

Figure #1

SCUBAPRO[®]

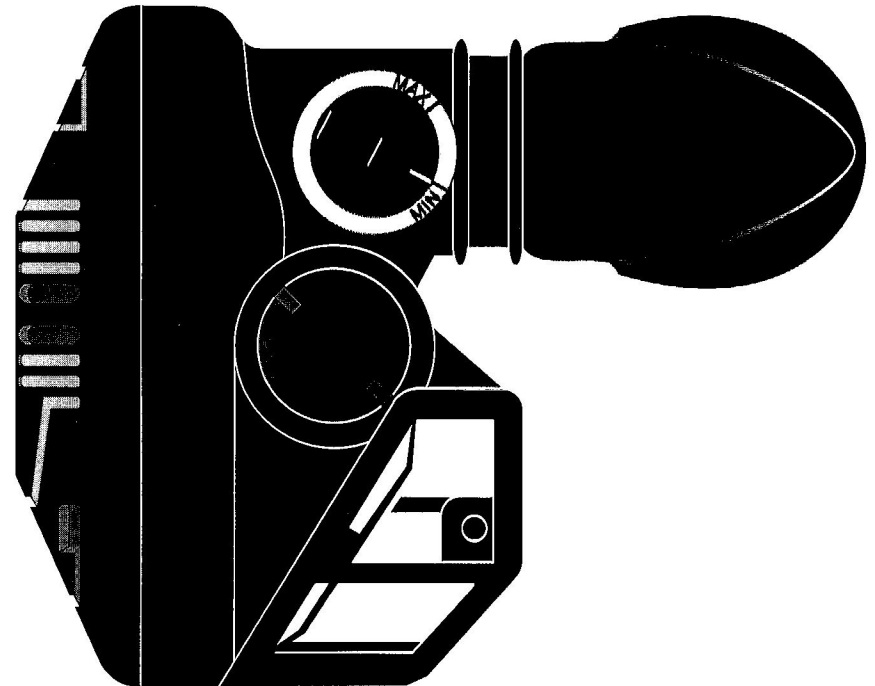
Technical Service Reference & Repair Guide

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R190

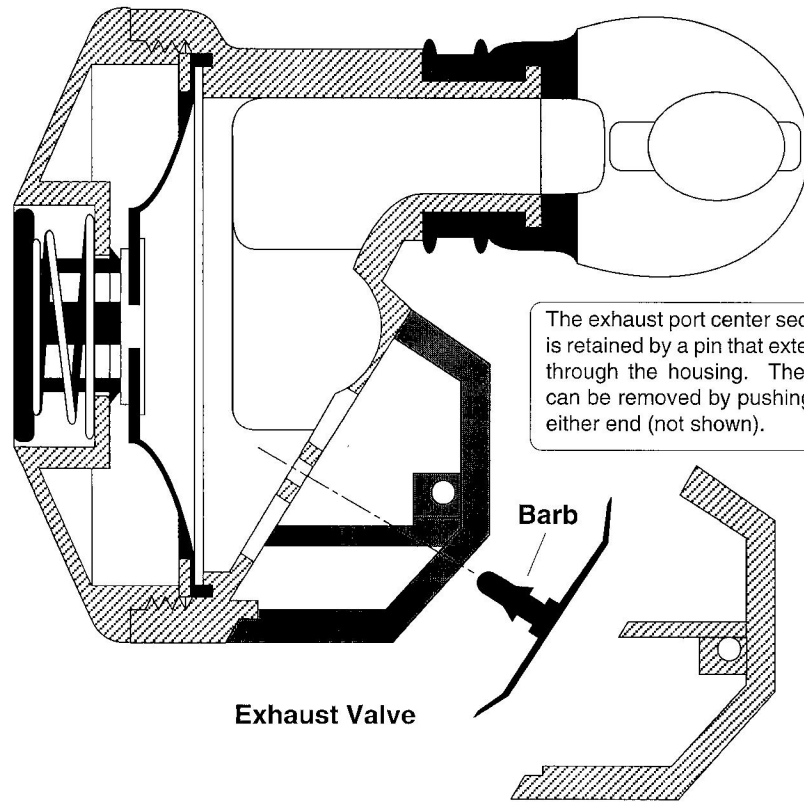
Second Stage



Important Note: The following information "is not" designed to be a complete training guide for infield servicing of the R190 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 R190 Second Stage Case Assembly



The exhaust port center section is retained by a pin that extends through the housing. The pin can be removed by pushing on either end (not shown).

The exhaust valve is serviced by removing the exhaust port center section. To replace the exhaust valve, insert the leading end of the valve into the hole in the center of the spider. Pull the valve into the housing from the inside using needle nose pliers. Be sure that it is firmly in place with the molded barb indexed properly with the housing.

Purge Button
(decal not shown)

Purge Spring

Cover

Friction Ring

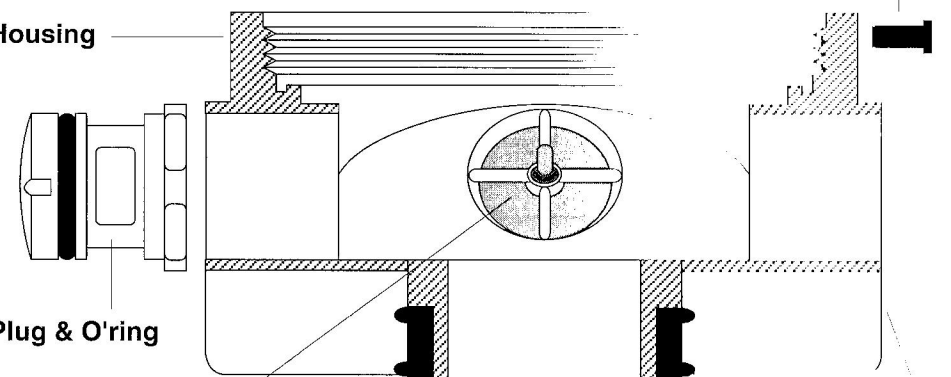
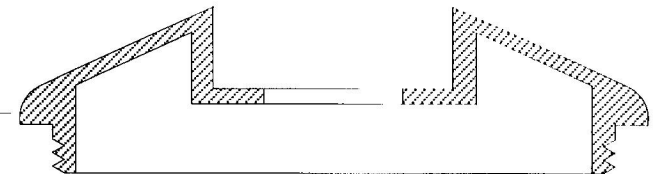
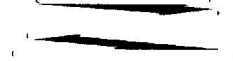
Diaphragm &
Center Disc

Housing

Plug & O'ring

Exhaust Valve

Mouthpiece



Cover
Pin

Exhaust
Port

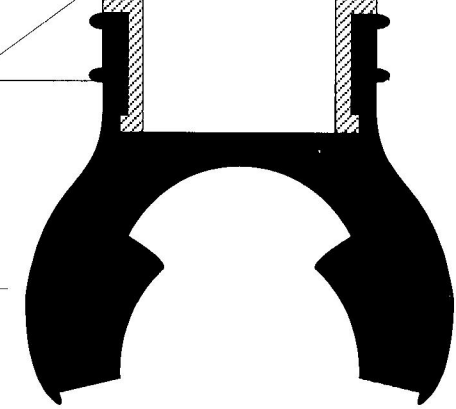


Figure #3

SCUBAPRO® R190 Second Stage Downstream Valve Parts

Note:

This illustration shows all of the R190 downstream valve components. The order of assembly is very important and will be covered in figure #5. At the time of this writing, a new poppet design was being considered. Be sure to keep up-to-date with current engineering bulletins regarding all new parts. The poppet seat and nylon locknut are always replaced during annual service. Other components may be reused provided that they are not worn or damaged.

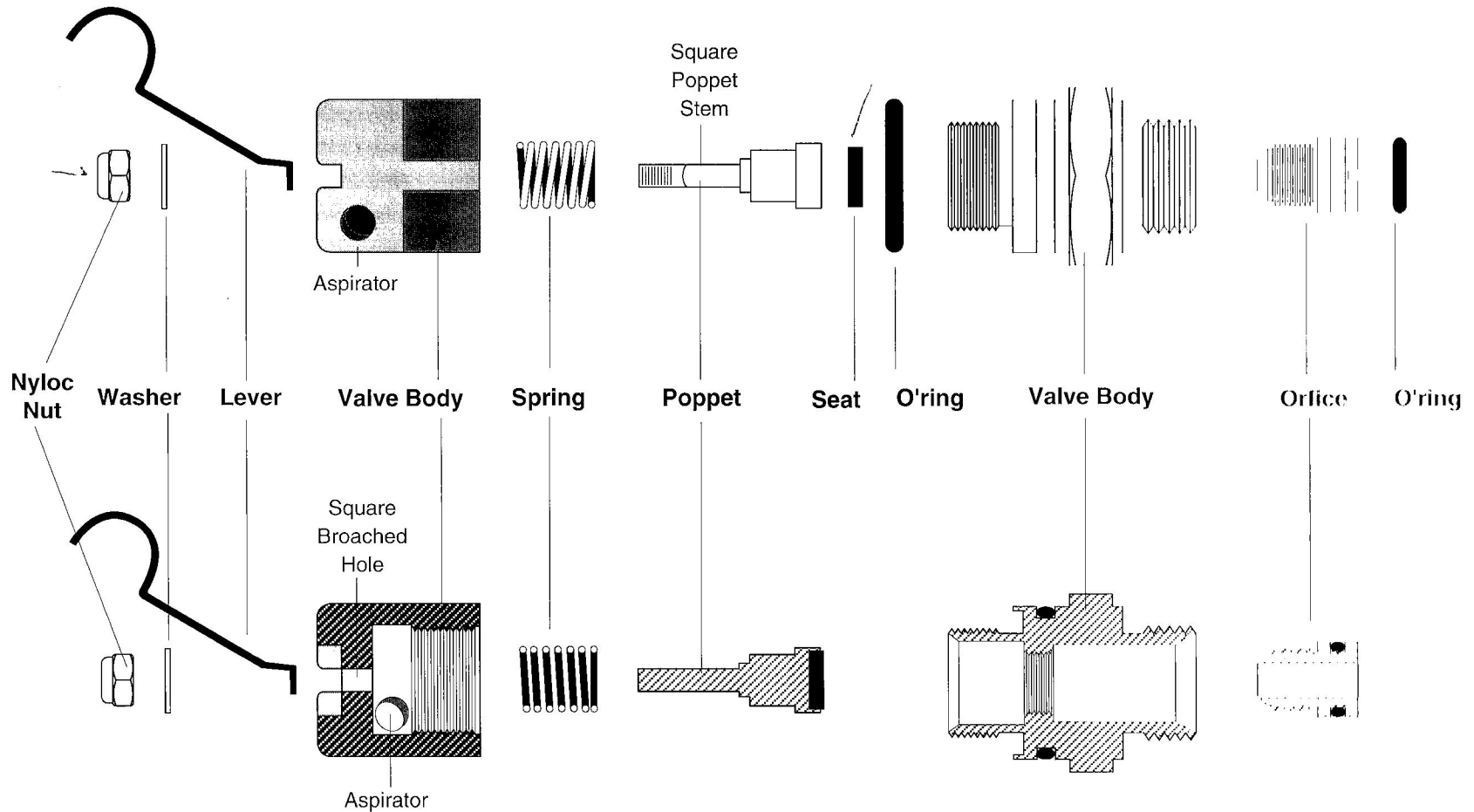


Figure #4

SCUBAPRO® R190 Second Stage Valve Assembly

Notes:

The R190 downstream valve is assembled into the case as two pre-assembled units. The inner valve body, lever, nylon locknut, washer, poppet, and spring are assembled as a unit and installed from inside the case; and the outer valve body and orifice are pre-assembled and installed from outside the case. The illustrations to the right show the valve in its entirety as if it were completely installed in the case to highlight the actual valve function without overcomplicating the drawing.

Preliminary setup:

The middle cutaway shows the valve in the closed position. The poppet stem is square and must be aligned with the square broached hole in the valve body. The spring tension can be adjusted by both the orifice and the nylon locknut. The preliminary setup for the R190 requires that both the nut and the orifice be positioned in approximately the right location. The nut should be threaded onto the poppet stem until one full thread is exposed outside the nut. The orifice should be threaded into the valve body until it bottoms out and then backed off 1.75 turns. These preliminary adjustments will place these components close to the final setting. Final adjustments will be made with the air turned on.

The illustration at the bottom shows the valve open with the lever fully depressed. Note how the lever pulls the poppet away from the orifice and allows the air to flow. The R190 has two aspirators drilled into the inner valve body. This design allows the complete valve to be installed in either side of the case so that left or right hose configurations can be used. This is an exclusive feature of the R190 and is covered in more detail in figure #6.

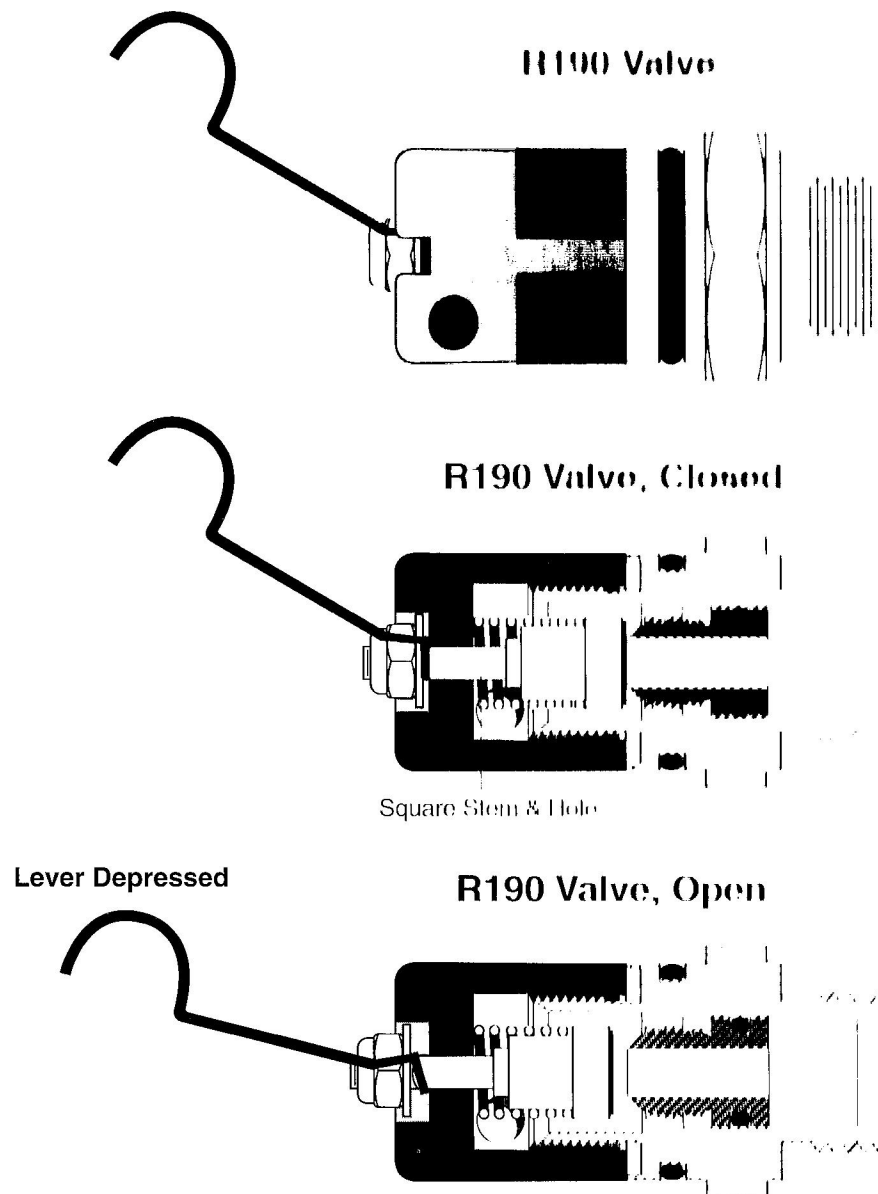
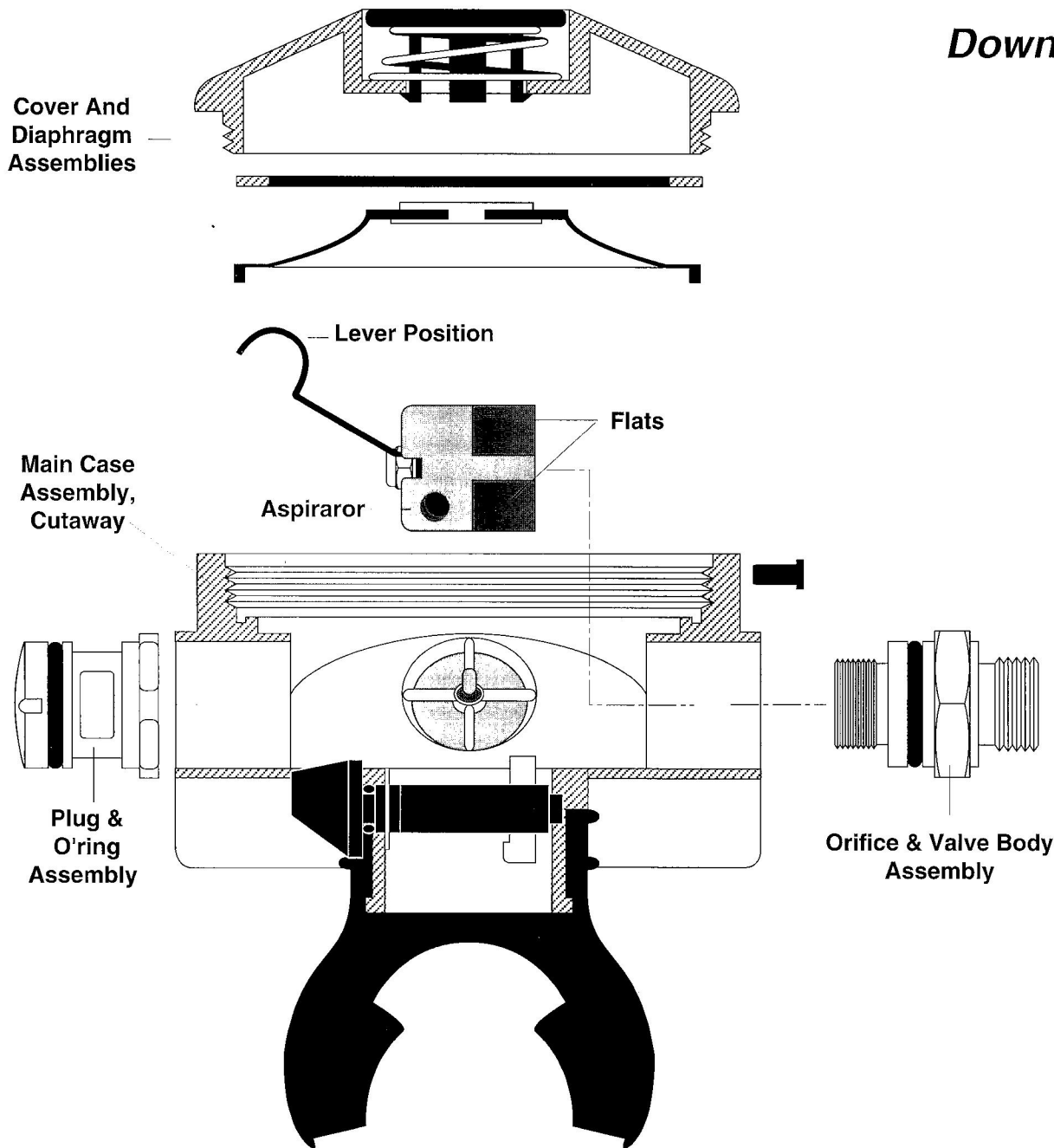


Figure #5

SCUBAPRO™ R190 Second Stage Downstream Valve Installation



Assembly Notes:

1. Pre-assemble the inner valve components: (i.e. lever, washer, nylon locknut, poppet, and spring). Remember that the square stem on the poppet must align with the square broached hole in the valve body. Due to the retracted position of the poppet and the spring force, it is difficult to hold the poppet with the spring compressed while the lever, washer, and nut are installed. This pre-assembly can be accomplished easily using the outer valve body as an assembly post. This should be done with the orifice "retracted" to prevent damage to the new poppet seal. Position the poppet and spring in the inner valve body and thread the two valve bodies together. **DO NOT FORCE!** If resistance felt, the square stem and hole are not aligned. Back the outer valve body out 1/2" turn and try again. Once the two halves are completely together, the lever, washer, and nut can be easily installed. Remove the outer valve body and depress the lever to be sure that the poppet slides easily and does not bind.

2. Install the inner pre-assembled unit into the case. Be sure that it is oriented with the case as shown in the drawing.

3. Install the outer valve body assembly together with the inner valve assembly and snug them with a wrench.

4. Position the orifice 1/34" turn up from the bottom while holding the lever depressed. This prevents the seal from being cut by the orifice.

5. The valve is now ready for "in on" adjustment.

Note: Do not install the plug or diaphragm assemblies at this time. It may be necessary to adjust the nylon locknut during the air on procedure. The nut can be adjusted by inserting a 1/4" nut driver through the plug hole.

Figure #6

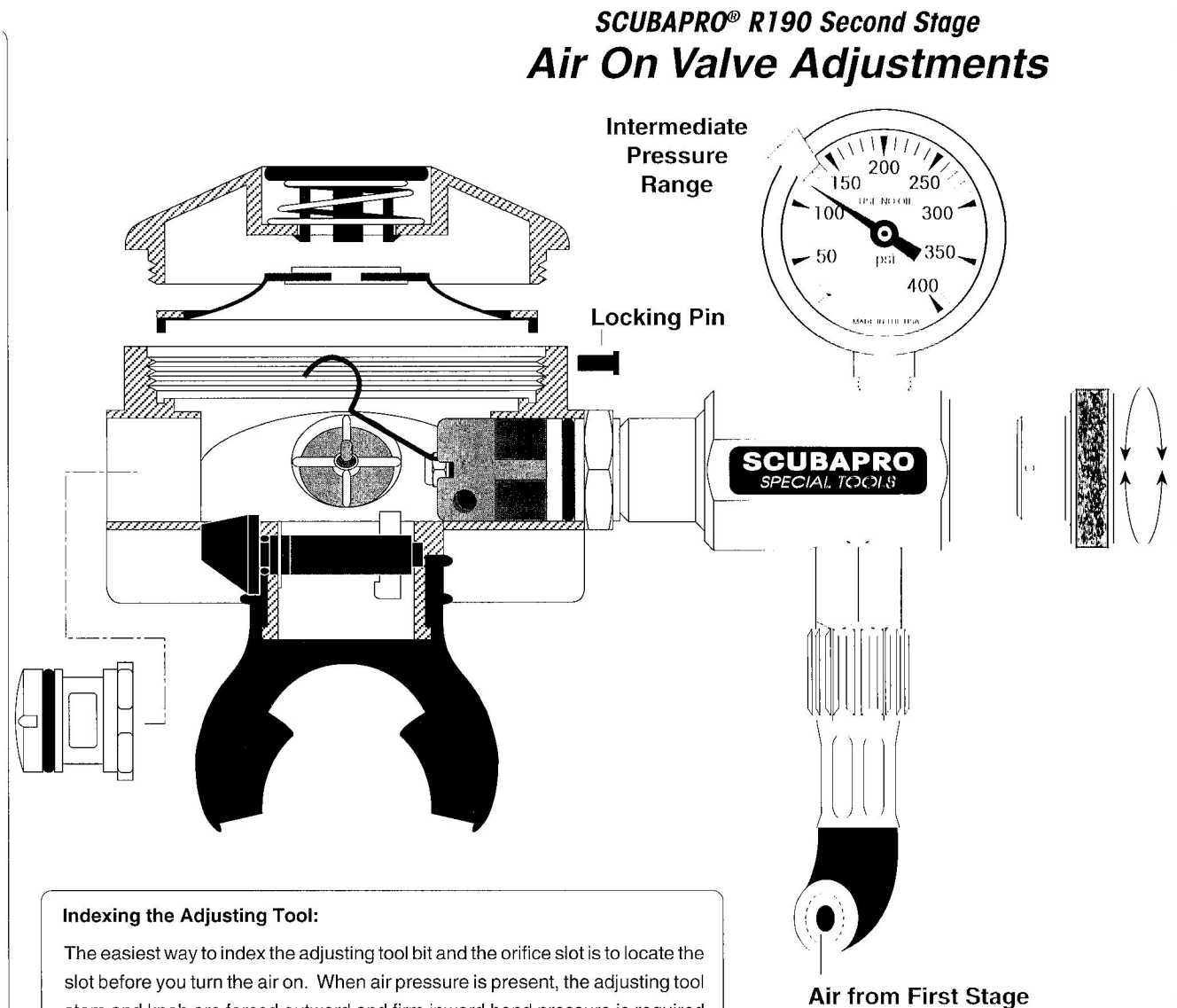
Air On, Orifice Adjustments:

1. Install the pneumatic adjusting tool to the R190 second stage.
2. Install the hose from the first stage to the adjusting tool.
3. Before turning the air on, index the adjusting tool bit with the orifice slot (see note, bottom center).
4. Turn the air on gently. The adjusting tool knob will pop outward in response to the air pressure.
5. If an audible air leak is heard, push inward firmly on the adjusting tool knob and rotate the orifice clockwise* (inward) until the leak stops.
6. If no audible leak is heard, rotate the orifice counterclockwise (outward) until a leak is present and then stop the leak by reversing the orifice rotation.
7. Purge the second stage several times to insure the leak does not reoccur.
8. If any slack is present in the lever after the orifice is adjusted, take up the slack by tightening the nylon locknut.
9. De-tune the orifice slightly to allow for the seat to take a set. The amount of de-tune necessary is best described as a clockwise rotation from 12:00 to 1:00.
10. Install the diaphragm, friction washer, and cover assembly. Lock the cover by inserting the plastic locking pin.
11. Check the inhalation and exhalation effort using the Magnehelic** gauge (see figure #9).

Note: For a complete description of the above tests and procedures consult Chapter 7, "Second Stage Adjustment Fundamentals".

* All references to clock rotation are described as if you were facing the part.

**Magnehelic - Registered trademark of Dwyer Instruments, Inc.



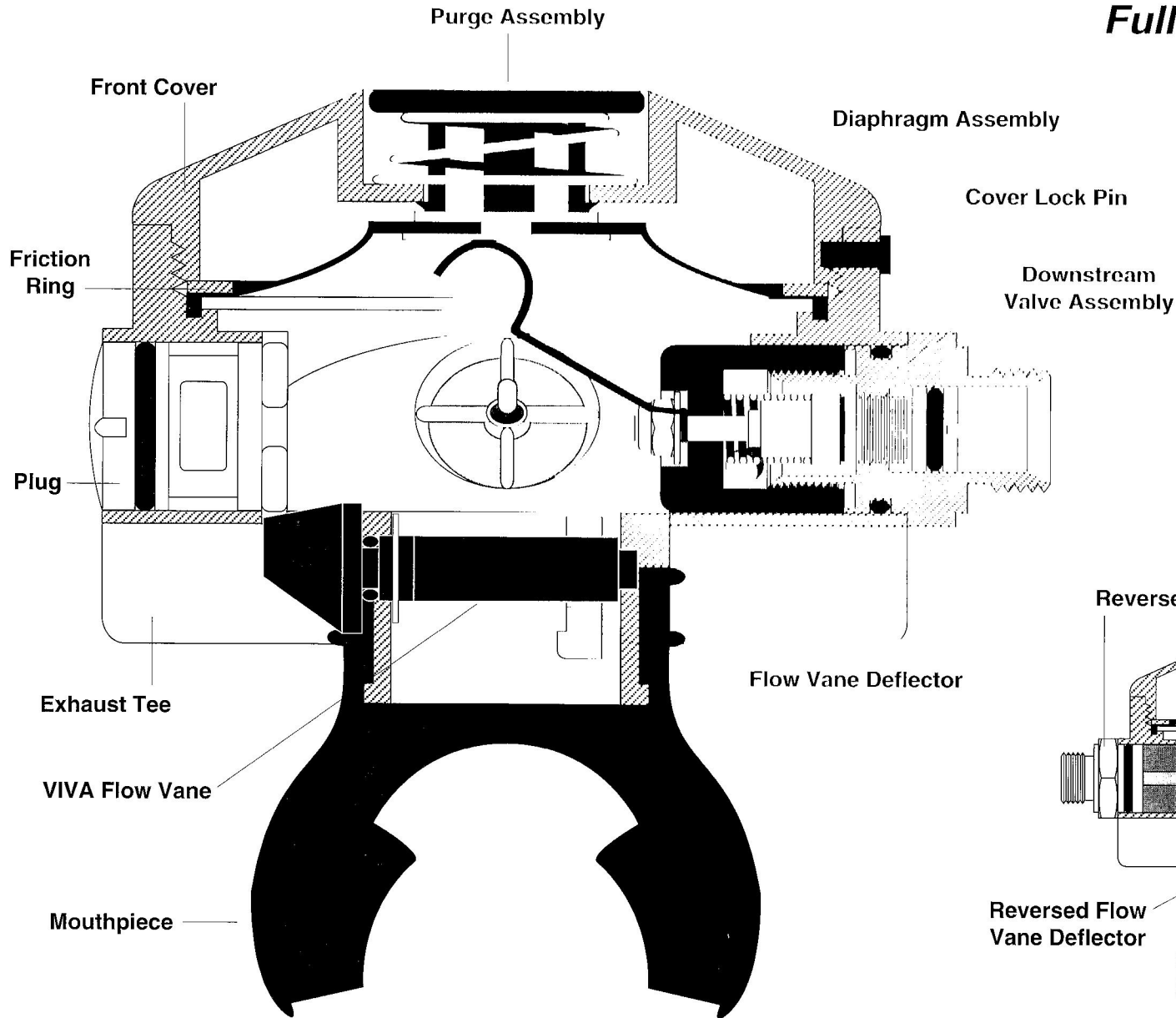
Indexing the Adjusting Tool:

The easiest way to index the adjusting tool bit and the orifice slot is to locate the slot before you turn the air on. When air pressure is present, the adjusting tool stem and knob are forced outward and firm inward hand pressure is required to overcome the force of the air. Trying to mate the bit and slot while pushing in on the knob can be difficult. If the two are indexed prior to turning the air on, the pressure will drive the stem and knob "straight outward" without altering the rotational alignment. By pushing "straight inward", the bit and slot will index perfectly and any rotation of the adjusting tool knob will also turn the orifice.

Air from First Stage

Figure #7

SCUBAPRO® R190 Second Stage Full Cutaway, Top View



Notes:

- The illustration to the left shows the R190 in a full cutaway view. It is important that the lever is just touching the underside of the diaphragm plate. The lever height can be checked by gently pushing on the purge button. The slightest movement should produce an air leak.
- The plug must be rotated 1/8 turn to lock it into place.
- The illustration below shows the valve and plug reversed to allow for a left side hose configuration. The adjustment procedure for this setup is identical to the normal right side hose mount. Be sure to install the flow vane deflector on the same side as the valve.

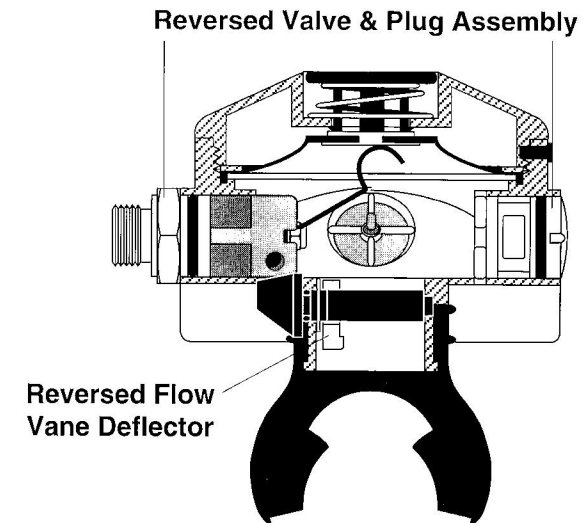
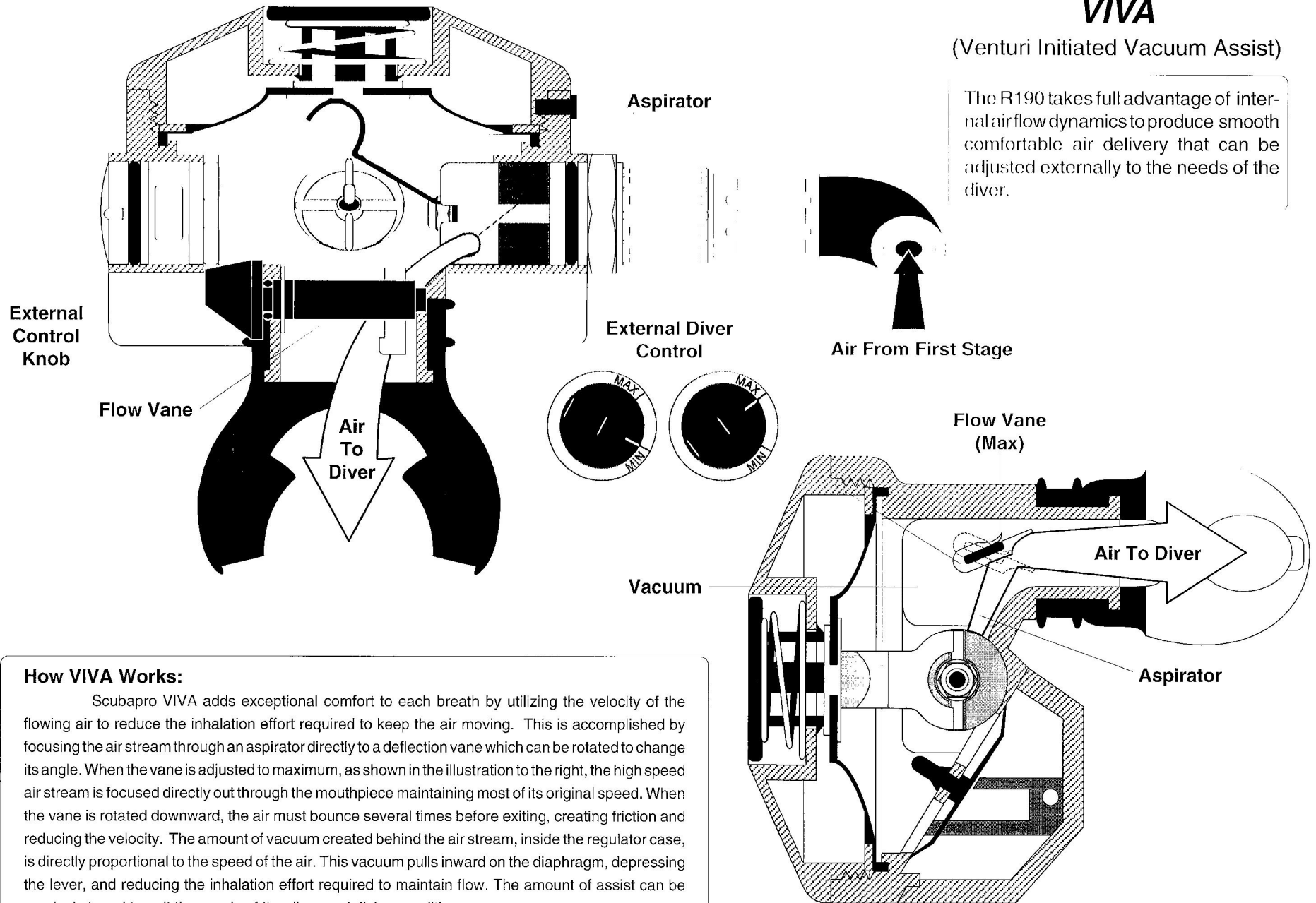


Figure #8

SCUBAPRO® R190 Second Stage VIVA

(Venturi Initiated Vacuum Assist)

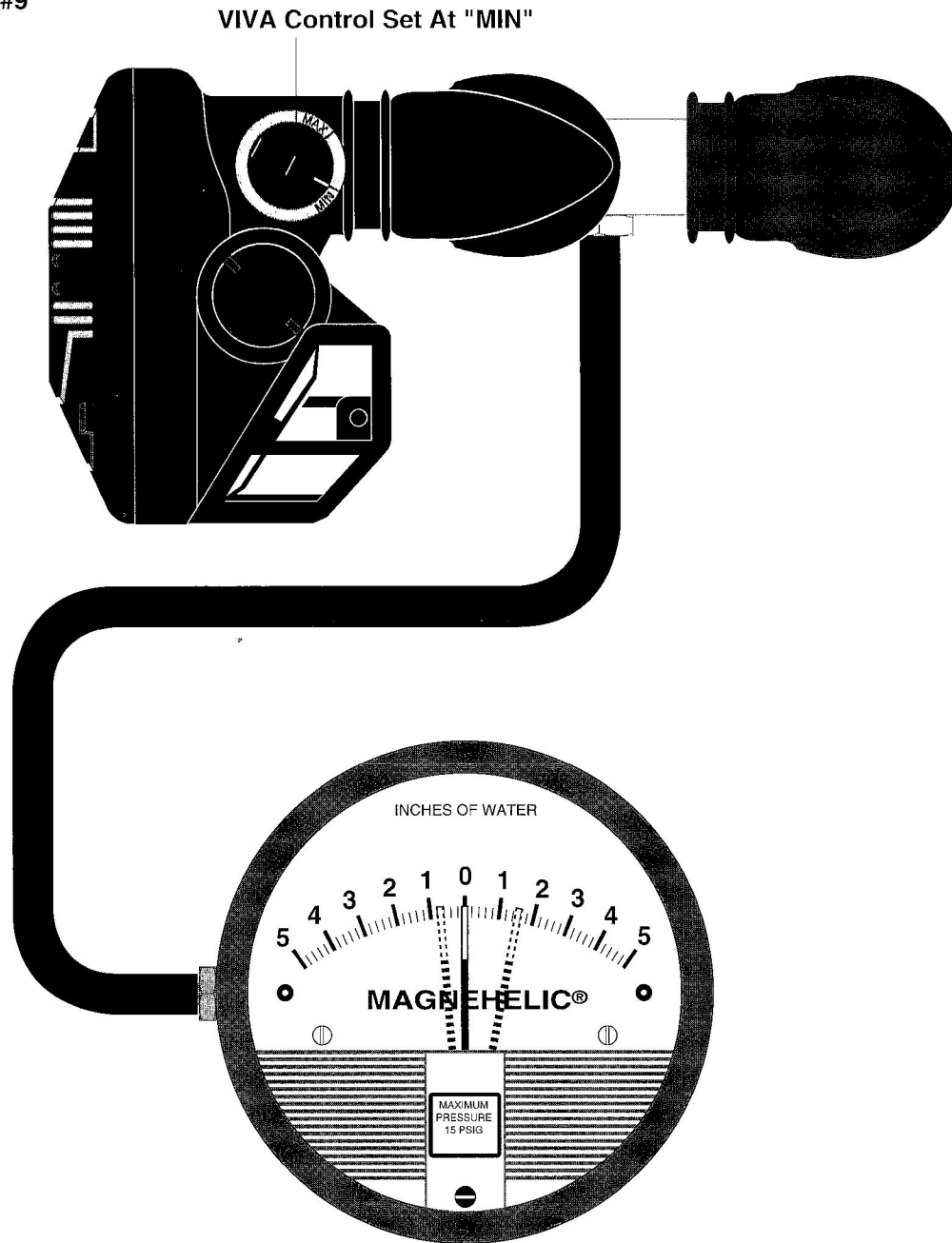
The R190 takes full advantage of internal air flow dynamics to produce smooth comfortable air delivery that can be adjusted externally to the needs of the diver.



How 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 directly to a deflection vane which can be rotated to change its angle. When the vane is adjusted to maximum, as shown in the illustration to the right, the high speed air stream is focused directly out through the mouthpiece maintaining most of its original speed. When the vane is rotated downward, the air must bounce several times before exiting, creating friction and reducing the velocity. 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 amount of assist can be precisely tuned to suit the needs of the diver and diving conditions.

Figure #9



SCUBAPRO[®] R190 Second Stage Magnehelic Gauge Checks

Magnehelic Gauge Checks:

1. Install the Magnehelic[®] gauge to the second stage as shown on the left.
2. Set the VIVA control to the "MIN" 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.

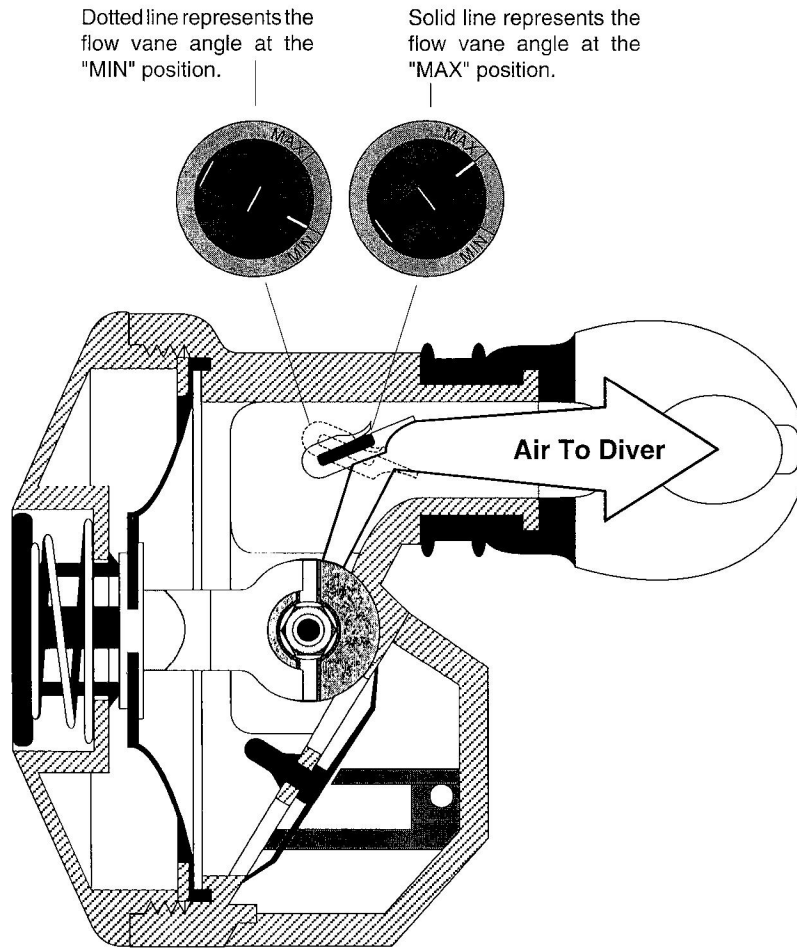
R190 Standards:

Inhalation Range: 1.4-1.6 Inches Of Water

Exhalation Range: .4-.6 Inches Of Water

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

Figure #10

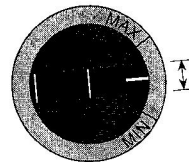


SCUBAPRO® R190 Second Stage VIVA Checks

VIVA Checks:

1. Remove the Magnehelic gauge and connect the first stage hose directly to the second stage. Be sure to firmly tension the hose connection.
2. Turn the air on.
3. Set the VIVA control at the "MIN" position and fully depress the purge button. The valve should stop immediately upon release of the purge button.
4. Set the VIVA control at the "MAX" position and fully depress the purge button. The valve should remain open and the air should "free flow" when the purge button is released. To stop the air flow, place your thumb over the mouthpiece opening.
5. Check the VIVA override position (see note below).

VIVA Override Position:



The point where the VIVA begins to override the resistance of the valve should be between the limits shown in the illustration to the left. This point is located by gradually increasing the VIVA effect and purging the second stage at each interval. At this position, the valve will try to free flow but will shut off by itself after a brief override. It is always advisable not to set the VIVA beyond this level when the second stage is returned to your customer. Take a few minutes and demonstrate this dynamic air flow assist. It provides exceptional breathing comfort when properly used.

Figure #11

SCUBAPRO® R190 Second Stage Trouble Shooting Guide

Continuous slow leak from second stage.

Cause:	Remedy:
• Defective poppet seat	• Replace seat
• Nicked or damaged orifice	• Replace orifice
• High Intermediate pressure	• See first stage trouble shooting
• Low spring tension	• Readjust orifice and nylon locknut

Inhalation effort is "higher" than specification.

Cause:	Remedy:
• Orifice adjusted too far inward	• Retract orifice and readjust nylon locknut
• Lever too low	• Adjust nylon locknut
• Dirty or corroded parts	• Clean all components
• Low intermediate pressure	• See first stage trouble shooting
• Low tank pressure	• Fill or replace tank

Inhalation effort is "lower" than specification.

Cause:	Remedy:
• Orifice is retracted too far	• Reset orifice and nylon locknut

Violent free flow from second stage.

Cause:	Remedy:
• VIVA adjusted beyond the override position	• Readjust VIVA control
• High intermediate pressure	• See first stage trouble shooting
• Poppet and lever stuck in the open/closed position	• Check poppet and valve body alignment

VIVA does not override demand effort at the MAX setting.

Cause:	Remedy:
• Valve adjusted too stiff	• Readjust valve beginning with orifice and nylon locknut
• Lever too low	• Adjust nylon locknut

Note: Slow air leaks can usually be traced to the seating compatibility of the orifice and poppet. Be sure that the old poppet is always replaced when the regulator is serviced. The groove in the old seat may not match with the orifice if you attempt to reuse it. The soft rubber material can also be easily cut or deeply grooved if repeated orifice adjustments are made.

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.

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

Note: The preceding causes and remedies are based upon proper assembly of the poppet, lever, and spring. If the square poppet stem is not properly aligned with the square valve body hole, the valve may be totally inoperative with the poppet stuck in the open position.

Note: When the regulator is properly adjusted, the VIVA will override the demand effort and cause the second stage to free flow at maximum capacity. This should occur at approximately the mid point of the VIVA range.