

D420 Service Manual

Use this manual at your own risk. It is not approved by Scubapro.

DIY service of scuba life support equipment may kill you.



This manual has been adapted from a copy of Version 1.0, March 2020 D420 SERVICE PROCEDURE, D420 SECOND STAGE GUIDELINES, DISASSEMBLY, ASSEMBLY, ADJUSTING AND FINAL TEST, published by Johnson Outdoors. As no copyright notice was observed on the document, any use of copyrighted material is unintended and inadvertent. The document had apparently been translated from the Italian, and text has been modified for clarity where translated phrases were unclear. The author has made additions and modifications based upon his experience, which have not been approved by Scubapro. Use this document at your own risk.

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General Notes

This regulator is designed for use with Enriched Gas (Nitrox) to EAN40. Use only perfectly cleaned tools in a cleaned environment

Cleaning procedure

Please refer to the "SCUBAPRO CLEANING PROCEDURE" document

Seals and O-Rings

- All seals and o-rings shall be perfectly clean.
- Check o-ring lands for imperfections or burrs, and clean as needed.
- All o-rings, in particular those for dynamic use, must be lubricated, along with any adjacent moving parts. The approved lubricant is Christolube MCG-111. Previous Technician Seminars have indicated that Tribolube 71 is also acceptable, though this is not found in official Scubapro publications.
- Note: The lubricant container, as well as tools and brushes used for service must be perfectly clean, free from dust, hydrocarbons or other particulate matter.

Plastic or rubber components

- The components, particularly on sealing surfaces, should be free of deformation or damage.
- All threaded components should screw freely and without resistance, leaving no excessive gap, unless otherwise specified.

Metallic components

- Metallic components should not have separated from the regulator or regulator part. Chrome plating should be smooth without deformation, imperfections or damage.

Tools

- Flat blade screwdrivers, 2.5mm and 5mm
- Non-serrated thin bladed, sharp knife
- Pin punch (MK2 seat tool) PN 43.300.210 or 1.5mm hex key



- Flow Vane Face Spanner PN 43.420.012 or small pin face spanner



- Scubapro Multitool PN 43.040.000 or small pin face spanner



- 3/32" Allen key PN 43.002.101
- 2mm, 5mm and 6mm hex keys
- O-ring pick PN 43.300.107
- 3/16" wooden dowel or blunt brass pick

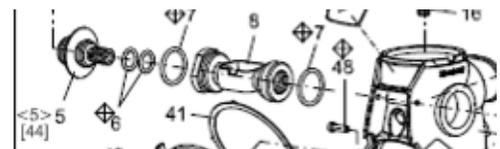
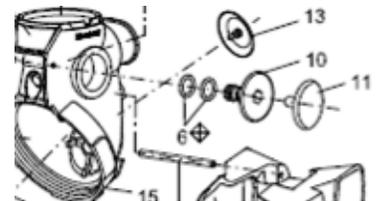
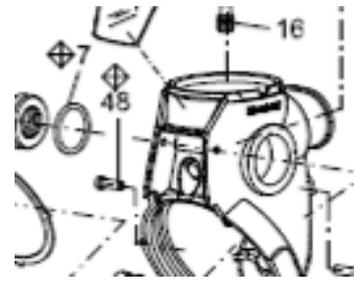


- Small needle nose pliers, forceps or tweezers
- Front Ring Retaining Tool PN 43.404.003 or rubberized "jar lid remover"
- Torque wrench PN 43.300.998
- 6mm Hex drive extension PN 43.040.009



Disassembly Procedure

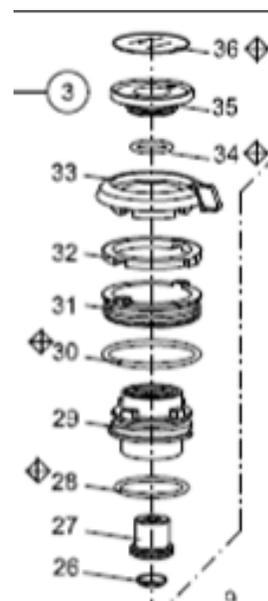
1. Remove the mouthpiece clip or zip tie and the mouthpiece.
2. Lift the cover pin (48) from the case by using an appropriate tool (e.g. 2.5 mm screwdriver), and then grasp carefully with forceps and remove.
3. Using a thin-bladed knife, carefully lift the decal (36) from the flow vane cap (35). Avoid scratching the flow vane plug (35) beneath the decal.
4. Push the purge lever pin (45) out of the case with a pin punch (MK2 HP seat tool) or 1.5mm hex key. Remove the purge button (44) and spring (43) and set aside.
5. Unscrew the face plate (42), rotating counterclockwise from the case. If necessary, use the SCUBAPRO D420 special tool PN 43.404.003 or a rubberized pad.
6. Carefully lift out the diaphragm thrust washer (41) and the diaphragm (40).
7. By using the multi tool (function #9) or a face spanner with a counterclockwise motion, unscrew the flow vane plug (35) from the case.
8. The dive switch (33) and the flow vane washer (32) can then be lifted out. O-ring (34) may fall out at this time.
9. Use a 3/32" Allen key to fully unscrew the small lever hex screw (16) from the bottom of the housing (18). The lever (37) will now be loose and it can be carefully removed.
10. Remove the decorative cap (11) from the case plug (10) by carefully lifting with a brass spade or a flat blade screwdriver.
11. Using a 6mm Allen key, unscrew the case plug. Use a brass pick to carefully remove both o-rings.
12. Next, unscrew the hose inlet (5) with a 6mm Allen key and pull it out from the housing support (8). As above, carefully remove both o-rings (6).



13. By using a face spanner or tool PN 43.420.012 grasp the tabs on the flow vane ring (31) and unscrew it from the case by rotating counter clockwise. The sub-assembly consisting of the flow vane ring (31), two o-rings (28 and 30), the flow vane (29), the hex adjuster screw (27) and possibly o-ring (34) is now loose.

Note: the spring (25) and the spring support (26) are also now loose. Use care to avoid dropping parts with the next step.

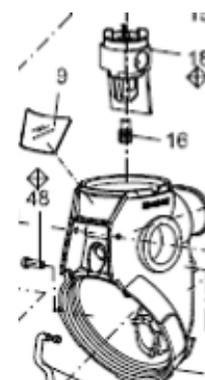
Holding the case upright, lift the assembly from the case. Then carefully turning the case upside down, collect the spring (25) and spring support (26) in your hand as they fall out. The poppet (stem assembly) (49) may also fall out.



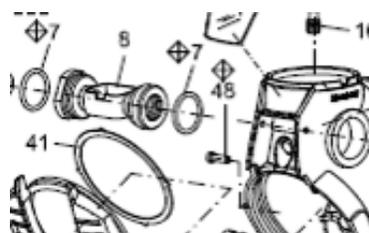
14. Then, grasping the flow vane ring (31), pull it apart from the flow vane (29). Remove o-ring (30) and o-ring (28). Using a 5mm Allen key, engage the adjustment screw (27), loosen it *clockwise* and remove from the flow vane from below. Its o-ring (34), if it has not fallen out before, will now be loose. Remove it.

15. Pushing in an upward direction against the square deflector at the rear of the housing (18), push the housing up and out of the case.

If it did not fall out in step 13. above, the poppet (stem assy) (49) is accessible and can be carefully removed with a thumb and index finger or small forceps.



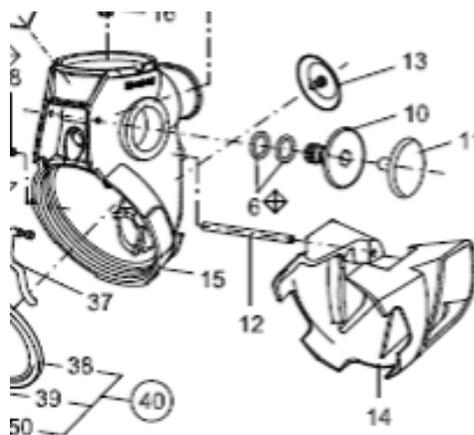
16. Push the housing support (8) in the direction of the LP hose inlet (i.e., from the opposite side). Push it out of the case and remove the o-rings (7) with a brass or plastic pick, being careful not to score the o-ring groove.



17. Use a pin punch or 2mm hex key to remove the exhaust tee pin (12). The exhaust tee (14) is now removable from the case.

Note: the exhaust tee is thinner and more delicate than the case. To avoid breakage, use care in sliding the ears of the tee around and off the case.

18. The exhaust valve (13) is now accessible and can be replaced, if necessary. Inspect the valve for complete sealing against the case. Inspect the edge for damage. Confirm that the barb is locked inside the spokes on the case. The exhaust valve is not normally removed at annual service, unless damaged.



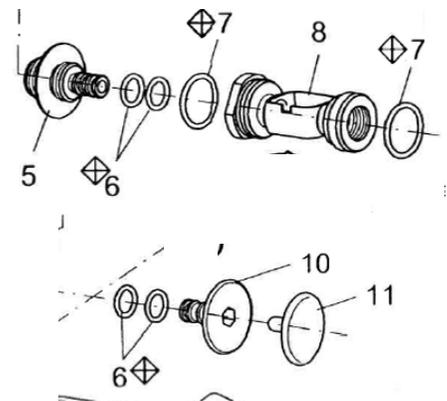
DISASSEMBLY IS NOW COMPLETE

Reassembly Procedure

1. If the exhaust valve (13) must be replaced, first ensure the land where the valve edge will seal is clean and without scratches. Remove the old valve by cutting the barb of the center silicone nipple where it penetrates the inside of the case. Insert the new valve by carefully pulling on the center nipple from the inside of the case, and ensure that the barb has completely entered the case. Check valve retention by slightly pulling the leaflet outwards. Cut the nipple off short, leaving approx. 1mm beyond the end of the barb.
2. Carefully fit the exhaust tee (14) around the case, without excessively bending the ears of the tee. Insert the pin (12) in the case, verifying that the pin enters with some friction. Ensure that the pin rests equally on both ends. Check that the exhaust valve is not pinched between the case and the tee.

Many Scubapro o-rings are numbered via an eight digit system that typically follows the format 01.050.xxx. In this manual, o-rings will hereinafter be described only with the last three digits following a decimal point (e.g. .160), as well as with the diagram number in parentheses. The full part number will be listed where it does not follow the 01.050. format.

3. Lightly lubricate two .160 o-rings (7) and carefully fit them into the grooves of the housing support (8). Assure that they are not twisted. Next, lubricate four .364 o-rings (6). Fit two onto the hose inlet (5), and two onto the case plug (10).
4. Holding the second stage with the mouthpiece tube facing towards you, insert the housing support (8) inside the case (15) from the right side. Make sure the notch in the housing support is facing upwards and away from you.
5. Carefully remove the housing (18) from its paper wrapper. Note especially that the circular knife edge in the top of the housing is delicate, and must not be allowed to contact tools or any metal instrument. Inspect this knife edge for damage or defects. It should be flat and even. If any imperfections are noted, do not use the housing, and obtain a replacement from another service kit.



5. Hold the housing with the square flap facing downward and toward you, and the case with the mouthpiece tube facing toward you. Insert the housing into the support, and using only the ball of your thumb, press it downward fully, engaging the tooth on the housing in the notch of the housing support. Take special care to not put any pressure on the knife edge. Inspect the housing placement by looking through both sides of the housing support (where the hose inlet and plug will be inserted), and ensure that the housing's side holes are centered in the support.

7. Using a 6mm Allen key, screw the hose inlet (5) and the plug (10) into the housing support. Note that the hose can be mounted on either side of the regulator. Standard hose position is to have the hose inlet (5) on your right, when the case is held with the mouthpiece tube toward you.

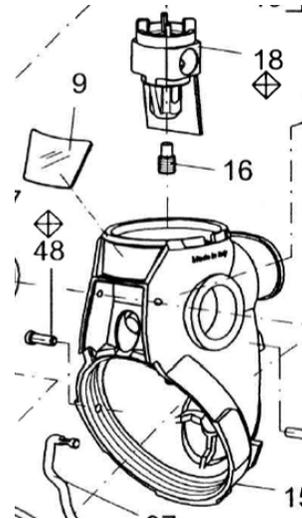
8. Using a 6mm hex extension attached to a torque wrench, tighten the hose inlet in the case to 44 in-lb (5 Nm). With a 6mm hex key, tighten the case plug finger tight.

9. Place the case flat on the bench in front of you, mouthpiece tube facing down. Insert the lever (37) from the left side into the oval hole in the housing such that the narrowed flat in the lever is centered. Gently allow the lever to drop against the square flap of the housing.

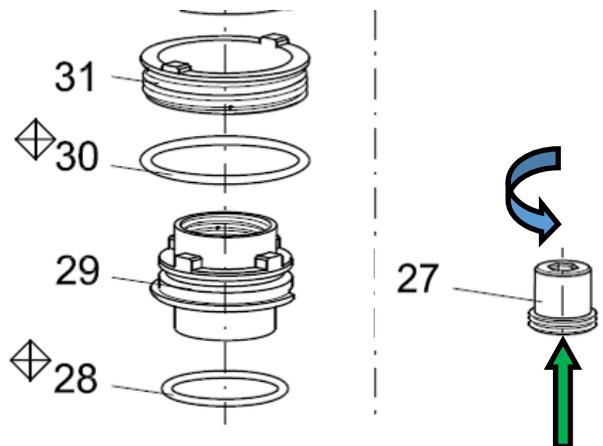
10. Insert the hex screw (16) unthreaded end first, and using a 3/32" Allen key, screw the hex in until it is just flush with the bottom of the housing. Set the regulator aside briefly.

11. Lightly lubricate the .177 (28) and .164 (30) o-rings. Carefully place the .164 o-ring (28) in the dedicated groove of the flow vane (29) and the .177 o-ring (30) in the groove of the flow vane ring (31). Ensure that they are not twisted.

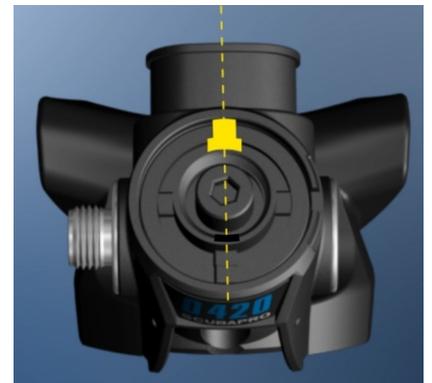
12. Using a 5mm hex key screwing counterclockwise from above, and pushing up from below, insert and screw the adjustment screw (27) all the way into the flow vane (29) until it stops. Do not force the screw past the stop.



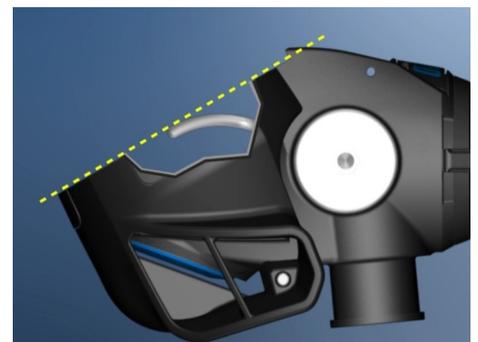
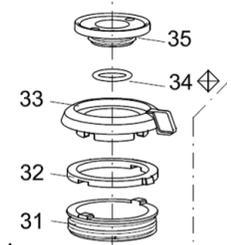
In this picture, the lever has been raised to facilitate viewing the initial position of the hex screw. The lever will normally fall against the square flap of the housing once the hex has been screwed into position, until the poppet and spring have been added.



13. Press fit the flow vane (29) inside the flow vane ring (31), until the vane is up against the ring and the teeth of the two parts are at the same level. Set this assembly aside.
14. Remove the poppet (stem assy) (49) from its paper envelope. Handling it carefully, generously lubricate the .323 o-ring at the base of the poppet (stem assembly) (49).
15. Returning to the regulator set aside earlier, and using a pair of tweezers, forceps or other delicate instrument, grasp the poppet (stem assembly) (49) by the top nut and carefully insert it in the opening made by the housing knife edge. Take care to not strike the knife edge with the metal end of the poppet. Lower the poppet into position, until its round top is contained within the four teeth of the housing, and the nut is uppermost.
16. Set the spring support (26) on the top of the spring (25), and carefully balance both on top of the poppet in the regulator housing. Taking the flow vane sub-assembly from step 13. above, screw the whole unit all the way in into the case (15), first by hand, and then using a special tool (PN 43.420.012) or a pin spanner braced against the two teeth of the flow vane ring. Do not force it, but tighten it, stopping with teeth at 12 & 6 o'clock.
17. NOTE: It is critical that the teeth of the flow vane ring (31) **and** the flow vane (29) are positioned in a 12 o'clock/6 o'clock orientation. Rotate the inner flow vane until its biggest tooth rests at the 12 o'clock position with the mouthpiece up.



18. Insert the flow vane washer (32), ensuring that when the tab is in the slot of the case, the grooves meet the teeth of the flow vane ring (31). Rotate the flow vane ring slightly as needed to allow the washer to fall into place. Insert the dive switch (33), matching its larger groove to the bigger tooth in the flow vane (29). Insert a lightly lubricated .347 o-ring (34) into the space around the hex adjustment screw (27). Insert the flow vane plug (35), and using a pin spanner or the Multitool (function #9), tighten it clockwise. Do not tighten excessively. Move the dive switch to be sure it slides freely with a minimum of friction.
19. Holding the regulator mouthpiece down, screw or unscrew the lever adjustment hex screw (16) with a 3/32" Allen key, until the top edge of the lever is level with the rim of the case. Note that if the regulator is instead held vertically, the lever may fall forward of the plane of the case rim, giving incorrect feedback regarding lever height.



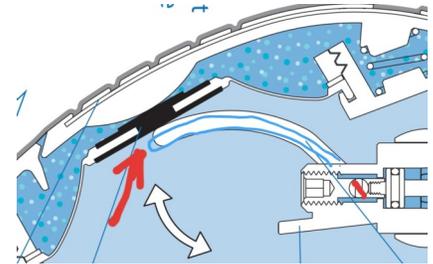
*NOTE: To avoid unnecessary play in the lever, it is best to make the adjustment above while the 2nd stage is pressurized, as the lever will drop 0.25-0.5mm upon pressurization. See **Tuning and Final Adjustment** below.*

20. Examine the diaphragm (38) for cuts, holes or an irregular edge. Check that the disc insert (50) is secure in its groove in the diaphragm. Do not insert the diaphragm at this time.

Tuning and Final Testing

1. Connect the second stage to the LP hose and pressurize the regulator with 125-145 psi. Using a 5mm hex key, turn the adjustment screw (27) just until there is no air leak.
NOTE: Rotating the adjustment screw clockwise increases spring tension on the poppet, and increases inhalation effort (“cracking effort”); counterclockwise rotation decreases spring load and lowers cracking effort.
2. Insert the diaphragm assembly (40) in the groove of the case (15). Using a small dowel or other blunt tool, confirm that the diaphragm rim is fully seated in the groove. Do NOT lubricate the diaphragm edges.
3. NOTE: This next step specifically differs from a subsequent instruction in the translated Scubapro manual.

Before attaching the faceplate, tap lightly with one finger on the center disc of the diaphragm, and confirm that when the regulator is pressurized, there is approximately 0.25-0.5mm of separation between the lever and the diaphragm disc. That separation may disappear when the regulator is depressurized. Adjust lever height with a 3/32” hex key in the lever hex screw (16).



4. Insert the thrust washer (ring) (41), again ensuring that it is fully seated, and then screw on the faceplate (retaining ring) (42) using your palm or a suitable tool (PN 43.404.003), until the hole in the faceplate is aligned with the same hole in the case (15). Note: the thrust washer (41) will pull the sides of the diaphragm inward slightly as the faceplate is screwed in. *Therefore, tap the diaphragm disc to confirm that there is a tiny gap between the lever and the diaphragm center disc (in contrast with Step 6 below). If a gap is not found, remove the diaphragm and adjust the hex screw (16) counterclockwise to lower the lever fractionally.*
5. Insert the purge button spring (43) into its groove in the case (15). Carefully fit the purge button (44) into the case, ensuring that the restraining hook at the bottom of the purge button is inside the cutout in the faceplate. Using pressure against the spring to align the holes in the top of the purge button with the holes in the case, secure the purge button with the pin (45). Confirm that the pin enters with some friction, and that it is symmetric on both ends. Operate the purge button and confirm that it returns freely when pressed.

~~Deleted from the translated SP manual: 6. Be sure that the lever is in contact with the diaphragm disc and the value of the cracking effort measured with the Magnehelic shall be in the range between 1.2-1.6 Inch H2O. If this is not the case, disassemble the components previously assembled in the above points 2, [4] and [5] of this chapter, then adjust the hex screw (16) with a 3/32" Allen key, reassemble the components and re-adjust the screw adj, (27): rotating clockwise will increase the inhalation effort. Repeat these operations until you reach the cracking effort required while at the same the lever is in contact with the diaphragm disc.~~

It has been this author's observation that if the lever is in contact with the diaphragm when the regulator is pressurized, diaphragm elasticity may apply a counterforce to the poppet spring whenever the spring adjuster is screwed in, making tuning unstable. By design, this theoretically shouldn't occur, due to the presence of a retaining hook at the bottom of the purge lever which should prevent the diaphragm from being placed under tension by the valve lever. Nonetheless, tuning instability has repeatedly been noted when Step 6 is followed as written, and that same instability disappeared when the lever was lowered 0.25-0.5mm.

*Note however, that lowering the lever decreases maximum valve opening. A significant decrease in lever excursion could lead to **inadequate air delivery and death**. Therefore, anyone following these steps must assess for her/himself whether a loss of 0.5mm in lever excursion is significant. A substitute Step 6 is inserted below.*

- 6 (Substitute). With the regulator pressurized and with a 0.25-0.5mm gap present between the back of the diaphragm disc and the lever, turn the adjustment screw (27) to change cracking effort.

NOTE AGAIN: Scubapro prescribes no gap between lever and diaphragm in the original Service Manual.

Turning the adjustment screw (27) clockwise increases cracking effort and counterclockwise decreases cracking effort. The cracking effort should be set to 1.2-1.6 inches water column on the magnehelic. Due to case geometry and the huge air delivery of this center-balanced design, tuning this regulator “hot” (below specification) is specifically not recommended.

For best practice, the adjustment screw should be turned only when the purge lever is depressed, to avoid the possibility that spring binding against the poppet will cause the knife edge to cut the seat. Therefore, to minimize air supply loss when the purge is pressed, a LP hose “On/Off” slide valve can be used to quickly depressurize the regulator during adjustments, in lieu of repeatedly turning off the gas supply and depressurizing the hoses before pressing the purge button.

7. Attach the mouthpiece (47) to the case with the clip (46) or zip tie.
8. Place the dive switch in the Pre-Dive position (forward), and confirm that freeflow cannot be initiated with a brisk tap on the purge valve. If freeflow occurs in the Pre-Dive position, confirm that
- a) the mouthpiece is in place,
 - b) the supplied Intermediate Pressure is 125-145 psi,
 - c) that cracking effort is at least 1.2”WC, and
 - d) that the flow vane subassembly has been correctly assembled and installed.

7. Depressurize the system, and perform a leak test without air supply, or by closing the inlet with a finger or a plug. Using light suction applied to the mouthpiece, create a vacuum and assure that there is no leak into the case. Any leak on suction may require examination or disassembly to highlight a possible hole in the diaphragm or exhaust valve, or a malpositioning of the exhaust valve sealing edge. A cracked case may also be revealed by this test.

8. Apply the decal (36) to the flow vane cap (35), paying attention to its orientation. Apply the decal centered in its groove and positioned as shown in the picture(s) adjacent.

9. Fit the safety pin (48) into the aligned holes of the case (15) and faceplate (42).

10. Press the decorative cap (11) into the hex recess of the case plug (10), ensuring that it is secure, and there is no gap between the plastic trim and the metal plug.



THIS COMPLETES REASSEMBLY AND TUNING