

Figure #1

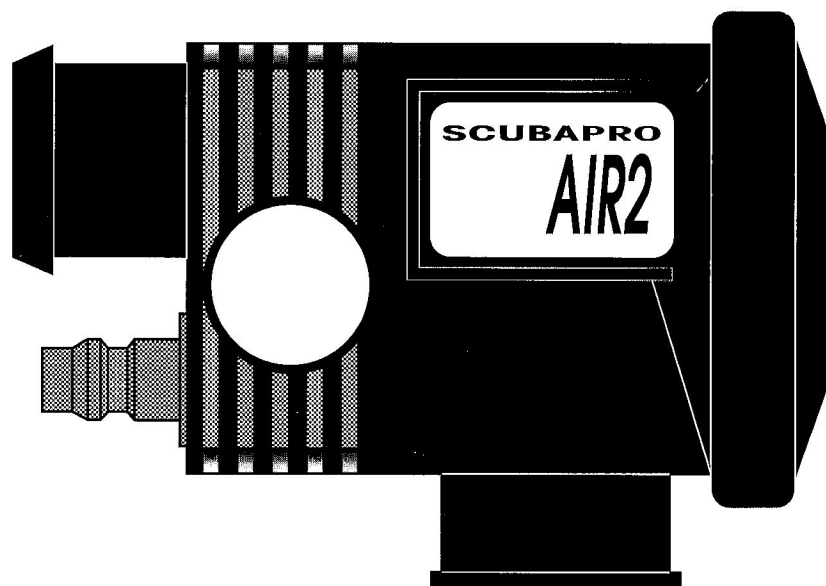
# SCUBAPRO<sup>®</sup>

## *Technical Service Reference & Repair Guide*

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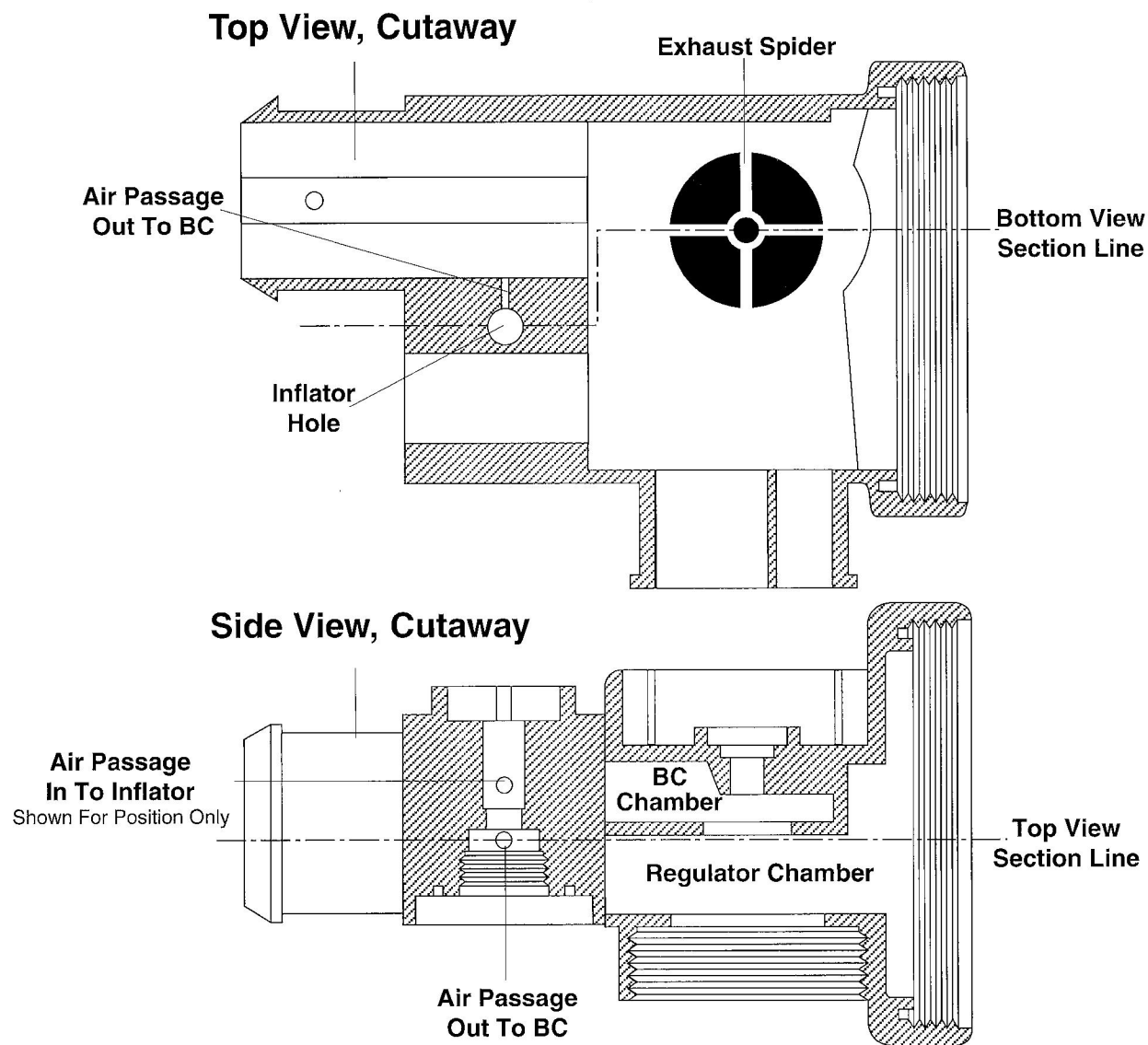
## **Air 2** Third Generation *Alternate Inflation Regulator*



**Important Note:** The following information "is not" designed to be a complete training guide for infield servicing of the Air 2 Alternate Inflation Regulator. All Scubapro technicians are required to attend an annual repair clinic to insure safe handling and servicing of Scubapro products.

Figure #2

## SCUBAPRO Air 2 Alternate Inflation Regulator Case Assembly



### Notes:

The Scubapro Air 2 utilizes three separate valve systems to control the air flow and provide the dual function:

- Downstream regulator valve
- Dump/Exhaust valve
- Inflator valve

Each of these mechanisms will be described in Figures #3, #4, #5, and #6 respectively. To understand the relationship of how these valves work in conjunction with each other, it is important to visualize how the case assembly is cut away. The illustrations to the left show the case in two cutaway views.

The top view is cut along the section line shown in the side view. Take note that the line passes through the case slightly below center and intersects the air passage to the BC.

The side view is cut on a stepped line that passes through the center of the inflator hole and then goes upward 90° and passes through the center line of the exhaust spider. The air passage to the inflator, shown in the side view, is indicated for position only. This hole enters the inflator hole from the opposite side and is not visible in either illustration. The side view also shows how the case is internally chambered to separate the BC air from the regulator. This relationship will be important when the Dump/Exhaust valve is discussed.

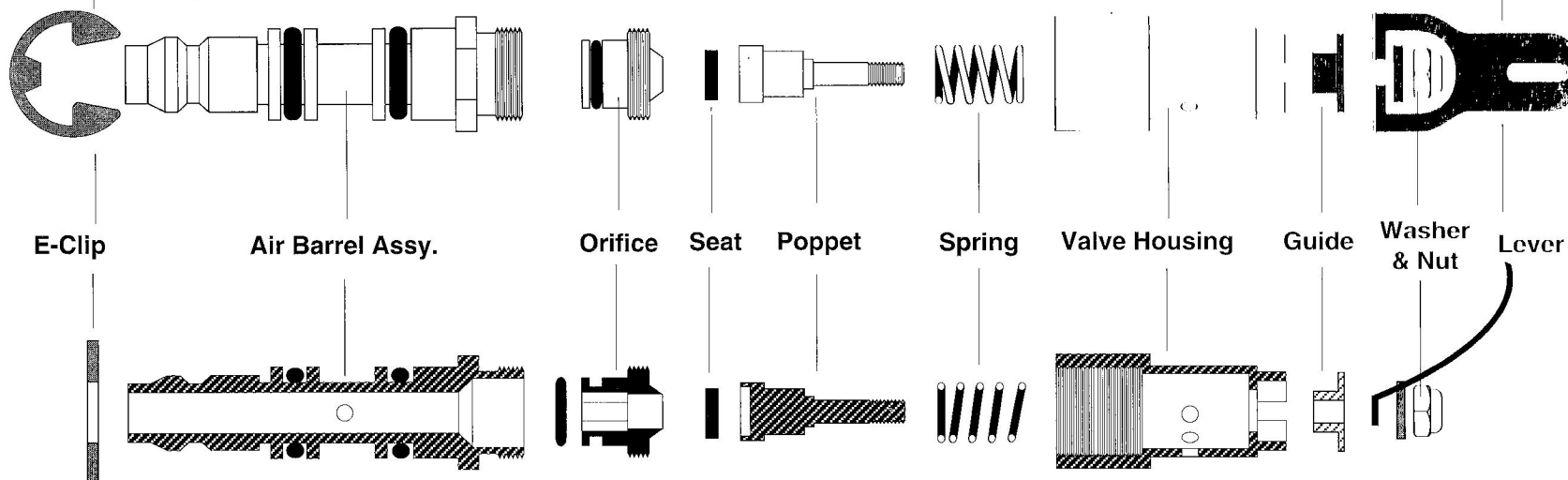
I apologize for the complexity of this illustration, but you will understand the need for this information as you progress through this appendix. Refer to this page as often as necessary to establish the overall relationship of the Air 2 function.

Figure #3

## SCUBAPRO Air 2 Alternate Inflation Regulator Downstream Valve Components

E-Clip Rotated 90° For Clarity

Lever Rotated 90° For Clarity



### Note:

The Scubapro Air 2 regulator utilizes a classic downstream valve. The illustration below shows the valve in the closed position. When the lever is depressed (moved to the left), the poppet is pulled away from the orifice allowing air to flow out through the aspirator. The orifice position can be adjusted after assembly by inserting a 3/16" allen wrench through the air barrel. The nyloc nut can also be used to control spring tension. Always replace the poppet seat and nyloc nut during annual service. The full adjustment procedure is covered in this appendix under its own heading.

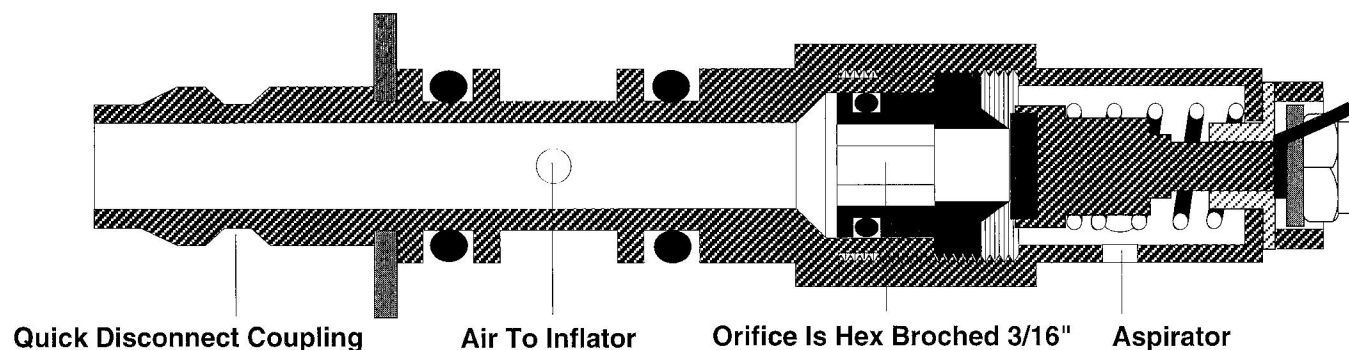


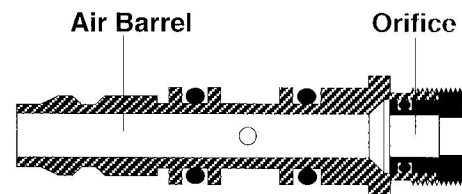
Figure #4

## SCUBAPRO Air 2 Alternate Inflation Regulator Regulator Valve Assembly Instructions

### Notes:

Preassemble the valve parts shown to the right by using the "Spider Tool". The threaded post on the tool will hold the poppet and compressed spring in place while the bushing, lever, washer, and nut are assembled. Thread the nyloc nut onto the poppet stem until one full thread is exposed above the nut.

Install the lever pointing "left" (as shown) when you are facing the machined "flat" on the housing. The lever also points away from the aspirator holes.



Preassembled Valve



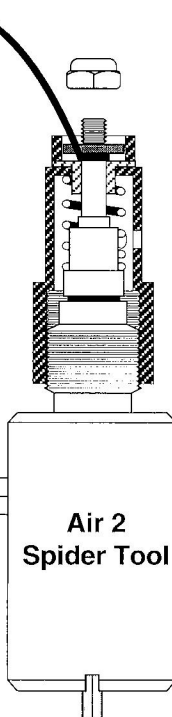
### Valve Installation:

After the valve has been preassembled, install the orifice and air barrel into the end of the air barrel. Thread the preassembled valve and air barrel assembly together as far as they will go and then back the air barrel off so that the machined flats are aligned. These flats must be aligned to install the completed assembly into the main case. If you look inside the case from the open diaphragm end, you will see a molded flat ledge on the bottom side of the case. The machined flats on the completed valve and air barrel assembly must align with the molded flats in the case. Push the valve assembly into the case as far as it will go and install the E-clip on the outside of the opposite end. Do not install the diaphragm, friction ring, and cover at this time.

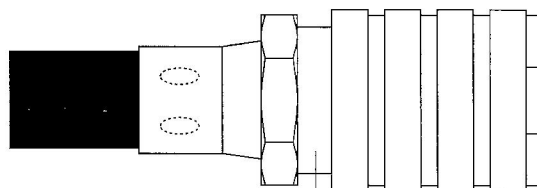
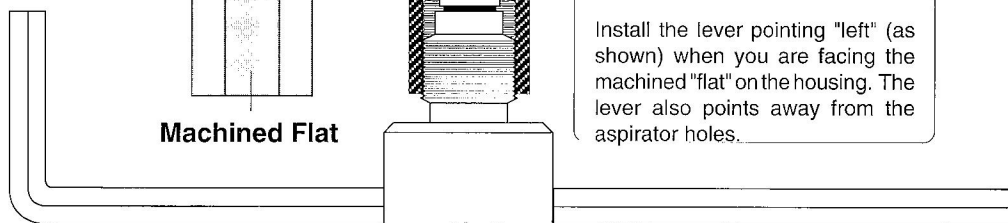
### Spider Tool:

The spider tool is a special tool designed to simplify the assembly and disassembly of the Air 2. One end provides the assembly post incorporated above. The other end is used to remove/install the delicate plastic spider from the case. The cross handle is a 3/16" allen wrench used for adjusting the orifice.

Air 2 Spider Tool



Machined Flat



Air 2 Quick Disconnect Chuck & Hose

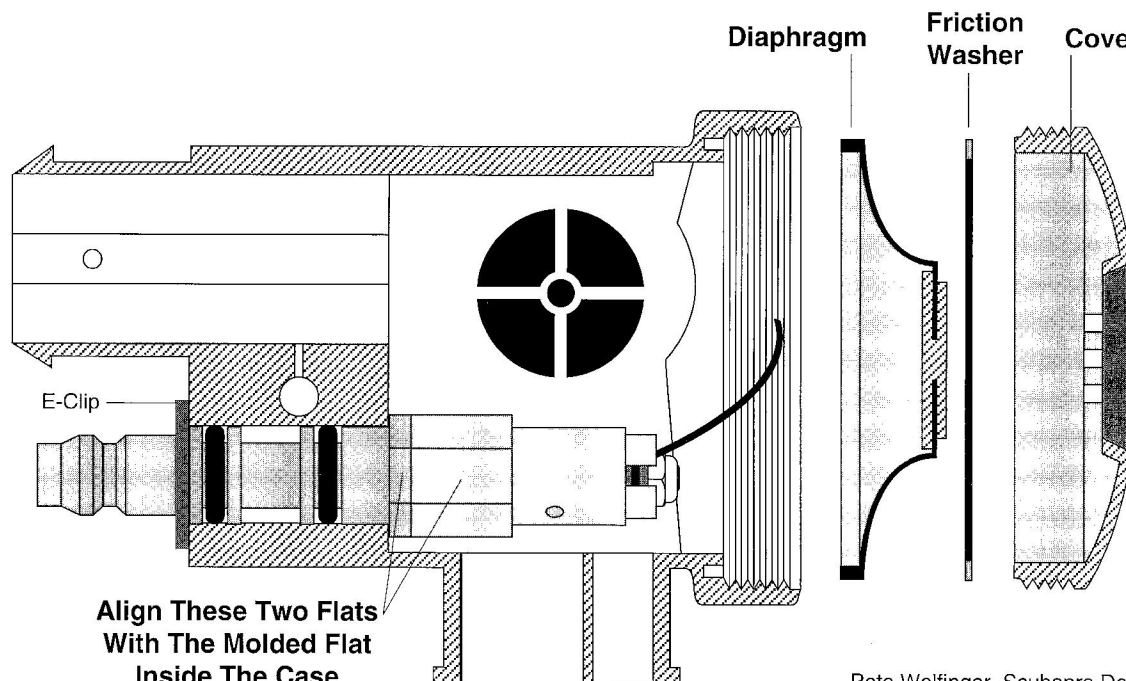
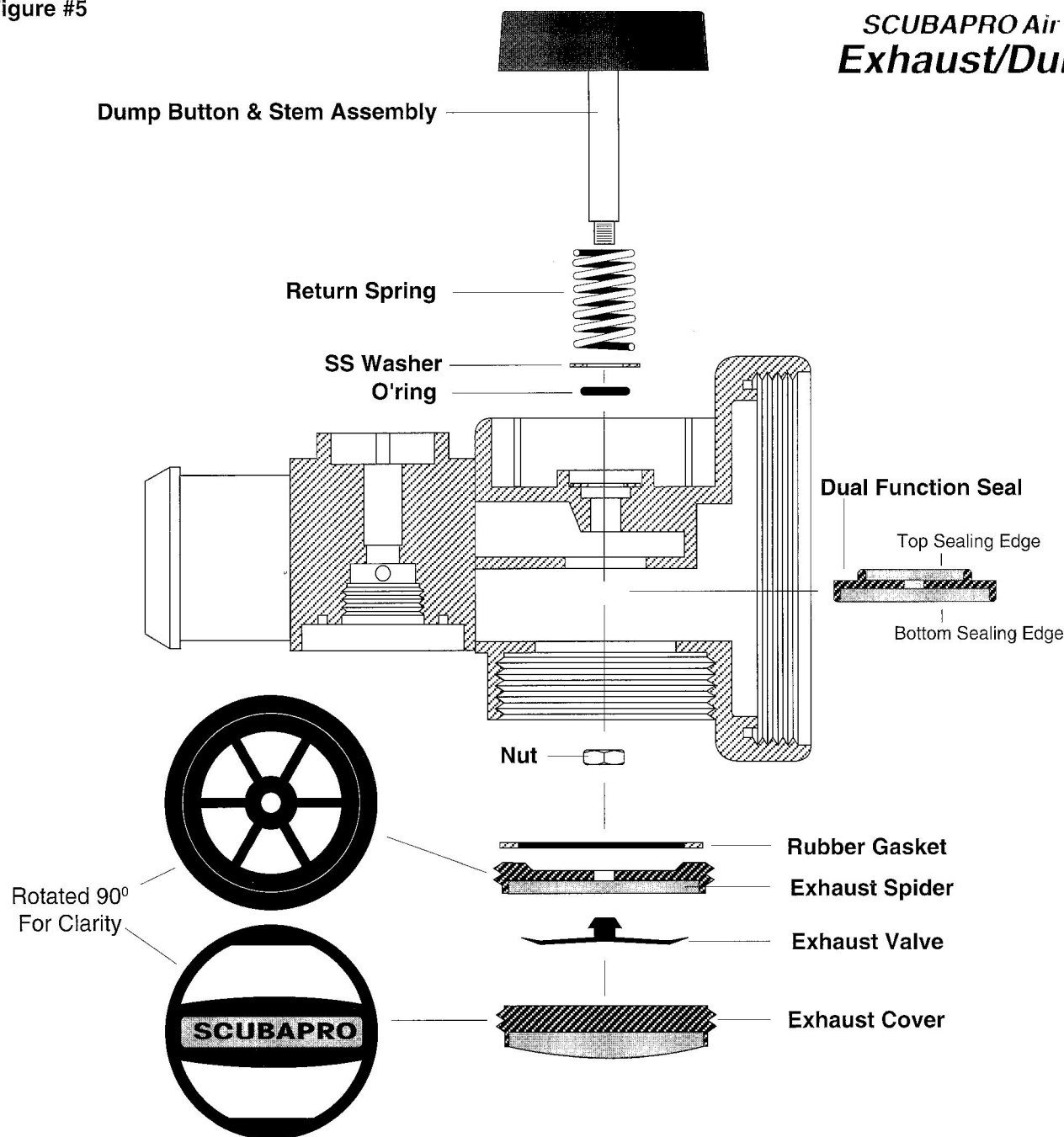




Figure #5

## SCUBAPRO Air 2 Alternate Inflation Regulator Exhaust/Dump Valve Components



### Notes:

The illustration to the left shows the exhaust/dump valve components in an exploded view.

- The dump button and stem are permanently bonded at the factory. If replacement is necessary, they are replaced as a single unit.

- The stem o-ring is dynamic and is replaced annually.

- The dual function seal is orientated with the large sealing edge "down" and the small sealing edge "up", as shown. It is installed through the front of the case and retained by the stem and nut.

- The nut does not have the nyloc feature to preserve as much space as possible. Be sure that this nut is securely tensioned so that it will not work loose during use.

- The exhaust spider (shown in two views) is removed/installed using the spider tool to avoid damage to the delicate plastic webs. A flat rubber gasket provides the seal between the spider and the main case.

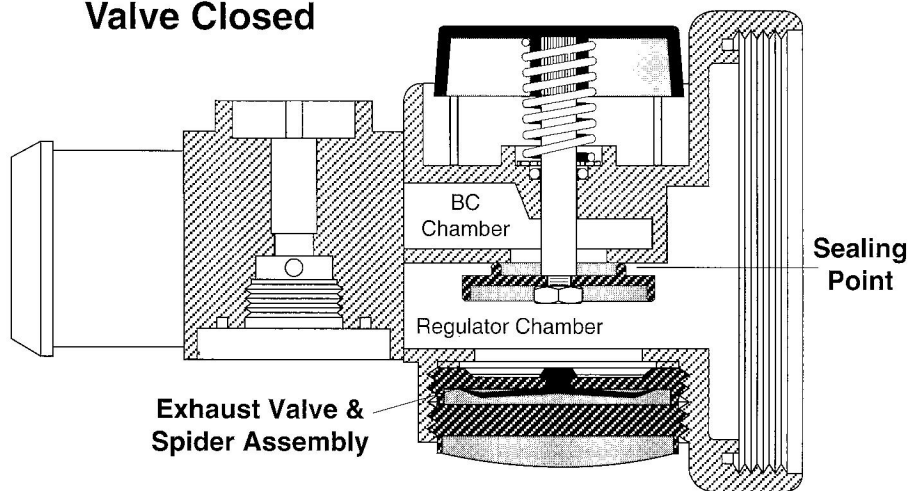
- If the exhaust valve is replaced, the top of the insertion nipple is removed to reduce its overall height (see figure #6).

- The exhaust cover provides protection for the exhaust valve and forms a thread lock to secure the spider.

All components are installed from the respective side of the case as shown. For complete assembly cutaway, see figure #6.

Figure #6

### Valve Closed



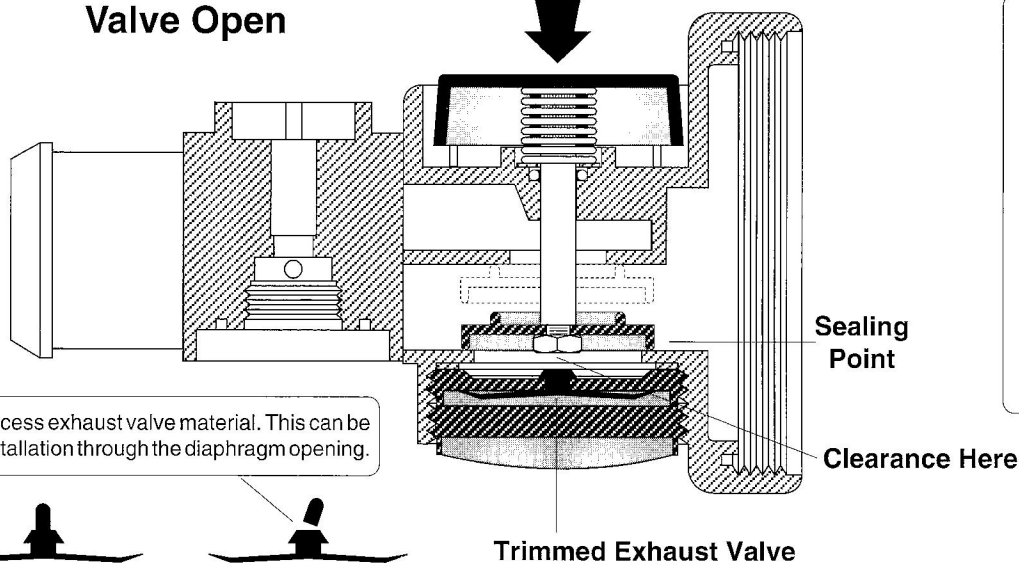
## SCUBAPRO Air 2 Alternate Inflation Regulator Exhaust/Dump Valve Function

### Exhaust/Dump Valve Closed:

The illustration to the left shows the exhaust/dump valve components completely assembled in the closed position. Take special note that the dual function seal is positioned to retain the air inside the BC. The regulator can be used in this position and the exhaust valve will function normally to remove exhaled air and maintain the watertight integrity of the case. If the power inflator is used, the air will be retained inside the BC. While the dual function seal is configured downstream to the BC air, it is not to be considered a safety release device. The BC should be equipped with the appropriate OPV valve(s) to release excessive pressure. This valve(s) should flow at a rate that is greater than the flow of air from the power inflator.

### Dump Button Fully Depressed

### Valve Open



### Exhaust/Dump Valve Open:

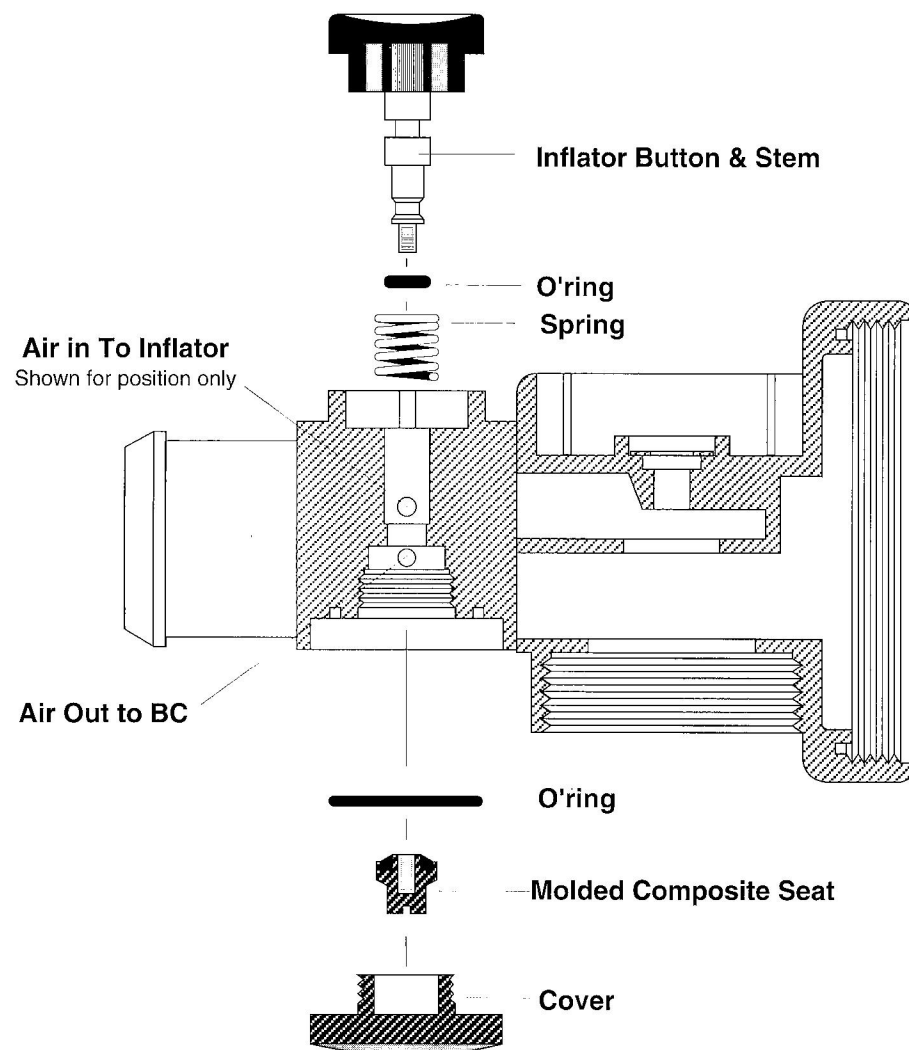
When the dump button is fully depressed, the dual function seal is in a position that allows the air to be vented from the BC. The exhaust valve is also sealed allowing the BC to be orally inflated. This mechanism is one of the key features of the Air 2. Be sure to check that the dual function seat is functioning properly before returning the Air 2 to your customer.

**Important Note:** If the exhaust valve requires replacement, be sure to remove the excess material on the tip of the valve retainer. If this is not removed, the nut and stem may push the exhaust valve out of the spider when the button is fully depressed. Always be sure that sufficient clearance is present between the nut and exhaust valve when the button is fully depressed.

Clip off the excess exhaust valve material. This can be done after installation through the diaphragm opening.



Figure #7



## SCUBAPRO Air 2 Alternate Inflation Regulator Power Inflator Components

### Notes:

The illustration to the left shows the Power Inflator components in an exploded view.

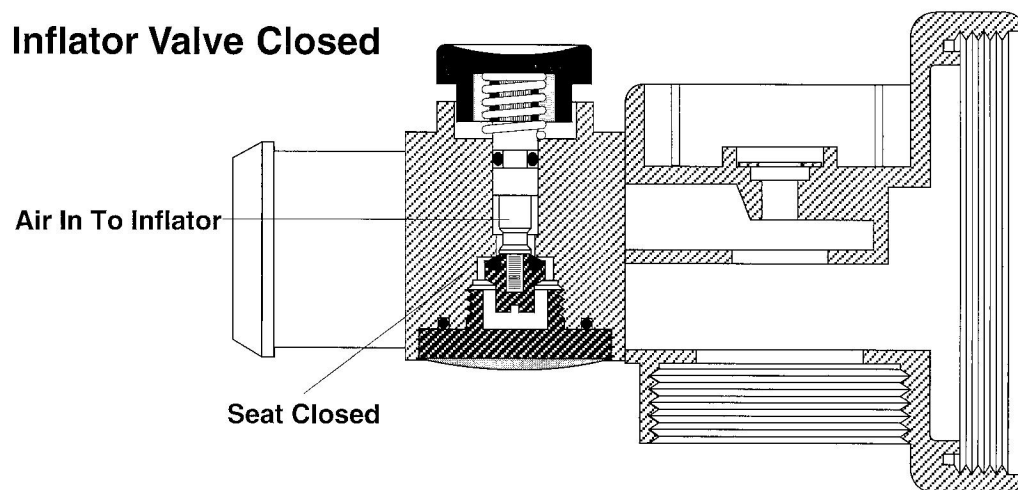
- The inflator button and stem are permanently bonded at the factory. If replacement is necessary, they are replaced as a single unit.
- The stem o-ring is dynamic and is replaced annually.
- The inflator seat is a machined brass part with a seating material permanently bonded to the brass after it is chrome plated. It is installed/removed via a screwdriver slot cut in the lower end.
- The cover is installed/removed by inserting a coin in the molded slots on the exterior of the part (slots not shown).

**Air Passages:** Due to the way the case is cutaway, the incoming air channel can not be shown in its exact position. For the purpose of these illustrations only, its position on the vertical axis is required to explain inflator function (see figure #8).

Figure #8

## SCUBAPRO Air 2 Alternate Inflation Regulator Power Inflator Function

### Inflator Valve Closed



### Power Inflator Function:

The illustration to the left shows the power inflator components completely assembled with the valve in the closed position. In this position, the spring is maintaining tension on the seat preventing any air flow from reaching the BC. When the inflator button is depressed, the air flows around the seat and through the cross hole into the BC hose. This valve is a fully balanced spool valve as the incoming air pressure pushes equally in both directions. (For a complete description of the balanced spool valve consult Chapter Five, figure #70.)

Inflator Button  
Fully Depressed

### Inflator Valve Open

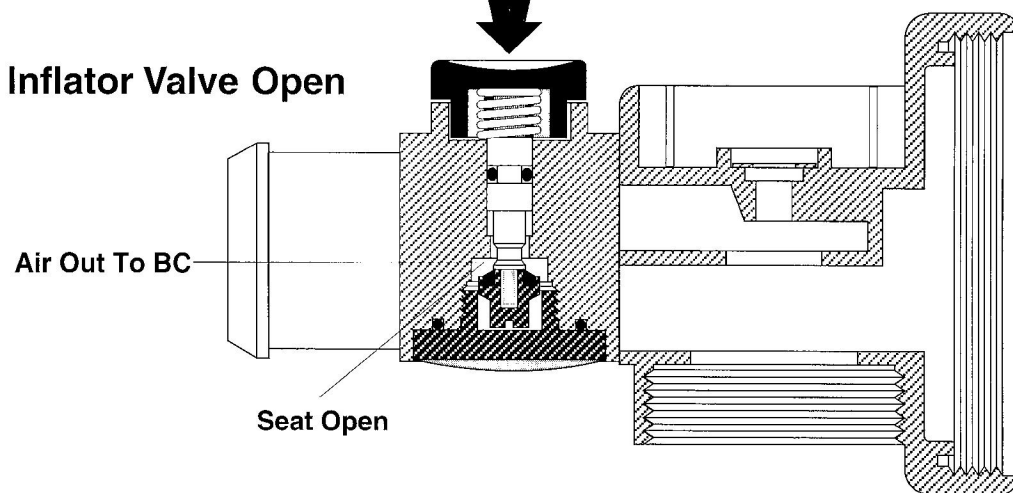


Figure #9

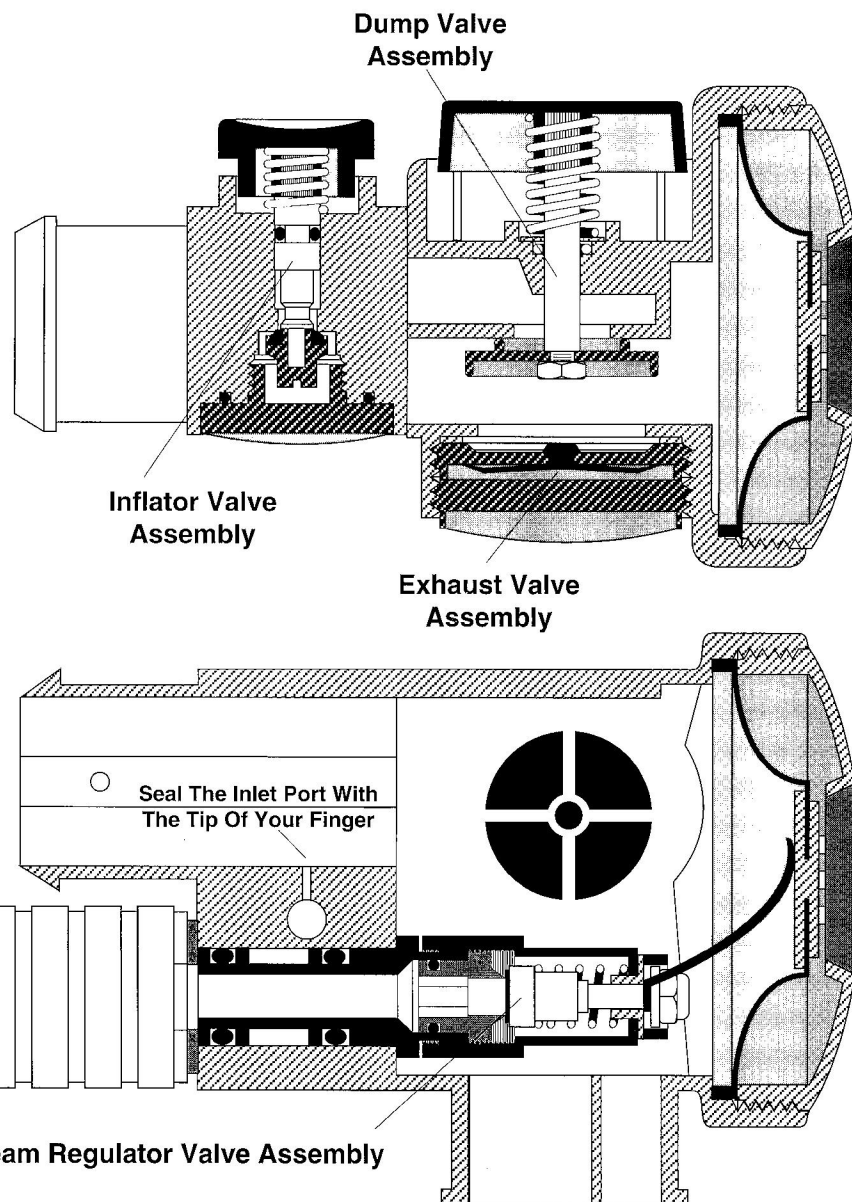
## SCUBAPRO Air 2 Alternate Inflation Regulator Full Cutaway Power Inflator, Exhaust/Dump, & Regulator

### Power Inflator:

- Replace the stem o-ring and composite seat annually.
- To check for inflator leaks, insert your finger into the BC hose port and seal the inlet hole with the tip of your finger. If any air is getting by the composite seat, you will hear a "squeak" when you cover the hole. Depress the inflator button slightly with your finger still over the hole. The squeak should occur and then stop when you let go of the inflator button.

### Exhaust/Dump:

- Replace the stem o-ring annually.
- Before installing the diaphragm assembly, check to be sure that the dual function seal is making solid contact with the case in both the stationary and depressed positions.
- Check to be sure that the excess material has been removed from the exhaust valve nipple if a new valve has been installed.



### Downstream Valve Adjustments:

- Replace the poppet seat and nyloc nut annually.
- Preset the orifice away from the poppet as far as it will go. This is accomplished by inserting a 3/16" allen wrench through the air inlet hole and turning the orifice counterclockwise until it stops against the air barrel shoulder.
- Preset the nyloc nut so that one full thread is exposed outside the nut.
- Install the Air 2 quick disconnect coupling and gently turn the air on.

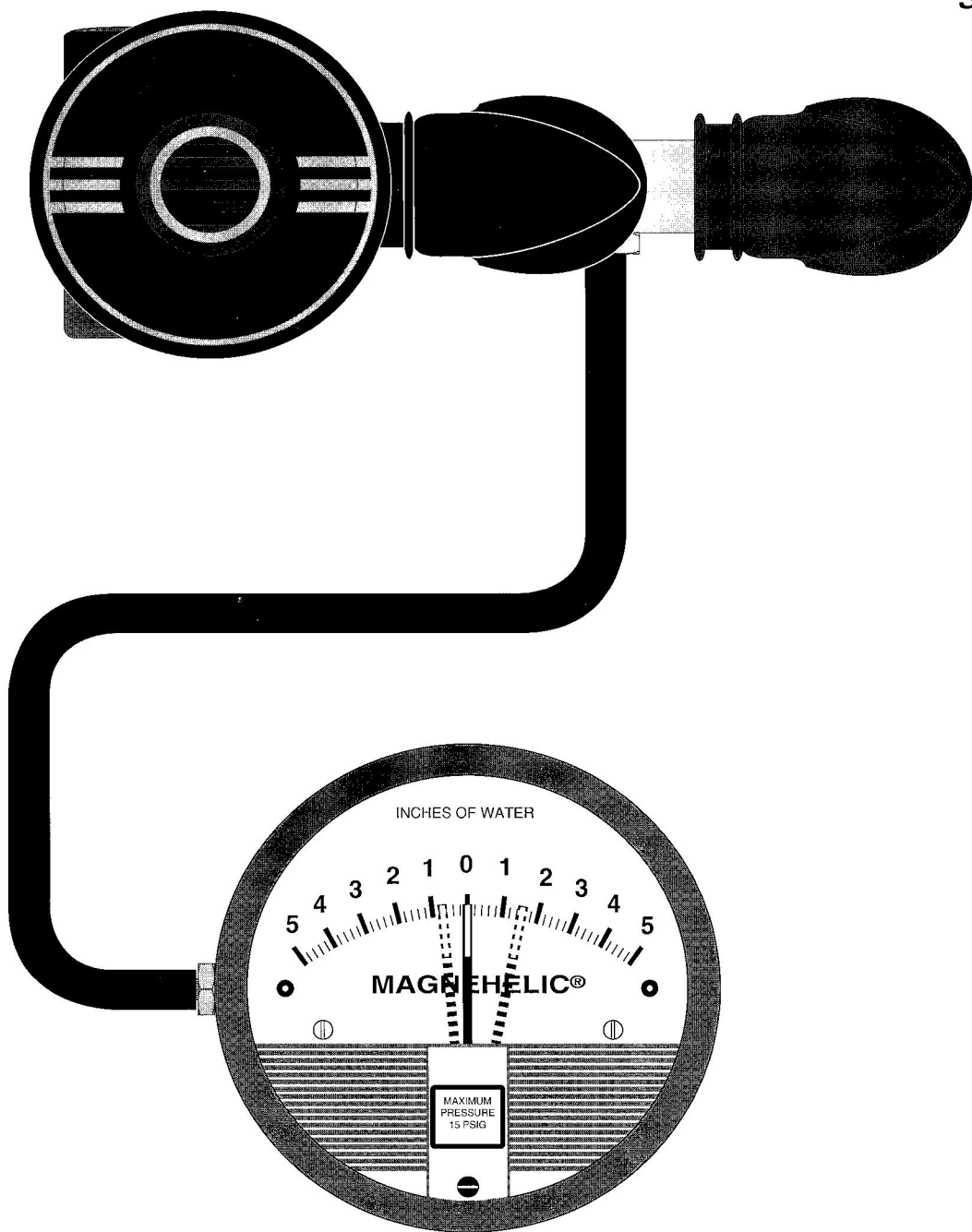
A. If no audible leak is heard, turn the nyloc nut clockwise until an air leak is heard, then turn the nut counterclockwise until the leak stops. This procedure is done to determine the precise point where the downstream force overrides the spring. Cycle the lever several times to be sure that the adjustment is correct. As a final step, detune the nyloc nut from 12:00 to 11:00 to allow for the seat taking a set. Install the diaphragm and cover assembly and check the inhalation and exhalation effort using the Magnehelic gauge (see figure #10).

B. If an audible leak is heard as soon as the air is turned on, disconnect the Air 2 coupling and adjust the orifice inward (clockwise) 1/4 turn using a 3/16" allen wrench. Reconnect the coupling and listen for the leak. If the leak still exists, turn the orifice inward an additional 1/4 turn and try again. Continue this procedure until you eliminate the leak. Repeat procedure "A".

- After the air has been turned off and the system purged, run a vacuum test to insure watertight integrity of the case.

• Note: For a complete description of the above standard tests, consult Chapter Seven, "Adjustment Fundamentals".

Figure #10



## ***SCUBAPRO Air 2 Alternate Inflation Regulator Magnehelic Gauge Checks***

### **Magnehelic Gauge Checks**

1. Install the Magnehelic \* gauge to the Air 2 as shown to the left
2. Turn the air on gently
3. "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 Air 2 cracks open and delivers air. Take several readings to insure accuracy
4. "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.

### **Air 2 Standards:**

Inhalation Range: 1.4-1.8 Inches Of Water

Exhalation Range: .4-.8 Inches Of Water

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

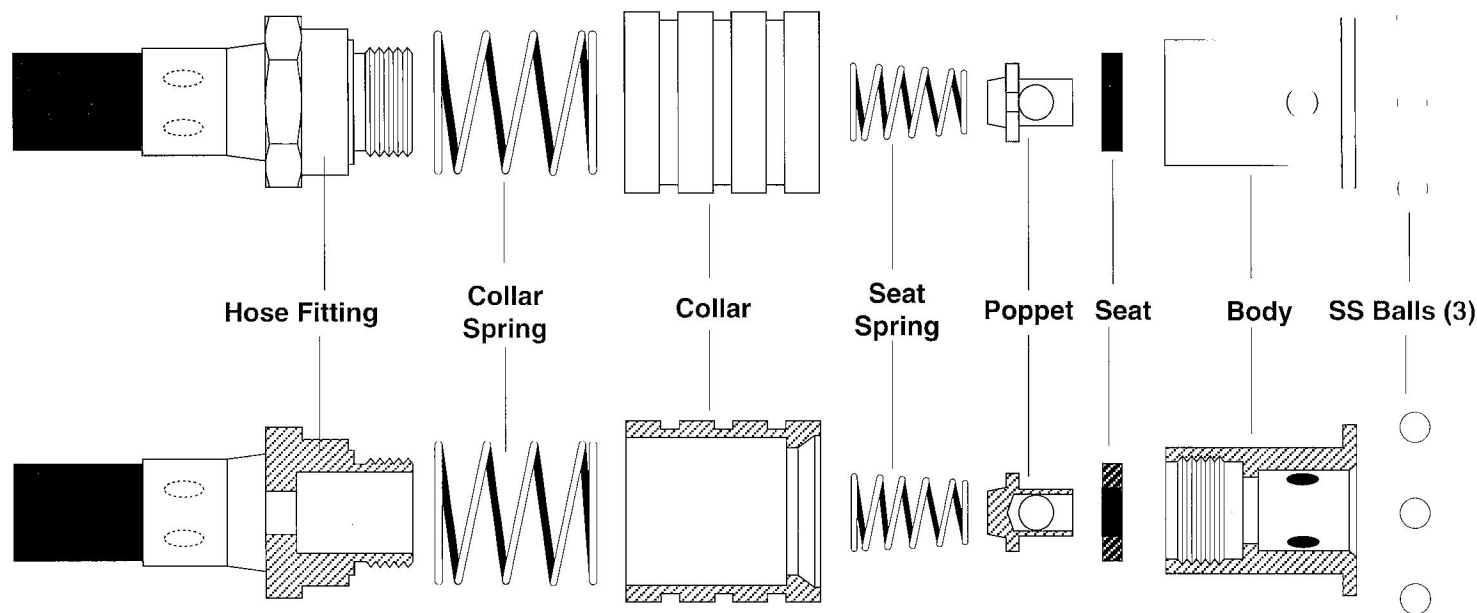
\*Magnehelic - Registered trademark of Dwyer Instruments, Inc.

Figure #11

## SCUBAPRO Air 2 Alternate Inflation Regulator Quick Disconnect Coupling



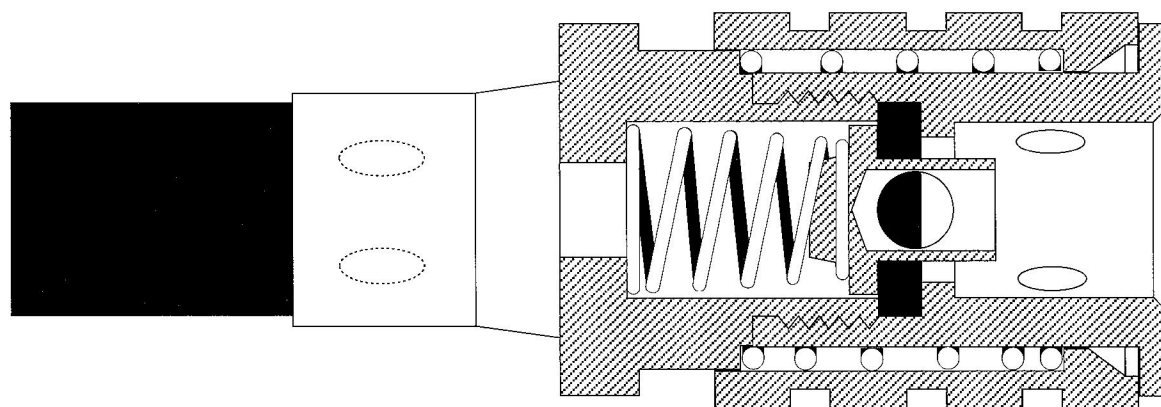
Seal Rotated 90° For Clarity



### Assembly Order & Tips:

- Fill the ball bearing holes in the body with silicone grease and insert the three balls. The silicone grease will keep the balls in place during assembly.
- Slide the collar over the body and insert the collar spring between the collar and body.
- Insert the seal into the threaded end of the body and install the poppet with the open end toward the SS balls.
- Install the seat spring on top of the poppet with the small end contacting the poppet.
- Thread the above assembly together with the hose fitting.

### Cutaway Assembly (Enlarged)



### Coupling Operation:

The Air 2 quick disconnect coupling is a basic "upstream valve". Incoming air from the first stage pushes the poppet and seat into the closed position. When the male section of the connector (not shown) is installed, the poppet is forced backwards and air is allowed to flow through the hole and into the center hole of the male connector. The seat sealing surface is reversed and now seals on the end of the male connector providing an airtight union.

Note: The seat is the most critical component insuring an airtight seal. Always replace the seat during annual service. Do not attempt to turn the seat over and reuse it. The seat actually seals on both sides and reversing its position is not recommended.

Figure #12

## SCUBAPRO Air 2 Alternate Inflation Regulator Trouble Shooting Guide

### Continuous slow leak from the downstream valve.

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| <b>Cause:</b> .....                  | <b>Remedy:</b>                     |
| • Defective or old poppet seat ..... | • Replace seat                     |
| • Nicked or damaged orifice .....    | • Replace orifice                  |
| • High Intermediate pressure .....   | • See first stage trouble shooting |
| • Low spring tension .....           | • Readjust orifice & nyloc nut     |

### Inhalation effort is "higher" than specification.

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| <b>Cause:</b> .....                 | <b>Remedy:</b>                     |
| • Orifice adjusted in too far ..... | • Readjust orifice & nyloc nut     |
| • 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.

- |                                      |                             |
|--------------------------------------|-----------------------------|
| <b>Cause:</b> .....                  | <b>Remedy:</b>              |
| • Orifice is retracted too far ..... | • Reset orifice & nyloc nut |

### Violent free flow from second stage.

- |  |   |
|--|---|
| <b>Cause:</b> .....                                | <b>Remedy:</b>                                  |
| • High intermediate pressure .....                 | • See first stage trouble shooting              |
| • Poppet or lever stuck in the open position ..... | • Check for obstructions or damaged valve parts |

### Continuous slow leak from the inflator ( continuous BC inflation).

- |                                    |                                    |
|------------------------------------|------------------------------------|
| <b>Cause:</b> .....                | <b>Remedy:</b>                     |
| • Defective composite seat .....   | • Replace seat                     |
| • Dirty or corroded parts .....    | • Clean all components             |
| • High intermediate pressure ..... | • See first stage trouble shooting |

### External air leaks around the dump or inflator buttons.

- |                                       |                                    |
|---------------------------------------|------------------------------------|
| <b>Cause:</b> .....                   | <b>Remedy:</b>                     |
| • Defective or dry stem o'rings ..... | • Replace and/or lubricate o'rings |

Note: Slow air leaks can usually be traced to the seating compatibility of the orifice & poppet seat. Be sure that the old seat 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 neoprene 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 Air 2, 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 downstream valves can become "unstable" if they are adjusted below 1.0 H<sub>2</sub>O.

Note: The preceding causes and remedies are based upon proper assembly of the poppet, lever, spring, and guide bushing. If any of these components are improperly installed, a violent free flow could occur as soon as the air is turned on.

Note: Unwanted inflation of the BC is a dangerous problem as it could cause the diver to ascend at an improper rate. Check to be sure that the inflator is functioning properly before returning the Air 2 to your customer.