



# R1 / R10 2nd Stage Service Manual



## PATRIOT & ICON 2ND STAGE

These models are downstream demand valve second stage regulators - smaller and lighter than most other primary second stages. They provide breathing gas as you demand it with low inhalation resistance. Breathing effort is factory set to the average performance level required by most divers.

They are provided with front-mounted purge buttons and orthodontically designed mouthpieces. They can be used as primary second stages or as an octopus.

NOTE: If this second stage is shipped from the factory specifically as an Octopus, the inhalation effort is set slightly higher to reduce sensitivity.



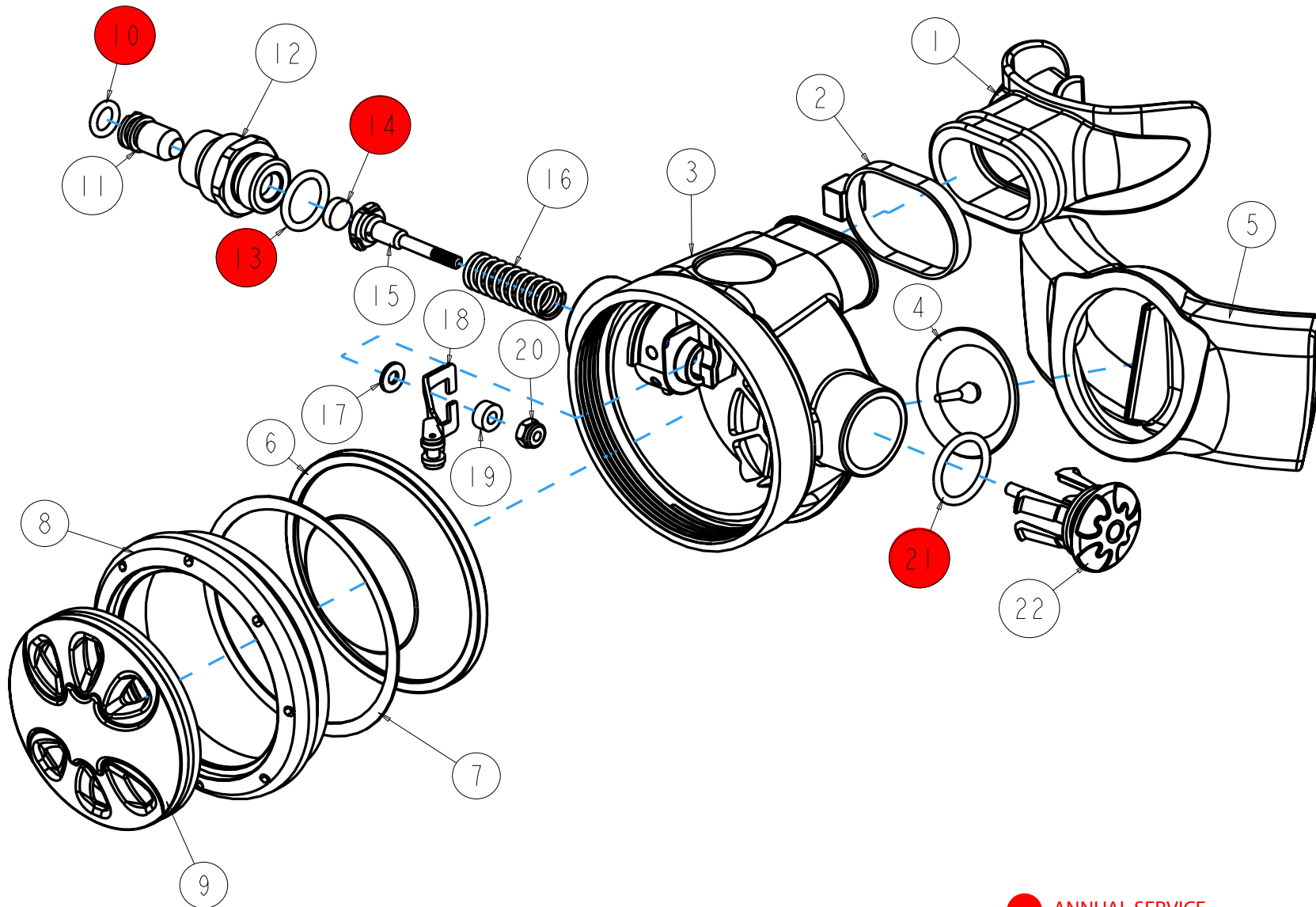
## SPECIFICATIONS

### PINNACLE AS-202 SECOND STAGE REGULATOR

|                       |  |
|-----------------------|--|
| AIR FLOW              | 33 cu. ft. (935 liters/min). @ 1 atmosphere    |
| INHALATION RESISTANCE | 0.9" -2.0" (2.3 - 5.08 cm) w.c. @ 1 atmosphere |
| EXHALATION RESISTANCE | 0.6" (1.52 cm) w.c. max. @ 1 atm.              |
| RECOMMENDED LUBRICANT | LTI Christo-Lube 111®                          |

### AS-202 SECOND STAGE REGULATOR

|           |                                  |               |
|-----------|----------------------------------|---------------|
| TYPE      | POPPET VALVE , BALANCE DIAPHRAGM |               |
| WEIGHT    | 5 lb. ( w/o hose )               |               |
| MATERIALS | COVER                            | PU            |
|           | HOUSING                          | ABS HI-IMPACT |
|           | LP SEAT                          | SILICONE      |
|           | O-RING                           | Buna-N        |
|           | DIAPHRAGM                        | SILICONE      |
|           | EXHAUST VALVE                    | SILICONE      |
|           | MOUTHPIECE                       | SILICONE      |



**ANNUAL SERVICE  
REPLACEMENT PARTS:  
790491**

| <b>NON - ADJ 2ND REGULATOR PART LIST</b> |                |                    |              |
|--|----------------|--------------------|--------------|
| <b>NO</b>                                | <b>ITEM NO</b> | <b>DESCRIPTION</b> | <b>Q' TY</b> |
| 1  | 0178           | MOUTHPIECE         | 1            |
| 2  | 0182           | NYLON TIE          | 1            |
| 3  | 0241           | MAIN HOUSING       | 1            |
| 4  | 0177           | EXHAUST VALVE      | 1            |
| 5  | 0180           | EXHAUST COVER      | 1            |
| 6  | 0185           | DIAPHRAGM          | 1            |
| 7  | 0187           | DIAPHRAGM WASHER   | 1            |
| 8  | 0263           | COVER RING         | 1            |
| 9  | 0195           | PURGE BUTTON-AS    | 1            |
| 10                                       | 2-010-01       | O-RING             | 1            |
| 11                                       | 0266           | ORIFICE            | 1            |
| 12                                       | 0244           | COUPLING           | 1            |
| 13                                       | 2-906-01       | O-RING             | 1            |
| 14                                       | 0250           | AS-202 LP SEAT     | 1            |
| 15                                       | 0249           | POPPET             | 1            |
| 16                                       | 0270           | MAIN SPRING        | 1            |
| 17                                       | 0245           | THINNER WASHER     | 1            |
| 18                                       | 0246           | LEVER ARM          | 1            |
| 19                                       | 0247           | THICKER WASHER     | 1            |
| 20                                       | 0248           | LOCK NUT           | 1            |
| 21                                       | 2-016-01       | O-RING             | 1            |
| 22                                       | 0251           | SIDE PLUG          | 1            |

The procedures in this manual apply to the PINNACLE AS-202 type 2ND stage. Refer to the exploded views as you read through the service section of this seminar. The Item Numbers referred to in the service section are those seen in the corresponding exploded view.

## SERVICE KIT LIST 790491

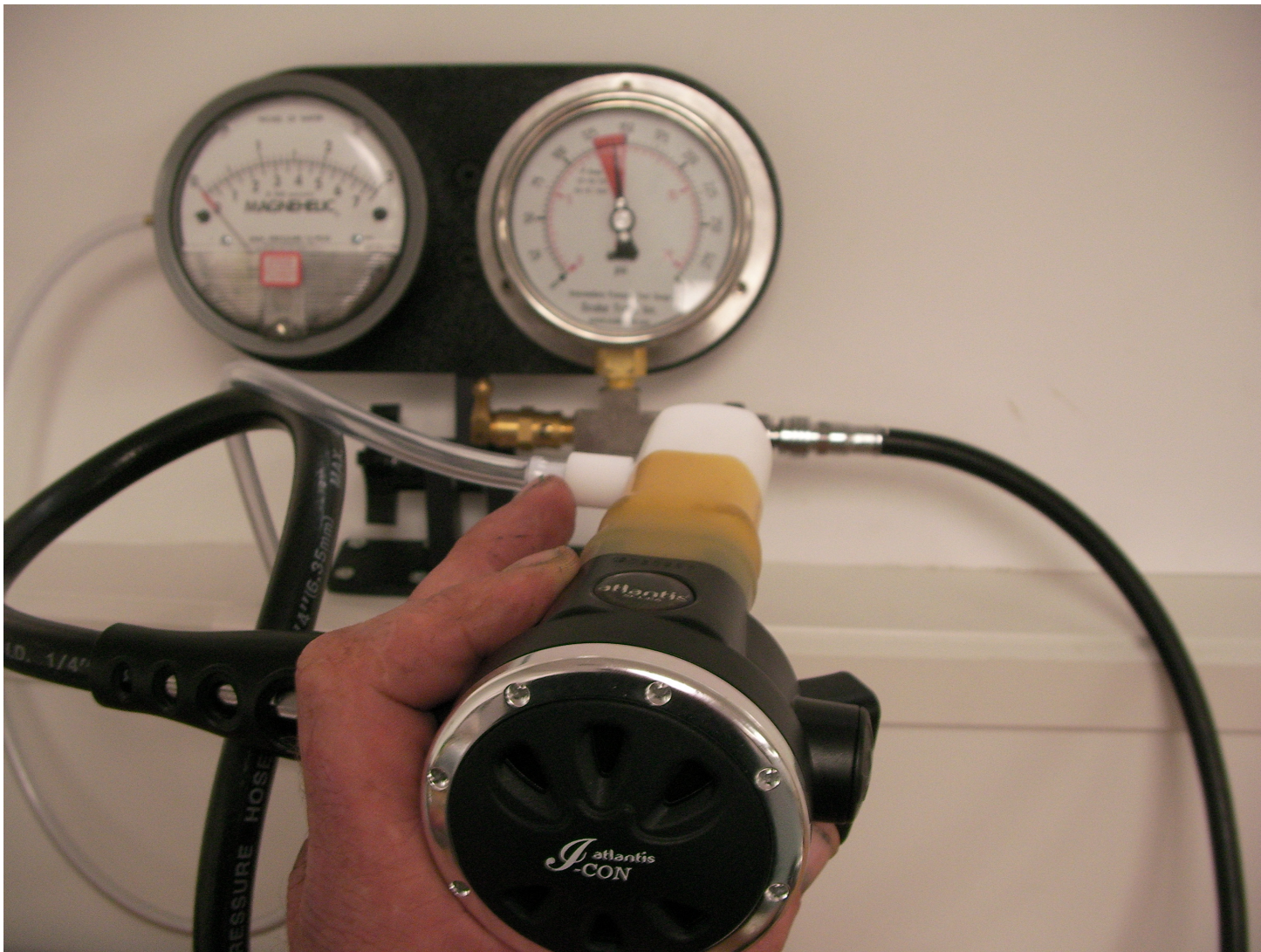
| NO | PART NO  | DESCRIPTION | Q'TY |           |
|----|----------|-------------|------|-----------|
| 10 | 2-010-01 | O-RING      | 1    | Orifice   |
| 13 | 2-906-01 | O-RING      | 1    | Coupling  |
| 14 | 0250     | LP SEAT     | 1    |           |
| 21 | 2-016-01 | O-RING      | 1    | Side Plug |

Torque Specifications:

| Description     | Item # | Torque                     |
|-----------------|--------|----------------------------|
| COUPLING        | 12     | 85-95 in/lbs (9.6-10.7 Nm) |
| Hose inlet end  |        | 2-3 ft/lb (3-4 Nm)         |
| Hose outlet end |        | 2-3 ft/lb (3-4 Nm)         |

## SERVICE PROCEDURES FOR THE AS-202

Before you begin disassembly of the regulator, test the first and second stages for output pressures and leakage. Pre-testing in this way will help the technician to pinpoint any specific problems requiring repair.





TOOLS REQUIRED FOR 2ND STAGE SERVICING

- AS-202 2nd Stage Annual Service Kit 790491

ADJUSTABLE PIN SPANNER (RING SPANNER) = COVER RING

6" & 8" ADJUSTABLE WRENCHES = HOSE

SIDE CUTTING PLIERS = MOUTHPIECE

1/4" COMBINATION WRENCH = LOCK NUT

4MM POPPET TOOL = POPPET

19MM RING SPANNER / HEX SOCKET = COUPLING

TORQUE WRENCH

IN-LINE ADJUSTMENT TOOL

INTERMEDIATE PRESSURE TESTING GAUGE

MAGNEHELIC GAUGE

CHRISTO LUBE OR

DOW CORNING COMPOUND / SILICONE GREASE

O'RING PICKS

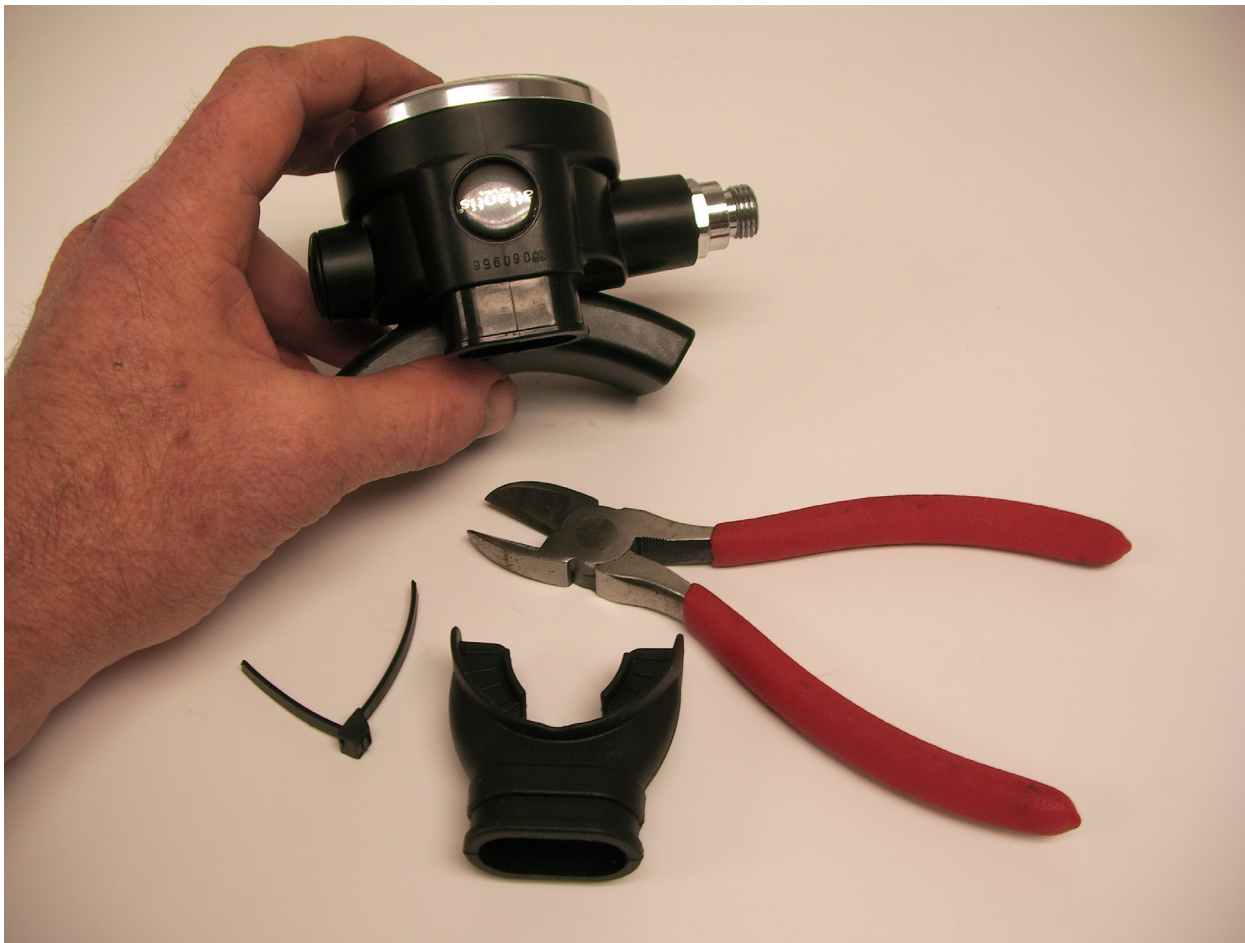
SOAPY SPRAY



Use the 6" and 8" adjustable wrenches to loosen the hose nut from the COUPLING (12). Remove the hose assembly from the second stage. Inspect the hose assembly for any cuts or cracks, especially on the hose at the metal ferrules. Blow the interior bores of the hoses.

Replace the hose assembly if any cuts or cracks are found. Remove and discard the O-rings from each end of the hose. Clean, rinse, and blow-dry the interior bores of the hoses. Replace the hoses if necessary.

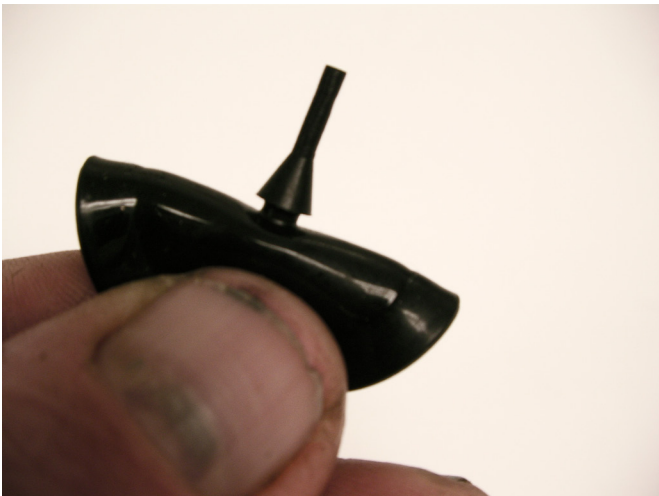
If the mouthpiece is in good condition, you can remove it and it can be reused. Remove the mouthpiece (1) by cutting the mouthpiece tie (2) with side cutting pliers. Discard the old mouthpiece tie. Examine the condition of the mouthpiece.



Put the exhaust cover (5) into hot water for a moment. Remove the exhaust cover (5) from the housing by pulling it back.



Before removing the exhaust valve (4) from the housing (3), bend the valve over as far as it will go from the top, bottom, left, and right sides. If it fails to snap back quickly, and does not lie perfectly flat against the housing exhaust grid, the valve should be replaced. If it does snap back satisfactorily, remove it by pulling it out with your fingers. Inspect the sealing edges. If they appear smooth, and the locking tab on the nipple is good, the valve can be reused.



Unscrew the cover ring (8) from the housing (3).

If the cover is difficult to remove you can try several methods to loosen it;

1. Heat the 2nd stage body surrounding the Ring by running hot water from a tap over it. When the plastic is hot, it will expand and loosen the threads.
2. Use an adjustable pin spanner.
3. Rubber pads are available to use in the hand to loosen tight jar lids. These pads will allow you to get a better grip on the Cover Ring (8)

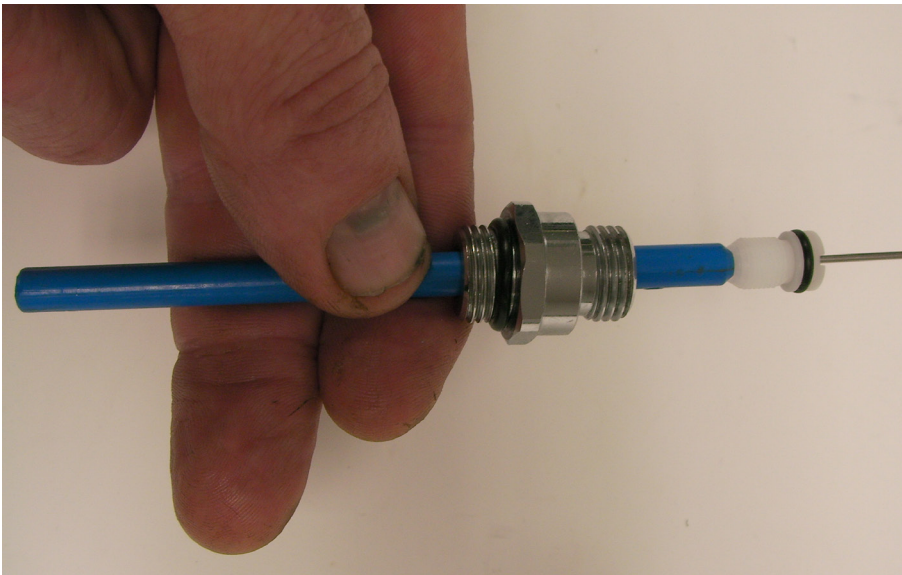


Remove the DIAPHRAGM WASHER (7) and the diaphragm (6) from the housing (3).

Remove the side plug (22) from the housing (3). Remove and discard the o-ring (21).

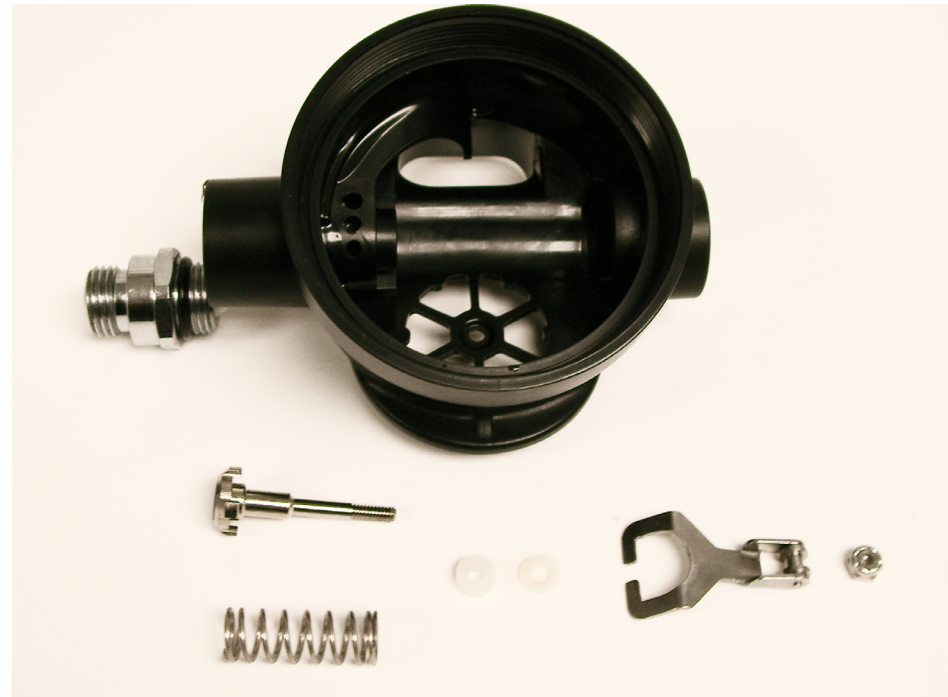


Loosen and remove the coupling (12) with a 19MM HEX SOCKET / RING SPANNER from the housing (3). Use an ADJUST TOOL to turn the orifice left (11) until you can remove it. Remove and discard all o-ring (13, 10) from coupling and orifice.





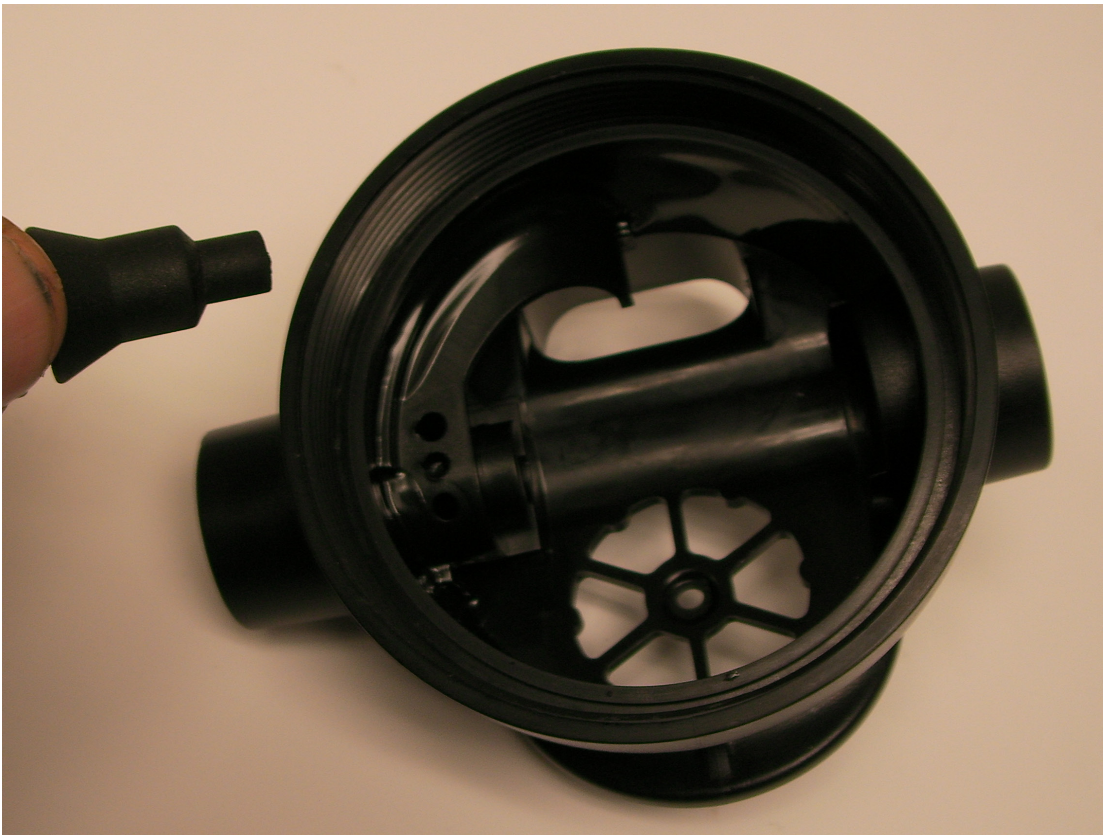
Before removing the poppet (15) check and record the poppet thread length that protrudes through the nut screw (20). Use the 1/4" COMBINATION WRENCH to hold the nut screw (20) and use the 4H POPPET TOOL to turn the poppet (15) left until you can gently remove it. The spring (16), lever arm (18), thick washer spacer (19), thin washer spacer (17) and nut screw will fall when the poppet (15) removed. Remove the LP seat (14) from the poppet (15).



## CLEANING AND INSPECTION OF THE 2nd STAGE

Rinse all plastic and silicone parts in a fresh warm soapy water solution.

Rinse with clean warm water and then blow the parts dry with compressed air to remove any sand and dust particles. DO NOT use vinegar or other acid solutions on the plastic parts since this will cause the plastic to become brittle!



If necessary because of deposits or corrosion, clean all metal parts of the second stage in an ultrasonic cleaner or cleaning solution.

| <b>SOLUTION</b>  | <b>COMMENTS</b>   |
|--|---|
| <b>Hot Soapy water</b>   | <b>Preferable. Good for plastic, silicone and plated metal parts.</b>   |
| <b>Vinegar and water (equal part solution) (weaker solution in Ultrasonic Cleaner)</b> | <b>Ingredients easily available. Approx. 15 min. cleaning time. May damage chrome finish. Never use on plastic parts. Vinegar dissolves the plastics in most polymers making them brittle and more prone to breakage.</b> |
| <b>Simple Green R and Water</b>  | <b>Simple Green is a readily available degreaser. Read the product label for mixing ratios with water.</b>  |
| <b>Cleaning solutions recommended by ultrasonic cleaner manufacturers</b>              | <b>The preferred choice. Check with the manufacturer for strengths and recommended uses for their cleaners. Choose soap solutions over acidic ones.</b>   |

Inspect the housing (3) for any cracks or nicks. Look particularly closely at the area where the exhaust valve (4) seals and where the o-rings (21, 13) are placed. Replace the housing if any cracks are found.

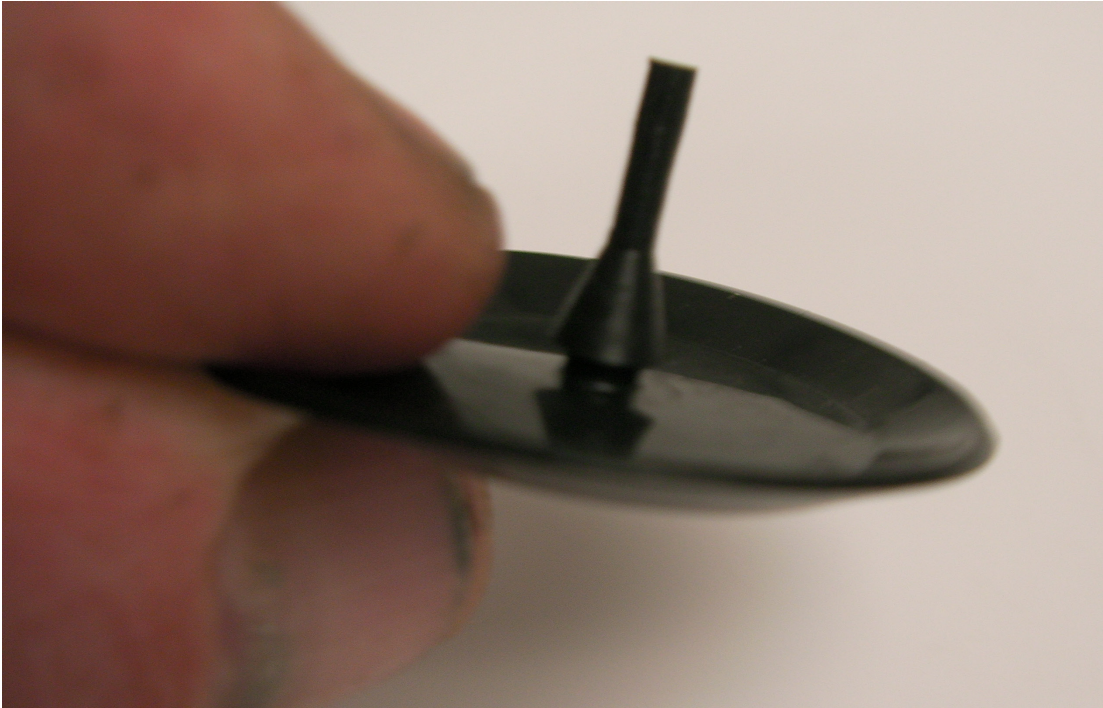


Inspect the sealing surface on the orifice (11) (where the seating seal (14) seals) for any nicks or scratches. Replace the orifice (11) if any serious defects are found at the sealing area, or if the threads appear worn out.

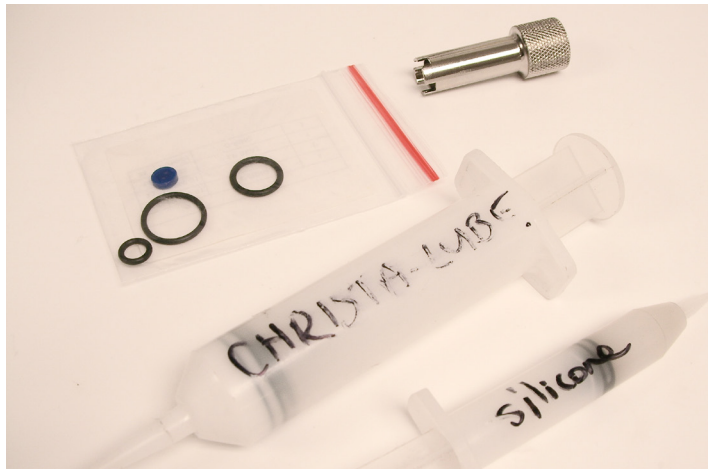
Blow all dust and debris out of the orifice with clean compressed air.



Inspect the exhaust valve (4). Look carefully at the base of the barbed nipple where it comes out of the middle of the valve. Look for any tearing at this point. Replace the valve if any tears are found. Replace the valve if nicks or tears are found at the sealing edges of the valve.



During an Annual Overhaul, all parts included in the Annual Service Kit are replaced no matter what the condition of those parts. Carefully examine all other parts of the second stage for signs of deterioration. Replace those parts too where necessary.



## PRELIMINARY ASSEMBLY OF THE SECOND STAGE

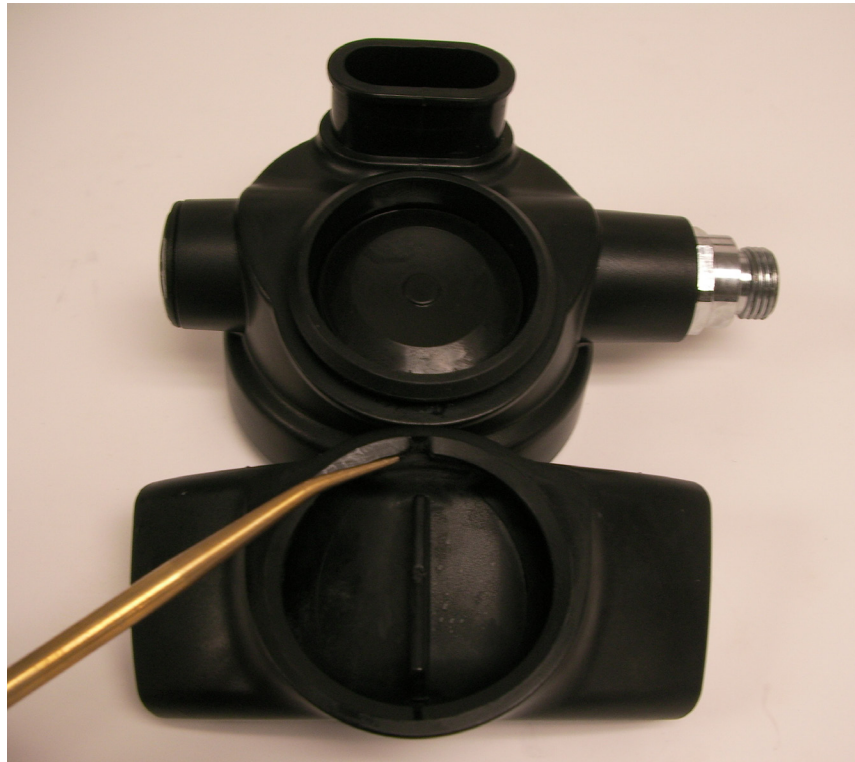
Ensure that all parts are clean. Before installing new O-rings into the regulator, lightly lubricate the O-rings with Dow-Corning 111 Silicone Grease or LTI Christo-Lube 111®.





Install the exhaust valve (4) into the housing by inserting the nipple into the square hole from the outside of the body. Reach inside the case and pull the nipple firmly with the fingers until you hear or feel it “click” into place. Inspect the exhaust valve to see that it is properly seated. Take care not to get any lubricating grease on the exhaust valve during this procedure.

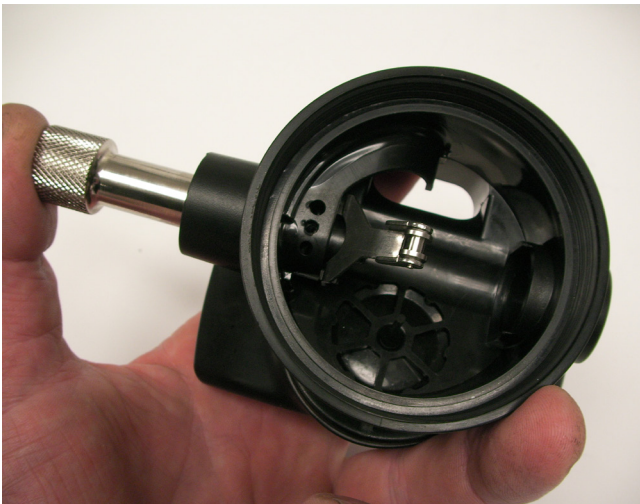
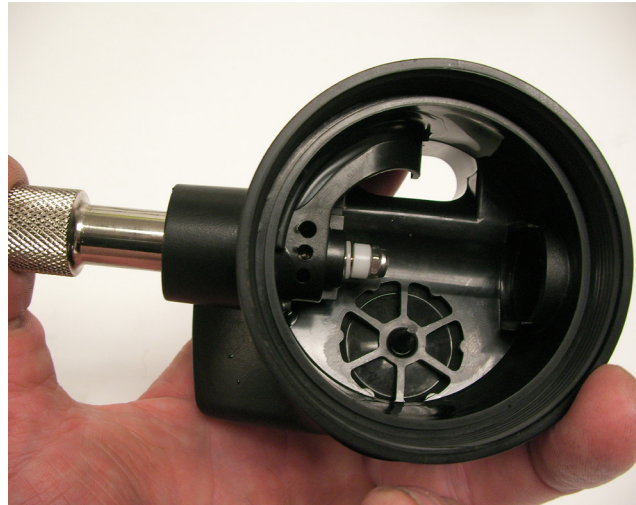
Put the exhaust cover (5) into the hot water for a moment. Install the exhaust cover (5) onto the body.



Insert the new LP seat (14) into the poppet (15). Install the spring (16) onto the poppet. Insert the poppet assembly you have just assembled, into the housing (3).



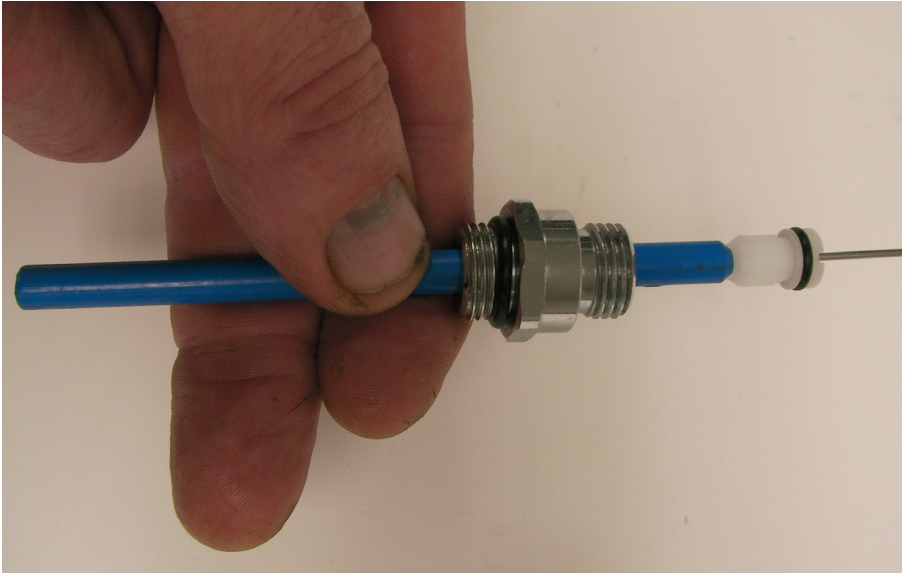
Use the 4H POPPET TOOL to push the poppet (15). Install the thin washer (17) first, and then the thick washer (19). Hand tight the nut screw (19) to the poppet. Push the poppet tool with a little more force and insert the lever arm (18) between the thin washer (17) and the thick washer (19).



Use the 1/4" COMBINATION WRENCH to hold the nut screw and turn the poppet tool right until the poppet thread length, showing is the same as your record.



Re-assemble the orifice (11) into the coupling (12) and screw into the main body / housing with a 19mm ring spanner.



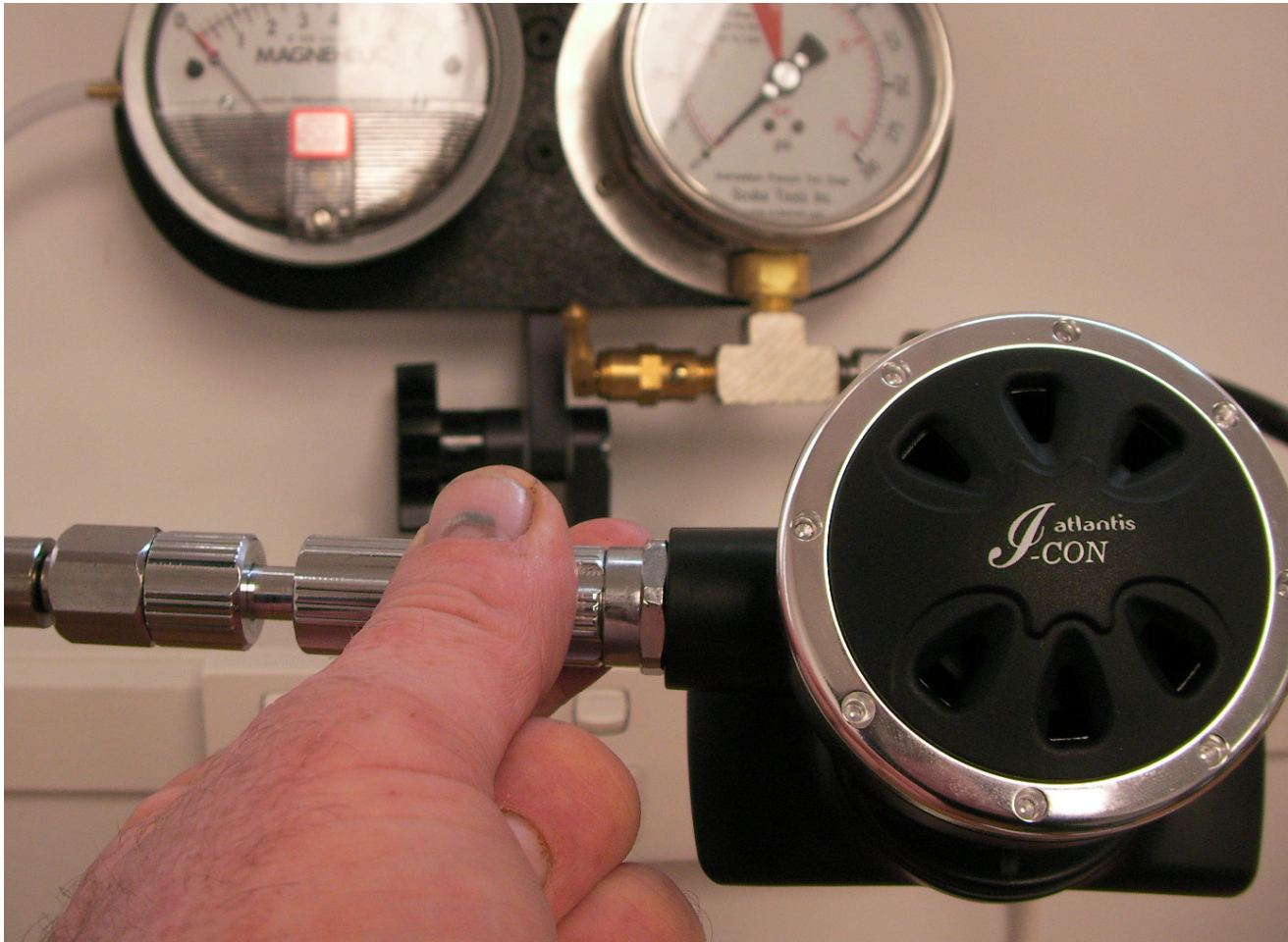
Install the diaphragm (6) into the housing (1) so that it sits evenly on the ledge. Install the diaphragm washer (7) over the diaphragm. Screw the cover ring (8) assembly into housing.



## SET-UP OF THE SECOND STAGE

Keep the adjust tool inserted into inlet nipple of the second stage adjustable orifice.

Install the hose between a serviced first stage and the second stage, hand tighten snugly.

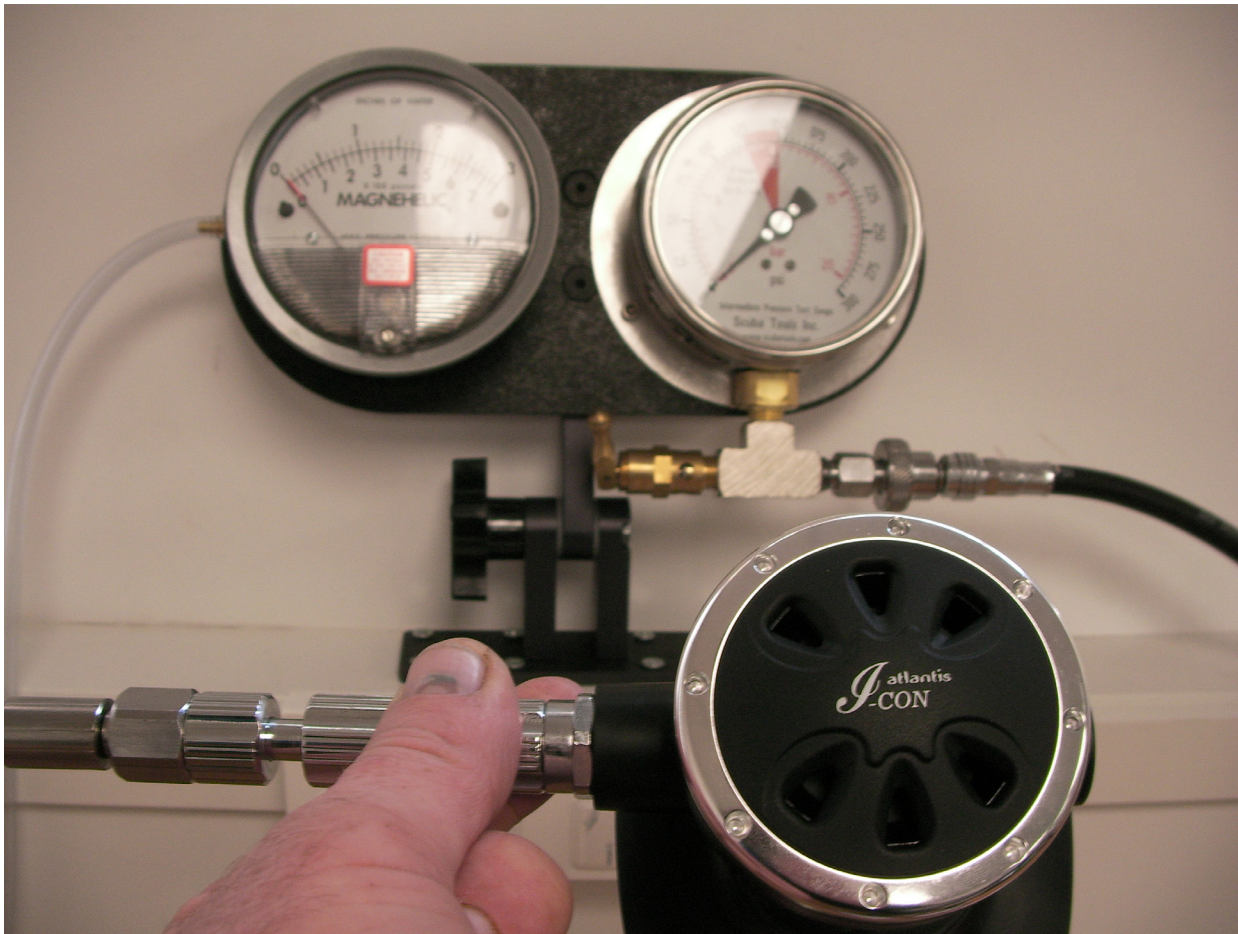


Note: Attach the second stage to the overhauled and properly adjusted first stage that it is going to be used with, mounted on an air tank filled to the maximum pressure the regulator is going to be used with. Install an intermediate pressure gauge into one of the low-pressure ports.





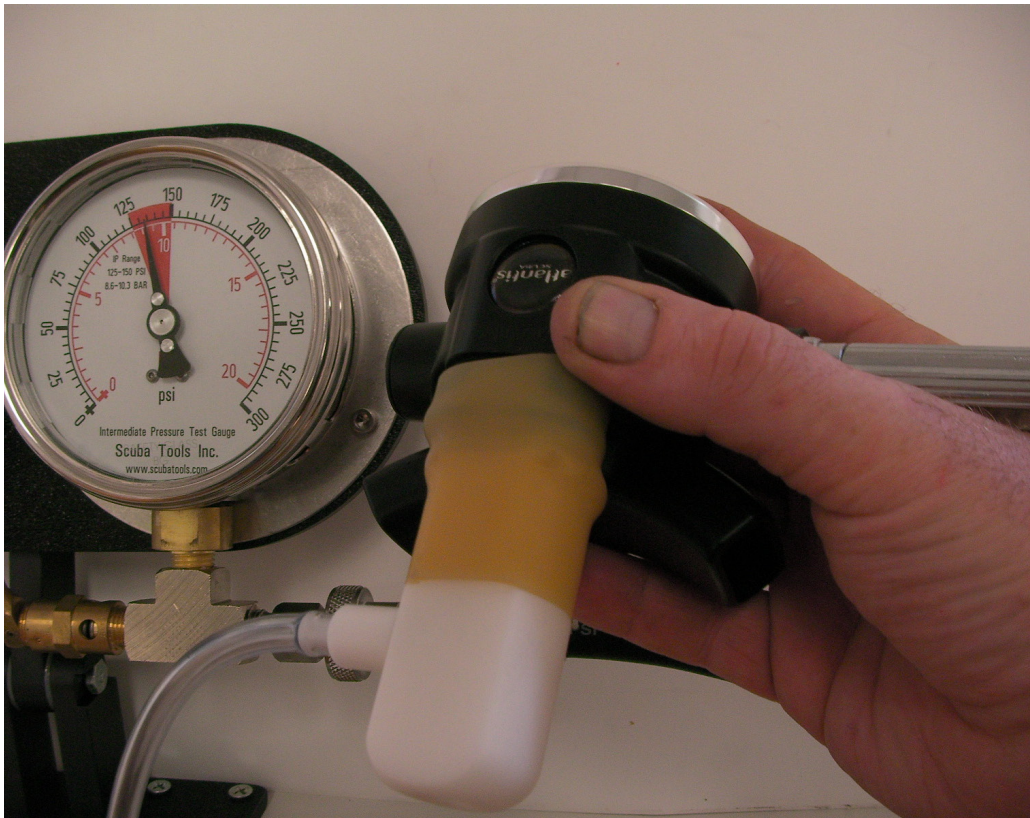
Carefully turn the air on. There should be no air leaking from the second stage with proper intermediate pressure applied to the hose. Adjust the ADJUST TOOL by turning left to feel a little leaking and then turn the orifice right until the leaking just stops, then turn one more 1/8th of a turn.



Check and adjust the work of breathing by attaching the Magnehelic gauge to the second stage. Monitor the Magnehelic needle on the inhalation and on the exhalation. Adjust to the appropriate work of breathing.

Primary 2nd Stage = 1 to 1.5 inches of water

Alternate 2nd Stage = 1.25 to 2 inches of water



Work the lever up and down a few times while the regulator is pressurized by purging.

After reaching the proper pressure setting, push the purge cover on the second stage again several times and watch how the intermediate pressure reading responds. When the purge cover on the second stage is depressed, the intermediate pressure reading will drop. When the purge cover is released the pressure should return immediately to the proper lock-up pressure and stay there.

Let the regulator sit with the tank valve turned on for several minutes. The intermediate pressure reading may rise about 3 psi in the first three seconds after lock-up, but after that it should not rise more than another 4 psi (.3 bar) in five minutes.

Remove the adjustment tool, replace the hose and torque to specified torque (3-4Nm).

Re-check the work of breathing.



Replace mouthpiece with cable tie.