

Figure #1

SCUBAPRO®

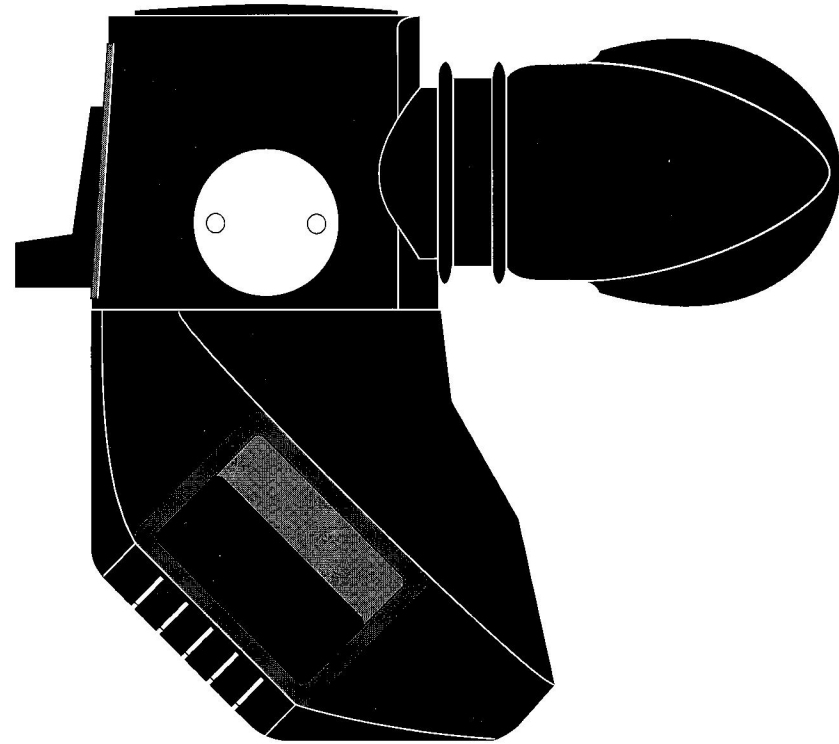
Technical Service Reference & Repair Guide

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D400

Second Stage



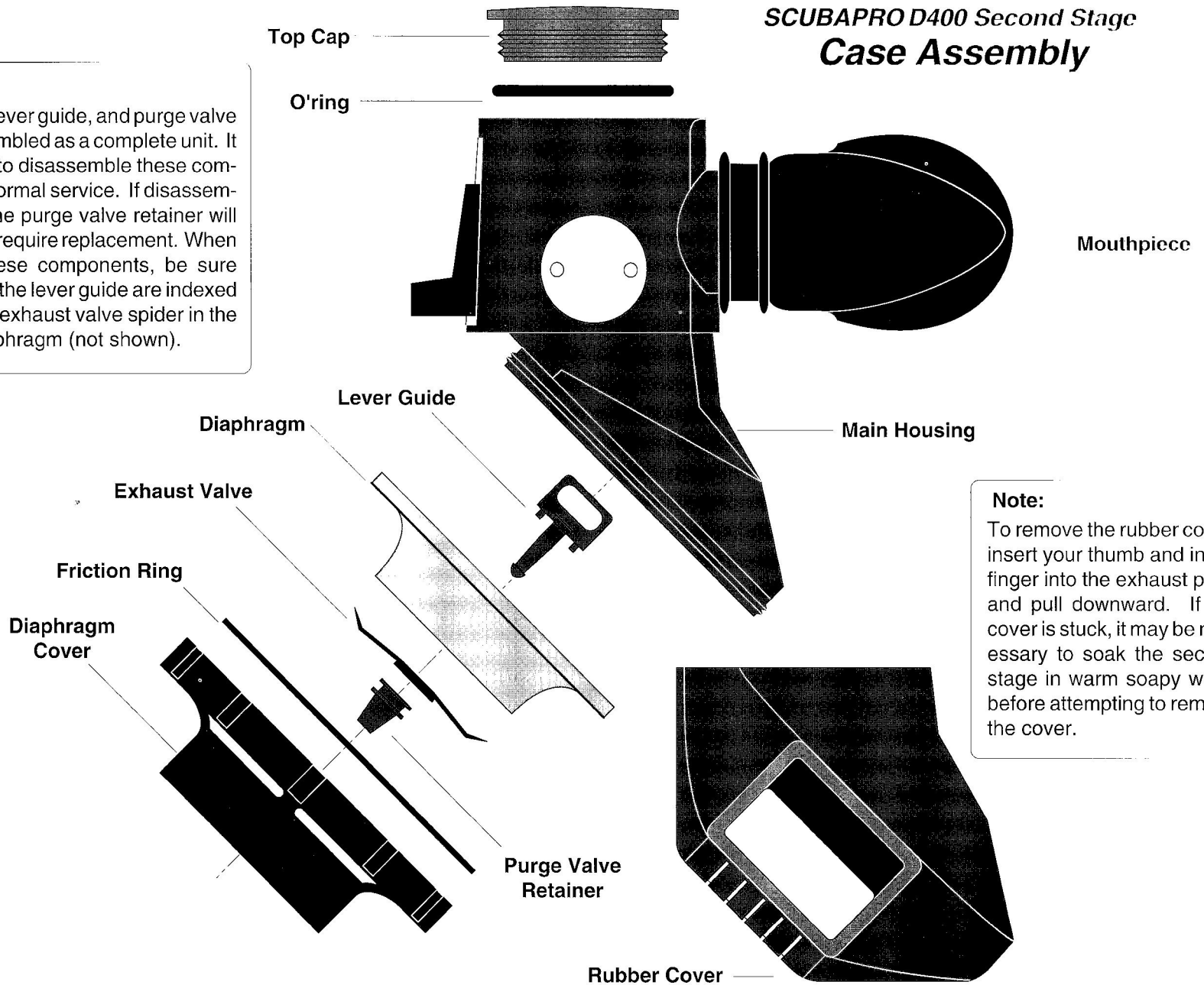
Important Note: The following information "is not" designed to be a complete training guide for infield servicing of the D400 second stage. All Scubapro technicians are required to attend an annual repair clinic to insure safe handling and servicing of Scubapro products.

Figure #2

SCUBAPRO D400 Second Stage Case Assembly

Note:

The diaphragm, lever guide, and purge valve retainer are assembled as a complete unit. It is not necessary to disassemble these components during normal service. If disassembly is required, the purge valve retainer will be damaged and require replacement. When reassembling these components, be sure the small tabs on the lever guide are indexed properly with the exhaust valve spider in the center of the diaphragm (not shown).



Note:

To remove the rubber cover, insert your thumb and index finger into the exhaust ports and pull downward. If the cover is stuck, it may be necessary to soak the second stage in warm soapy water before attempting to remove the cover.

Figure #3

SCUBAPRO D400 Second Stage Dive Pre-Dive Assembly

Note:

The D400 Dive Pre-dive assembly is seldom removed during annual service. The o'ring under the switch is the only part that may require attention. If the initial vacuum test reveals that the watertight integrity of the case requires attention, proceed as follows: assemble a new switch and o'ring before removing the existing one. Loosen the retaining screw by inserting a small screwdriver through the mouthpiece opening. When the existing switch and o'ring are removed, replace it with the new pre-assembled switch and o'ring. This procedure should be completed while maintaining hand pressure on the screwdriver. This procedure will eliminate the task of realigning the internal components.

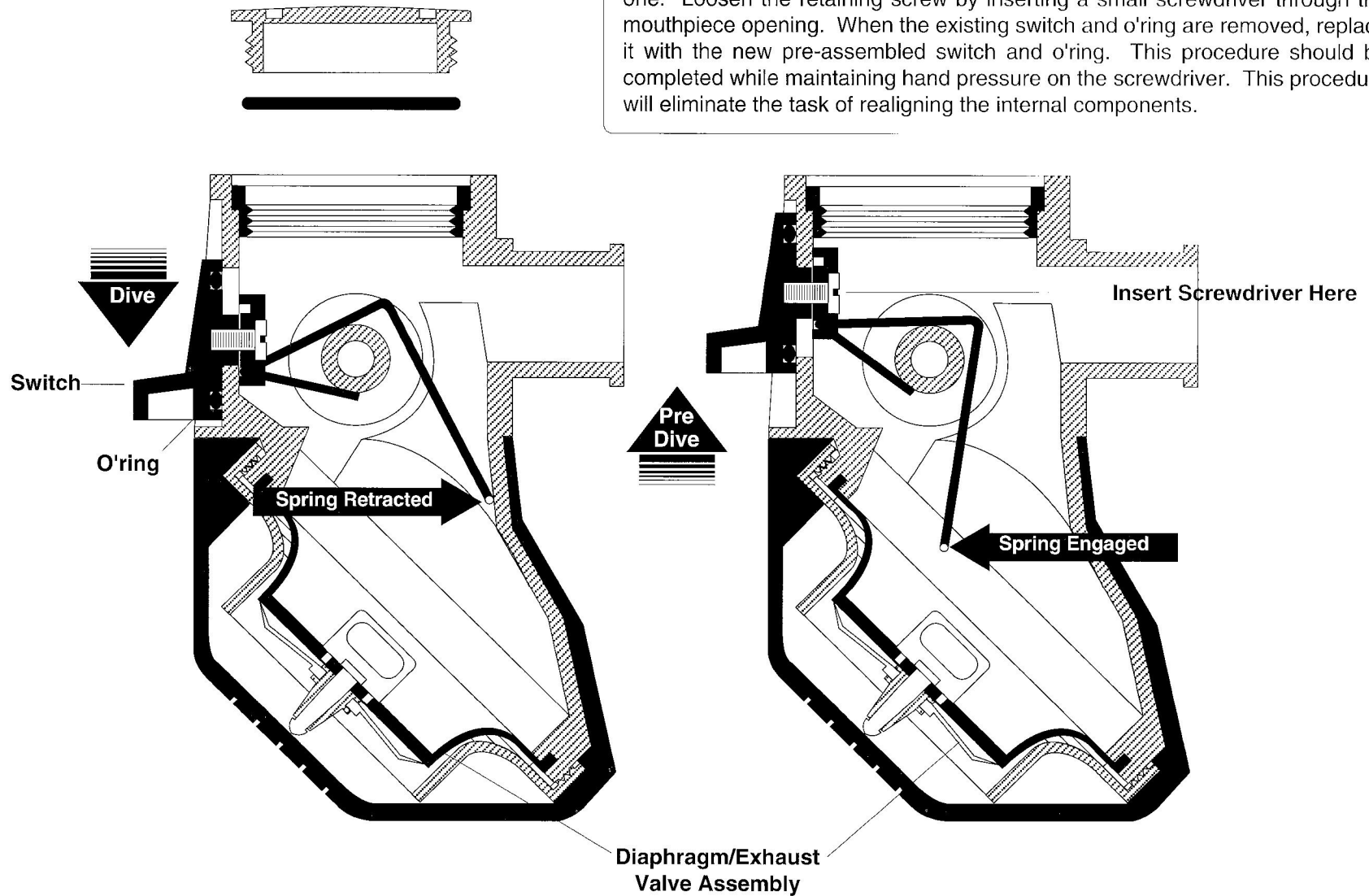
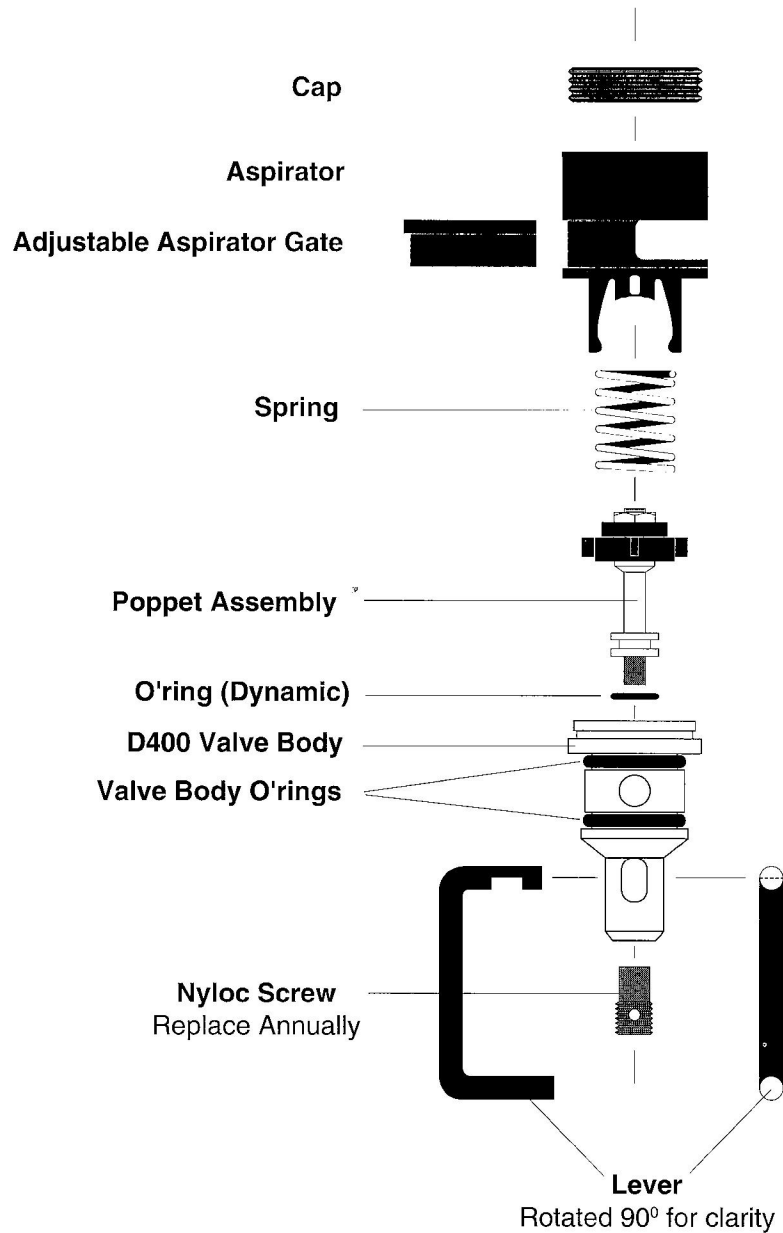


Figure #4

SCUBAPRO[®] D400 Second Stage Balanced Coaxial Flow Valve Parts



Notes:

The illustration to the left shows the D400 valve components in the exploded view. The poppet seat, poppet o'ring, and nyloc screw are always replaced during annual service.

The poppet detail below shows the order of assembly of the poppet components. You will need a 5.5mm nut driver, socket, or wrench to remove and replace the nut. A small adjustable wrench will work in a pinch, but is not recommended. Be sure that the seat is installed with the soft side down. The o'ring serves to provide expandable tension to maintain the security of the nut. Do not over tighten the nut. Apply sufficient tension to compress the o'ring and secure the nut.

Poppet Detail:

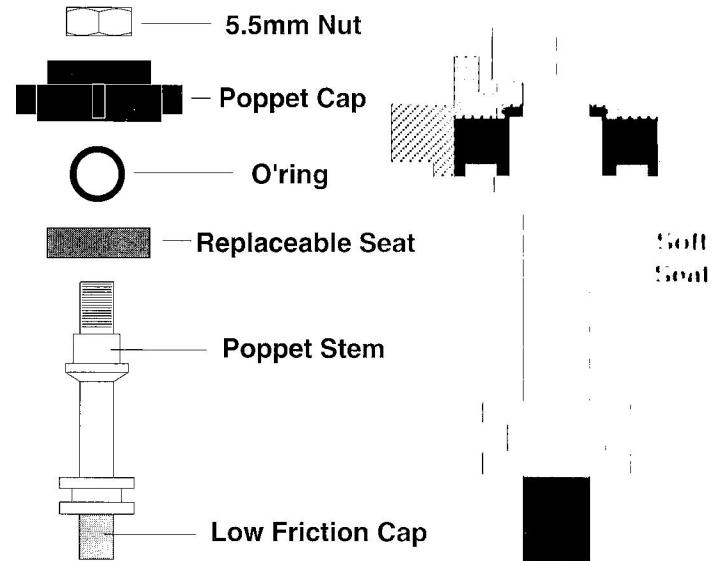
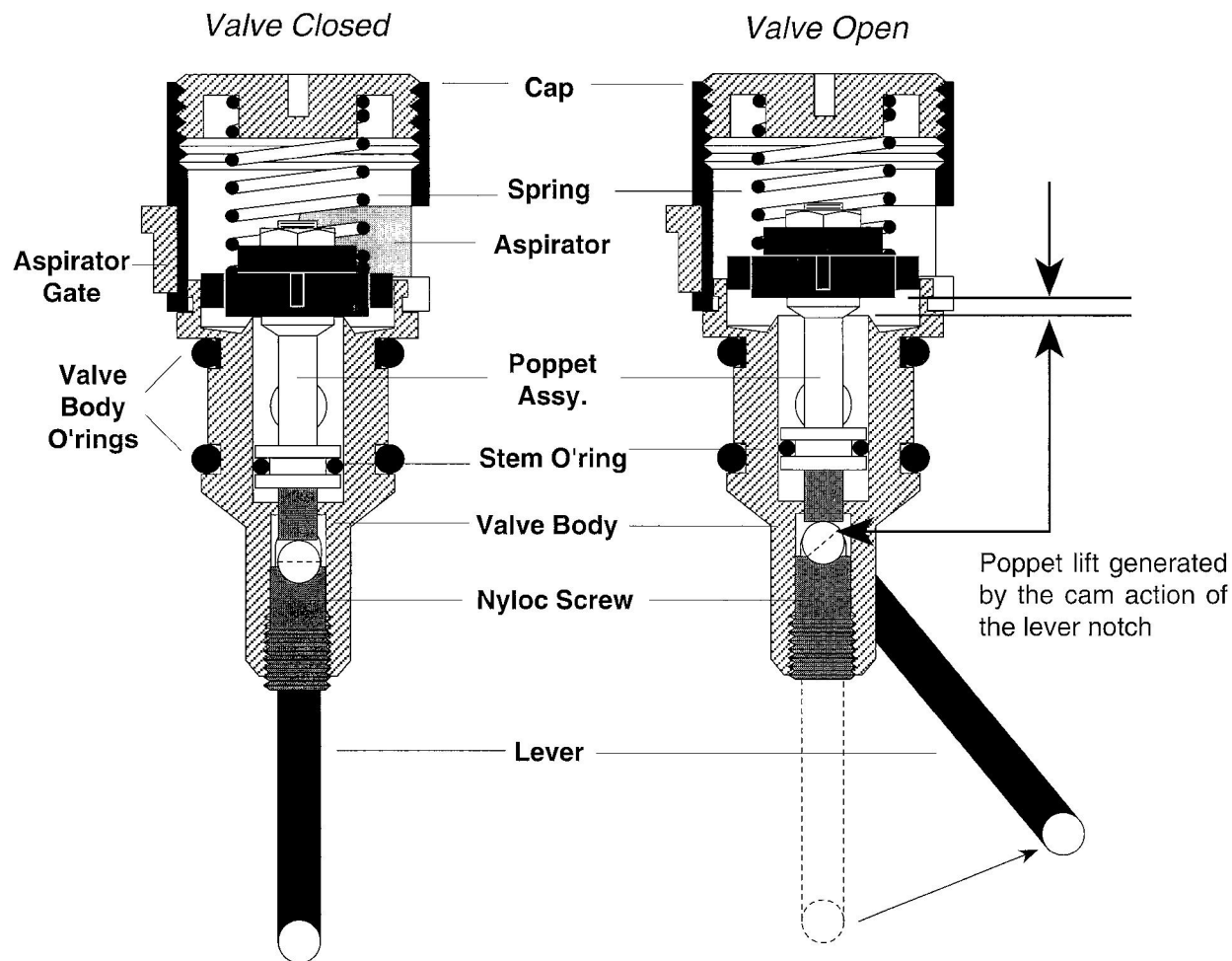


Figure #5

SCUBAPRO® D400 Second Stage Valve Assembly

Note:

The illustration below shows the D400 valve in both the open and closed position. Take special note of how the cam action of the lever notch generates poppet lift. The final setup of the D400 requires following the proper sequence of adjustments. Read the remainder of this appendix before attempting to complete the adjustment procedure.



Assembly Notes:

1. Install the nylon lock screw in the main valve body. The screw is replaced annually and should feel firm when it is threaded into place. Continue threading this screw into the body until two threads remain exposed out side the body.
2. Install the poppet assembly into the top of the valve body. The poppet stem O'ring is dynamic and is always replaced during annual service.
3. Snap the aspirator onto the main valve body. See figure #6 for alignment details.
4. Snap the aspirator gate over the aspirator with the protruding ledge up. See figure #6 for details.
5. Install the lever between the poppet and nylon screw. See important installation information covered in figure #6.
6. Install the spring on top of the poppet cap.
7. Thread the cap into the aspirator until it is flush with the top of the aspirator and then continue threading it downward an additional 1/2 turn. This is the preliminary adjustment position. The final adjustments will be made with the air turned on.

Important Note:

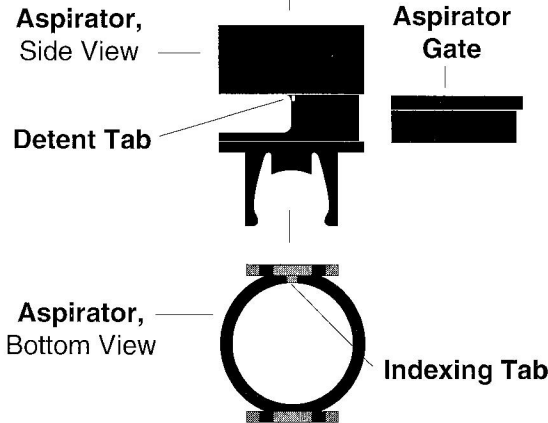
It is very important at this point in the assembly there is clearance between the lever and the poppet. This space will be eliminated after the final spring adjustments are completed with the air turned on. The clearance is controlled by the position of the nyloc screw. You should be able to wiggle the lever back and forth slightly without lifting the poppet off of the seat. If the nyloc screw is adjusted too far in, the poppet seat will not make contact with the valve body knife edge making final spring tension adjustments impossible.

Figure #6

SCUBAPRO® D400 Second Stage Valve Component Alignment

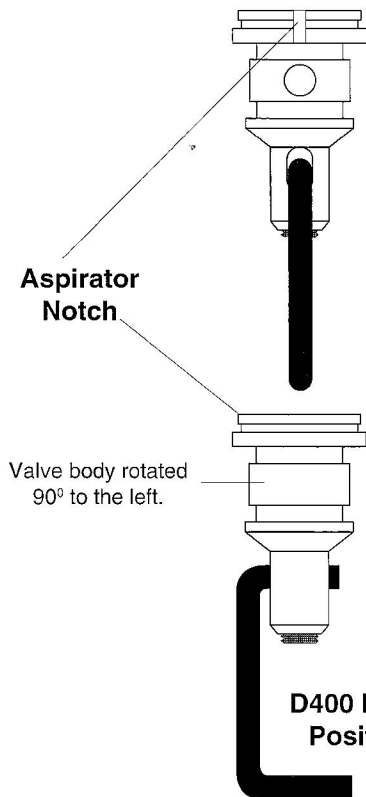
Aspirator Installation:

When installing the D400 aspirator, align the indexing tab located on the underside of the aspirator with the aspirator notch on the valve body (see aspirator bottom view). This feature maintains the rotational alignment of these two components. The aspirator fits the valve body snugly and firm hand pressure is required to snap it into place. Align the indexing tab and notch and then snap the opposite side into place in the valve body groove.



Aspirator Gate Installation:

The aspirator gate is used to control the intensity of the VIVA assist. By rotating the gate, the air stream can be focused to increase/decrease internal second stage vacuum. Small notches are molded into the gate on the inside of the upper rim (not shown). These notches must index with the detent tab on the aspirator. In this position the gate can be "clicked" into the selected position during the adjustment procedure and the detent tab and notches will maintain the adjusted angle during use.

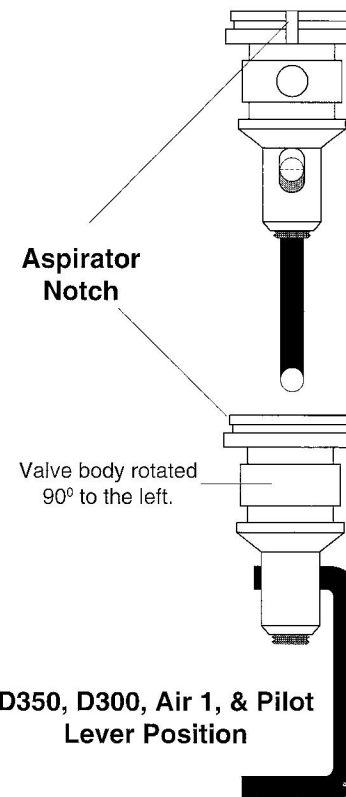


D400 Lever Position:

When installing the D400 lever, it is very important that the lever is facing in the proper direction. The illustration to the left shows the correct orientation of the D400 lever and valve body. The best reference relating to this orientation is the aspirator notch machined into the upper ledges of the valve body. The D400 lever is installed so that the open ends of the lever are facing "away" from the aspirator notch.

Previous Models' Lever Position:

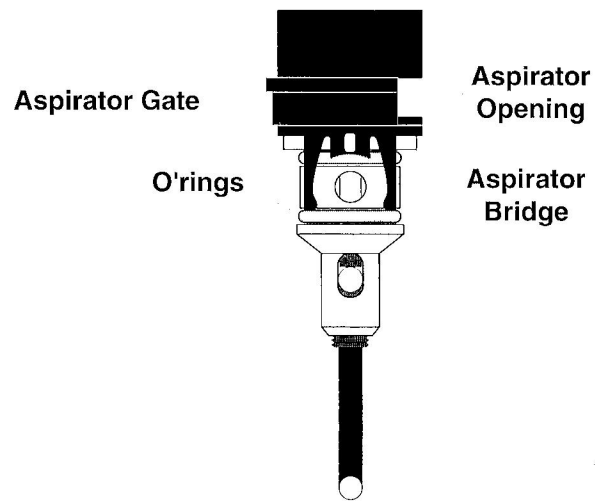
On the D350, D300, Air 1, and Pilot second stages, the lever is installed in the opposite direction. Position the lever in these units so that the open ends of the lever face "toward" the aspirator notch. See illustration to the right.



D350, D300, Air 1, & Pilot Lever Position

Figure #7

SCUBAPRO[®] D400 Second Stage Installing The Valve Assembly



Notes:

When the valve assembly is installed into the main housing, it is important that the aspirator opening is facing "outward" toward the mouthpiece opening. It is possible to install the valve assembly backwards with the aspirator facing the switch side of the main housing.

The lower portion of the aspirator forms a bridge that snaps over the air tube. This feature stops the valve from rotating while adjustments are being made or while the second stage is in use.

The o'rings will slide into place easier and without damage if some lubrication is present on both the o'rings themselves and the center bore of the air tube. Nontoxic silicone spray works well for this assembly procedure.

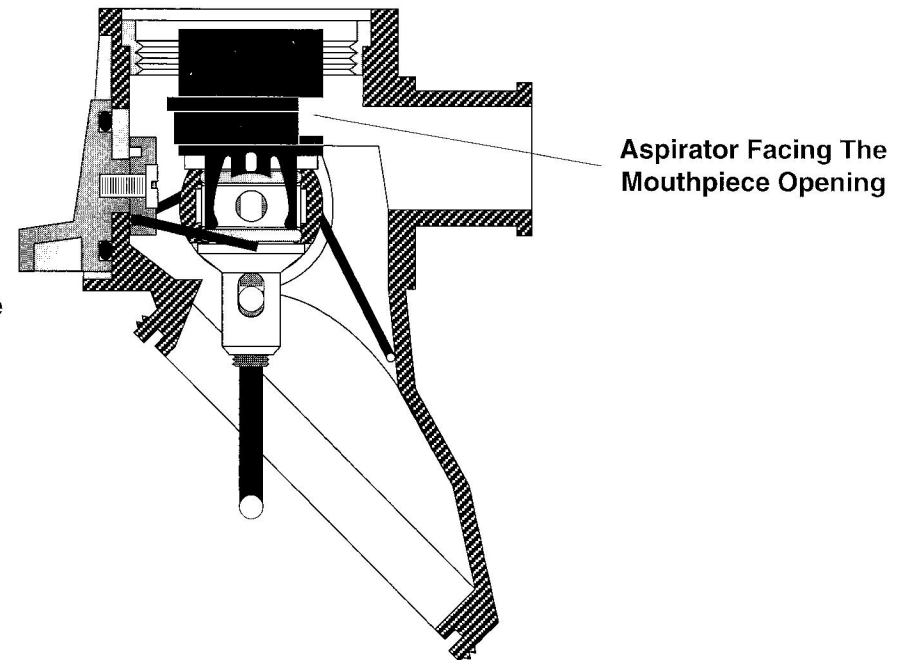
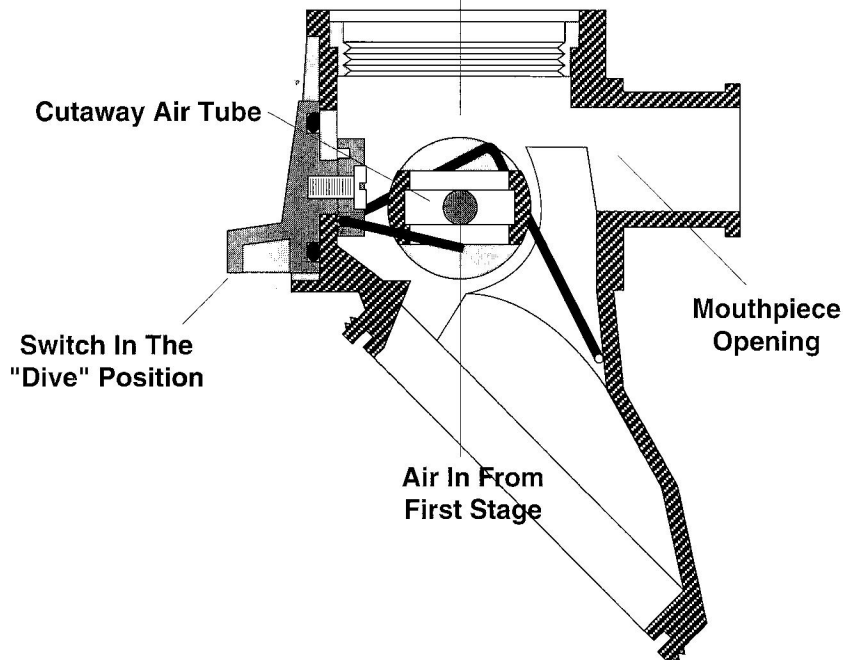


Figure #8

SCUBAPRO® D400 Second Stage "Air On" Valve Adjustment Procedure

D400 Valve Adjustment Procedure:

Important: Be sure that the valve is pressed completely into the air tube before applying air pressure to the second stage. Failure to do so may cause the valve assembly to dislodge and blow out through the top of the housing. Always turn the air on gently and point the top of the second stage in a direction that will not place you or anyone else in danger.

1. Connect the hose from the first stage and gently turn the air on.
2. Cycle the valve several times by depressing the lever. There should be some play in the lever at this point to insure that the poppet can firmly seat against the valve body knife edge.
3. If an air leak is heard, insert a screwdriver into the aspirator cap and turn it inward (clockwise) 1/4 turn. Note: There is a tendency for the spring to wind up radially when the cap is turned inward. This radial load actually reduces spring tension and can keep the spring from exerting the necessary increase in force required to stop the leak. When cap adjustments are made, always go slightly further than necessary and finish the adjustment by backing the cap outward (counterclockwise).
4. Cycle the valve several times to be sure that the poppet is reseating consistently.
5. If an audible air leak is still present, repeat steps 3 and 4 again. Continue this procedure until the air leak stops. If the leak is still present after the cap has been turned inward 2 1/2 turns, check again to be sure that the lever is free. Additional clearance can be added by backing the nyloc screw outward. If this fails to stop the leak, replace the poppet seat and repeat the adjustment procedure.
6. The final adjustment is to remove the clearance between the nyloc screw, lever, and poppet stem. Turn the nyloc screw inward (clockwise) until an audible leak is heard and then back it outward until the leak stops. Only the slightest detune is necessary on the D400 due to the toughness of the poppet seat compound.
7. After all the above adjustments are completed in the proper sequence, cycle the valve a minimum of 5 more times to be sure that the adjustment is stable.
8. Install all of the diaphragm/exhaust valve components and covers.
9. See figure #9 for full cutaway assembly and figure #10 for additional adjustment procedures.

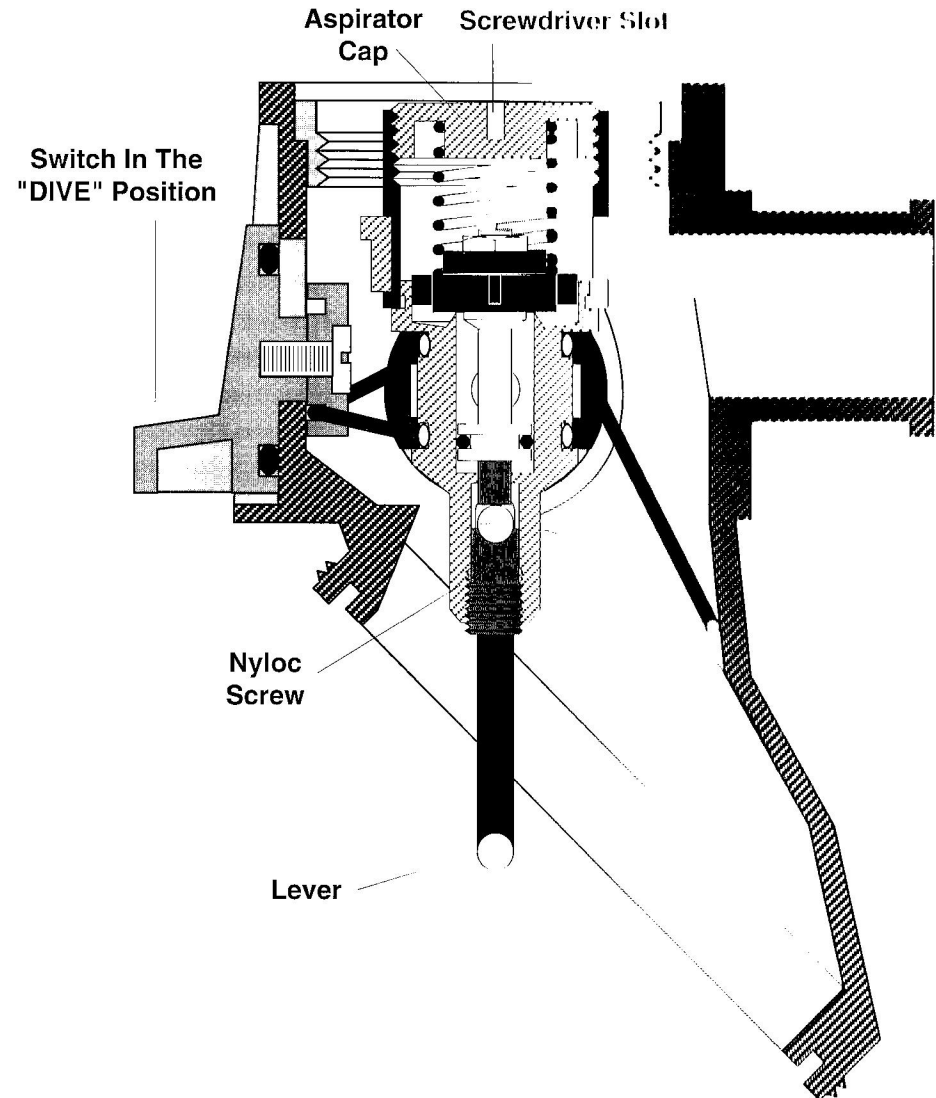


Figure #9

SCUBAPRO® D400 Second Stage Full Cutaway Assembly

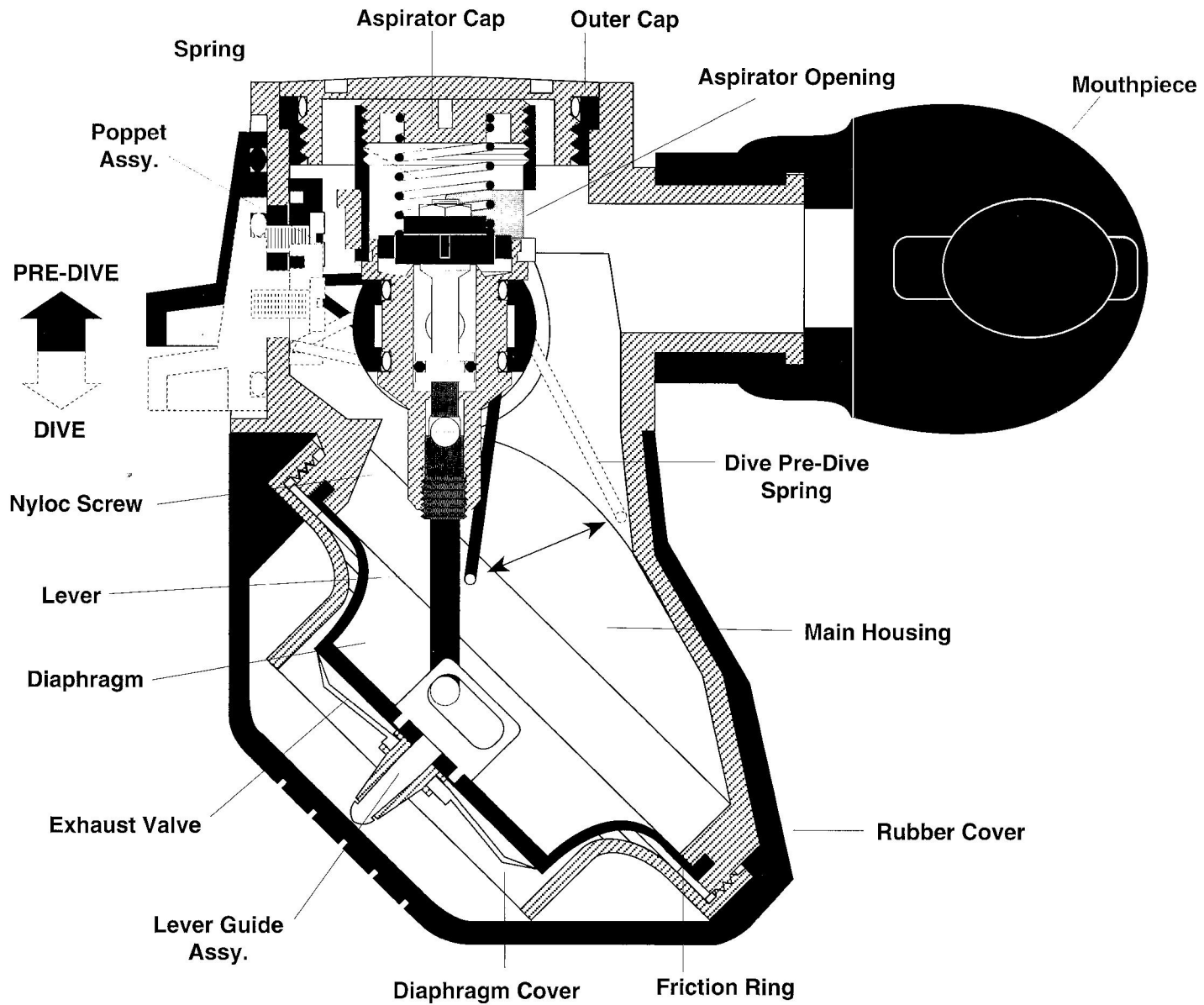
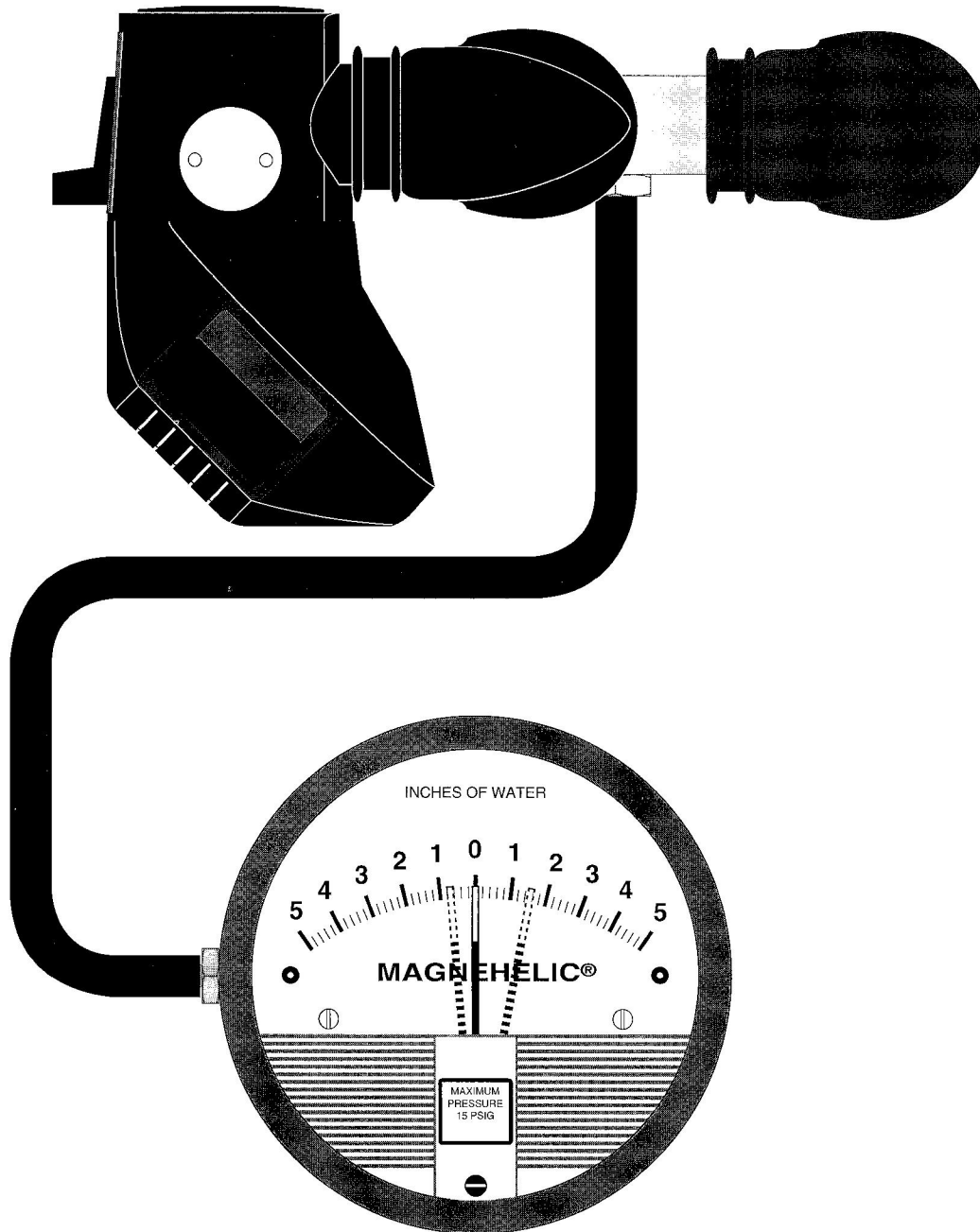


Figure #10



SCUBAPRO® D400 Second Stage Magnehelic Gauge Checks

Magnehelic Gauge Checks:

1. Install the Magnehelic* gauge to the second stage as shown to the left.
2. Set the Dive Pre-Dive Switch to the "Dive" position
3. Turn the air on gently.
4. "Inhale" through the Magnehelic mouthpiece extension "as gently as possible" while watching the Magnehelic needle move to the right. Observe the precise reading on the gauge when the second stage cracks open and delivers air. Take several readings to insure accuracy.
5. "Blow" through the Magnehelic mouthpiece extension "as gently as possible" while watching the needle move to the left. Observe the reading on the gauge when the exhaust valve releases and passes air. Take several readings to insure accuracy.
6. Set the switch to the "Pre-Dive" position and repeat step #4

D400 Standards, Dive Position:

Inhalation Range: 1.0-1.5 Inches Of Water

Exhalation Range: .4-.6 Inches Of Water

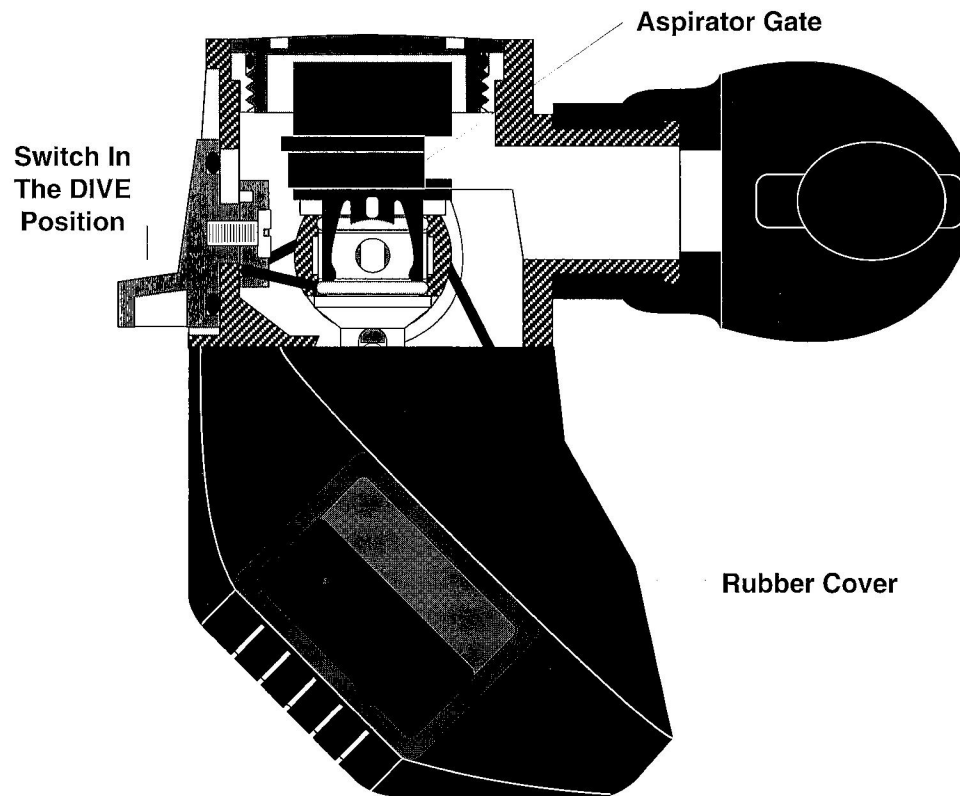
D400 Standards, Pre-Dive Position:

Inhalation Range: 1.6-2.0 Inches Of Water

Note: For a complete description of the above test procedure consult Chapter 7, "Second Stage Adjustment Fundamentals".

*Magnehelic - Registered trademark of Dwyer Instruments, Inc.

Figure #11



How The D400 VIVA Works:

Scubapro VIVA adds exceptional comfort to each breath by utilizing the velocity of the flowing air to reduce the inhalation effort required to keep the air moving. This is accomplished by focusing the air stream through an aspirator. The amount of vacuum created behind the air stream, inside the regulator case, is directly proportional to the speed of the air. This vacuum pulls inward on the diaphragm, depressing the lever, and reducing the inhalation effort required to maintain flow. The D400 aspirator can be rotated to change the direction of the high speed air. In the full open position, the maximum amount of assist is generated. When the aspirator gate is rotated to the left or right, the air must bounce several times before exiting, creating friction and reducing the velocity. This reduction in the speed of the air also reduces the amount of assist generated. The D400 VIVA assist is not diver adjustable. The level of assist is set by the regulator technician during service.

SCUBAPRO[®] D400 Second Stage VIVA Adjustments

D400 VIVA Adjustments:

1. Turn the air on.
2. Set the Dive Pre-Dive switch in the "Dive" position.
3. The mouthpiece should be installed on the second stage before the VIVA adjustments are made.
4. Position the aspirator gate so that it is pointing directly out through the mouthpiece in the full open position. This adjustment is accomplished by inserting a small screwdriver through the mouthpiece and pushing either edge of the aspirator gate. The gate will rotate on the aspirator in a series of detent click stops. Listen for the gate to snap into place as it is rotated.
5. Purge the second stage by squeezing the rubber cover. The second stage should "free flow" producing a noticeable discharge of air. This air flow can be stopped by placing your index finger over the mouthpiece opening.
6. Close the aspirator gate "one click" and purge the second stage again. If the free flow is still present, continue to click rotate the gate until you find the point where the D400 will not free flow when it is purged. The gate can be rotated in both directions.
7. This aspirator gate position is considered to be the standard location for general use. If your customer prefers a different setting to accommodate particular diving conditions, you can adjust the gate to suit his preference.
8. After the air is turned off and the second stage is fully purged, be sure to run a vacuum test to insure watertight integrity of the second stage.
9. Check all hose connections before returning the regulator to your customer.

Figure #12

SCUBAPRO® D400 Second Stage Trouble Shooting Guide

Continuous slow leak from second stage.

Cause:	Remedy:
• Defective poppet seat	• Replace poppet seat
• Nicked or damaged knife edge	• Replace valve body
• High Intermediate pressure	• See first stage trouble shooting
• Low spring tension	• Readjust aspirator cap
• Nyloc screw too far in	• Back off the nyloc screw

Note: Slow air leaks can usually be traced to the seating compatibility of the poppet seat and valve body knife edge. Be sure that the old poppet seat is always replaced when the regulator is serviced.

Inhalation effort is "higher" than specification.

Cause:	Remedy:
• Spring tension is too high	• Readjust aspirator cap
• Nyloc screw too far out	• Readjust nyloc screw to reduce clearance
• Dirty or corroded parts	• Clean all components
• Low intermediate pressure	• See first stage trouble shooting
• Low tank pressure	• Fill or replace tank

Note: Provided that the adjustment procedure has been followed, hard breathing symptoms can often be corrected by proper cleaning and lubrication. If you are attempting to adjust a dirty or dry second stage, you may need to overhaul, clean, and lubricate the unit before the inhalation effort can be improved.

Inhalation effort is "lower" than specification.

Cause:	Remedy:
• Aspirator cap too far out	• Readjust aspirator cap inward

Note: It is seldom considered a problem when a regulator breathes too easily, but balanced valves can become "unstable" if they are adjusted below 1.0" H₂O. Low cracking efforts also dramatically affect the VIVA range.

Violent free flow from second stage.

Cause:	Remedy:
• VIVA adjusted beyond the override position	• Readjust aspirator gate
• High intermediate pressure	• See first stage trouble shooting
• Poppet or lever stuck in the open position	• Check for obstructions or damaged valve parts

Note: The preceding causes and remedies are based upon proper assembly of the valve and diaphragm components. Be sure that the lever guide is aligned so the the lever can travel freely as the second stage is cycled.

VIVA does not override demand effort in the open position.

Cause:	Remedy:
• Valve adjusted too stiff	• Readjust valve or replace spring
• Switch in the Pre-Dive position	• Switch to Dive position

Note: When the regulator is properly adjusted, the VIVA will override the demand effort and cause the second stage to free flow when the aspirator gate is fully open. Be sure the valve is clean, lubricated, and adjusted properly before replacing parts.