubricated o-ring into its land in the BCD end can be a challenge. The simplest approach is to use a specialty tool such as Scubatools #12-100-500, which guides the o-ring into place quickly, and can in fact be used without removing the Schrader valve (Fig. 108).

Fig. 108

Alternatively, it is possible to place a 1/4" wad of tissue paper in the bottom of the BCD end where the Schrader valve rested. You are creating a "floor" where a new o-ring won't slip below the level of the land, and is instead forced into the land. Use an amount of paper that when squashed flat with a dowel, rests level with the bottom of the o-ring land (Figs. 109, 110).

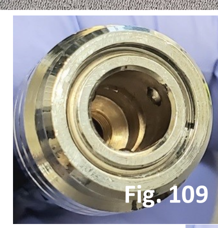


Fig. 109

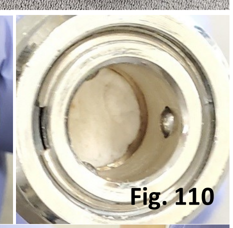


Fig. 110

Ensure that you have the correct o-ring size for your BCD fitting. Squeeze the lubricated o-ring into the fitting, and using a thin dowel, push it inside until it catches in the land on one side. Work the dowel around the land to seat the remaining portions of the o-ring (Fig. 111).

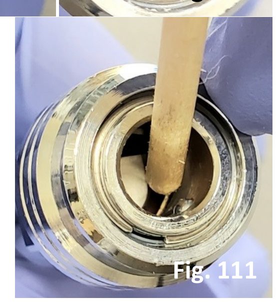


Fig. 111

7. Replace the Schrader valve, screwing clockwise with the Schrader valve tool. Do not overtighten the valve. The seal is made with the plastic seal on the valve body, and not with the threads.
If your BCD fitting does not easily lock into place, you may need to substitute a 3-903 for what you thought was a 2-011 o-ring.
A thicker 2-011 may shear off, or prevent the collar from locking.
Now place a tiny dot of lube in each of the ball bearing holes inside the fitting. Finally, add a lubricated 2-011 o-ring to the first stage end.

This completes BCD Hose service.

DEEP6 SIGNATURE SECOND STAGE SERVICE

DISASSSEMBLY

1. Remove the LP hose. Attach an open end wrench to the hose nut and attempt to unscrew it. If the Heat Sink Nut (#27) begins to turn with the hose nut, attach a thin-profile 11/16" wrench to the narrow flats and hold the heat sink nut in place while the hose is removed (Fig. 112).


Fig. 112

2. Unscrew the faceplate in a counterclockwise direction, and set it aside. Use a blunt brass spade to loosen the thrust washer, if present, and lift it out (Fig. 113). Not all Signature Second Stages will carry one. Do not disassemble the faceplate assembly. It is cleaned as a single unit. If disassembly is required, see Appendix A below.

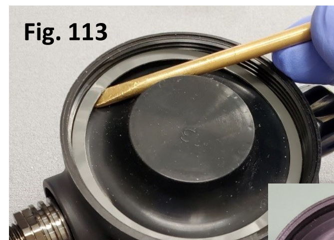


Fig. 113

3. Run a blunt brass spade in the groove around the perimeter of the diaphragm, to break any seal between it and the case (Fig. 114). Once it is loose, lift it free.
If the diaphragm is stuck to the case, do not pull on the diaphragm disc, but continue to work the perimeter of the diaphragm with a blunt tool until it comes free. Do not use a sharp tool.


Fig. 114

4. Loosen the Heat Sink Nut (#27) with an 11/16" wrench.
Unscrew it until it is even with the end of the threaded end of the barrel, but <u>do not remove it</u> (Fig. 115).


Fig. 115

Now strike the heat sink nut firmly with the palm of your hand. The reason for leaving the nut in place is to protect the lever tips from sudden hard contact with the case when a possibly stuck barrel assembly suddenly breaks free.

5. Remove the Heat Sink Nut completely and set it aside.

6. Unscrew the Adjustment Knob (#18) fully until it stops. Grasp the case as shown in Fig. 116 at right.
Simultaneously pull on the lever of the Deflector (away from the case), as you push on the hose end of the barrel with the palm of your hand (into the case).
Pulling on the Deflector will prevent you from losing the barrel pin (#10).

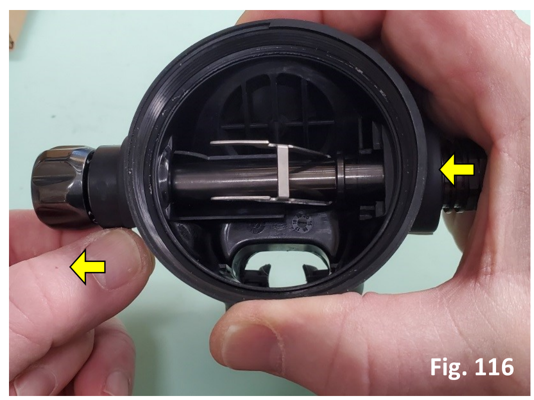


Fig. 116

7. Depress the lever against the barrel, and grasping the Deflector Knob, pull the Deflector and barrel assembly completely from the case (Fig. 117). Make sure the lever slides under the edges of the case opening. Rotating the assembly 180° may facilitate passage of the lever out of the case.


Fig. 117

8. Using a fingertip, remove the 2-014 o-ring (#8) from the recess in the hose side of the case, if it has not already fallen free.

9. Confirm that the Adjustment Knob is fully unscrewed counterclockwise against its stop, to retain the Pin (#10). Depress the lever and rotate the Deflector (#7) 180° around the barrel until the deflector flange covers the lever (Fig. 118). Now slide the deflector assembly (with o-ring #6) off the hose end of the barrel (Fig. 119). Separate the o-ring from the deflector and set the pieces aside.

Fig. 118

Fig. 119

10. Perform the next step over a surface which will contain a loose, rolling part! Identify the shiny ends of the Pin (#10) adjacent to the Adjustment Knob (Fig. 120). Rotate the barrel 90 degrees so that the pin is vertical (Fig. 121), and loosen the Adjustment Knob clockwise. The Pin should fall out onto the work surface (Fig. 122). If it does not fall free, attempt to push it out with a 1.5mm hex key. If it does not come free, turn the Adjustment Knob in a full turn more, soak the end of the barrel assembly in warm 50% vinegar for 10 minutes and try again.

Fig. 120

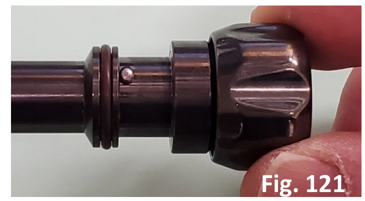


Fig. 121

Fig. 122

12. Once the Pin has been removed, unscrew the Adjustment Knob completely.

TR It may require continued turning with a gentle pull to smoothly remove the knob, as its o-ring tends to catch against the threads of the barrel.

13. When the Adjustment Knob is removed, the Balance Cylinder (#16) and Main Spring (#15) may or may not drop out. Do not lose them while handling the barrel. If they fall out, set them aside.

14. Take the Adjustment Knob, and push the curved end of a thick Parker blunt brass pick into the hole in the shaft of the Adjustment Knob (#18) (Fig. 123). Lever the Plug (#20) out of the knob with the tip of the tool (Fig. 124), and remove it.

Fig. 123

Fig. 124

15. Using a thin pick, remove the 2-011 duro 70 o-ring (#17) from the Adjustment Knob and set it aside. Remove the two o-rings #19 and #21 from the Plug (Fig. 125).

Fig. 125

The Deep6 Signature Second Stage is unique in having a specially designed Turbine Piston in its poppet assembly that improves airflow down the barrel. Additionally, the Turbine Piston increases safety at service and during a dive, by allowing any rotational position on insertion and in motion. Finally, the lever feet in the Signature design are longer than with other brands, ensuring that the poppet never disengages, further increasing diver safety.

These safety features come at a small cost: it can be slightly more difficult to remove the poppet assembly from the barrel than with other designs. Fortunately, the following steps make it easy.

Note the width of the head of the Piston head compared with the space between the feet of the lever (Fig 126).

The legs of the lever must be spread to that extent **(without permanently bending the metal)** in order for the poppet to drop free (Fig. 127).

Note the length of the lever feet in Fig. 128 at right. Their longer length (compared with other designs) ensures continuous engagement with the Turbine Piston in any piston position - an added safety feature.

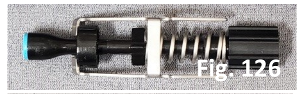


Fig. 126

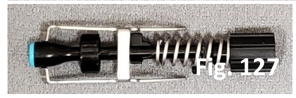


Fig. 127


Fig. 128

16. Take the black mouthpiece zip-tie from the service kit and thread the pointed end up in between one leg of the lever and the barrel (Fig. 129).

17. Form a large loop with the zip-tie and thread it down through the lever on the other side of the barrel (Fig. 130).

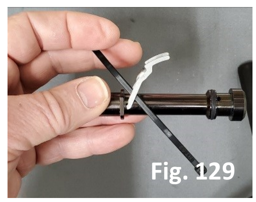


Fig. 129


Fig. 130

18. Fold the lever down, ensuring that the zip-tie is snug against the feet of the lever (Fig. 131). The required spread of the legs is thus provided by the zip-tie (Fig. 132).


Fig. 131


Fig. 132

19. Simply tilt the barrel hose-end up and the poppet assembly will drop free from the other end (Fig. 133). If the Low Pressure Seat (#12) is stuck to the Orifice (#28), the poppet assembly may not drop out. In that case, **gently** push a 1/8” wooden dowel through the center hole in the orifice from the hose end and dislodge the assembly (Fig. 134).

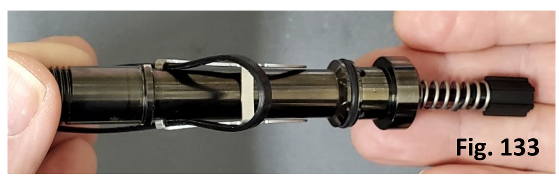


Fig. 133


Fig. 134

NOTE: If the poppet assembly does not drop out with gentle pressure, <u>proceed to Step 20 below</u>. Do not force the assembly from the barrel.
Your chosen zip-tie was probably too thin to provide the required spread of the lever legs.

20. (Optional) If the Turbine Piston (#13) remains stuck in the barrel despite spreading the legs of the lever with a zip-tie, the safest way to proceed is by removing the lever completely.

a) Gently pull the leg of the lever nearest you by firmly grasping it with two fingers and pulling **carefully**. Pull on the lever only as much as is required for the lever foot to clear the square broach in the barrel (Fig. 135), and lift the foot up and free of the barrel.

b) Placing a small piece of paper over the barrel to protect the PVD anti-corrosion finish (Fig. 136), lift the lever past vertical until the tiny feet of the lever (one visible in the opposite square broach) are horizontal.

c) Grasp the other leg of the lever and gently slide it out of the broach.

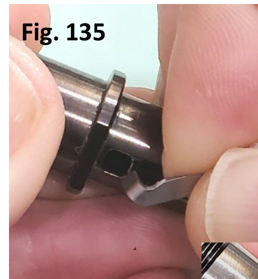


Fig. 135

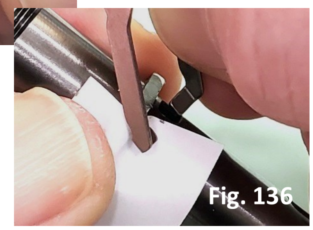


Fig. 136

d) The poppet assembly will now drop free, or if adherent to the orifice, can be gently pushed out with a 1/8" dowel (Fig. 137).


Fig. 137

21. Disassemble the poppet assembly, and set the Main Spring (#15) and Balance Cylinder (#16) aside.

22. Using a fingernail, remove the Low Pressure Seat (#12) from the Turbine Piston (#13) and discard it. Using a fine brass pick, carefully remove the two 2.42 x 0.82 mm o-rings (#14) from the shaft of the Turbine Piston (Fig. 138) and discard them.

TR When using a brass pick, <u>always</u> gently slide the pick into the land parallel to the o-ring, and underneath it. Do not damage the plastic land for this critical o-ring by digging with the point.

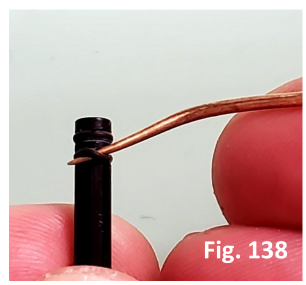


Fig. 138

23. Inspect the lever legs to confirm that they are parallel, and square to the cross-bar of the lever (Fig. 139).

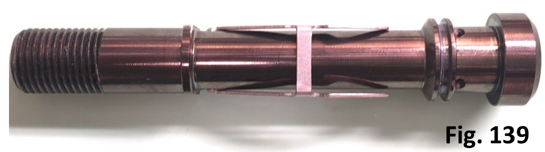


Fig. 139

24. If the lever was removed, inspect the feet of the lever to confirm that they remain symmetrical (Figs. 140, 141).
Set the lever aside.

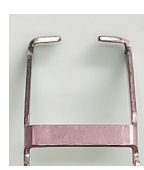


Fig. 140

NOTE: If the lever does not retain its rectangular, symmetrical shape, contact Deep6 for a replacement.

<u>Do not re-bend the lever</u> in an attempt to "make it work", as the metal has become brittle at the point of any bend. Any residual bend in the lever may either impair lever action or risk disengagement from the Turbine Piston, **which may be fatal**.

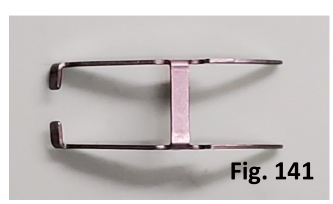


Fig. 141

25. Loosen the Orifice (#28) completely by unscrewing it counterclockwise at least seven turns, using a 5mm hex key. It will not fall out of the barrel, due to the sealing o-ring (#29).

26. Using a 1/8” wooden dowel inserted in the knob end of the barrel, carefully push the orifice from the barrel (Fig. 142).

If resistance is felt, confirm that you have not caught the dowel on one lever foot. If your dowel is too large, it may not pass between the feet of the lever without catching.

Maneuvered carefully, the dowel will either push on the knife edge or catch on the hex ledge inside the orifice.

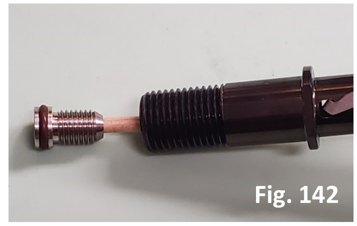


Fig. 142

27. If it was not already done, carefully cut the mouthpiece zip-tie (side cutting snips are safest) and remove the mouthpiece. Discard the zip-tie.

28. Using a stubby flat-bladed screwdriver braced against the palm of your hand, and with thumb and middle finger braced against the case for control, carefully push on the short tab inside the right side of the exhaust tee. Push at a 45° angle to the case, so that force is directed both inward and backward.

The Exhaust Cover (#5) will pop free (Fig. 143).

Do not depress the tab more than 1mm! If the cover does not easily disengage, do not push further, to avoid breaking the tab. Instead, reassess your engagement of the screwdriver with the tab, and the direction of your push.

Fig. 143

29. Inspect the exhaust valve for damage or debris. Inspect the spokes for damage. Inspect the flat face of the case for debris or salt crystals which will need cleaning in the next stage of service, to ensure a perfect seal (Fig. 144).

NOTE: If undamaged, the Exhaust Valve is not removed at service. Proceed to Step 30 only if replacement is necessary.

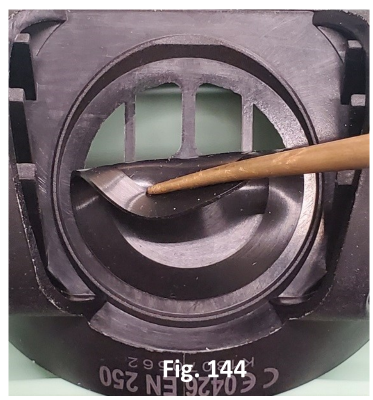


Fig. 144

30. (Optional) To remove the Exhaust Valve, carefully pull on the arrow barb protruding from the inside of the case and cut the spindle of the valve (Fig. 145). Pull both pieces free and discard them.

Although it is possible to remove the valve without cutting, the pull required to do so risks cracking the spokes of the case, as well as damaging the valve barb. **This is not recommended.** Additionally, replacing a used valve with a short barb (previously cut stub) is extremely difficult, and risks damaging the case during reinsertion.

Do not try to reuse a removed exhaust valve.

Fig. 145

This completes disassembly of the Signature second stage.

INSPECTION

1. Rotate the Orifice between two fingertips, with a fingernail of the opposite hand lightly pressed against the knife edge (Fig. 146). Feel for any "catch" or irregularity, which may indicate damage to the knife edge that may impair sealing and raise cracking effort. Inspect under magnification, if possible. Damage to the knife edge may require replacement of the part.

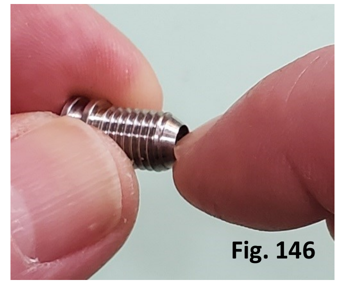


Fig. 146

2. Holding the diaphragm up to a bright light, grasp the skirt and gently stretch segments of the skirt, working your way completely around the diaphragm. Look for a pinhole that appears with stretching. If a hole is discovered, discard the diaphragm. Do not attempt to repair it with any type of glue.

3. Stretch the wings of the mouthpiece and flex it. Look for cuts or holes that may not be apparent at rest (Fig. 147).

Fig. 147

4. Inspect the lever on or off the barrel. Confirm that the sides are parallel (Figs. 148, 150). If off the barrel, confirm that the feet are aligned with each other (Fig. 149). If on the barrel, confirm that the legs do not bind against the barrel (Fig. 150).

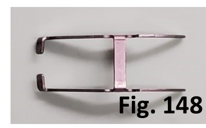


Fig. 148

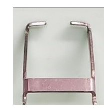


Fig. 149

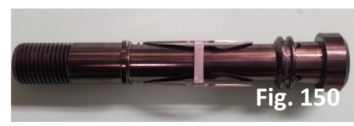


Fig. 150

5. Carefully inspect the case under bright light, looking for any cracks.

SECOND STAGE PARTS CLEANING

Cleaning of the second stage for oxygen use theoretically requires less stringent technique due to the lower pressures involved once breathing gas has left the first stage. Two of the three parts of the fire triangle are present: oxygen and fuel (plastic parts, not to mention residual hydrocarbons from poorly filtered gas or poor maintenance technique). However, an ignition source is harder to find in this lower pressure environment. The typical ignition source in a first stage is either from adiabatic heating after "slam" valve opening, or impact heating and ignition from particulates (tank oxides) striking a fuel source (valve seat) in a high speed air pathway. Neither condition is easily met in a second stage. Nevertheless, we take the position that the same care should be exercised in oxygen cleaning second stage components as is taken with the first stage.

Note that due to the many plastic components in a second stage, not all techniques listed on pages 21-23 (First Stage Parts Cleaning) are applicable. Refer to that section for the proper techniques for cleaning and inspection.

Many second stage metal parts should be cleaned and inspected using the full range of techniques. Those parts include the Air Barrel (#9), Lever (#11) and Orifice (#28). However, the Heat Sink Nut, Pin and Adjustment Knob/Plug require only general cleaning and verdigris corrosion removal.

All plastic parts (within or outside the high oxygen environment) require only gentle detergent cleaning and thorough rinsing.

Second stage service kit parts for oxygen use should receive a gentle detergent wash and thorough rinse.

Inspection technique after oxygen cleaning for all parts is as described on pages 22-23.

SECOND STAGE REASSEMBLY (INITIAL)

1. Lay all cleaned parts out in a manner similar to the Second Stage Reassembly Parts Layout photo. Ensure that all used parts have been replaced with their corresponding Service Kit item. Remove all used components from the work area, so there are no duplicate components present. When finished, there should then be no remaining components on the work surface. This will serve as a check that no parts have been omitted during reassembly.

2. When lubricating o-rings, a thin film or shine on the o-ring is all that is necessary. Excess lube only serves to attract grit. Do not lubricate generously except where specifically indicated.

3. Take the Low Pressure Seat (#12), and with clean, dry gloves, firmly press the shaft into the end of the Turbine Piston (#13). Do not lubricate the seat shaft. Use a flat surface to press the seat into place if necessary (Fig. 151). Ensure that the seat edges meet the piston on all sides.

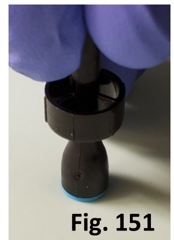


Fig. 151

4. Lubricate the two 2.4mm o-rings (#14) and place them in the lands on the end of the Turbine Piston (poppet). Generously lubricate <u>the gap</u> between the two o-rings (Fig. 152).. The gap then serves as a lubricant reservoir. Now slip the Balance Cylinder (#16) on the end of the poppet just enough that both o-rings are <u>barely inside</u> the neck of the Balance Cylinder

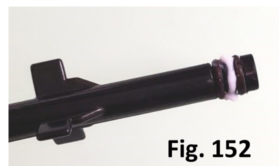


Fig. 152

5. Hold the poppet assembly vertical (LP seat down without spring) and push it firmly against a polished surface (Fig. 153). Perform a "Bounce Test" to confirm that the Balance Cylinder seals with the Turbine Piston. A quick tap with a forefinger against the base of the Balance Cylinder (Fig. 154) should result in the cylinder bouncing back up most of the way (Fig. 155). This should be repeatable as long as the hole in the LP seat remains sealed. Set the assembly aside. If the test fails, the Balance Cylinder, Turbine Piston, LP seat or o-rings may need replacement.

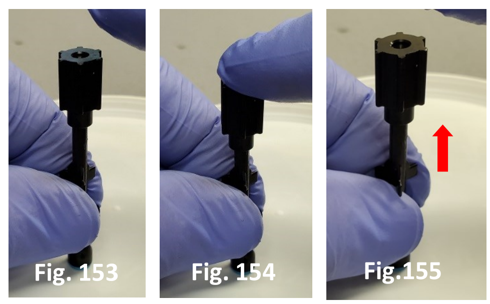


Fig. 153 Fig. 154 Fig.155

6. Add **<u>unlubricated</u>** o-rings #19 and #21 to the lands in the Plug (#20) and insert the plug into the Adjustment Knob (#18). If lubricated, the pressure of the air trapped between the o-rings, coupled with the slipperiness of the lubricant, may cause the plug to extrude slightly after installation. Instead, use a blunt Parker curved pick to work the plug back and forth twice after insertion (~1/8") and then check that the plug cap is fully seated, when viewed from the outside of the knob.

7. Lubricate the 2-011 o-ring (#17) and place it on the end of the Adjustment Knob. Set this component nearby.

8. Place a lubricated 2-010 o-ring (#29) in the land in the end of the Orifice (#28). Taking care to avoid <u>any</u> contact between the knife edge and the barrel, screw the orifice into the barrel with a 5mm hex key. Take extra care on initial insertion to not cross-thread the parts.

9. Using the 5mm hex, screw the orifice clockwise, fully into the barrel until it bottoms, and then <u>unscrew the orifice exactly three full turns</u>.

10. Taking a lubricated 2-015 o-ring (#8), slide it carefully over the threaded end of the barrel and over the lever (if present). Place it in its land at the knob end of the barrel.

11. (Optional) If the lever was previously removed, it is replaced at this step. Inspect the lever to confirm that its legs are parallel, at right angles to the crossbar, with symmetric feet.

a) Holding the barrel in your left hand with the threaded end on the left, and with the hole in the shaft of the barrel pointing **away** from you, lift the lever past vertical until the lever feet are horizontal, and hook one foot of the lever in the square broach facing you (Fig. 156).

b) Fold the lever flat and place a slip of paper over the barrel to protect the PVD finish.

c) Pulling <u>gently</u> on the other leg, lift it over the barrel and spread the legs just enough to allow the other foot to slip into the square broach (Fig. 157).

d) Confirm placement of the lever on the <u>correct side of the barrel</u> by looking at the hole in the mid-barrel with the threaded hose end held on the right. In this orientation, the lever should be **on top** of the barrel (Figs. 158, 159).

e) Reinspect the lever, and confirm that the legs remain parallel and do not bind against the barrel.

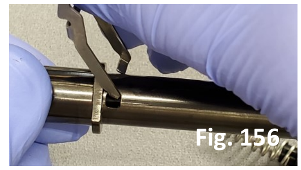


Fig. 156

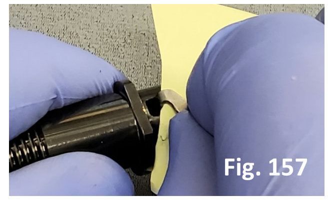


Fig. 157

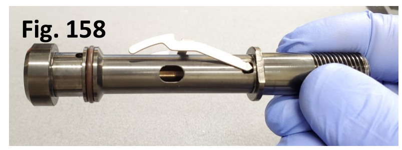


Fig. 158


Fig. 159

12. Taking the poppet assembly, separate the Balance Cylinder from the Turbine Piston and slide the Main Spring (#15) over the shaft of the piston. Insert the Balance Cylinder into the spring end and engage the tip of the piston. Set this assembly nearby for the next step.

13. Taking the zip-tie from the service kit, insert it up inside one leg of the lever, between the lever and barrel (Fig. 160).

14. Making a large loop in the zip-tie, slide it over the barrel and down inside the leg on the opposite side (Fig. 161).

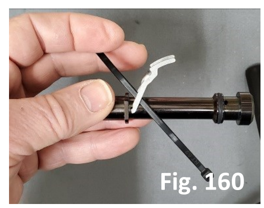


Fig. 160


Fig. 161


Fig. 162

15. Fold the lever flat against the barrel with the zip-tie held at a right angle to the barrel nearest the lever feet (Fig. 162). Taking the poppet assembly in one hand, while holding the lever and zip-tie together, carefully insert the LP seat into the knob end of the barrel and push the poppet assembly into the barrel (Fig. 163).

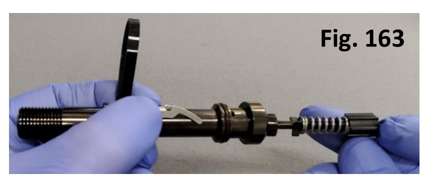


Fig. 163

16. Continue to hold the zip-tie against the feet of the lever. Using a wooden dowel, push on the Balance Cylinder sitting in the barrel end. Slight resistance may be felt as the LP seat slides past the feet of the lever. Approximately 5mm further in, the poppet assembly should come to a stop as the Turbine Piston collar reaches the lever feet. Remove the zip-tie and allow the lever to drop flat.

17. With a dowel pressing lightly against the Balance Cylinder, the lever should spring up (Fig. 164). If the lever does not spring up, see step 18 below. Pressing on the lever should create pressure against the dowel as the spring is compressed inside. The pin hole (red arrow) should be clear.

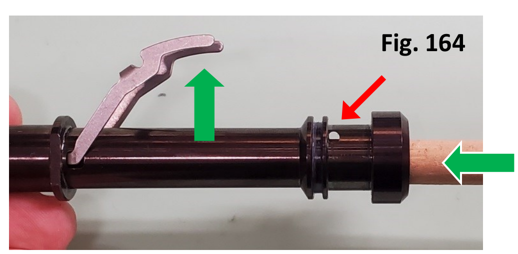


Fig. 164

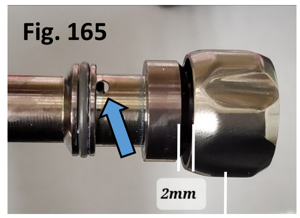
18. (Optional)

If the lever does not rise when the poppet assembly meets what feels like the end of the barrel, it has caught on the lever feet. The Balance Cylinder will be blocking the pin hole. Two strategies can fix this.

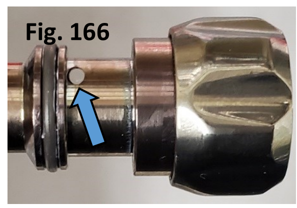
a) Try repeating steps 13-16 with a slightly thicker zip-tie. This may spread the lever feet enough to now allow the poppet to pass between the lever feet. OR,

b) Tip the barrel and allow the poppet assembly to fall out. Remove the lever following step 20 under Disassembly above. Inspect the poppet assembly and identify the LP seat and the large collar around the Turbine Piston (#13). Slowly reinsert the poppet assembly, and using a bright light, watch for the passage of the LP seat face past the tiny square broach in the barrel where the lever rested. Push in the poppet assembly a further 5mm. If the collar of the Turbine Piston appears in the broach, carefully tap the barrel until the assembly backs out slightly. Carefully holding the barrel horizontal to prevent shifting of the poppet assembly, reinsert the lever following step 11 above. Now repeat step 17 above.

19. Insert the Adjustment Knob into the Barrel, and carefully rock the knob to slide the o-ring past the internal threads. Now thread the knob into the barrel. The lever should stay up. When the knob is approximately 2mm from reaching the barrel collar, you will see the o-ring end of the knob finish sliding past the pin hole (Fig. 165).

Fig. 165


20. Continue screwing the knob in, until the pin hole is clear (Fig. 166).

Fig. 166


21. Insert the Pin (#10) spanning both pin holes, holding it symmetrically protruding from each hole. Unscrew the Adjustment Knob until it binds against the pin.
NOTE: The end of the Adjustment knob will tend to displace the pin to one side due to friction, as it begins to bind (Fig. 167).
Take care to ensure that the pin ends protrude symmetrically (Fig. 168), so that the Deflector (#7) will not catch on one pin end in step 23.

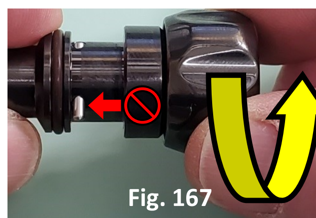


Fig. 167

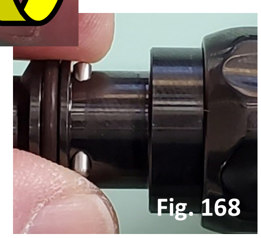


Fig. 168

22. Take a lubricated 2-019 o-ring (#6) and slide it over the Deflector (#7) until it rests adjacent to the Deflector lever.

23. Slide the Deflector over the hose end of the barrel, adjustment tab first, until it begins to cover the lever (Fig. 169). Depress the lever and slide the Deflector (cylindrical flange up) onto the lever. Ensure the Deflector flange covers the lever, and slide the Deflector as far as it will go (Fig. 170). Rotate the Deflector until the lever is uncovered, <u>taking care that the lever doesn't spring up suddenly</u> as the flange clears the lever (Fig. 171). Orient the Deflector so the flange covers the hole in the mid -shaft of the barrel, and lever action is unimpeded. Now fully seat the Deflector at the Knob end, covering and retaining the Pin (#10). If the Deflector catches against one pin end, slide the Deflector back, exposing the pin. Screw in the adjustment knob slightly and recenter the pin. Unscrew the adjustment knob to again hold the pin. Try again to fully seat the Deflector. Now set the barrel assembly aside.


Fig. 169


Fig. 170

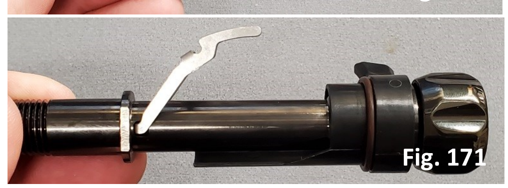


Fig. 171

24. Optional If the Exhaust Valve (#4) was removed, install a new exhaust valve by sliding the barbed spindle through the center hole in the case from the outside. Grasp the nipple with your fingertips (Fig. 172) and gently tug until the barb pops through the hole. Wetting the valve may help with installation. Ensure that the leaflet of the valve seats flat against the outside of the case. Carefully cut the end of the spindle off, leaving a 1-2 mm protrusion past the end of the conical barb.


Fig. 172

25. Hook <u>both</u> tabs protruding from the left side of the Exhaust Cover (#5) into the recess in the case (Fig. 173). Carefully seat the cover in the recess in the case, and press on the <u>right</u> side edge until you hear the tab underneath "click" into its locked position (Fig. 174). Confirm that the edge of the cover is flush with the case.


Fig. 173

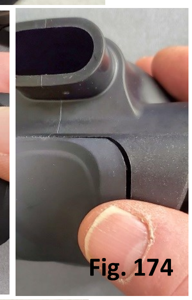


Fig. 174

26. Hold the case with the open face toward you. Pick up the barrel assembly and slide the threaded end into the case from the right. Guide the assembly using the knob only, and do not dislodge the Deflector (Fig. 175).

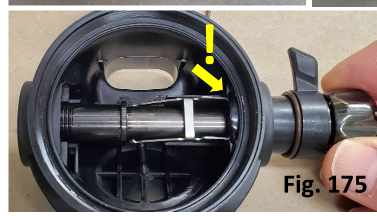


Fig. 175

TR The lever will be depressed as it passes into the case. Control the lever with a finger. Take care that it doesn't spring up abruptly when it enters the case.

Engage the threaded end in the case hole on the left.
As you slide the barrel in completely, ensure that the Deflector Lever slides into its case slot on the right (Fig. 176), and that the flat guides on the barrel slide smoothly between the vertical lugs molded into the left side of the case (Fig. 177).

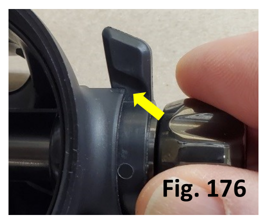


Fig. 176

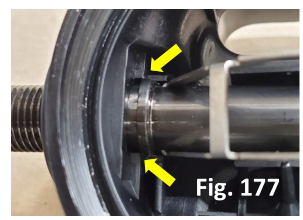


Fig. 177

27. Holding the barrel assembly fully seated with the palm of your hand, slide a lubricated 2-015 o-ring (#8) onto the threaded end of the barrel. Push it down the barrel shaft (Fig. 178). Lightly lubricate the barrel threads. Spin the Heat Sink (#27) nut onto the barrel to seat the o-ring fully in its recess in the outside of the case. Tighten the Heat Sink Nut onto the barrel, finger tight.

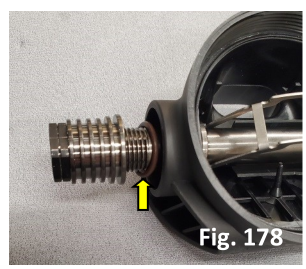


Fig. 178

28. SPECIFICATION Torque the Heat Sink Nut to 35 in-lb.

Do not overtighten the heat sink nut. Excess torque may deform the case, as well as twist the barrel inside the case so that the lever legs are no longer vertical.
If this happens, replacement of the case will be required to safely dive the regulator.

27. Blow through the threaded end of the barrel. If the valve leaks at this pressure, screw the orifice in clockwise using a 5mm hex in 1/4 turn increments until it seals to heavy lung pressure.

TR Always depress the lever when manipulating the orifice, to prevent the knife edge from cutting the low pressure seat.

This completes initial assembly of the Signature second stage.

SECOND STAGE FINAL REASSEMBLY AND TUNING

Final reassembly and tuning is generally conducted under pressure. The lever drops 0.5-1mm upon pressurization, and adjustment under pressure ensures that you retain maximum lever excursion once valve sealing is obtained.

1. With the faceplate and diaphragm off, connect a low pressure hose from your tuned first stage to an inline adjuster, and connect the adjuster to the second stage (Fig. 179). Ensure that the inline adjuster tip can reach the hex broach in the adjustable orifice (#28), and that it is engaged.

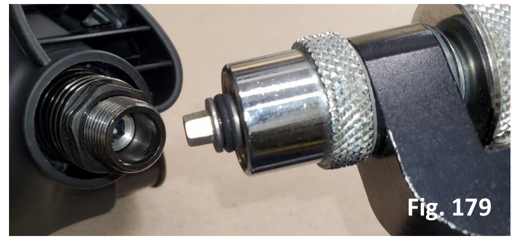


Fig. 179

2. Pressurize the system (turn on the tank) and confirm that the second stage valve leaks. Slowly turn the orifice clockwise until the leak just stops. If the valve did not leak, depress the lever slightly and unscrew the orifice until it leaks, and then screw it back in <u>until it just stops leaking</u>. The valve is now sealed at your first stage's Intermediate Pressure.

TR Spring pressure on the seat will gradually indent it during storage. This is the functional equivalent of backing out the orifice, and a freeflow will likely follow in the next three months. Therefore...

3. Press lightly on the lever to lift the seat from the knife edge, <u>and add 1/12 clockwise turn on the inline adjuster</u>.
A 30° turn (1/12 turn) is most easily visualized as "5 minutes on the clock." **This is your initial orifice position.**
Disengage the hex tip of the inline adjuster, but leave the tool connected. The lever position should be approximately as seen in Fig. 180 at right, <u>when pressurized</u>. **The top of the lever should never be lower than 1mm below the case rim, when pressurized!** If the lever is lower than this, see Troubleshooting, page 51.

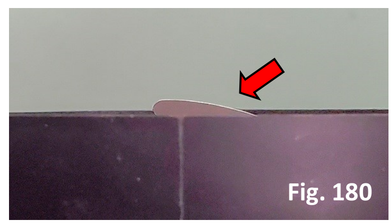


Fig. 180

4. Set your diaphragm carefully in the case, and use a thin dowel to tamp the edges down into the seating groove. There should be a <u>perfect</u> fit of the diaphragm in this groove, and the diameter of the diaphragm should be <u>exactly</u> the size of the case (Fig. 181). If the diaphragm appears slightly small, see step 6 on the next page.

⚠ A small diaphragm may not fully engage the case and may become dislodged during a dive. **This may be fatal!**

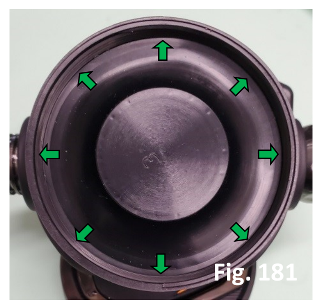


Fig. 181

5. If the lever seemed high in step 3 above, confirm that the diaphragm is not "dangling", or lifted out of its sealing recess by the lever arms. This can be detected by a tilt in the diaphragm disc (Fig. 182),

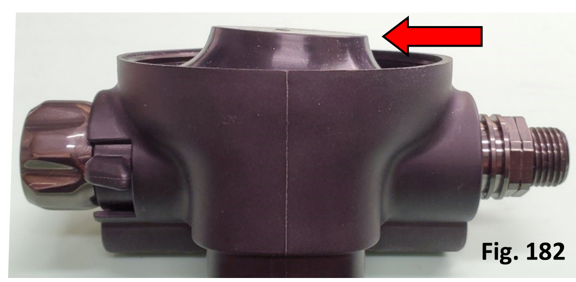


Fig. 182

or by a difference in thread count where the diaphragm edges meet the case (Fig. 183).

If the diaphragm is held up out of its recess, remove the diaphragm and screw in the orifice in 1/12 turn increments ("5 minute increments"), replacing the diaphragm each time until it is fully seated. Remember to depress the lever while making orifice adjustments.


Fig. 183

6. (Optional) It is rarely the case that a stored, loose diaphragm will not maintain its full diameter, due to the natural elasticity of the compound (Fig. 184). This is primarily an issue with diaphragms which are not clamped in the case, but have been "saved up" in case of need.


Fig. 184


Fig. 185

To resize a stored diaphragm, grasp the skirt between each thumb and forefinger, approximately 1" apart (Fig. 185). Stretch the skirt 1/4", then shift your finger position to an adjacent portion of the skirt. Stretch 1/4" again, working your way around the skirt until you have performed this 5-6 times. Inspect the diaphragm for pinholes against a bright light.


Fig. 186

Set the diaphragm back in the case and inspect its diameter. If the diaphragm fully fills the inner diameter of the case (Fig. 186), tamp it into its groove and proceed to step 7.

If the diameter remains slightly small, repeat this operation and inspection until the diaphragm assumes its full original size.

7. With the diaphragm seated, and the orifice and lever height now at their initial adjustment points, seat the thin thrust washer (if present) around the perimeter of the diaphragm (Fig. 187). If a thrust washer is not included with your diaphragm, moisten the upper rim of the diaphragm with a wet fingertip.

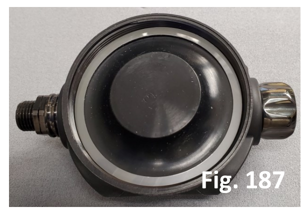


Fig. 187

8. Place a thin 1" line of lubricant in between a first and second thread on the faceplate assembly. Screw on the faceplate. It should reach a hard stop with the Deep6 logo oriented properly on the case (Fig. 188).

Fig. 188

TR It is best to start attaching the faceplate by <u>unscrewing</u> until a slight click is heard or felt as the first thread of the faceplate drops off the first thread in the case. This will help prevent cross-threading.

9. Depressurize the regulator set, and remove the inline adjuster. Do not attach the hose yet.

10. CRITICAL STEP: Before attaching the hose, cover the hose inlet with your finger and inhale gently from the mouthtube. There should be <u>no</u> leak of air into the case. If the regulator leaks, see Troubleshooting, page 51. Reattach the hose with the nut "finger tight."

11. Repressurize the regulator set, and listen carefully for leaks. Turn off the tank and confirm that there is no drop in SPG pressure over five minutes, from a very tiny leak. Alternatively, carefully submerging the second stage in water (without initiating a freeflow), look for a slow leak of bubbles from the mouthpiece. If any leak is found, go to step 12. Otherwise, skip to Step 13.

12. If a leak is noted, depressurize the system, as the front cover may be slightly depressing a high lever. Reattach the inline adjuster and repressurize the system. As in step 3 above, press lightly on the lever and add 1/12 turn clockwise ("5 minutes on the clock"). Release the lever and confirm that there is no leak by repeating step 11. If a leak recurs, there is a flaw in the LP seat-to-orifice interface, or a leak in the balance cylinder mechanism. See Troubleshooting, page 51.

With the orifice and lever adjusted, it remains only to adjust "cracking effort" (the effort required to open the valve).

NOTE: With a smooth orifice knife edge, this regulator's valve will tolerate very low cracking effort without leaking on the surface. However, tuning "hot" (to lower than 1.0 inches of water) will result in slight freeflow when looking straight down in the water. This is not recommended.

SPECIFICATION The minimum cracking effort of the regulator should be between 1.0 and 1.4 inches of water.

Setting Cracking Effort

13A. Magnehelic or Water Manometer To measure cracking effort, connect the mouthpiece of a magnehelic or manometer to the mouthtube on the case of the second stage. Confirm that the Adjustment Knob is fully unscrewed against the stop.

TR While simultaneously watching an Intermediate Pressure gauge attached to a BCD hose, gently inhale from the magnehelic mouthpiece. The cracking effort is the magnehelic value noted when the IP first begins to drop. The valve will open "to feel", with no more than an additional 0.1" effort.

Note the value when the valve opens. **If the initial cracking effort is less than 0.9", add one more 1/12 turn clockwise to the orifice. A maximum of one additional 1/12 turn is allowed. Do not turn the orifice in further, or the lever will drop and impair flow!**

Now recheck cracking effort. If minimum cracking effort is still less than 0.9", see Troubleshooting, page 51. If minimum cracking effort is at least 0.9", screw in the Adjustment Knob until the cracking effort reaches your desired value. Note the amount the knob has been turned (1/4 turn, 1/2 turn, etc.). Always dive the regulator with at least this amount of Knob Adjustment. In contrast, if the minimum cracking effort with the knob fully out is more than 1.4 inches of water, see Troubleshooting on page 51.

Now, fully screw in the Adjustment knob. Recheck cracking effort and confirm that the valve will not open at less than 1.7 inches of water. Then, unscrew the knob to the minimum position determined above. **Always store the second stage with the Adjustment Knob fully out to reduce wear on the LP seat.**

13B. Water Immersion As an inexpensive alternative to using a magnehelic, cracking effort can be measured in a bowl of water or sink. The distance the diaphragm is submerged (in inches of water) when the Intermediate Pressure first begins to drop (the valve begins to open) is the same as the value obtained with a more expensive device. The challenge is that the diaphragm cannot be seen with the faceplate installed. Instead, Fig. 189 below will help you locate the "zero point" and distance submerged.

Pressurize the system and confirm that the Adjustment Knob is fully unscrewed. Hold the pressurized regulator perfectly horizontal as you submerge it. It may require the use of a large bowl to prevent the attached hose from tilting the regulator as the hose levers against the edge of the bowl. Note the point at which the Intermediate Pressure first begins to drop. Using the diagram at right, determine the cracking effort. The regulator should begin to hiss gently, approximately 0.1" deeper in the water.

TR Be careful! Rapid submergence of the regulator may cause a full-on freeflow, splattering water widely!

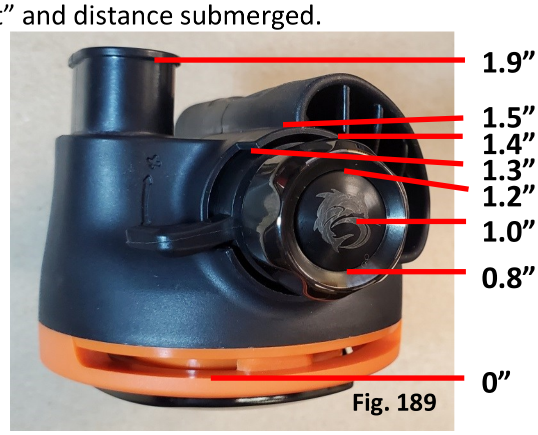


Fig. 189

1.9"	Bottom of Mouthtube Rim
1.5"	Joint of Case and Exhaust Tee
1.4"	Top of Knob
1.3"	Top of deflector lever notch
1.2"	Top of Plug
1.0"	Center of Adjustment Knob
0.8"	Bottom of Plug
0.0"	Groove in faceplate below seam

Note the value when the valve opens. **If the initial cracking effort is less than 0.9", add one more 1/12 turn clockwise to the orifice. A maximum of one additional 1/12 turn is allowed. Do not turn the orifice in further, or the lever will drop and impair flow!** Now recheck cracking effort. If minimum cracking effort is still less than 0.9", see Troubleshooting, page 51. If minimum cracking effort is at least 0.9", screw in the Adjustment Knob until the cracking effort reaches your desired value. Note the amount the knob has been turned (1/4 turn, 1/2 turn, etc.). Always dive the regulator with at least this amount of Knob Adjustment.

In contrast, if the minimum cracking effort with the knob fully out is more than 1.4 inches of water, see Troubleshooting on page 52 below.

Now, fully screw in the Adjustment knob. Recheck cracking effort and confirm that the valve will not open at less than 1.7 inches of water. Then, unscrew the knob to the minimum position determined above. **Always store the second stage with the Adjustment Knob fully out to reduce wear on the LP seat.**

14. Now attach the hose to the second stage. Use two wrenches (one thin 11/16" wrench to hold the Heat Sink Nut and prevent over-torquing of the barrel assembly).

SPECIFICATION Torque the low pressure hose nut to 35 in-lb.

This completes assembly and tuning of the Signature second stage.

Discussion of Cracking Effort Limits

The steps above specify a minimum cracking effort of 0.9" after orifice adjustment. The discussion below will show why this is a critical limit.

Do not add more than one more 1/12 turn increment to the orifice after initial adjustment.

In Fig. 190 at left, we see a normal lever height. However, due to an old, weak spring, this valve sealed at only 0.7" cracking effort. In order to reach specification, this diver continued screwing in the orifice until he reached 1.0", and the resulting lever position is seen in Fig. 191 at right.

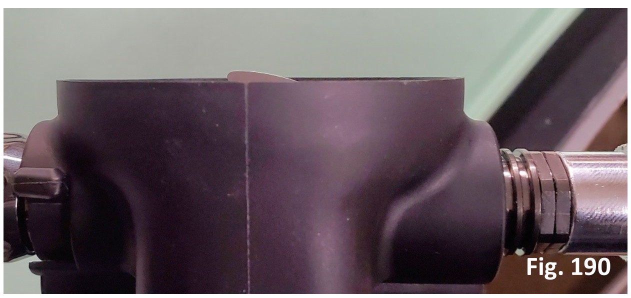


Fig. 190

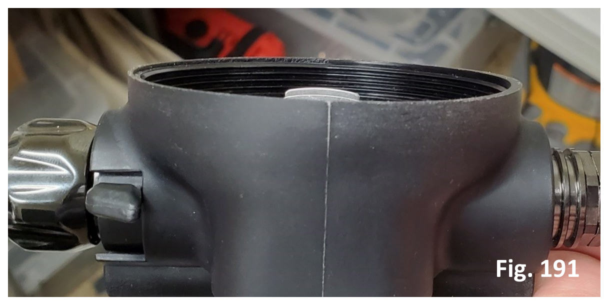


Fig. 191

The low lever in Fig. 191 will severely limit valve opening, producing a dangerously inadequate air flow below 60 feet! This is the reason that only one additional 1/12 turn increment is allowed to increase minimum cracking effort. Beyond this, turning the orifice in further will cause the lever to fall.

This diver had an alternative. Instead, he/she could have left the lever at the correct height, and screwed in the adjustment knob until a 1.0" cracking effort was obtained. Now, however, he/she would be left with only a half turn of remaining adjustment knob movement. Adding that last half turn would give a maximum cracking effort of only 1.3 inches of water - below maximum specification.

What was really needed in this case was slightly increased spring force, obtained by either adding a shim between the spring and balance cylinder (Fig. 191), or replacing the spring itself. Either component is available from Deep6.

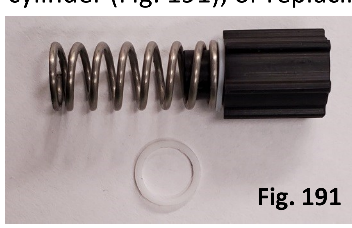


Fig. 191

FIRST STAGE TROUBLESHOOTING

PROBLEM	LIKELY CAUSE(S)	SOLUTION(S)
Intermediate Pressure Drift (Less than 8 psi)	New HP Seat	Cycle the regulator 200-300 times with small breaths Leave first stage pressurized overnight
Intermediate Pressure Drift (Greater than 8 psi)	Debris caught between seat/volcano Damaged HP Seat Damaged volcano	Remove LP port plug; open tank valve & flush 5 sec Replace HP Seat Dress volcano knife edge with soft pencil eraser Replace regulator body (#13)
Intermediate Pressure Creep (IP rise <u>does not stop</u>)	Debris caught between seat/volcano Damaged HP Seat Damaged volcano Damaged Balance Plug o-ring land Damaged Balance Plug o-ring	Remove LP port plug; open tank valve & flush 15 sec Replace HP Seat Replace Regulator Body Replace Balance Plug Replace o-ring (pg. 27)
Low Intermediate Pressure	Adjustment Cap (#32) not adjusted correctly Broken or cracked mainspring (#34)	Remove environmental seal (pg. 14) Adjust IP via Spring Adjuster (pg. 31) Replace mainspring (#34)
Intermediate Pressure drop of <u>more than 20 psi</u> during a second stage purge with a full (3000 psi) tank	Impaired HP gas flow Clogged Metal Filter (#10) Impaired HP seat motion	Open tank valve fully Replace Metal Filter (#10) with gloves with <u>no lube</u> Examine balance plug o-rings and HP seat shaft; lube
Environmental Seal Bulging	Seal installed with reg unpressurized Seal retaining ring loose Helium leak through main diaphragm Air leak at main diaphragm	Reinstall existing seal (pg. 32) Reinstall existing seal (pg. 32) Reinstall existing seal (pg. 32) - will recur Tighten diaphragm clamp (pg. 26) or complete service
Bubbles at any hose or port plug	Loose fitting Damaged o-ring	Tighten fitting Replace o-ring
Bubbling at joint between ribbed IP cap and main regulator body	Loose IP cap Damaged IP cap o-ring (#13)	Tighten with #5 hook spanner Replace 2-024 duro 70 o-ring
Bubbling at joint between diaphragm clamp and main regulator body	Loose Diaphragm clamp Damaged Diaphragm Damaged seating land	Tighten clamp with #5 hook spanner (pg. 26) Replace Diaphragm Replace Regulator Body and/or Diaphragm Clamp
Bubbling at tank connection	Damaged tank o-ring (yoke) Damaged DIN o-ring (DIN) Damaged DIN Retainer o-ring (#12) Damaged Yoke Retainer or DIN Housing o-ring (#11)	Replace tank o-ring Replace o-ring (#6) Replace o-ring (#12) Replace o-ring (#11)
Regulator moves on tank after pressurization	Loose Yoke or DIN retainer (probably due to under-torquing)	Tighten retainer and torque to specification Complete removal and replacement preferred, to prevent shearing o-ring #11 (pg. 29 or 30)
Bubbling at tank connection to reg body	Loose DIN or yoke retainer (probably due to under-torquing) Damaged o-ring #11	Field fix: Loosen retainer two turns, then retighten Permanent repair: reattach retainer (pgs. 29 or 30) Replace o-ring (pg. 29 or 30)
Second Stage Freeflow	High Intermediate Pressure (stable) High IP due to IP Creep Second Stage Problem	Adjust IP (pg. 31) See "Intermediate Pressure Creep" Above See Second Stage Troubleshooting below
Second Stage Zero Flow	Tank off Sintered metal filter clogged IP extremely low Second Stage Problem	Turn on tank Replace filter (complete service likely required) Adjust IP via Spring Adjuster (pg. 31) See Second Stage Troubleshooting below

SECOND STAGE TROUBLESHOOTING

PROBLEM	LIKELY CAUSE(S)	SOLUTION(S)
Failed negative pressure check (gentle inhale with finger over hose inlet)	Test conducted with 1st stg attached Diaphragm damaged or displaced Case cracked O-ring #8 on barrel damaged O-ring #8 under Heat Sink Nut damaged or missing O-ring #17 on Adjustment Knob damaged or missing	Leak is from open first stage valve; disconnect/retest Remove faceplate; inspect and reattach/replace Inspect under bright light; replace case Replace o-ring #8 Replace o-ring #8 Replace o-ring #17
Bubbling from hose connection	Loose connection Damaged o-ring	Tighten to 35 in-lb Replace o-ring (pg. 35)
Second Stage Freeflow (includes very slow bubbling that may not be audible)	High Intermediate Pressure (stable) High IP due to IP Creep Second Stage Orifice mis-adjusted Damaged orifice knife edge Damaged or “old & indented” LP seat Damaged orifice o-ring #29 Damaged Piston o-ring #14	Adjust IP (pg. 31) See IP Creep Above Tune Second Stage (pg. 47) Replace orifice Service Second Stage and replace LP seat (#12) Replace o-ring #29 Replace o-ring #14
Second Stage Zero Flow	Tank off Sintered metal filter clogged IP extremely low Lever Disengaged - reg “rattles”	Turn on tank Replace filter (complete service likely required) Adjust IP via Spring Adjuster (pg. 31) Service Second Stage; inspect for lever breakage
Poor air delivery	Adjustment Knob Screwed In Fully Low First Stage IP Low lever position - reg “rattles” Debris in valve assembly	Unscrew Adjustment Knob to tuned position See First Stage Troubleshooting above Retune Second Stage (pg. 47) Service Second Stage
Regulator Breathes Wet	Cracking Effort Set Too Low (“Hot”) Exhaust Valve defective Case cracked O-ring #8 on barrel damaged O-ring #8 under heat sink damaged or missing O-ring #17 on Adjustment Knob damaged or missing O-ring #6 damaged	Screw in Adjustment Knob to raise cracking effort Remove Exhaust Cover; clean leaflet or replace valve Inspect under bright light; replace case Replace o-ring #8 Replace o-ring #8 Replace o-ring #17 Replace o-ring #6
Minimum cracking effort with Adjustment Knob fully out is less than 0.9” of water after reassembly and <u>two</u> 1/12 turn additions after sealing	Poppet mainspring (#15) has weakened.	Add shim to poppet assembly - contact Deep6 Replace mainspring (#15) - contact Deep6
Minimum cracking effort with Adjustment Knob fully out is more than 1.4” of water after reassembly.	Scratched orifice requires excess spring pressure to seal Spring is caught on neck of Balance Cylinder Damaged LP seat requires excess spring pressure to seal	Polish or replace orifice knife edge Disassemble poppet assembly and inspect; reassemble Replace LP seat #12
Maximum cracking effort with Adjustment Knob fully screwed in is less than 1.7” of water.	Poppet mainspring (#15) is weak. LP seat is heavily indented Orifice (#28) is scratched	Replace or shim spring (#15) - contact Deep6 Service second stage and replace LP seat Replace orifice (#28)
Lever is more than 1mm below case rim after sealing the LP seat to the orifice and adding 1/12 turn.	Orifice is scratched or flawed, requiring heavy pressure to seal LP seat is heavily indented Mainspring (#15) has weakened	Replace or polish orifice knife edge Service second stage and replace LP seat Replace or shim spring (#15) - contact Deep6

QUICK REFERENCE SERVICE STEPS - FIRST STAGE

- Modified Grade E Air only
- Use a maximum of 40 psi gas for drying and disassembly, wherever possible
- Do not lubricate threads except where specifically indicated in the manual

FIRST STAGE DISASSEMBLY

1. Remove all hoses and SPG
2. Plug all LP and HP ports except 1 HP, and 1 LP on side of turret
3. Use two #5 hook spanners to remove environmental cap (#39) without loosening diaphragm
4. Peel out environmental diaphragm (#38); invert reg and drop out transpiston (#37)
5. Unscrew Spring Adjuster (#35) to remove all mainspring pressure
6. Mount reg in vise and using #5 hook spanner, loosen diaphragm clamp (#36)
7. Invert reg and unscrew diaphragm clamp from below, catching contained loose parts
8. Mount reg in vise and pop out diaphragm with compressed air ⚠ NO METAL TOOLS!
9. Invert reg and drop out valve lifter (#30)

10 - Yoke: Mount reg in padded vise (not using vise holder) and remove Knob
11 - Yoke: Using 3” extension and 3/4” socket, remove Yoke Retainer
10 - DIN: Mount reg in padded vise (not using vise holder) and remove DIN Retainer and Wheel
11 - DIN: Using 13/16” wrench or socket, remove DIN Housing

12. Mount reg in vise with IP cap up and loosen IP cap (#24) with #5 hook spanner
13. Remove IP cap and remove 2-024 o-ring from body; push out diaphragm with dowel if needed
14. Mount turret in vise and disassemble turret from IP cap with 8mm hex
15. Remove thrust washer and two o-rings
16. Remove all remaining port plugs
17. Loosen Balance Plug (#21) with 4mm straight shaft hex key ⚠ Do not use ball-end key
18. Invert reg and unscrew balance plug by hand, maintaining upward pressure
19. Disassemble balance plug assembly and remove two o-rings ⚠ NO METAL TOOLS!

FIRST STAGE REASSEMBLY

1. Lay out parts per Reassembly Parts Layout photo
2. Drop valve lifter into body
3. Gently fold diaphragm and slide under threads into groove ⚠ NO LUBE on or near diaphragm
4. Use brass spade to confirm seating
5. Screw spring adjuster into 5-thread end of diaphragm clamp exactly three turns
6. Assemble diaphragm clamp ass’y upside down with washer, spring, lube, washer and spring pad
7. Screw diaphragm clamp up into reg body from below, to retain loose parts; mount reg in vise
8. **SPECIFICATION** Tighten diaphragm clamp to 266 in-lb OR metal-to-metal, whichever is first
9. Tighten spring adjuster three more turns
10. Assemble balance plug assembly with 3-905 o-ring, lubed 2-006 o-ring, spring and HP seat
11. Screw up into reg body, ⚠ taking care to center valve lifter pin in HP seat face on initial insertion
12. **SPECIFICATION** Torque balance plug to 80 in-lb with ⚠ straight-shaft 4mm hex;
13. Unscrew spring adjuster 1 turn
14. Assemble turret, **SPECIFICATION** torquing turret to IP cap with 8mm hex to 150 in-lb
15. Attach lubed IP cap to reg body; tighten using #5 hook spanner with firm metal-to-metal contact

16 - Yoke: Assemble yoke retainer with yoke, saddle, filter and sealing o-ring ⚠ Check o-ring duro!
17 - Yoke: Screw yoke ass’y up into reg body, not inverting until sealing o-ring is trapped in place
18 - Yoke: **SPECIFICATION** Torque yoke retainer to 230 in-lb in one smooth motion; add dust cap/knob
16 - DIN: Filter, o-ring ⚠ Check duro, saddle on housing; screw up into body; invert after o-ring trapped
17 - DIN: **SPECIFICATION** Torque DIN housing to 230 in-lb in one motion; add wheel/retainer/o-ring
18 - DIN: **SPECIFICATION** Torque DIN retainer to 80 in-lb

19. Add port plugs, leaving one HP and two LP open for tuning
20. Tune IP to 138 psi at 500 psi tank pressure; increase IP at 3000 psi tank as needed to reach 125 psi

QUICK REFERENCE SERVICE STEPS - SECOND STAGE

⚠
- Modified Grade E Air only
- Use a maximum of 40psi gas for drying and disassembly, wherever possible

SECOND STAGE DISASSEMBLY

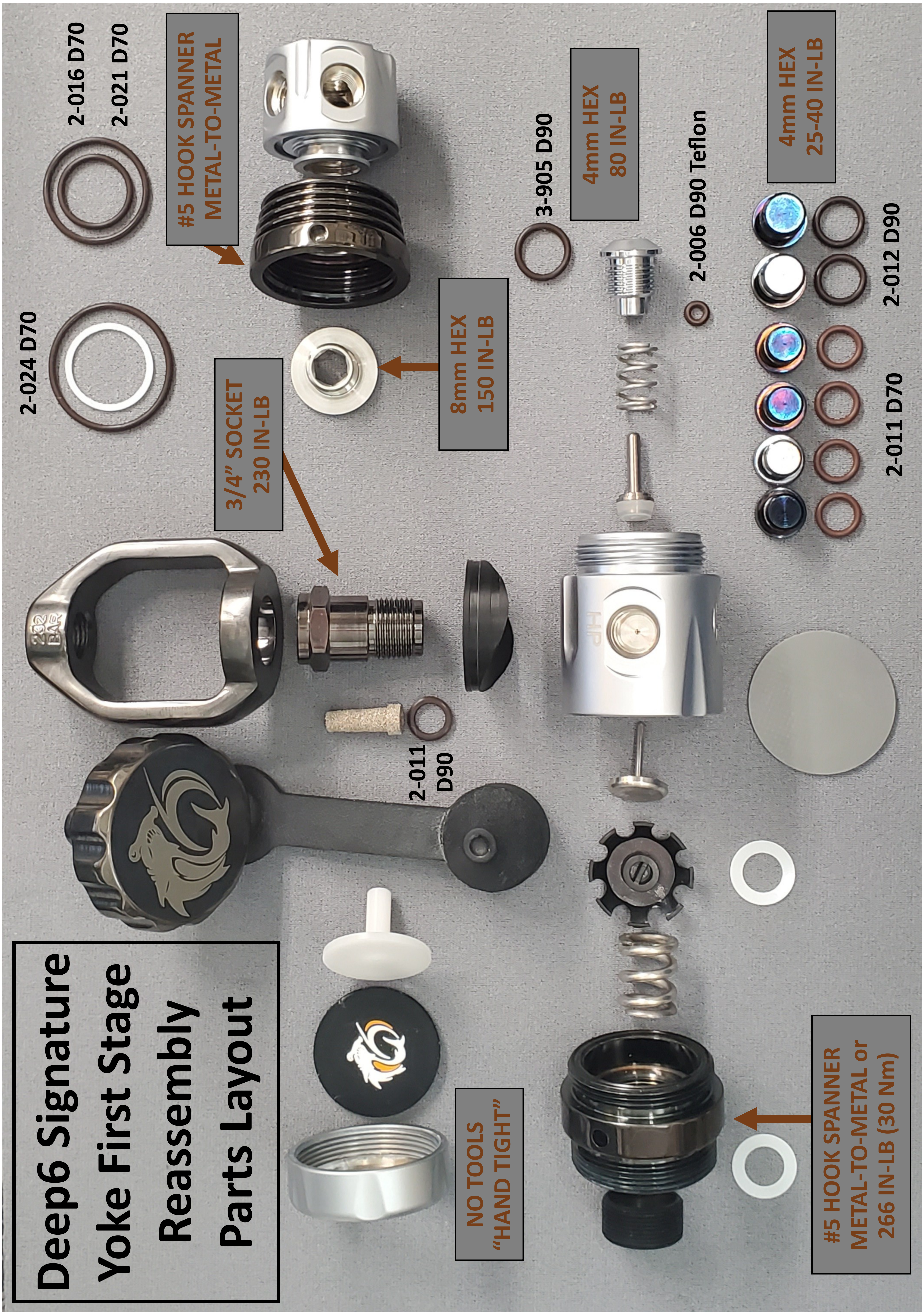
1. Remove hose with two wrenches to retain Heat Sink Nut (#27)
2. Remove faceplate; loosen thrust washer and diaphragm with Parker spade and remove
3. Loosen Heat Sink Nut (#27) as far as threaded end of barrel
4. Unscrew Adjustment Knob until it stops (to hold pin)
5. Loosen barrel with palm strike on Heat Sink Nut; remove it, then pull on Knob and Deflector lever
6. Hold lever down and slide out barrel assembly and Deflector
7. Remove o-ring #8 from hose side of case (may fall out during barrel removal)
8. Fold lever down, rotate Deflector (#7) to cover it and slide it off barrel; remove its o-ring
9. Loosen Adjustment Knob and allow Pin (#10) to fall out
10. Remove Adjustment Knob, Balance Cylinder (#16) and Main Spring (#15)
11. Remove knob plug and its o-rings; remove knob o-ring
12. Thread zip-tie between lever and barrel to spread legs; tilt barrel and allow poppet assembly to fall out
13. Remove lever only if necessary to extract poppet ⚠ Don't bend legs!; disassemble poppet assembly
14. Unscrew orifice fully and push out with 1/8" dowel
15. Remove mouthpiece
16. Use stubby screwdriver to carefully depress Exhaust Cover tab; remove cover; inspect valve
17. Remove Exhaust Valve only if damaged

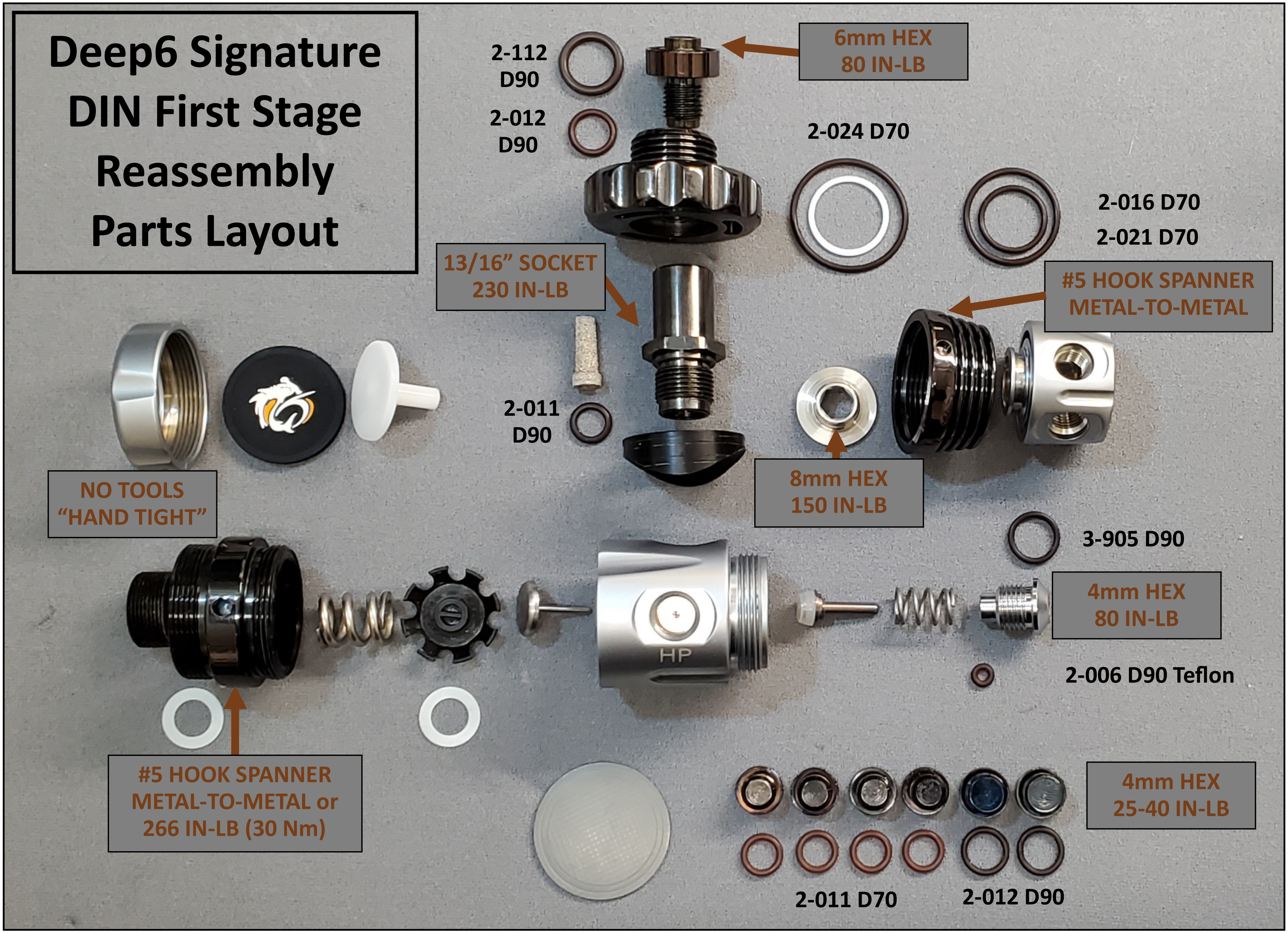
SECOND STAGE INTIAL REASSEMBLY

1. Lay out parts per Quick Reference photo
2. Insert LP seat without lube; add o-rings to Turbine Piston and lube gap; perform "Bounce Test"
3. Reinstall Knob Plug with unlubricated o-rings; add lubricated knob o-ring
4. Install orifice o-ring and screw orifice in fully; back out three turns
5. Install barrel o-ring
6. Reinstall lever if removed
7. Assemble Turbine Piston, Main Spring and Balance Cylinder; set nearby
8. Use zip-tie threaded between lever legs and barrel to spread lever legs 2mm
9. Install poppet assembly and confirm piston contact with lever feet by lever action
10. Install Adjustment Knob until Pin holes are clear
11. Center the Pin (#10) in holes and unscrew Adjustment Knob to capture
12. Add o-ring to Deflector; install from hose end; pass flange over lever, then rotate to allow lever action
13. Install new Exhaust Valve (#4) if needed, and cut spindle 1-2mm past barb; attach Exhaust Cover (#5)
14. Slide barrel into case; protect lever from jumping; align barrel flats with case lugs
15. Install o-ring #8 onto hose end; attach Heat Sink Nut finger tight
16. **SPECIFICATION** Torque Heat Sink Nut to 35 in-lb. ⚠ Do not over-torque!
17. Using lung pressure, tighten orifice to seal

SECOND STAGE FINAL REASSEMBLY AND TUNING

1. Seal orifice at IP; add 1/12 turn on orifice
2. Check lever height while pressurized; check for high lever diaphragm "dangle"; lower if necessary
3. Check replacement diaphragm diameter (stretch older stored diaphragm in segments to fit, if needed)
4. Install diaphragm, thrust washer (if present) and faceplate; depressurize/remove inline adjuster
5. Negative pressure check without hose
6. Repressurize; check for leaks; fix leaks with inline adjuster to "seal plus 1/12 turn"
7. Check min cracking effort; add only 1/12 turn more to orifice to raise cracking effort to 0.9" if needed
8. Troubleshoot persistent min cracking effort under 0.9/over 1.4 inches water
9. **SPECIFICATION** Set cracking effort 1.0-1.4"; remember knob position for desired cracking effort


Deep6 Signature
Yoke First Stage
Reassembly
Parts Layout
NO TOOLS
"HAND TIGHT"
2-011
D90
3/4" SOCKET
230 IN-LB
2-024 D70
8mm HEX
150 IN-LB
#5 HOOK SPANNER
METAL-TO-METAL
2-016 D70
2-021 D70
3-905 D90
4mm HEX
80 IN-LB
2-006 D90 Teflon
4mm HEX
25-40 IN-LB
2-012 D90
2-011 D70
#5 HOOK SPANNER
METAL-TO-METAL or
266 IN-LB (30 Nm)



Deep6 Signature
DIN First Stage
Reassembly
Parts Layout
2-112
D90
2-012
D90
6mm HEX
80 IN-LB
2-024 D70
2-016 D70
2-021 D70
13/16” SOCKET
230 IN-LB
#5 HOOK SPANNER
METAL-TO-METAL
2-011
D90
8mm HEX
150 IN-LB
NO TOOLS
“HAND TIGHT”
3-905 D90
4mm HEX
80 IN-LB
HP
2-006 D90 Teflon
#5 HOOK SPANNER
METAL-TO-METAL or
266 IN-LB (30 Nm)
4mm HEX
25-40 IN-LB
2-011 D70
2-012 D90

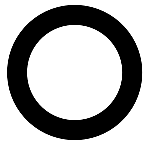

Deep6 Signature
Second Stage
Reassembly Parts Layout
2-019
D70
2.42 x 0.82
D70 Teflon
35 IN-LB
DEEP
FULLY SEAT ORIFICE
THEN BACK OUT
THREE TURNS
2-015
D70
2-010
D70
2-015
D70
2-011
D70 Teflon
2-006
D70
2-014
D70

First Stage Service Kit Components

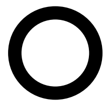
(All components actual size)

DIN

(6) 2-112 D90 O-ring Viton
10-AS568-112-04



(15) 2-012 D90 O-ring Viton (1)
1O-AS568-012-04



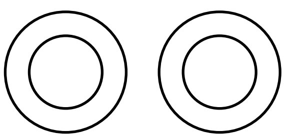
Yoke

No Unique Service Kit Items

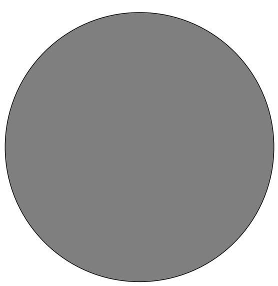
Common

IP Compartment

(33) Antifriction Washer (2)
1P-01-005-02



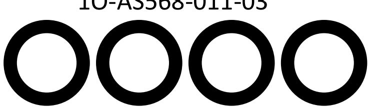
(31) Diaphragm, 1.4”
1P-01-010-03-01



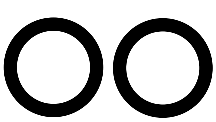
(3)

Port Plugs

(29) 2-011 D70 O-rings (Viton) (4)
1O-AS568-011-03

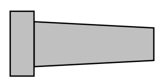


(15) 2-012 D90 O-rings (Viton) (2)
1O-AS568-012-04

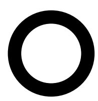


HP Compartment

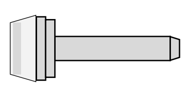
(10) Filter
1F-01-005-02



(11) 2-011 D90 O-ring (Viton)
1O-AS568-011-04

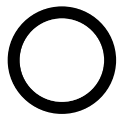


(17) HP Seat
1B-01-002-02-PAH



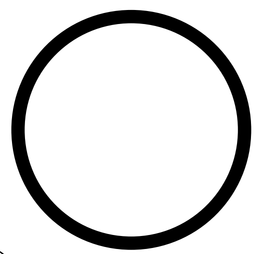
(18) 2-006 D90 O-ring (Teflon)
1O-AS568-006-07

(20) 3-905 D90 O-ring (Viton)
1O-AS568-905-04

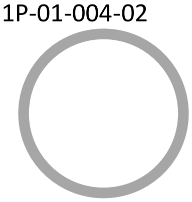


IP Cap/Turret

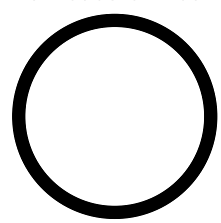
(16) 2-024 D70 O-ring (Viton)
1O-AS568-024-03



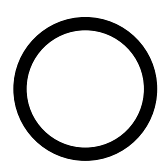
(23) Swivel Thrust Washer
1P-01-004-02



(26) 2-021 D70 O-ring (Viton)
1O-AS568-021-03



(25) 2-016 D70 O-ring (Viton)
1O-AS568-016-03

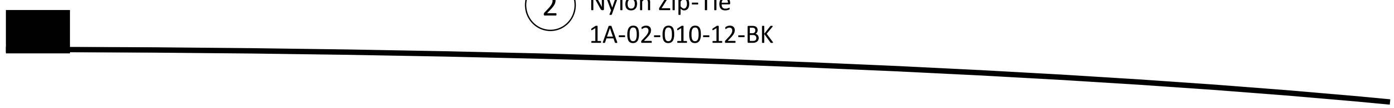


Scale: Reproduce this diagram at a scale that makes this line exactly 4.0 inches long

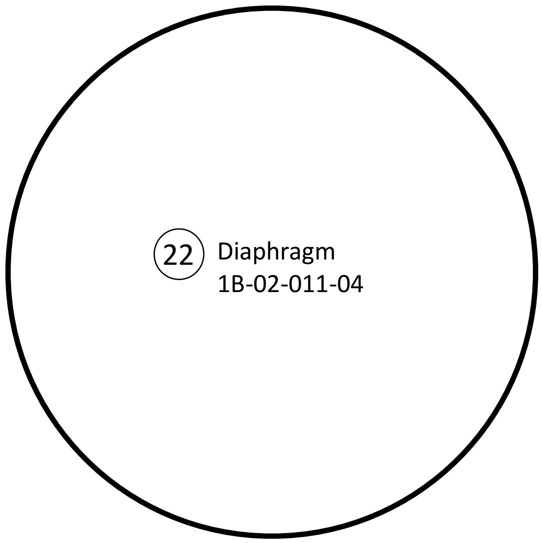
Second Stage Service Kit Components

(All components actual size)

2 Nylon Zip-Tie
1A-02-010-12-BK



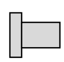
3 Mouthpiece
1Z-10-00005-05-BK-GY



22 Diaphragm
1B-02-011-04

Poppet Assembly

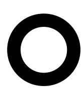
12 Low Pressure Seat
1B-02-022-06



14 2.4x.82mm D70 O-rings (Teflon) (2)
1O-EKM-2.4x.82-06

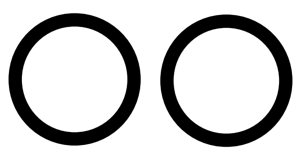
Orifice

29 2-010 D70 O-ring (Viton)
1O-AS568-010-03

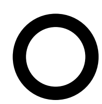


Barrel Assembly

8 2-015 D70 O-rings (Viton) (2)
1O-AS568-015-03

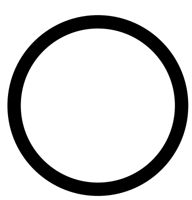


17 2-011 D70 O-ring (Teflon)
1O-AS568-011-06



Deflector

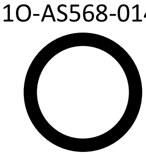
6 2-019 D70 O-ring (Viton)
1O-AS568-019-03



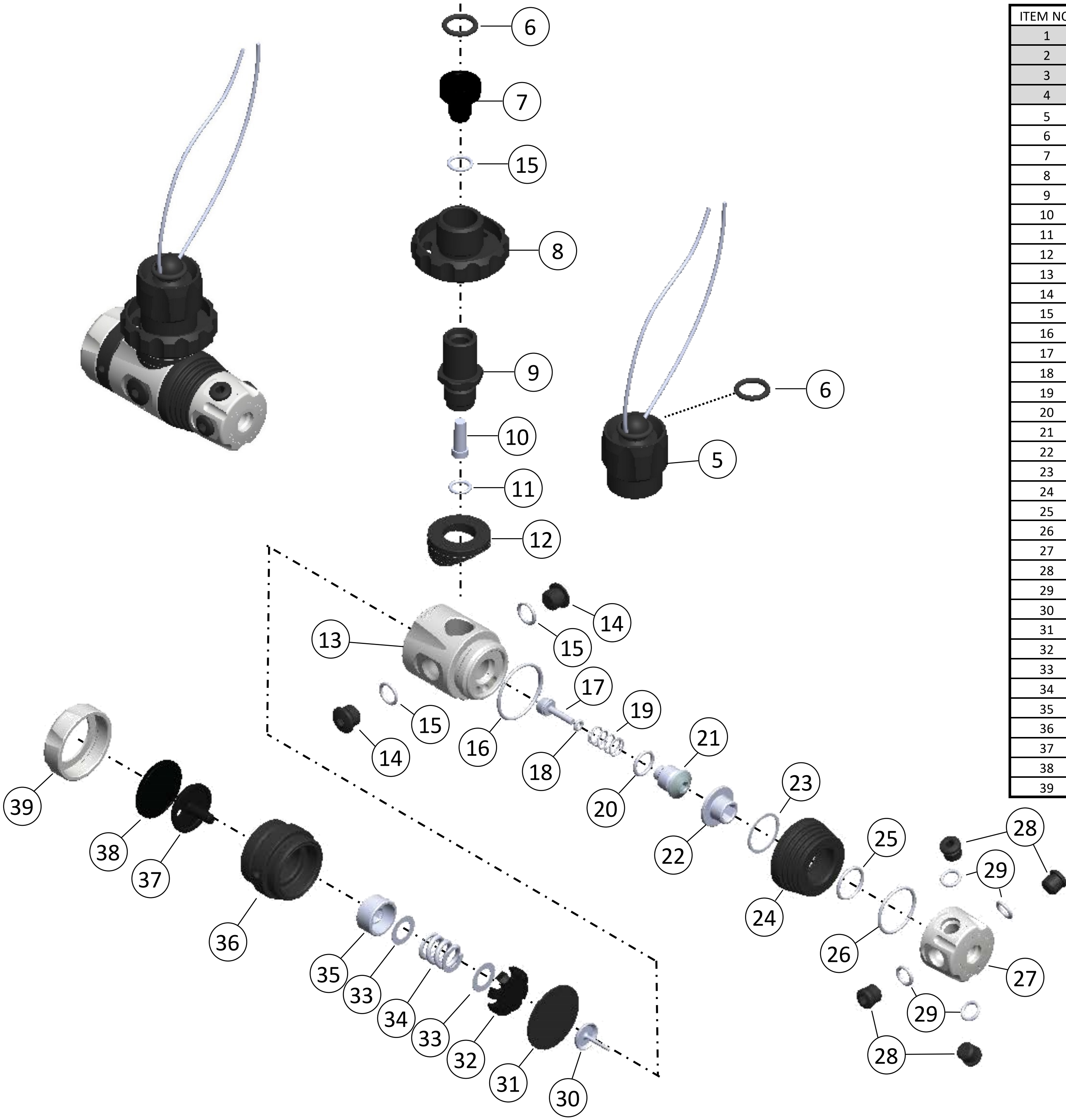
Plug

19 2-006 D70 O-ring (Viton)
1O-AS568-006-03

21 2-014 D70 O-ring (Viton)
1O-AS568-014-03

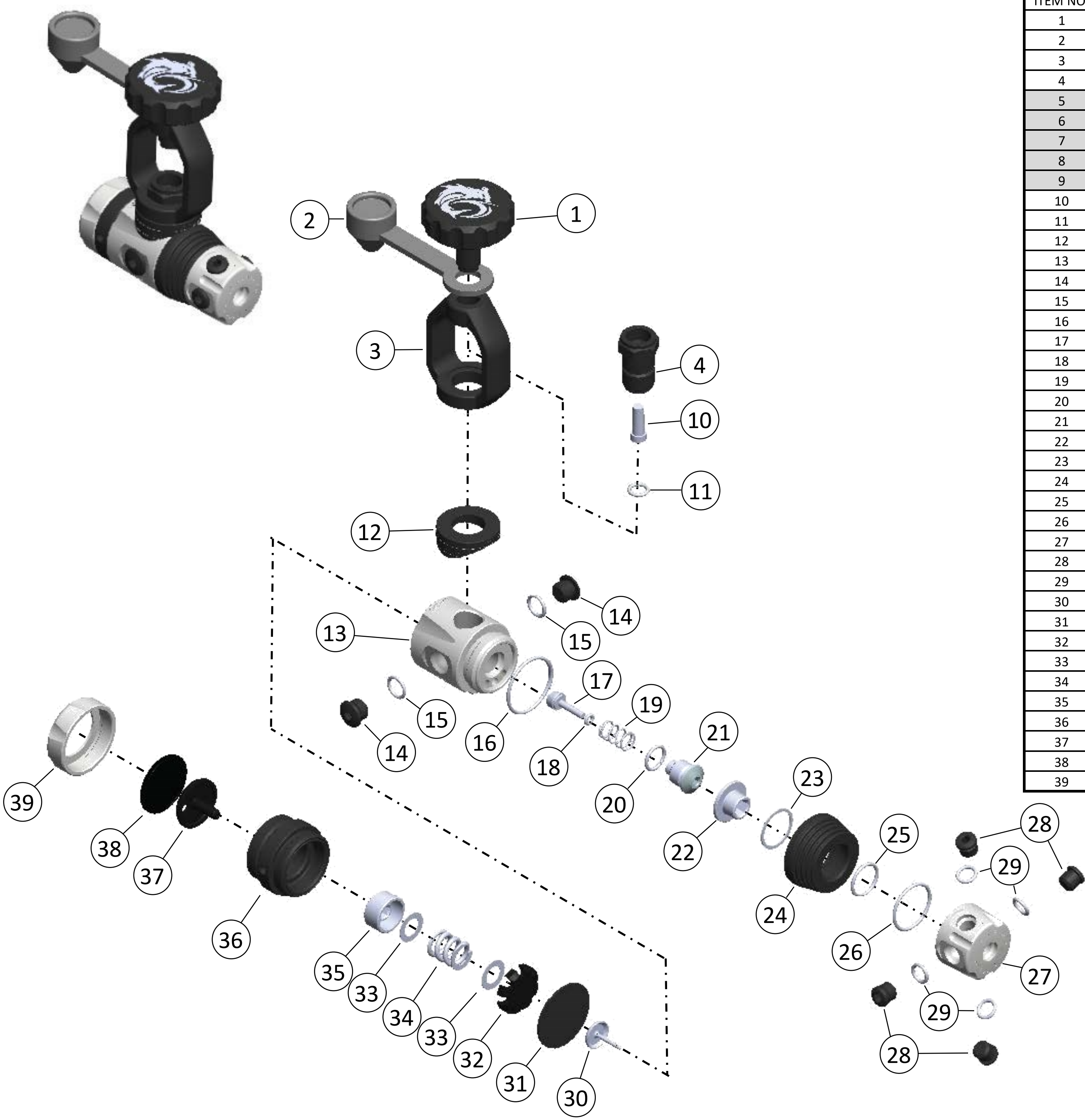


Scale: Reproduce this diagram at a scale that makes this line exactly 4.0 inches long



ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1		YOKE ITEM	N/A
2		YOKE ITEM	N/A
3		YOKE ITEM	N/A
4		YOKE ITEM	N/A
5	0Z-10-00080-01-D6	DIN DUST CAP (D6)	1
6	10-AS568-112-04	112 O-RING D90	1
7	1C-01-007-07-PVD	DIN RETAINER	1
8	1C-01-017-12-PVD	DIN WHEEL	1
9	1C-01-017-15-PVD	DIN HOUSING	1
10	1F-001-005-02	FILTER	1
11	1O-AS568-011-04	011 O-RING D90 VITON	1
12	1C-01-017-14	D6 SADDLE	1
13	1C-01-017-09-PSC-R	D6 BODY	1
14	1C-01-015-02-PVD	HP PORT PLUG	2
15	1O-AS568-012-04	012 O-RING D90 VITON	3
16	1O-AS568-024-03	024 O-RING D70 VITON	1
17	1B-01-002-02-PAH	HP SEAT	1
18	1O-AS568-006-06	006 O-RING D90 TEFLON	1
19	1D-01-002-02	SEAT SPRING	1
20	1O-AS568-905-04	905 O-RING D90 VITON	1
21	1C-01-017-03	BALANCE PLUG	1
22	1C-01-004-07	SWIVEL RETAINER	1
23	1P-01-004-02	SWIVEL THRUST WASHER	1
24	1C-01-017-08-PVD	IP CAP	1
25	1O-AS568-016-03	016 O-RING D70 VITON	1
26	1O-AS568-021-03	021 O-RING D70 VITON	1
27	1C-01-017-07-PSC	SWIVEL TURRET	1
28	1C-01-015-01-PVD	LP PORT PLUG	4
29	1O-AS568-011-03	011 O-RING D70 VITON	4
30	1C-01-017-05	VALVE LIFTER	1
31	1P-01-010-03-01	DIAPHRAGM (1.40")	1
32	1A-01-017-08	SPRING PAD	1
33	1P-01-005-02	ANTI-FRICTION WASHER	2
34	1D-01-011-02	SPRING	1
35	1C-01-011-09-PBSC	SPRING ADJUSTER	1
36	1C-01-017-10-PVD	DIAPHRAGM CLAMP	1
37	1A-01-017-07-D6	D6 TRANSPISTON	1
38	1A-01-017-09	D6 SILICONE DISK	1
39	1C-01-017-11-PSC	ENVIRONMENTAL CAP	1

DEEP EXPEDITION DIVE GEAR		NAME
	DRAWN	SCOTT
	DATE	2017/10/17
SIZE A3	DWG NO 0RG1117YICAV-D6-MODIFIED	REV B
ORIGINAL FILE NAME: ORG1117DICAV-D6-SABOM(B)	SCALE:	1:2.5
MODIFIED BY: ROBERT C. SINGLER 2021/12/15	SHEET	1 OF 1

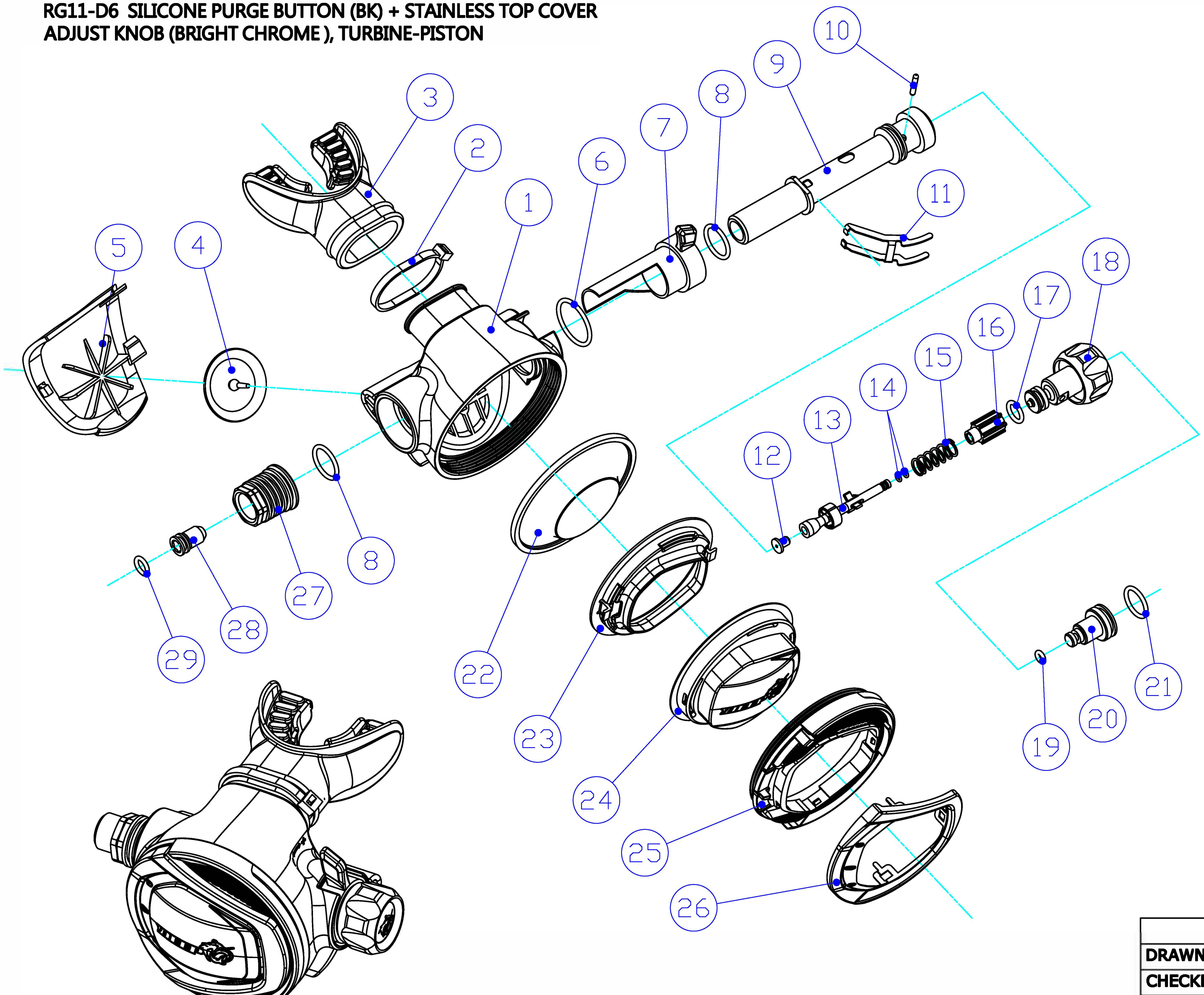


ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	1C-01-017-13-PVD-R	YOKE KNOB	1
2	1Z-ZG-341-0117-LA	DC-3 DUST CAP	1
3	1F-01-002-01-PVD	232 BAR YOKE	1
4	1C-01-012-09-PVD	YOKE RETAINER	1
5		DIN ITEM	N/A
6		DIN ITEM	N/A
7		DIN ITEM	N/A
8		DIN ITEM	N/A
9		DIN ITEM	N/A
10	1F-001-005-02	FILTER	1
11	1O-AS568-011-04	011 O-RING D90 VITON	1
12	1C-01-017-14	D6 SADDLE	1
13	1C-01-017-09-PSC-R	D6 BODY	1
14	1C-01-015-02-PVD	HP PORT PLUG	2
15	1O-AS568-012-04	012 O-RING D90 VITON	2
16	1O-AS568-024-03	024 O-RING D70 VITON	1
17	1B-01-002-02-PAH	HP SEAT	1
18	1O-AS568-006-06	006 O-RING D90 TEFLON	1
19	1D-01-002-02	SEAT SPRING	1
20	1O-AS568-905-04	905 O-RING D90 VITON	1
21	1C-01-017-03	BALANCE PLUG	1
22	1C-01-004-07	SWIVEL RETAINER	1
23	1P-01-004-02	SWIVEL THRUST WASHER	1
24	1C-01-017-08-PVD	IP CAP	1
25	1O-AS568-016-03	016 O-RING D70 VITON	1
26	1O-AS568-021-03	021 O-RING D70 VITON	1
27	1C-01-017-07-PSC	SWIVEL TURRET	1
28	1C-01-015-01-PVD	LP PORT PLUG	4
29	1O-AS568-011-03	011 O-RING D70 VITON	4
30	1C-01-017-05	VALVE LIFTER	1
31	1P-01-010-03-01	DIAPHRAGM (1.40")	1
32	1A-01-017-08	SPRING PAD	1
33	1P-01-005-02	ANTI-FRICTION WASHER	2
34	1D-01-011-02	SPRING	1
35	1C-01-011-09-PBSC	SPRING ADJUSTER	1
36	1C-01-017-10-PVD	DIAPHRAGM CLAMP	1
37	1A-01-017-07-D6	D6 TRANSPISTON	1
38	1A-01-017-09	D6 SILICONE DISK	1
39	1C-01-017-11-PSC	ENVIRONMENTAL CAP	1

DEEP EXPEDITION DIVE GEAR		NAME
	DRAWN	SCOTT
	DATE	2017/10/17
SIZE A3	DWG NO 0RG1117YICAV-D6-MODIFIED	REV B
ORIGINAL FILE NAME: 0RG1117YICAV-D6-SAB0M	SCALE:	1:2.5
MODIFIED BY: ROBERT C. SINGLER 2021/12/15	SHEET	1 OF 1

0RG211ABK3SQD6

RG11-D6 SILICONE PURGE BUTTON (BK) + STAINLESS TOP COVER
ADJUST KNOB (BRIGHT CHROME), TURBINE-PISTON



0RG211ABK3SQD6 PART LIST

NO	ITEM NO	DESCRIPTION	Q'TY
1	1A-02-011-21-BK-CEN	MAIN HOUSING	1
*2	1A-02-010-12-BK	NYLON TIE	1
*3	1Z-10-00005-05-BK-OR	MOUTHPIECE	1
*4	1A-02-010-02	EXHAUST VALVE	1
5	1A-02-011-04	EXHAUST COVER	1
*6	1O-AS568-019-03	VITON 019-N70 O-RING	1
7	1A-02-011-39	DEFLECTOR KNOB, D6	1
*8	1O-AS568-015-03	VITON 015-N70 O-RING	2
9	1C-02-011-04-PVD	AIR BARREL	1
10	1C-02-011-05	PIN	1
11	1Z-ZG-342-0206-WH	LEVER	1
*12	1B-02-011-06	LP SEAT	1
13	1A-02-012-22	TURBINE PISTON	1
*14	1O-EKM-2.42X0.82-06	TEFLON 2.42X0.82 N70 O-RING	2
15	1D-02-012-01	MAIN SPRING	1
16	1A-02-012-09-01	BALANCE CYLINDER	1
*17	1O-AS568-011-06	TEFLON 011-N70 O-RING	1
18	1C-02-011-22-01-CD	ADJUST KNOB (CHROME)	1
19	1O-AS568-006-03	O-RING AS568-006 N70	1
20	1C-02-011-24	ADJUST KNOB PLUG	1
21	1O-AS568-014-03	O-RING AS568-014 N70	1
22	1B-02-011-04	DIAPHRAGM	1
23	1A-02-011-41	COVER RETAINER, D6	1
24	1A-02-011-38	PURGE COVER, D6	1
25	1A-02-011-40	TOP COVER, D6	1
26	1S-02-011-01-EP	TRIM RING , D6	1
27	1C-02-011-21-CD	HEAT SINK NUT (CHROME)	1
28	1C-02-011-23	ORIFICE	1
*29	1O-AS568-010-03	VITON 010-N70 O-RING	1

"*" SERVICE KITS (REF)

	NAME	DATE
DRAWN	EVAN	2017/10/17
CHECKED		
ENG APPR		
MGR APPR		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS
ANGLES ±0.5˚
1 PL ±0.1, 2 PL ±0.05

DEEP EXPEDITION DIVE GEAR

TITLE
RG11-D6 SILICONE PURGE BUTTON (BK) + STAINLESS TOP COVER ADJUST KNOB (BRIGHT CHROME), TURBINE-PISTON

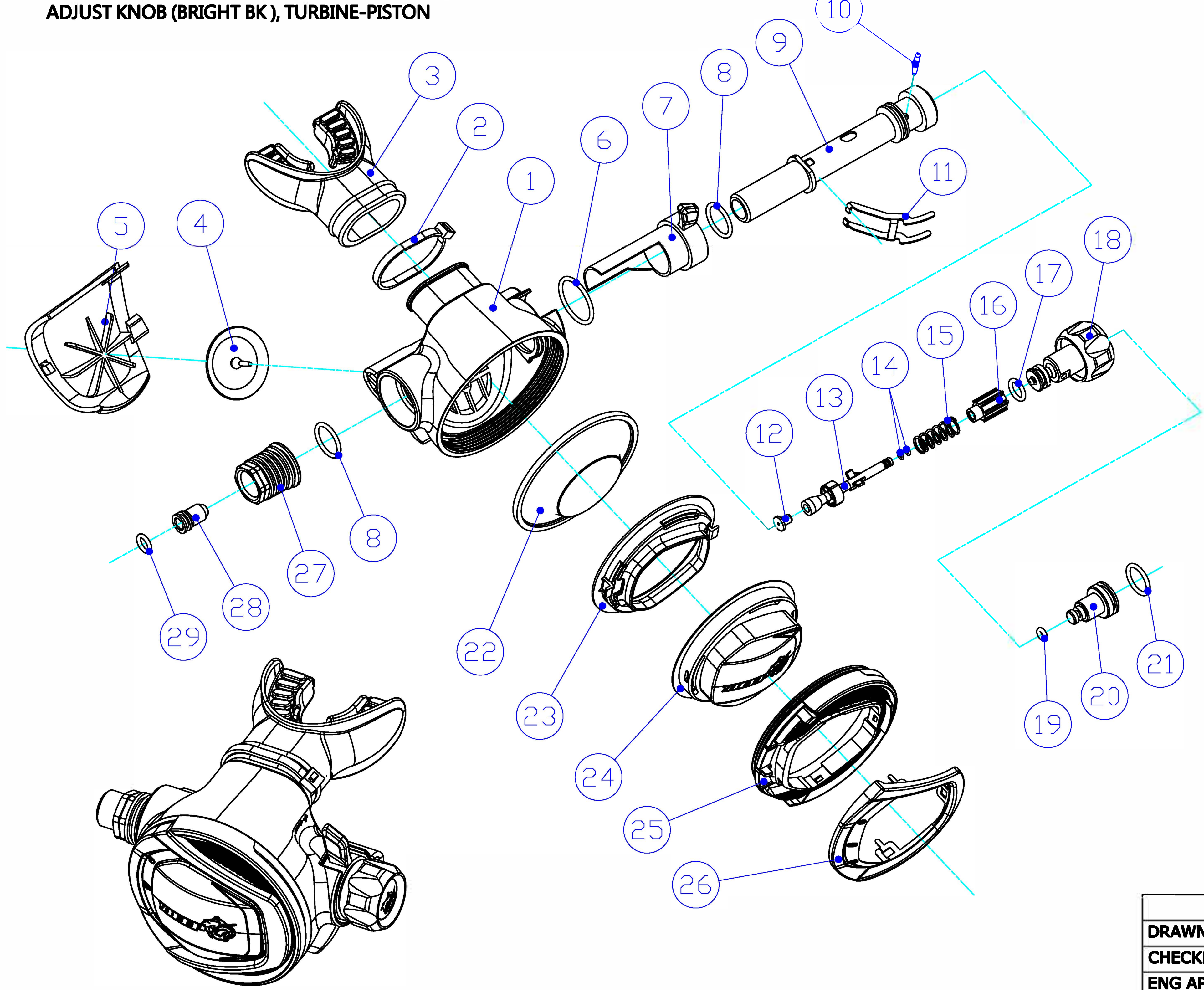
SIZE	DWG NO	REV
A3	0RG211ABK3SQD6	B

FILE NAME : 0rg211abk3sqd6.asm

SCALE: | WEIGHT: | SHEET 1 OF 1

0RG211ABK3SQD6-PVD

RG11-D6 SILICONE PURGE BUTTON (BK) + STAINLESS TOP COVER (BRIGHT BK)
ADJUST KNOB (BRIGHT BK), TURBINE-PISTON



0RG211ABK3SQD6-PVD PART LIST			
NO	ITEM NO	DESCRIPTION	Q'TY
1	1A-02-011-21-BK-CEN	MAIN HOUSING	1
*2	1A-02-010-12-BK	NYLON TIE	1
*3	1Z-10-00005-05-BK-OR	MOUTHPIECE	1
*4	1A-02-010-02	EXHAUST VALVE	1
5	1A-02-011-04	EXHAUST COVER	1
*6	1O-AS568-019-03	VITON 019-N70 O-RING	1
7	1A-02-011-39	DEFLECTOR KNOB, D6	1
*8	1O-AS568-015-03	VITON 015-N70 O-RING	2
9	1C-02-011-04-PVD	AIR BARREL (PVD)	1
10	1C-02-011-05	PIN	1
11	1Z-ZG-342-0206-WH	LEVER	1
*12	1B-02-011-06	LP SEAT	1
13	1A-02-012-22	TURBINE PISTON	1
*14	1O-EKM-2.42X0.82-06	TEFLON 2.42X0.82 N70 O-RING	2
15	1D-02-012-01	MAIN SPRING	1
16	1A-02-012-09-01	BALANCE CYLINDER	1
*17	1O-AS568-011-06	TEFLON 011-N70 O-RING	1
18	1C-02-011-22-01-PVD	ADJUST KNOB (PVD)	1
19	1O-AS568-006-03	O-RING AS568-006 N70	1
20	1C-02-011-24	ADJUST KNOB PLUG	1
21	1O-AS568-014-03	O-RING AS568-014 N70	1
22	1B-02-011-04	DIAPHRAGM	1
23	1A-02-011-41	COVER RETAINER, D6	1
24	1A-02-011-38	PURGE COVER, D6	1
25	1A-02-011-40	TOP COVER, D6	1
26	1S-02-011-01-PVD	TRIM RING , D6 (PVD)	1
27	1C-02-011-21-PVD	HEAT SINK NUT (PVD)	1
28	1C-02-011-23	ORIFICE	1
*29	1O-AS568-010-03	VITON 010-N70 O-RING	1

"*" SERVICE KITS (REF)

	NAME	DATE
DRAWN	EVAN	2017/10/17
CHECKED		
ENG APPR		
MGR APPR		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS
ANGLES ±0.5°
1 PL ±0.1, 2 PL ±0.05

DEEP EXPEDITION DIVE GEAR

TITLE
RG11-D6 SILICONE PURGE BUTTON (BK) + STAINLESS TOP COVER (BRIGHT BK) ADJUST KNOB (BRIGHT BK), TURBINE-PISTON

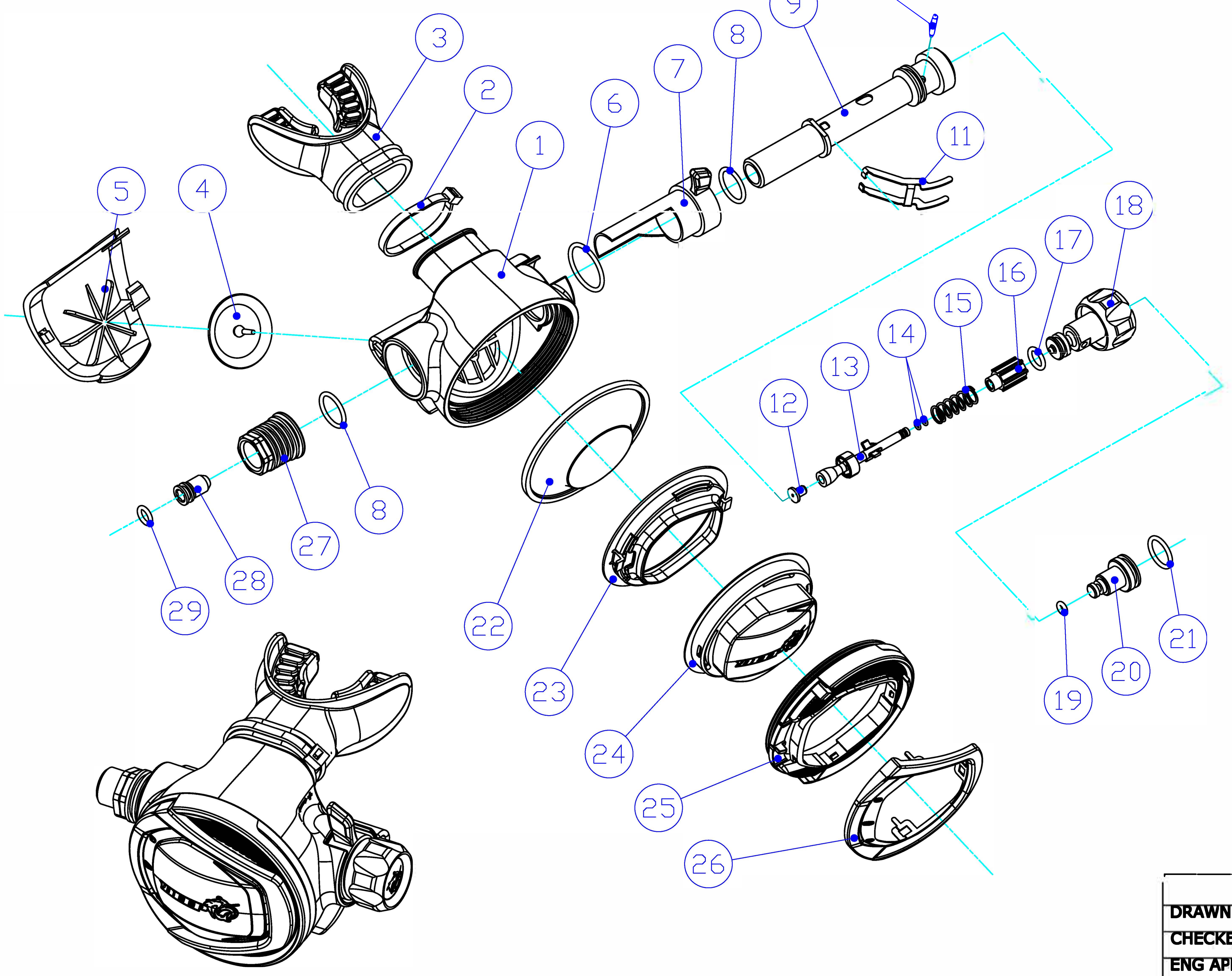
SIZE	DWG NO	REV
A3	0RG211ABK3SQD6-PVD	B

FILE NAME : 0rg211abk3sqd6.asm

SCALE: | WEIGHT: | SHEET 1 OF 1

0RG211ABK3SQD6-OR

RG11-D6 SILICONE PURGE BUTTON (OR) + STAINLESS TOP COVER (BRIGHT BK)
ADJUST KNOB (BRIGHT BK), TURBINE-PISTON (OCTO)



0RG211ABK3SQD6-OR PART LIST

NO	ITEM NO	DESCRIPTION	Q'TY
1	1A-02-011-21-BK-CEN	MAIN HOUSING	1
*2	1A-02-010-12-BK	NYLON TIE	1
*3	1Z-10-00005-05-BK-OR	MOUTHPIECE	1
*4	1A-02-010-02	EXHAUST VALVE	1
5	1A-02-011-04-OR	EXHAUST COVER (ORANGE)	1
*6	1O-AS568-019-03	VITON 019-N70 O-RING	1
7	1A-02-011-39-OR	DEFLECTOR KNOB, D6 (ORANGE)	1
*8	1O-AS568-015-03	VITON 015-N70 O-RING	2
9	1C-02-011-04-PVD	AIR BARREL (PVD)	1
10	1C-02-011-05	PIN	1
11	1Z-ZG-342-0206-WH	LEVER	1
*12	1B-02-011-06	LP SEAT	1
13	1A-02-012-22	TURBINE PISTON	1
*14	1O-EKM-2.42X0.82-06	TEFLON 2.42X0.82 N70 O-RING	2
15	1D-02-012-01	MAIN SPRING	1
16	1A-02-012-09-01	BALANCE CYLINDER	1
*17	1O-AS568-011-06	TEFLON 011-N70 O-RING	1
18	1C-02-011-22-01-PVD	ADJUST KNOB (PVD)	1
19	1O-AS568-006-03	O-RING AS568-006 N70	1
20	1C-02-011-24	ADJUST KNOB PLUG	1
21	1O-AS568-014-03	O-RING AS568-014 N70	1
22	1B-02-011-04	DIAPHRAGM	1
23	1A-02-011-41	COVER RETAINER, D6	1
24	1A-02-011-38	PURGE COVER, D6	1
25	1A-02-011-40-OR	TOP COVER, D6 (ORANGE)	1
26	1S-02-011-01-PVD	TRIM RING , D6 (PVD)	1
27	1C-02-011-21-PVD	HEAT SINK NUT (PVD)	1
28	1C-02-011-23	ORIFICE	1
*29	1O-AS568-010-03	VITON 010-N70 O-RING	1

"*" SERVICE KITS (REF)

	NAME	DATE
DRAWN	EVAN	2017/10/17
CHECKED		
ENG APPR		
MGR APPR		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMETERS
ANGLES ±0.5°
1 PL ±0.1, 2 PL ±0.05

DEEP EXPEDITION DIVE GEAR

TITLE
RG11-D6 SILICONE PURGE BUTTON (OR) + STAINLESS TOP COVER (BRIGHT BK) ADJUST KNOB (BRIGHT BK), TURBINE-PISTON (OCTO)

SIZE	DWG NO	REV
A3	0RG211ABK3SQD6-OR	B

FILE NAME : 0rg211abk3sqd6.asm

SCALE: | WEIGHT: | SHEET 1 OF 1

Appendix A:
Faceplate Disassembly/Reassembly

Cleaning of the faceplate assembly as a single unit is recommended. If cleaning of individual faceplate components is necessary, it is possible to disassemble the faceplate. This is not recommended, due to the delicacy of the components. If disassembly is required, follow these steps.

Disassembly

1. Using a fingernail, <u>gently</u> pry the internal tab of the Cover Retainer (#23) upward no more than 1/2 mm (Fig. 192). The Cover Retainer will pop free.

2. When one side comes loose, repeat the operation with the other tab. Lift the Cover Retainer and Purge Cover free of the Top Cover and Trim Ring (Fig. 193).

Fig. 192

Fig. 193

3. Using a blunt plastic or brass pick, carefully lift the edge of the Purge Cover off of one protruding tab and lift the entire Purge Cover free (Figs. 194, 195). Do not pull the Purge Cover (#24) off the Top Cover by its edges!

Fig. 194

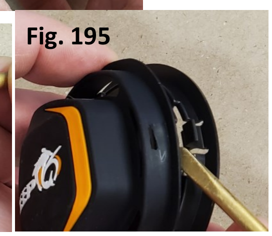


Fig. 195

4. Separation of the Trim Ring (#26) from the Top Cover (#25) is <u>not recommended</u>, because the Trim Ring locking tabs cannot be straightened and bent repeatedly. If required for repair, carefully grasp the penetrating tabs and unfold them (Fig. 196). Now pry the tabs inward and push the Trim Ring away from the Top Cover. Do not attempt to reuse the Trim Ring. Replace it with a new component.

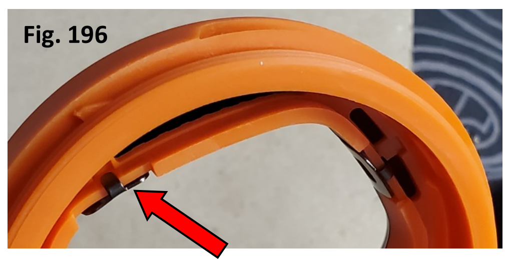


Fig. 196

Cleaning

Cleanse each component in a warm, soapy detergent solution. Rinse thoroughly in clean water before air drying. Ultrasonic cleaning and acid baths will damage the components.

Reassembly

1. If being replaced, gently press a new Trim Ring (#26) at the location of each penetrating tab, into the Top Cover (#25). Once the Trim Ring is seated, gently press around the perimeter of the ring to ensure it is fully mated to the cover. Fold the tabs onto the Top Cover.

2. Press the flexible Purge Cover (#24) onto the Cover Retainer, and lift the edges of the cover so the tabs in the retainer penetrate the small slots on either side of the Purge Cover (Fig. 197). Press gently around the full perimeter to seat.

Fig. 197

3. Locate the seating notches in the Top Cover where the Cover Retainer (#23) will latch. Slide the Cover Retainer with attached Purge Cover into the center of the Top Cover (Fig. 198). Carefully lift each tab from the inside of the Cover Retainer and press the retainer symmetrically into the Cover Ring from each side simultaneously.

Fig. 198

DEEP SIX

EXPEDITION DIVE GEAR