



ATOMIC
AQUATICS, INC.

TECHNICAL TRAINING
2nd Stages

2003

Regulator Cleaning

Check the regulator for any traces of contaminants.

Notify the customer if any unreasonable amounts of corrosion are observed while performing an inspection. Excessive amount of corrosion as seen on this regulator are usually attributed to a steel tank that has had moisture attack the walls of the tank over a period of time.

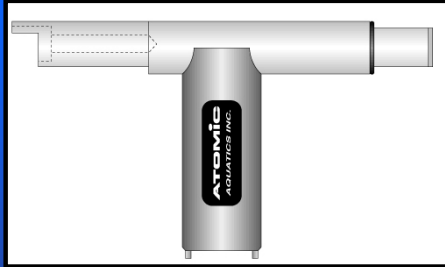


2nd STAGE DISASSEMBLY

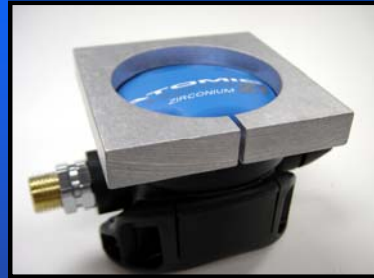
We are going to begin with the disassembly procedures I will be coming around the room to see that everyone has a firm grasp on what is being presented and if you would like specific information which may not have been covered I would ask if you wait until one of our breaks and I would be happy to assist your in very specific questions or concern you may have.

2nd Stage Regulator Tools

2nd Stage T-handle Tool



Front Cover Ring Rim Clamp T2, Z1 2nd



Front Cover Ring Rim Clamp M1



The tools we will be using to disassemble and assemble the regulators today are the 2nd stage t-handle tool which is designed exclusively for our 2nd stage, the piston bullet for installing the piston and other functions as well as the 1st stage t-handle wrench used for various procedures on our 1st stage regulators. Some of the other tools that you will need for a standard service are basic shop tools such as the wrenches mentioned on this slide.

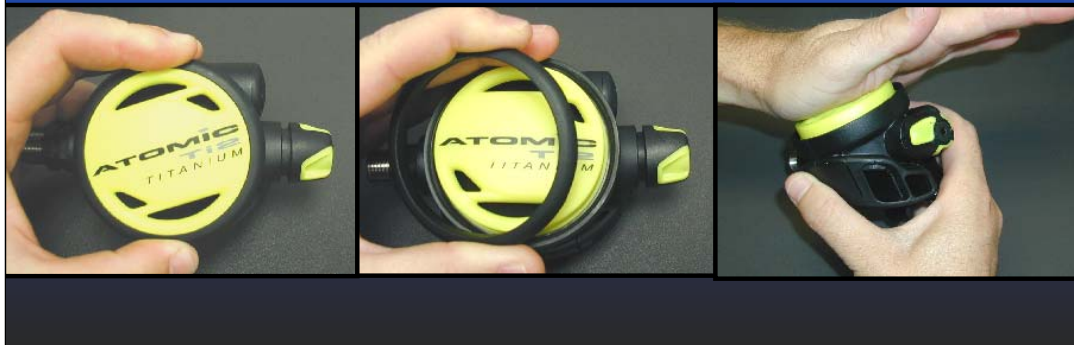
Front cover & diaphragm: Removal

(Pre 2002) (T1x, T1, B1, Z1)

Unscrew the cover ring surrounding the front cover.

If the cover ring cannot be removed by hand, use the 2nd stage rim clamp tool to help aid in the removal of the front cover.

Unscrew the diaphragm retaining ring by pressing down on the front cover with the palm of your hand and unscrew it.



Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be followed if the a new front cover color was to be requested by a customer.

Front cover & diaphragm: Removal (Pre 2002) (T1x, T1, B1, Z1)

Remove the diaphragm retaining ring.

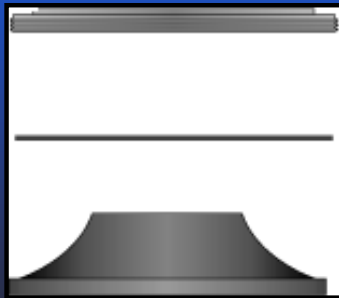
Lift out the thrust washer and diaphragm.



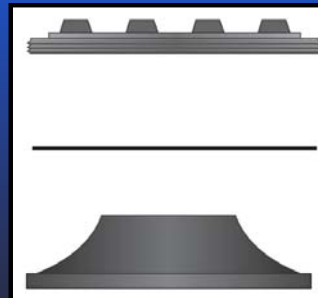
Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be followed if the a new front cover color was to be requested by a customer.

Front cover & Diaphragm retaining ring: (T1x, T1, M1, B1, Z1)



(Pre 1/2002)



(2002)

Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be followed if the a new front cover color was to be requested by a customer.

Front cover & diaphragm: Removal (1/2002) (T1x, T1, B1, Z1)

Unscrew the cover ring surrounding the front cover.

If the cover ring cannot be removed by hand, use the 2nd stage rim clamp tool to help aid in the removal.



Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be fallowed if the a new front cover color was to be requested by a customer.

Front cover & diaphragm: Removal (1/2002) (T1x, T1, B1, Z1)

Unscrew the diaphragm retaining ring by using the 2nd stage rim clamp tool to help aid in the removal process.

Remove the diaphragm retaining ring.

Lift out the thrust washer and diaphragm.



Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be fallowed if the a new front cover color was to be requested by a customer.

Front cover & diaphragm: Removal (M1)

Unscrew the cover ring and front cover as one unit.

If the cover ring cannot be removed by hand, use the 2nd stage rim clamp tool to help aid in the removal.

The front cover and the cover ring maybe separated for cleaning purposes.



Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be fallowed if the a new front cover color was to be requested by a customer.

Front cover & diaphragm: Removal (M1)

Unscrew the diaphragm retaining ring by using the 2nd stage rim clamp tool to help aid in the removal.

Remove the diaphragm retaining ring.

Lift out the thrust washer and diaphragm.



Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be fallowed if the a new front cover color was to be requested by a customer.

Exhaust cover & Exhaust valve (T1x, T1, B1, Z1)

The silicone rubber exhaust valve should never need replacement, and it is not normally necessary to remove these components, unless the customer complains of wetness during breathing.

In 2002 the silicone exhaust valve color has been changed to gray.

Locate the two slots in the bottom front of the case where the case and exhaust cover meet.

Use a flat bladed screwdriver that is close to the same width as the recess and pry the cover up slowly to unhook the snap. Repeat with the other side, then pull the cover off.

To reassemble, engage the top two tabs of the cover and snap the bottom of the cover over the two tabs molded into case.



The exhaust valve should never need replacement, and it is not normally necessary to remove these components however many animal such as cock roaches and termites love to eat silicon and it should be thoroughly looked at when servicing.

Exhaust cover & Exhaust valve M1

Locate the two slots in the bottom front of the case where the case and wide exhaust cover meet.

Use a flat bladed screwdriver that is close to the same width as the recess and pry the cover up slowly to unhook the snap. Repeat with the other side, then pull the cover off.

To reassemble, engage the top two tabs of the cover and snap the bottom of the cover over the two tabs molded into case.

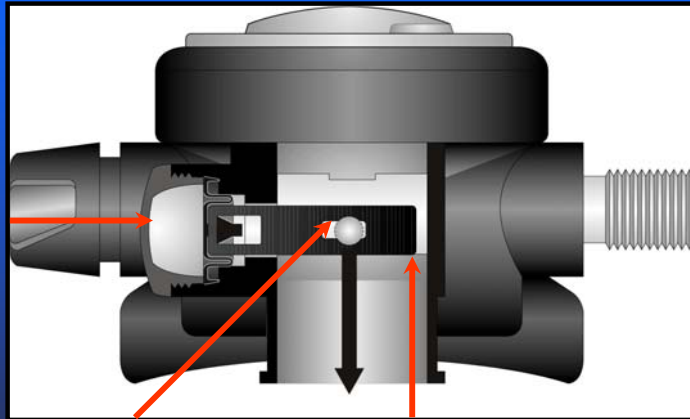


The exhaust valve should never need replacement, and it is not normally necessary to remove these components however many animal such as cock roaches and termites love to eat silicon and it should be thoroughly looked at when servicing.

Automatic Flow Control (AFC)

* EXCLUSIVE PATENTED ATOMIC AQUATICS FEATURE

The air inside the AFC Cover is sealed at atmospheric pressure.



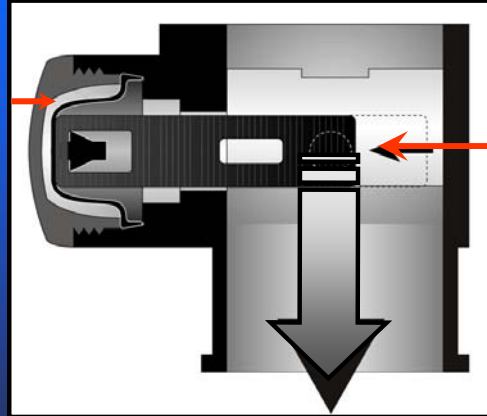
The air flowing over the center of the plunger causes minimum air flow assist.

At the surface, the AFC Plunger is fully extended, disrupting the air flow and stabilizing the regulator at the surface of the water.

Automatic Flow Control (AFC)

* EXCLUSIVE PATENTED ATOMIC AQUATICS FEATURE

The air inside the AFC Cover is sealed at atmospheric pressure.



At depth, increased ambient pressure forces the diaphragm into the AFC cover and the AFC Plunger is automatically retracted. Air flowing over the wide part of the plunger creates maximum air flow assist.

The plunger will move back and forth as the dive progresses increasing the venturi and performance at depth and stabilizing the regulator and shallower depth and most importantly at the surface all of these functions are done automatically. To test the AFC you may want to place the regulator in a pressure chamber taking the regulator down in depth to the equivalent of 60 feet and making sure that the plunger has retracted to its maximum position.

AFC Removal / Replacement

To check, manually push the plunger back into the case and check to see if it returns when released.

To disassemble, remove the AFC cover with a 2nd Stage T-handle tool.

Withdraw the diaphragm and plunger as an assembly.

Clean off the parts, check the diaphragm for tears and reassemble.



Inlet tube: Removal from case

Remove the jam nut.

Push the inlet tube out towards the knob end until the splines on the knob sleeve are just clear of the case.

Unscrew the knob assembly completely off the inlet tube.

Depress the lever and withdraw the tube from the case.



Lever, Poppet, Balance Chamber, & Spring: Removal

The balance chamber and spring should drop out of the tube.

Slightly opening the legs of the lever will allow the poppet to drop free. Spread one leg of the lever just enough to clear it from one side of the sleeve, then the other side. Don't overspread the lever legs more than needed or you may permanently deform it.

The balance chambers have been improved. Replace any early production "white" balance chambers with "black" ones supplied in the 2nd stage repair kit.



Lever sleeve: Removal

The lever sleeve is a low friction bearing for the lever pivot that will provide hundreds of thousands of cycles without wear. The lever sleeve should not be removed unless obvious damage is apparent. Do not attempt to re-use the sleeve once removed.

Lever sleeve-Removal

Spread one leg of the lever just enough to clear it from one side of the sleeve, then the other side. Do not overspread the lever legs more than needed or you may permanently deform it.

Spread apart the lever sleeve and remove it from the inlet tube.



The lever sleeve is a compound with Kevlar added to minimize wear and can perform for many thousands of cycles with no sign of abrasion. For training purposes please do not remove the lever sleeve as you will damage it. Please refer to the slide for instructions on how to disassemble and reassemble the lever sleeve.

Lever sleeve: Replacement

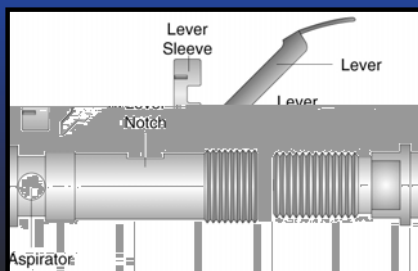
The lever sleeve should not be removed unless obvious damage is apparent. Do not attempt to re-use the sleeve once removed.

Lever sleeve-Replacement

Align the small tip on the inside of the collar with the small hole in the inlet tube.

The open sides of the square hole face towards the knob. Spread the sleeve enough to push it over into over the tube next to the groove it fits in. Slide it into the groove and make sure it snaps fully into position.

Note orientation of lever and sleeve to notch on tube.



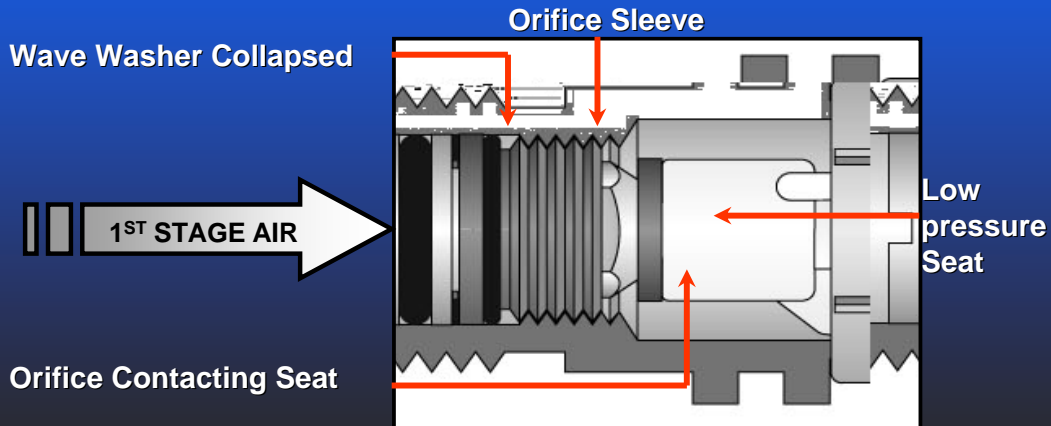
The lever sleeve is a compound with Kevlar added to minimize wear and can perform for many thousands of cycles with no sign of abrasion. For training purposes please do not remove the lever sleeve as you will damage it. Please refer to the slide for instructions on how to disassemble and reassemble the lever sleeve.

Seat saving orifice

* EXCLUSIVE PATENTED ATOMIC AQUATICS FEATURE

This orifice design dramatically prolongs the life of the low pressure seat. The orifice is free to travel back and forth in an adjustable orifice sleeve. Air from the 1st stage pressurizes the orifice and collapses the wave washer so that the orifice will contact the seat.

When the regulator is depressurized the wave washer retracts the orifice just enough to prevent contact with the seat.



The next feature which distinguishes the ATOMIC AQUATICS 2nd stages from others is the patent of the seat saving orifice. In basic terms it allows for the orifice to back off from the seat when the regulator is depressurized and prolongs the life of the seat. The key component of this feature is the wave washer which is a specifically designed so that pressure will force the washer flat and when depressurized and washer will rebound to its original shape causing the orifice to back off just enough to not cause an impression in the seat, and thus causing unneeded wear & tear on the seat. I have brought a display that shows this in great detail that I encourage you to look at during our break.

Seat saving orifice: Removal

The orifice is machined from a tough, corrosion proof titanium alloy, or stainless steel (M1, Z1). Avoid using hard tools or you may damage the orifice edge.

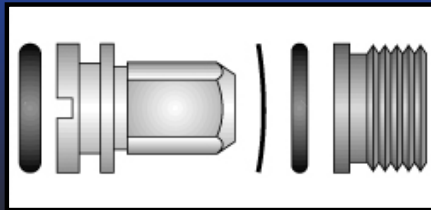
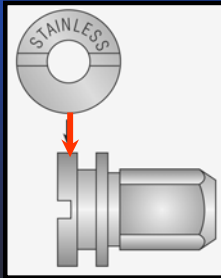
The orifice and wave washer can be removed by pushing a wood4ng -2.7J1 g-0.0376 0. Tm0 g

Seat saving orifice M1: Removal

The stainless steel orifice and zirconium inlet tube must be used to maintain special M1 enriched air rating. Do not substitute any other parts from any other models.

The M1 utilizes a corrosion proof 316 series stainless orifice because of its high temperature ignition point. Do not use hard tools or you may damage the orifice edge.

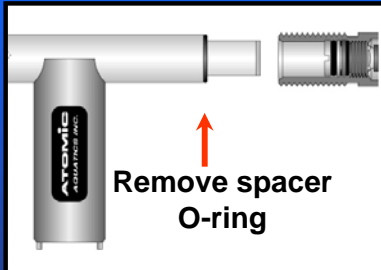
The orifice has been etched for easy identification.



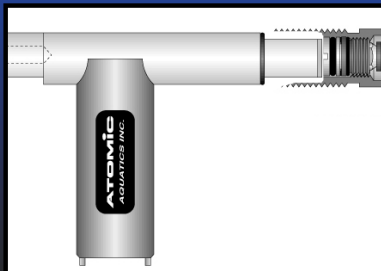
Seat saving orifice sleeve: Removal

The Seat Saving Orifice Sleeve is not normally removed. The o-ring on the sleeve is not a pressure seal but provides a friction fit to keep the sleeve from changing adjustment.

To remove the orifice sleeve:



Place the 2nd stage T-handle tool without the spacer o-ring into the inlet tube and align the flats so that they will engage.

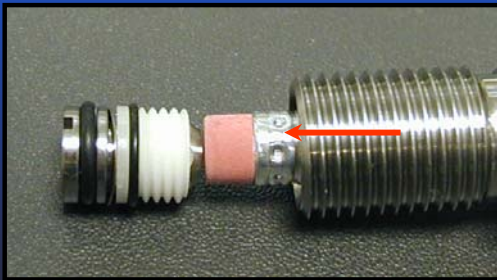


Unscrew the 2nd stage T-handle tool counter-clockwise slowly to loosen the orifice sleeve.

Seat saving orifice sleeve: Removal

The Seat Saving Orifice Sleeve is not normally removed. The o-ring on the sleeve is not a pressure seal but provides a friction fit to keep the sleeve from changing adjustment.

To remove the orifice sleeve:



Push out the sleeve, and orifice with a pencil (eraser end first) from the knob retainer end of the regulator to dislodge the orifice and sleeve.

Knob Components: Removal

Using a hex wrench, remove the knob retainer in the end of the knob. Screw the stem clockwise all the way into the adjustment sleeve by using the knob.

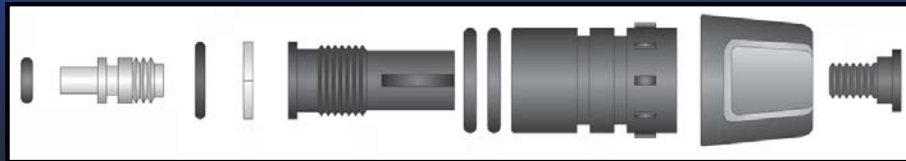
Remove knob from the sleeve.

Push the stem out of the adjustment sleeve.



Knob Components: Removal

Insert hex wrench into stem and turning clockwise-remove the spring pad.



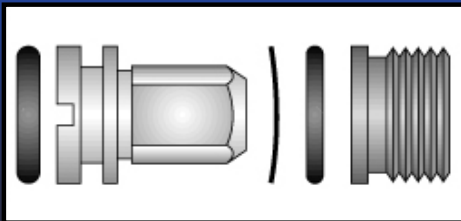
2nd STAGE ASSEMBLY

Seat saving orifice: Replacement

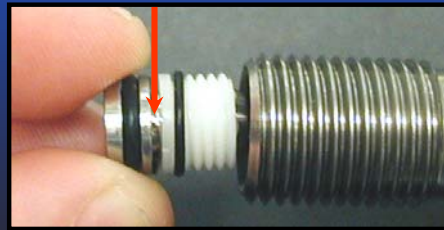
Lightly lubricate and replace the o-rings.

Install the wave washer, then place the orifice into the sleeve. The orifice, wave washer and sleeve is inserted by hand into the hose end of the inlet tube. The wave washer may be installed concave side facing either direction.

Do not use hard tools or you may damage the orifice edge.



Wave washer



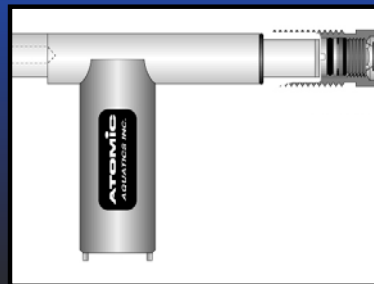
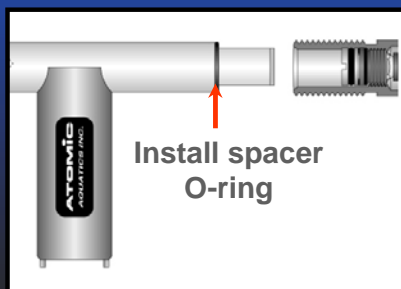
Seat saving orifice sleeve: Replacement

To replace the orifice sleeve:

Make sure that the o-ring is installed on the 2nd stage tool for proper adjustment of the orifice.

Place the 2nd stage T-handle tool into the inlet tube and align the flats so they engage the orifice.

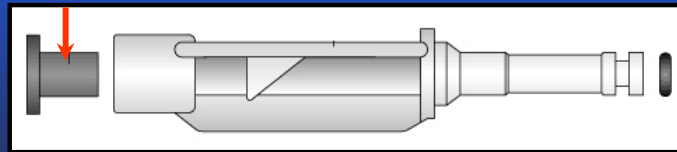
Screw the orifice with sleeve into the housing, using the slotted end of the second stage T-handle tool. The T-handle tool o-ring limits the installation depth of the orifice which provides the preliminary setting.



Poppet seat: Replacement

Grasp the silicone rubber seat and push it completely into the plastic poppet. When properly installed, the rubber seat sits flush to the end of the poppet.

Do not use lubricant when installing the LP seat.

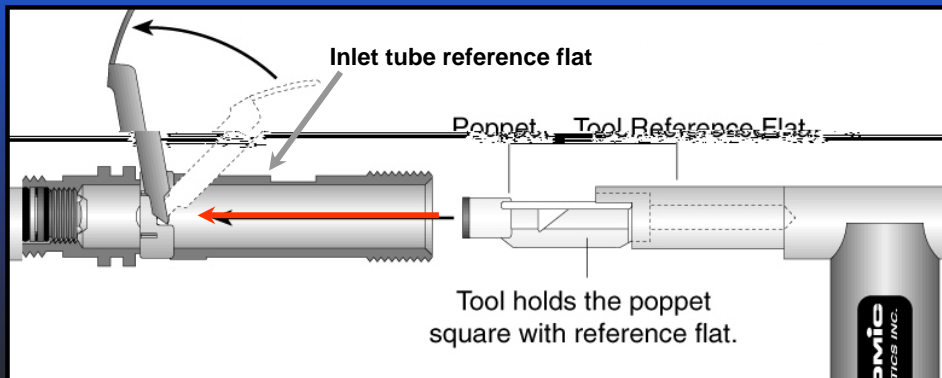


Replacing the poppet into the inlet tube

Make sure that the lever is installed.

Insert the poppet with o-ring into the second stage T-handle tool, and align the flat side of the poppet with the flat on top of the inlet tube.

Lift lever fully and push the poppet into the inlet tube until the poppet seat passes the legs of the lever and it snaps into place. The small tabs on the ends of the lever legs are notched at a 45 degree angle so when the lever is lifted, the poppet will slide easily into place.

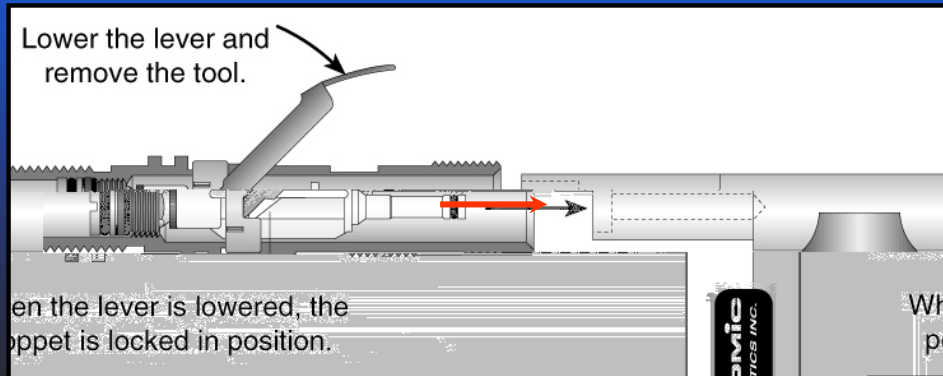


Replacing the poppet into the inlet tube

Make sure that the lever is installed.

Insert the poppet with o-ring into the second stage T-handle tool, and align the flat side of the poppet with the flat on top of the inlet tube.

Lower the lever to withdraw the T-handle tool, leaving the poppet in place.



Knob Components: Replacement

Replace and lubricate all o-rings, and washers.
Screw the spring pad into the stem fully using a hex wrench, counter clockwise.

Insert the knob stem into the adjustment sleeve and turn it counter clockwise to engage the thread.



Knob Components: Replacement

Place the knob onto the knob stem to complete turning the stem counter clockwise until it has reached a soft stop.

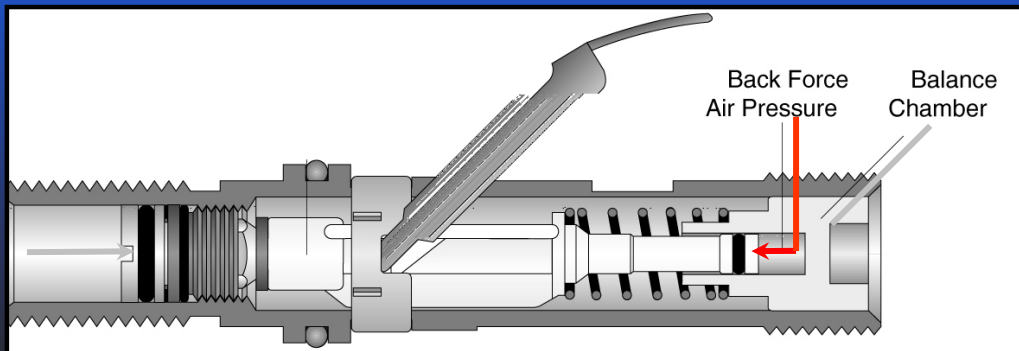
Verify that the knob stem has been turned all the way out counter clockwise to a soft stop.



FUNCTION: Demand Valve (Balanced)

The poppet has a hole through the center that allows the downstream pressure to reach the balance chamber. This back pressure forces the poppet toward the orifice and cancels most of the downstream force.

This “air balances” the poppet making it less sensitive to intermediate pressure variations.



Demand Valve Assembly

Insert the inlet tube with lever and poppet into the case, square end first. Rotate it to engage the square on the tube into the square on the case. Push the inlet tube part way into the case leaving the o-ring exposed as shown.

Thread the jam nut onto the tube until it is flush with the case. This procedure will temporarily lock the tube from turning when installing additional components.



Demand Valve Assembly

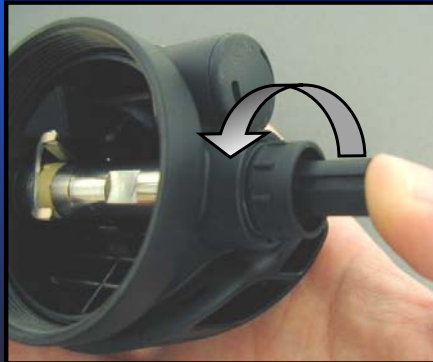
Install the spring, then the balance chamber.

Thread the adjustment sleeve assembly onto the tube, until it bottoms out.



Demand Valve Assembly

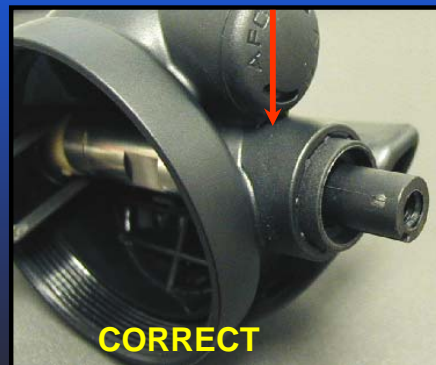
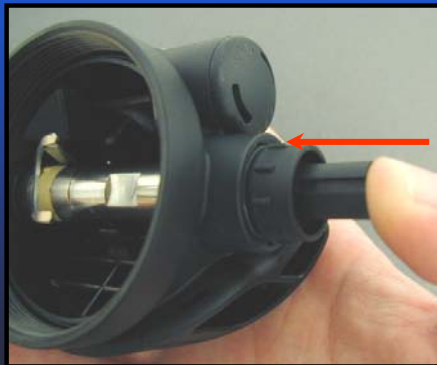
Look at the splines and turn the adjustment sleeve slightly counter-clockwise until the splines align with the grooves in the plastic case bore.



Demand Valve Assembly

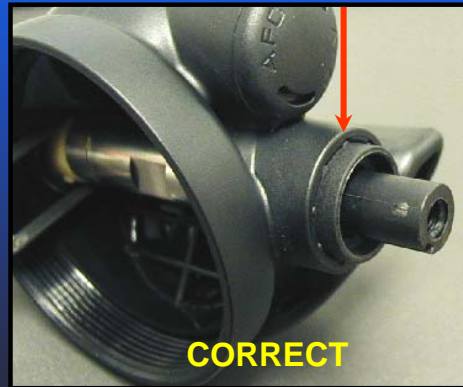
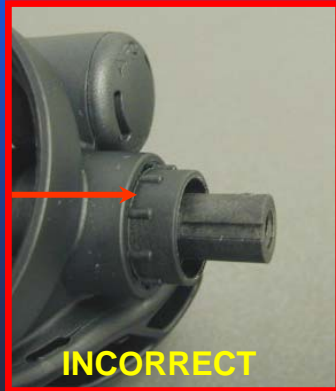
Push the adjustment sleeve all the way in to the case.

Verify the splines on the adjustment sleeve are inserted completely into the case.



Demand Valve Assembly

Check to see that the splines on the adjustment sleeve ARE NOT protruding from the case. If the splines are not aligned, the sleeve has not been treaded all the way down the tube.



Demand Valve Assembly

Verify that the tube is flush with the edge of the case on the hose side.

Tighten the jam nut, and torque to specifications.



(Jam nut removed for clarity)



Front cover & diaphragm: Assembly

(1/2002) (T1x, T1, B1, Z1)

Install the thrust washer and diaphragm.

Install the diaphragm retaining ring.

Tighten the diaphragm retaining ring.



Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

These steps would also be followed if the a new front cover color was to be requested by a customer.

Front cover & diaphragm: Assembly (1/2002) (T1x, T1, B1, Z1)

Tighten the cover ring surrounding the front cover.



When orienting the front cover to read correctly, always turn the cover clockwise as to not loosen the diaphragm retaining ring.

Paying special attention to the internal retaining ring when disassembling the front cover you will notice that was intentionally designed so that if the front cover ring was to be damaged, and the front cover to dislodge the diaphragm would remain secured in the case and the 2nd stage would continue to perform with no unexpected occurrences or safety concerns.

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2nd Stage adjustment

Pressurize and unscrew the orifice away from the seat until the lever reaches its highest possible position and does not leak. Use an inline adjustment tool attached to the first stage, with an intermediate pressure between 125-145 psi. Operate the lever several times (purge regulator), then screw the orifice back in so a very small amount of lever travel is allowed ($1/32''$) before the poppet unseats. Operate the lever again and test for leaks.



2nd Stage adjustment

The adjustment knob should be unscrewed to its full outer position. (Easiest Breathing) Screw the spring adjusting pad in or out with a 1/8" hex wrench until a cracking effort of approximately 1.0-1.4" is achieved, as measured with a magnahelic gauge. Water test to verify there are no air leaks.



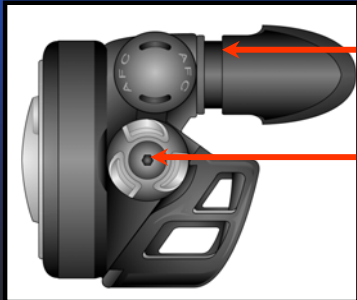
Water Test / Leak Test

If the cracking effort is set to low the regulator may free flow once submerged in the inverted position. This test can also be used if a magnahelic gauge is not available or to test the integrity of the exhaust valve. Cover and seal the mouthpiece tightly with your fingers and set the 2nd Stage underwater, with the exhaust valve up. If a stream of bubbles are detected, screw the spring pad in with a hex wrench, to increase the cracking effort until air no longer streams out the exhaust valve.



Water Test / Leak Test

Retest the inhalation effort as to not exceed 1.4" as measured with a magnahelic gauge. Gently purge and retest, and check for a stream of bubbles.



Install the mouthpiece and use a cable tie to secure it to the case.

Install the knob on the 2nd stage and secure with the knob retainer screw.



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www.AtomicAquatics.com

Cover Title.