

Is one of your Orifices Giving You Pain



The following is information on Plugging Orifice on a rEvo eCCR and not to be confused with a strictly manual rebreather. The manufacture does not recommend plugging the orifice and I will review a couple thoughts on this as well as historical perspective on how the orifice has changed over time. The following is NOT intended to be a "How To" on plugging an orifice, rather it is a caution you on the process. Several divers in recent years have made very simple mistakes that have serious consequences.

- 1) This is NOT for plugging a Manual mCCR, but an Electronic solenoid driven CCR that has a supplemental oxygen orifice
- 2) What is the reason for wanting to plug the orifice
 - You are wishing to go deeper
 - You are simply lazy like Ron and do not wish to have your oxygen leak out if you forget to close the valve, or if the valve gets bumped when you damn well know that you shut it off...
 - You are listening to some idiot on the internet who is very articulate and intellectual with tons of posts. Warning this is the Articulate Idiot that is a cyber diver and not a real world diver with common sense!
- 3) Before you start Phuking around with your rEvo you need to know what generation of Orifice, and Pressure setting that it was intended.
 - Never ASSume that your rEvo is in stock factory condition if you are not the original owner
 - Realize that rEvo has changed orifice type and size
 - Always record the IP before you start tearing apart your regulators

Original rEvo was a Manual or mCCR with an orifice that was shrink wrapped in a red plastic case.



The Flow rate on a rEvo (quote manual) - The rEvo manual states "The Output Pressure of the regulator is depth independent (Absolute Pressure Regulator)". Meaning the Apex first stage has a metal plate over the diaphragm to set the intermediate pressure at a fixed IP at the surface and does not adapt to depth changes. The fixed pressure was approximately 8 bar (116 psi) to allow a flow of + / - 0.6 Liters Per Minute. The rebreather would deliver oxygen until the diver reaches near the 8 bar Absolute pressure or approximately 267 fsw

There was undue concern from divers who wished to dive deeper than 260' and did not realize how easy it was to add external oxygen. Ok yes the first offboard injector was hoky, but with the Titan MAV block it was a snap. Regardless the notion that rEvo was not a deep diving ccr prevailed

Next Generation of rEvo hCCR was a hybrid with orifice and solenoid

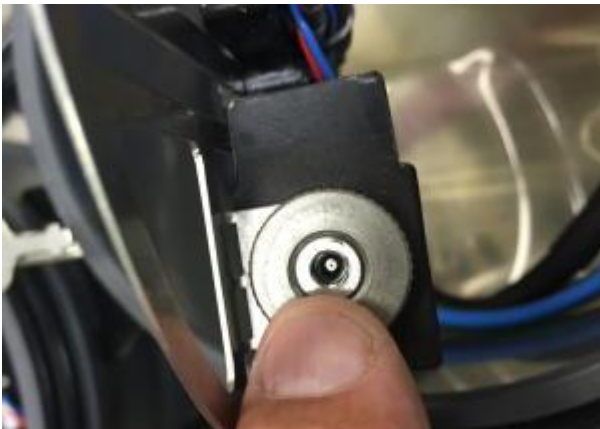


The Third(ish) and Fourth(ish) Generation is a Solenoid with an orifice combined

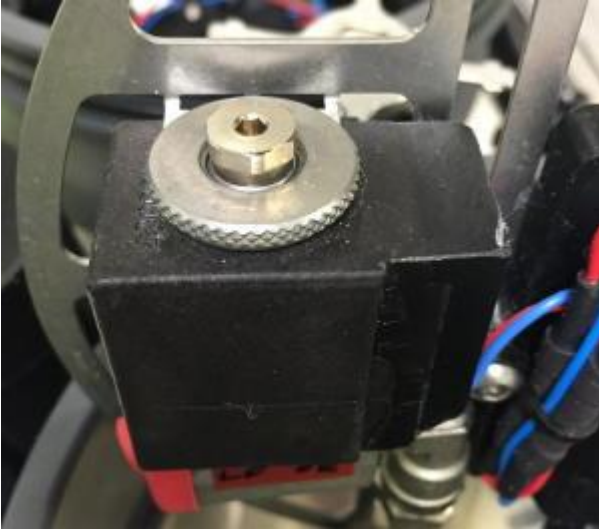


Its hard to keep track of the changes in *Third / Fourth'ish Generation of pressure as the orifice has been reduced in size to allow the pressure to increase, therefor allowing the diver to go to deeper surrounding (absolute) pressure. The factory does not send instructors any bulletins or notices on changes, rather it just shows up on your next order and you are left

Solenoid Orifice Open "leaky valve"



Solenoid Orifice Plugged

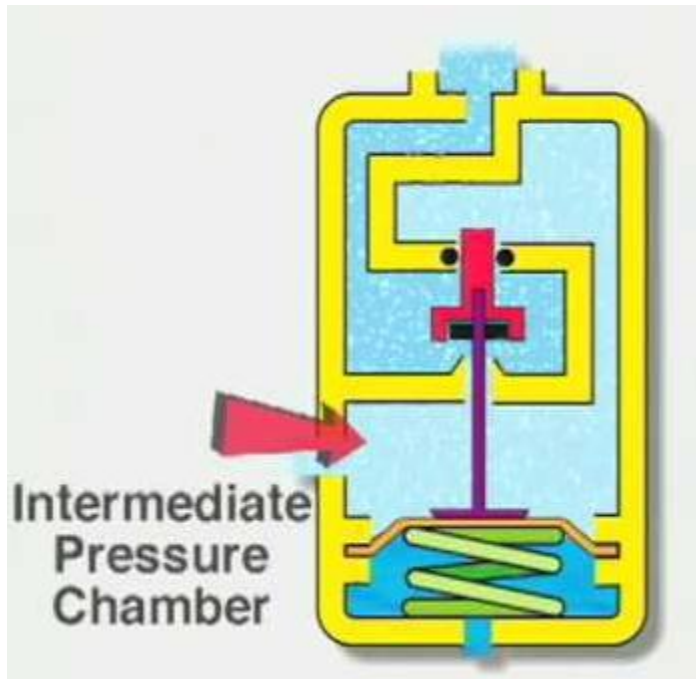


Solenoid Injection Port

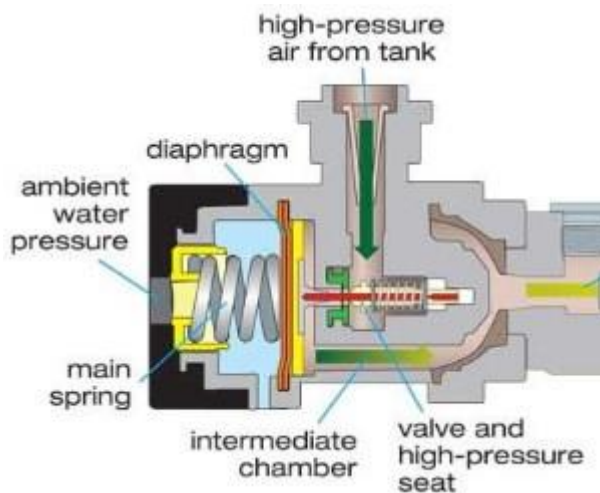


The output pressure of the Oxygen regulator is depth independent “Absolute Pressure Regulator”. This is common on rebreathers that have oxygen orifice such as KISS, or other manual rebreathers. A fixed plate, or stainless steel plug, is installed over the first stage ambient chamber diaphragm to block the regulator from sensing changing pressure.

The pictures of the Diaphragm Regulators are very crude but instructive for two points, the third diagram is an actual Apex drawing of the regulator used on rEvo.

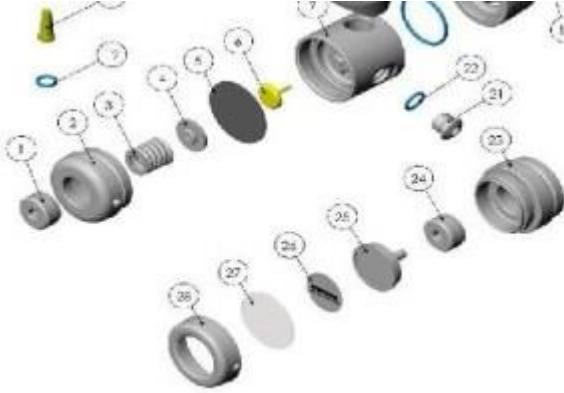


In this picture the bottom of the regulator space shows a small hole in darker blue, and a large spring. This is the Ambient Pressure Chamber. The diaphragm sits on top of the spring sense the pressure change when diver descends or ascends to adjust pressure at setting of approximately 130-150 psi over surrounding (ambient) pressure. The Intermediate pressure chamber is the low pressure gas that flows to the regulators hoses, or to the oxygen supply hose to orifice.



This image shows a red main diaphragm, a thin yellow "space" or void, and poppet pin. What is significant about this image is the yellow void is the tiny space is air filled and susceptible to squeeze when pressure at depth increases. The ambient water pressure pushes on the diaphragm. The big spring is what pushes against the high pressure that enters the regulator, and by adjusting the spring pressure on the diaphragm you set the IP or intermediate pressure. The high pressure cylinder gas is opposed by the large spring. The void below the diaphragm is then subject to "squeeze" by slight changes in ambient pressure.

Apex Diaphragm Regulator



This image shows 2 examples of "Exposed" Ambient Chamber, and "Dry Sealed" Ambient Chamber.

Parts #3, #4, #5, #6 all fit into part #7 on either option

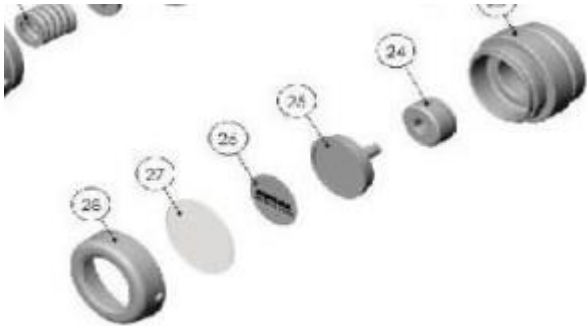
Parts #2 or #23 are interchangeable and do same job and parts #3 - #6 all fit underneath both in same order.

Part #1 or #24 are same adjustment screw for main spring

Part #25, #27, #28 are what create the Dry Seal

The Apex Regulator can be operated as either a Wet or exposed first stage, or and Environmentally Sealed Dry first stage.

Apex 1st Stage as used on rEvo



Diluent and Oxygen 1st Stage are identical with exception of part #25 is removed and rEvo Blank Plate is installed

Environmental End Cap, Hydrostatic Diaphragm, Pressure Transmitter



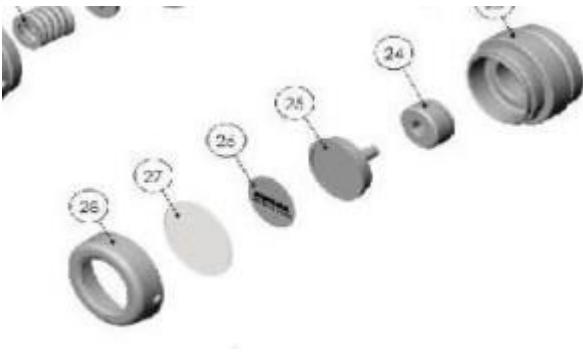
Remove parts #28 with spanner and you will see clear silicone Hydrostatic Diaphragm and the black plastic Pressure Transmitter #25

Body (Diaphragm Clamp) and Spring Adjuster



Here you see the Adjustment Nut #24 and Body part #23

Apex 1st Stage



rEvo Diluent 1st Stage is Dry Seal and includes all parts #23 - #28

Oxygen Side #28 Environmental End Cap, #00 Blank Plate, #27 Hydrostatic Diaphragm



rEvo Oxygen 1st Stage parts #23, #24
Remove part #25 Pressure Transmitter (#26 just a decal)
Install Blank Plate between parts #27 and #26

Parts



Parts #00 rEvo Blank Plug, #69 rEvo Orifice "Butt Plug", #25 Pressure Transmitter, #27 Hydrostatic Diaphragm

Common Problems and Mistakes

I'll not try to cover all the human errors, but a couple of the real popular Phuk Ups when a diver attempts to block the orifice and turn the Hybrid to a completely Electronic ccr.

1. When removing the Blanking Plug #00 the diver fails to install the #27 Pressure Transmitter. This will cause the top Hydrostatic Diaphragm #27 to squeeze and seal off the Intermediate chamber and not allow pressure to be transmitted to the main diaphragm. The regulator will essentially be blanked at depth and no oxygen will flow. *You must install the black plastic Pressure Transmitter #25
2. Install the #69 Orifice Plug in the correct hole - if you need assistance ask any woman what happens if you try to insert the plug in the wrong hole without asking....
3. Reduce the Intermediate Pressure on the oxygen side from apx. 155 psi to apx 135 - 140 psi. *If the IP is not changed the regulator will over compensate due to the "Over Balanced Diaphragm" design. The OPV on the oxygen first stage will dump your oxygen cylinder in quick order.
4. Failure to do research and understand which version of rEvo orifice or solenoid and pooch the entire project...Do your research and write down your starting and ending pressures with an IP gauge so you have accurate record of what you did.
5. Failure to consider the ramifications of removing the slight flow of oxygen that provides a slight metabolic life support. Consider just how easy it is to add a bump of oxygen rich gas at depth as it takes only a small amount for the short bottom intervals spent below 330 fsw.

Now if you are curious as to why rEvo would supply a plug for the orifice when they don't condone the idea of plugging the orifice, yet they do not supply the pressure transmitter??? I have an inside source that revealed that Paul is secretly hoarding the pressure transmitters as he is using them to build a 1:10 scale model Windmill!



So now you know.....

Safe Diving

Gib