Baby Booster Manual

KISS Rebreather, LLC.


Photo by Curt Bowen, ADM.

WARNING

Only those who are professionally trained as gas blenders and understand and are aware of the risks of working with high pressure gases such as air, oxygen and helium, should be using this booster.

When boosting oxygen, great care must be taken to ensure that all cylinders, lines, whips and any other equipment used, are oxygen clean and that oxygen compatible parts and lubricants are used.

Also, it is extremely important that when handling oxygen great care is taken to open all valves extremely slowly. Remember, the needle on your gauge moves at a preset rate. You can not judge the speed of the gas flow by watching this needle. Crack the valve and open with great care.

Remember that for an oxygen fire or explosion to occur, three things need to happen. First, you need oxygen. Second, there needs to be fuel present. The fuel is generally oil or another contaminant. Third, you need a spark or a source of ignition. When opening a valve too quickly, the force of the flow can cause ignition.

OPEN ALL VALVES SLOWLY!!!!!!!!!!!!!

THIS MANUAL SHOULD BE READ IN FULL PRIOR TO OPERATING THE BABY BOOSTER!!

OXYGEN CLEAN & OXYGEN COMPATIBLE

On the previous WARNING page, it states that great care must be taken to ensure that all equipment is oxygen clean and that oxygen compatible parts and lubricants should be used. While it is important that we start out with everything oxygen clean, it is very important that all gas blenders understand that oxygen clean is a point in time!!

An item can be oxygen clean for a brief period but once put into service it should always be considered to be contaminated to some degree.

As stated on the previous page, we need oxygen, fuel and a source of ignition for an oxygen fire or explosion to occur. Oxygen is obviously present and when dealing with high pressure gases, almost everything can be considered fuel. Even stainless hose fittings will burn in high pressure oxygen. That leaves the source of ignition. The most common sources of ignition in a gas booster are particle impingement and heat generated by compression. Particle impingement can be avoided in two ways. First, by attempting to keep particles out of the system. While this is an obvious solution, for all practical purposes it is impossible. The system will be contaminated. The second solution, and this also relates to compression heating, is to ensure that any particles in the system are not accelerated to the degree that they can cause ignition.

This is where the rule of opening the tank valves slowly comes in. Open the tank valves slowly, allowing the pressure to equalize across the booster when the supply pressure is higher than the fill pressure before starting the booster, and then open the drive gas valve slowly. Do not try to use the gauge as an indication of how slowly the pressure in the system is increasing. Most gauges have built in “snubbers” to prevent damage and will show a slow pressure increase even when the valves are opened quickly.

The most likely points of ignition when using a booster are the supply and fill whips attached to the booster. Opening either of the tank valves too quickly can easily generate enough heat to cause ignition. If the fill whips have quick connect fittings or other restrictions the risk of ignition is increased.

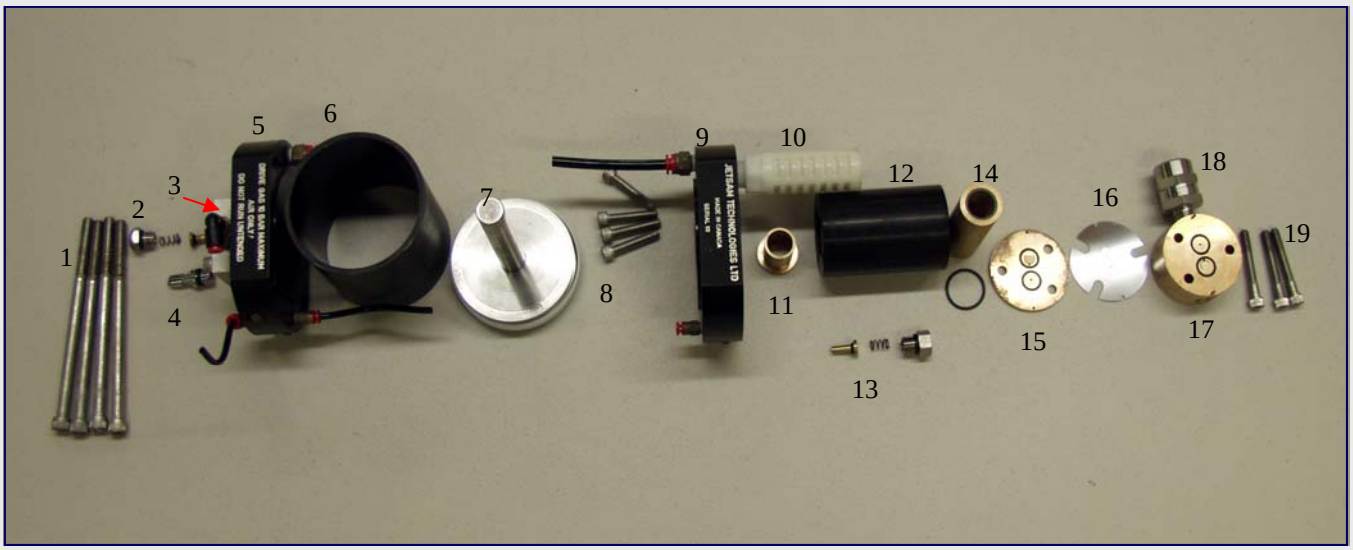
If you boost oxygen you will eventually have an oxygen fire. The risk can never be reduced to zero.

Table Of Contents

Specifications

- Drive cylinder displacement, 17.67 cubic inches (.29 Litres)
- High pressure cylinder displacement, 0.767 cubic inches (.0126 Litres)
- Pressure ratio, 23:1
  *(This is a mathematical ratio only. The actual pressure ratio will be less due to seal friction, dead space and gas compressibility.)
- Maximum drive gas pressure, 147 psi (10 bar) Air only!
- Maximum boost pressure @ 147 psi (10 bar) drive gas = 3200 psi (218 bar)
- Boost ratio, 5:1 with air, 3:1 with Helium
- Weight, 7 lbs. (3.2kg)

PARTS LIST

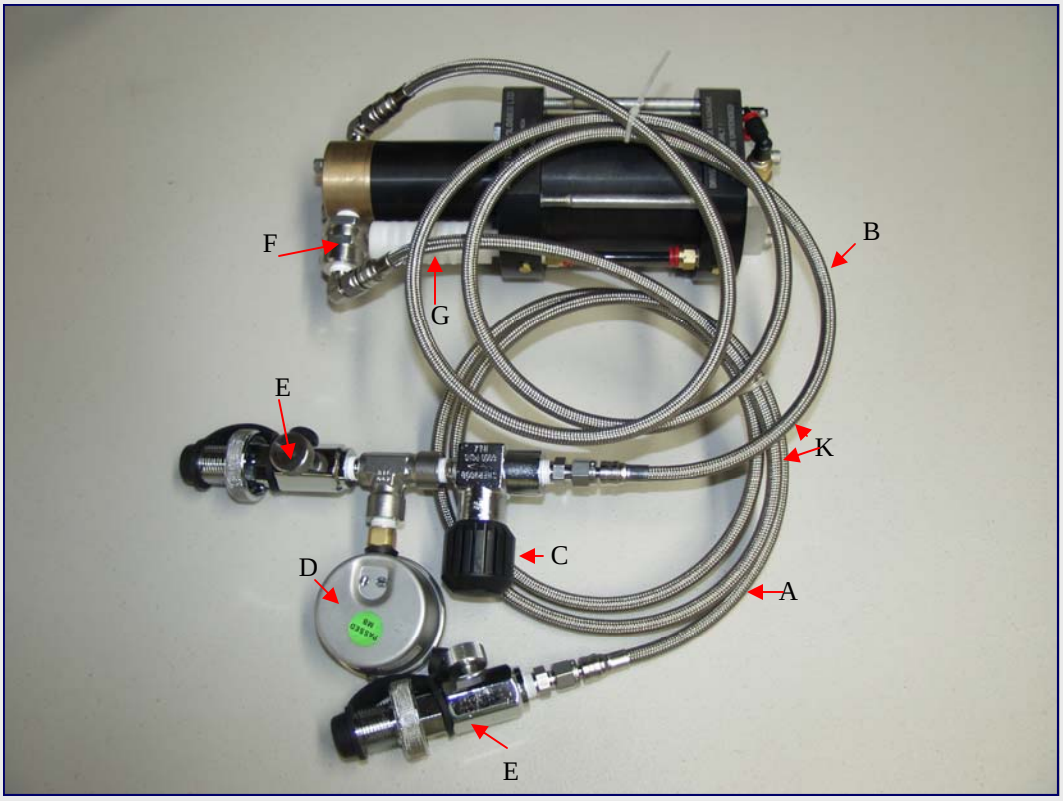


1. 4 5/16-18 X 5" screws
2. 1 PV-1, spring and plug
3. 1 Humphrey M42A valve
4. 1 Inflator stem
5. 1 DO NOT plate
6. 1 Composite tube
7. 1 Piston, with Teflon wear ring 2.75 X 3.00 X 3/8 and the HRU25-2.50-2.5 seal (V seal)
8. 4 1/4-20 X 1 1/4" screws
9. 1 JETSEM plate
10. 1 NAN300-N03 muffler
11. 1 Guide Bushing
12. 1 High pressure cylinder
13. 1 PV-2, spring and plug
14. 1 High pressure bushing and high pressure seal
15. 1 Valve plate
16. 1 Reed valve
17. 1 High pressure head
18. 1 7 micron Swagelok filter, SS-4FW5-7
19. 3 1/4-20 X 1 3/4” screws

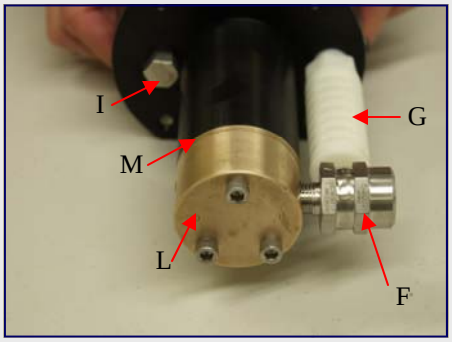
4 V75-012 Viton o rings - HP head and valve plate, 2 each
1 V75-020 Viton o ring - HP cylinder
1 N70-041 Neoprene o ring - DO NOT plate
1 N70-003 Neoprene o ring - PV-1
2 N70-006 Neoprene orings - PV-1 & PV-2

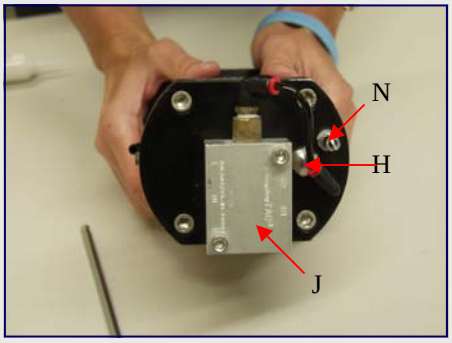
2 Allen keys

Components



A. Supply (Inlet) whip
B. Fill (Outlet) whip
C. Line valve
D. Gauge
E. DIN bleeder blocks
F. Filter
G. Muffler
H. PV1
I. PV2
J. Humphrey valve
K. SS/Teflon whips, 5 ft length.
L. High pressure head
M. Valve plate
N. Inflator Stem





Operation

To operate your new Baby Booster, first attach appropriate transfer whips to the inlet (I) and outlet (O) ports on the cylinder head. Then, attach the inlet whip to your supply tank and the outlet whip to the tank you are filling.

Slowly open the valves on the fill and supply tanks.

VERY SLOWLY IF YOU ARE BOOSTING OXYGEN!!!

If the fill whip has a line valve, open it. If the fill tank pressure is lower than the supply tank pressure, opening the line valve will allow them to equalize.

The drive gas cylinder is connected to the booster with a standard low pressure inflator hose which is attached to a first stage regulator that has been adjusted to 147 psi (10 bar).

To start boosting, slowly open the valve on the drive gas cylinder. There will be a clicking sound as the piston starts it's pressure stroke and a hissing sound from the muffler as the piston is returned to the bottom of it's stroke.

If the booster does not start when the valve is opened, try disconnecting and venting the inflator hose, reconnecting it again and then opening the valve.

Also, ensure that prior to opening the drive gas valve, the supply gas is hooked up and the valve is open. The booster won't cycle without pressure at the inlet port.

HOW IT WORKS

GENERAL

- The pumping speed is internally regulated. As long as the drive gas pressure is adequate, the boosting speed is dependant on two factors. The fill tank pressure and the supply tank pressure.

- The higher the supply tank pressure the better the pumping efficiency will be.

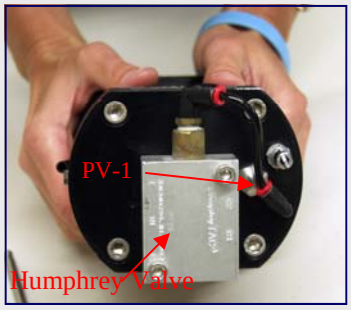
- An example: If the fill tank pressure is near the maximum (approximately 3200 psi/218 bar) each stroke will use 176.7 cubic inches (2.9 litres) of drive gas no matter what the supply tank pressure may be. If the supply tank pressure is 3000 psi (204 bar) the pumping efficiency would be approximately 90%. If the supply tank pressure is 500 psi (34 bar) the pumping efficiency will be approximately 12% and the drive gas consumed would still be 176.6 cubic inches (2.9 litres) per stroke.

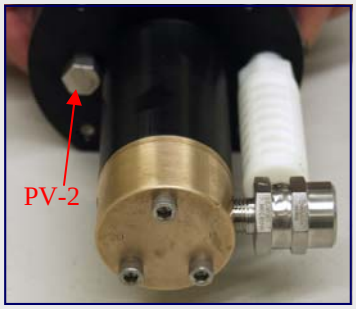
- The higher the fill tank pressure the slower the booster will cycle. Ultimately, the booster will stall as the fill tank pressure reaches the 23:1 ratio of drive gas pressure vs. fill tank pressure. For example, the drive gas pressure should be set to 147 psi (10 bar). With a ratio of 23:1, this means that at 3381 psi (230 bar), the booster will stall. (This is independent of the pumping efficiency.) (Remember, the actual boost pressure will probably be closer to 3200 psi (218 bar).

- Drive gas is consumed in direct proportion to the fill tank pressure and number of strokes.

- Using compressed gas to compress gas isn't necessarily efficient, but it can be convenient.

- As the supply tank pressure decreases the drive gas consumption increases dramatically and the time required to pressurize the fill tank increases due to less gas being actually delivered to the fill tank with each stroke.



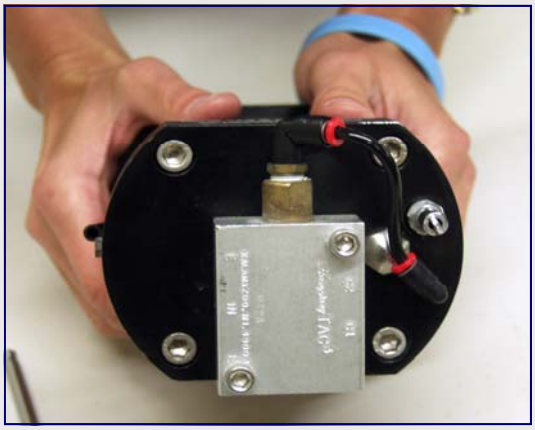


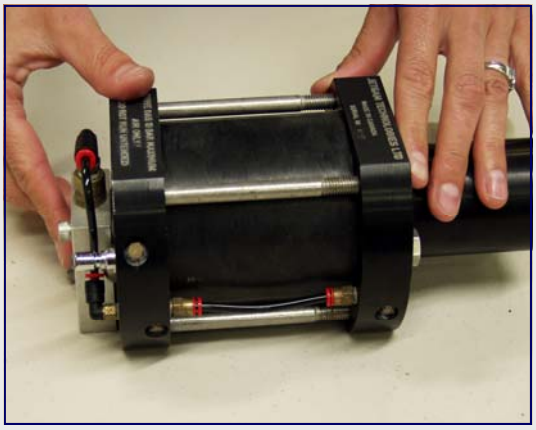
ACTUAL

When the valve on the supply tank is opened, the gas to be boosted enters the high pressure cylinder of the booster and pushes the piston to the bottom of it's stroke. When this happens, the piston contacts PV-1. PV-1 is a small "poppet" type valve that is located under the domed head hex plug, next to the low pressure fitting.

After the fill tank is opened and the drive gas is turned on, the drive gas flows through PV-1 to PV-2 and to the Humphrey valve and this starts the forward stroke. PV-2 is located under a flat hex plug on the top side of the booster.

The drive gas signals the Humphrey valve to allow the drive gas to start pushing the large piston and compressing the gas located in the high pressure cylinder that is too be boosted. When the large piston starts to move, PV-1 will close and the drive gas (signal) will be trapped in the line that connects PV-1, PV-2 and the Humphrey valve. This is the small black plastic tube that runs from the Humphrey valve through the “DO NOT RUN UNTENDED” plate and continues down the right side of the booster to the “JETSAM TECHNOLOGIES LTD.” plate.





When the drive piston gets to the end of it’s stroke, and has boosted the gas in the high pressure cylinder, it will run into PV-2. When this happens, PV-2 vents the signal and the Humphrey valve will stop trying to push the piston forward and vents the drive gas through the muffler. With the drive gas vented, the gas from the supply tank will start to push the piston to the bottom of the stroke again and the cycle starts over.

Fill Target	2400	3000	3200
Supply psi	Time/ min.		
500	27.75	66	
1000	7.5	14.75	19.25
1100	6.5	12.25	16.25
1200	5.25	10.5	14
1300	4.5	9.25	12.25
1400	4	8	10.75
1500	3.25	7.25	9.75
1600	2.75	6.25	8.5
1700	2.25	5.5	7.75
1800	2	5	7.25
1900	1.5	4.5	6.25
2000	1.25	4	5.5
2100	1	3.25	3.25
2200	0.5	3	3
2300	0.25	2.5	2.5
2400	0	2.25	2.25
Fill times for a 13 cu.ft. tank, from an 80 cu.ft tank, based on controlled conditions with a new booster, using air. Note: Helium takes longer.			

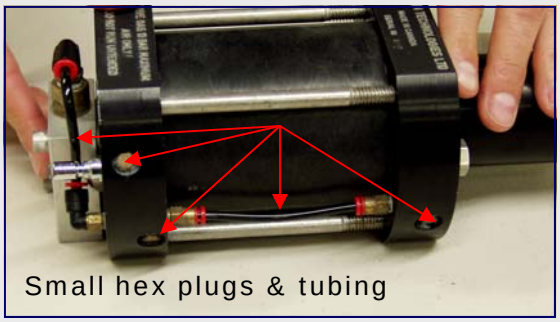
Fill Target	165	206	220
Supply BAR	Time/ min.		
34	27.75	66	
69	7.5	14.75	19.25
76	6.5	12.25	16.25
83	5.25	10.5	14
90	4.5	9.25	12.25
97	4	8	10.75
103	3.25	7.25	9.75
110	2.75	6.25	8.5
117	2.25	5.5	7.75
124	2	5	7.25
131	1.5	4.5	6.25
138	1.25	4	5.5
145	1	3.25	3.25
152	0.5	3	3
159	0.25	2.5	2.5
165	0	2.25	2.25
Fill times for a 13 cu.ft. tank, from an 80 cu.ft tank, based on controlled conditions with a new booster, using air. Note: Helium takes longer.			

Trouble Shooting

As divers, we know that eventually everything malfunctions. If problems arise with the Baby Booster, go through the following steps to determine what the problem is.

#1: Finding a leak in the drive gas line

If there is a leak in the line connecting PV-1, PV-2 and the Humphrey valve, leakage from any of these three valves or leakage from any of the three small hex plugs near this tube, the signal will be lost before the drive piston reaches PV-2. If this happens, the booster will develop a severe stutter, and it won't pump any gas. To determine where the leak is, first check that all of the small hex plugs are snug (don't tighten them too much or the threads will be stripped) and that the small tubing isn't damaged.



Small hex plugs & tubing

If the plugs or tube fittings aren't leaking the next possibility is that PV-1 or PV-2 are leaking. To determine which one is the problem disconnect the small tube at the "JETSAM" plate. To do this press the red ring towards the fitting and pull the tube out of the fitting at the same time. Fold the tube over to seal it and turn on the drive gas. If the booster still stutters the leak is somewhere in the "DO NOT" plate area or PV-1. If the booster quits stuttering and makes a full compression stroke the problem is in the "JETSAM" plate area or PV-2. By releasing and folding the tube the booster can be made to operate if the problem is in this area. By doing this, you have taken over PV-2's job.

When doing the above tests, ignore the plugs, fittings and tube on the other side of the booster. All they do is carry the exhaust drive gas to the muffler. If they were all removed, the only difference would be that the booster is louder.

*NOTE: If it turns out that there is a problem with one of the plugs on the signal circuit, a plug on the opposite side of the booster could be used.

If the problem turns out to be with either PV-1 or PV-2, refer to the section on stripping the booster on page 16.

*WARNING— Under no circumstances should the Humphrey valve ever be disassembled!! Once disassembled, this valve will never work again!! This valve should be good for about 1 million cycles.

#2: Leakage in the fill whips.

One of the most common problems is a leak in the fill whips. As this is a small booster, a very small leak will prevent the booster from pumping. A vent screw that isn't fully sealed will do this.

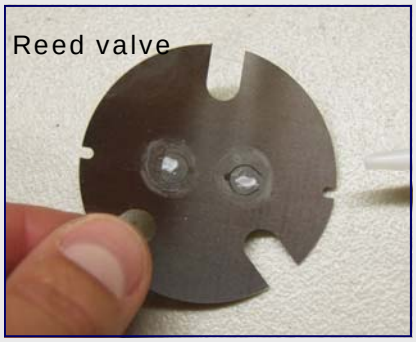
#3: Debris on the Reed valve.

Many times, pumping stops because of debris on the Reed valve. The Reed valve, which is located in the high pressure head, will leak if this happens. Many different substances have been found on the Reed valve. The most common, however, is Teflon tape. You can expect this problem anytime the fittings have been removed from the high pressure head or anytime the fill whips have been resealed with the Teflon tape.

*NOTE: This problem can be reduced by installing a Swagelok SS-4FW5-7 filter on the inlet port. Early boosters sold were not fitted with this filter. It can be ordered from Swagelok or from Jetsam Technologies. It is 1/4 NPT male x 1/4 NPT female. All current boosters sold will already have this filter attached.

To minimize the problem of Teflon tape in the system, clean all remnants of Teflon from the threads on the fittings when they are removed and from the HP head ports. When the fittings are rewrapped, start the Teflon one thread away from the end of the fittings.

If it is necessary to clean the Reed valve, first vent any pressure in the booster. Then, remove the 3 screws holding the high pressure head using a 3/16 Allen key. When removing the screws, remember to loosen them uniformly. Once the screws have been removed, you will have three screws, the head, the Reed valve and a valve plate.


Reed valve

The head and valve plate both have two O-rings each. They are V75-012 and they face towards the Reed Valve when the parts are assembled. Carefully wipe the Reed valve, being careful not to bend it as it is very thin. Also, check the surfaces of the head and valve plate for damage or debris. If there is debris present that is affecting the boosters performance, you will find it on the flat surfaces inside the O-rings that were holding the valves open. Carefully, clean the holes and surfaces of any particles, being extremely careful not to scratch the sealing surfaces! Once ready to reassemble, apply a light film of oxygen compatible lubricant to both sides of the reed valve, on the valves and reinstall them on the booster. At this time, the HP bushing should be cleaned and re-lubricated. See page 19 for instructions. When reinstalling, ensure that the large O-ring, V75-020, is still in position on the high pressure cylinder. Unfortunately, if there is debris in the supply gas or fill whips you may need to clean the assembly several times as the particles work their way through the system. A filter will help reduce this problem.

TECHNICAL NOTE ON THE REED VALVE AND EXTERNAL LEAKS

The reed valve is a direct metal to metal seal. They will always leak slightly. To check the leakage rate, pump the fill tank to maximum pressure and close the fill tank valve. Close the supply tank valve, vent the supply whip to zero pressure, and close the vent screw on the supply whip. Disconnect the drive gas whip. You should now have the supply whip at zero pressure, the fill whip at near maximum pressure, and no drive gas.

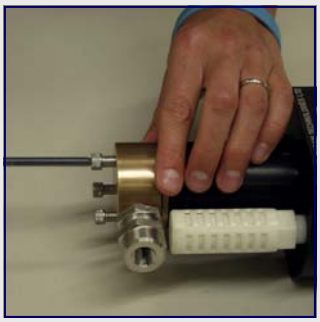
The gauge on the fill whip will slowly begin to drop as the gas in the fill whip leaks back through the Reed valve and flows into the supply whip. With 5' (1.5 m) Swagelok hoses on both the inlet and outlet and air (not helium) in the booster it should take approximately 5 minutes for the pressure to decrease by half. Different length or size of hose will change this rate. If you have a gauge on the supply side you can also check for external leaks. If the supply and fill whips are of the same internal volume and there is zero external leakage (this is unlikely) the pressure in the fill whip will drop by 50% of it's initial reading and stabilize there. After the pressure in the supply and fill whips equalizes any further leakage is from gas escaping from the system.

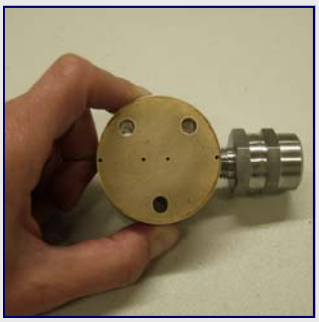
If the fill and supply hose pressures rapidly equalizes to half of the initial fill hose pressure and then slowly continue to drop the reed valves are leaking but the system does not have significant external leaks.

If the fill and supply hose pressures equalize to a pressure significantly lower than 50% of the initial fill hose pressure and the pressure continues dropping then there is an external leak in the system.

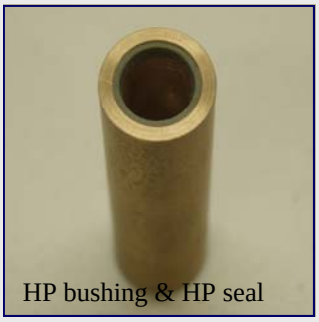
It is normal for the system to leak slightly. A five minute leak down to zero after the supply and fill hose pressures equalize is generally not a problem. There are at least 8 O-rings, two vent screws, and approximately 15 pipe fittings in the system and this test is being done with a minute volume of gas. If there is a significant external leak it is probably somewhere in the fill whips, not the high pressure seal. The high pressure seals have been very reliable. These are the same seals used in the Jetsam electric drive booster. They normally last for 4-5 years on the electric boosters.

#4: Replacing the HP Seal





In the event that you need to replace the HP seal, first the HP head must be removed from the booster. Using the enclosed Allen wrench, slightly loosen each screw prior to fully removing them.
Once the HP head has been removed, the HP bushing (bronze sleeve) will need to be removed from the booster. Removing it may be tricky. First, using a piece of plastic, push the piston to the bottom of it's stroke and shake the high pressure bushing out of the front of the booster. DO NOT DROP IT! If that does not work, insert your finger into the high pressure bushing and pull it out. If that doesn't work either, with the piston pushed to the bottom of it's stroke, connect the drive gas whip and slowly open the tank valve. The piston should move forward and push the high pressure bushing out of the booster far enough that it can be pulled out. If that didn't work, see the following page for instructions on dismantling the booster.



HP bushing & HP seal

The HP seal is located in the recess on the end of the HP bushing. Lift the seal out of the recess with your finger. *WARNING: DO NOT USE ANY SHARP TOOLS TO REMOVE OR INSTALL THE HP SEAL!!

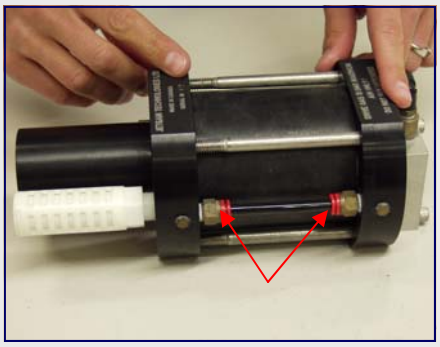
If there is no seal in the recess, it is probably still on the piston rod.

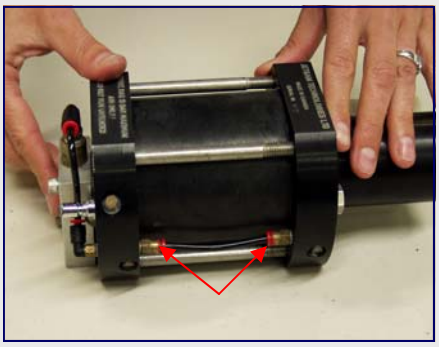
Clean any old residue of Christolube. The lubricant will start out white but it turns black and gummy after time. Inspect the HP bushing to ensure that there are no gouges in it. Apply a small amount of oxygen compatible grease to the edges of the new seal and place it in the recess with the spring side down. DO NOT force it into place. Carefully work the edges of the seal into the recess and make certain the spring expander has not popped out of its grove. Apply a small amount of grease to the inside of the HP bushing and re-install in the high pressure cylinder.

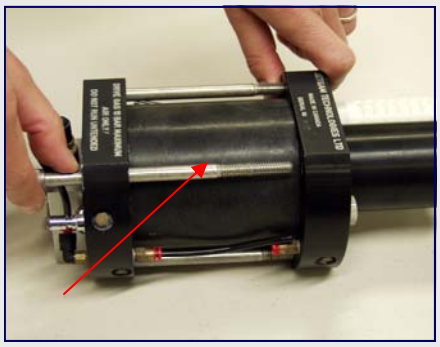
BOOSTER DISASSEMBLY

If the HP bushing is still stuck in the booster, the booster will have to be disassembled. Prior to disassembly ensure that all gas sources are disconnected and vent any pressure in the system.

First remove the HP head and set the parts aside. Next, disconnect the tubes running from the JETSAM plate to the DO NOT plate. These tubes are removed by pressing the red collar towards one of the fittings and pulling on the tube. Then, remove the 4 large screws holding the booster together. Use the 1/4" Allen key which was enclosed with your booster. Once the screws have been removed, pull the DO NOT plate off, and then pull off the composite tube. If the piston didn't come out with the tube, pull it out of the HP bore.





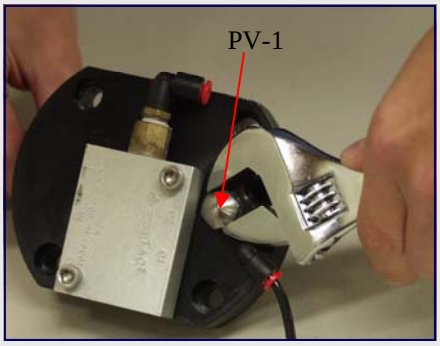


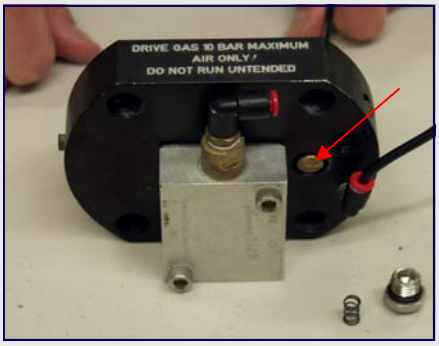
Once the DO NOT plate and the composite tube have been removed, you can see the four screws that hold the HP cylinder to the JETSAM plate. When these screws are removed the high pressure cylinder can be separated from the JETSAM plate and then you can push the HP bushing out of the HP cylinder and get at the HP seal.

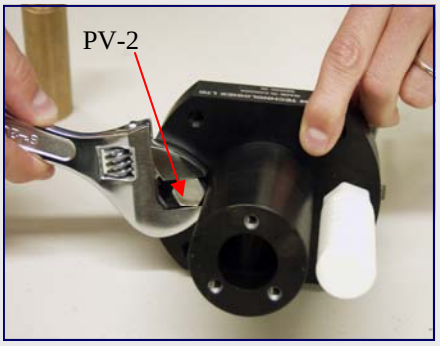
If you need to access the guide bushing, you will be able to see it in the front of the JETSAM plate. It can easily be pushed out. This part is unlikely to ever need replacing unless you have been running the booster 24/7 to fill your doubles with 100% oxygen.

PV-1 AND PV-2

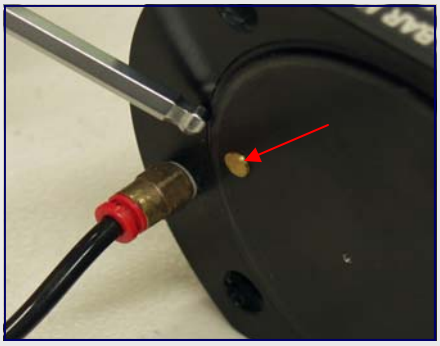
These parts can be removed by unscrewing the large hex plugs on the DO NOT and JETSAM plates. Take care not to lose the springs located underneath these plugs. PV-1 will need to be pushed out of the plate as it has 2 O-rings on it and is tight in the plate. PV-2 will probably fall out as it only has 1 O-ring on it and is loose in the plate.







Replacing the O-rings is the only thing that can be done for these parts and even these should last many years. If you do need to replace them, cut the old ones off the valve stems and take care not to damage the O-ring grooves. Remember to lightly lubricate the new O-rings. Also, ensure that the holes that the valves go into are clean.



When you reassemble PV-1, you will need to push it back into the hole in the DO NOT plate as the small O-ring creates a tight fit in the hole. PV-2 will drop easily into the hole. When these plugs are correctly installed, they should protrude about 1 mm above the surface of the plates.

#5: Damaged HP bushing

If debris has worked its way past the Reed valve and has gotten into the HP bushing, the piston will score the bushing. If this happens, generally the piston will get stuck and stop moving. Or, bits of metallic debris will work there way up, lodge on the Reed valve and the booster will stop pumping properly. In either case, remove the HP head and look at the Reed valve. Is there any metallic debris visible? If yes, it could also be from the fill whips, tank valves or from the supply tank. So, check the HP bushing for evidence of scoring or damage. You will not need to disassemble the booster any further to do this. Even if the piston is stuck in the up position, you should still be able to see if there is any damage to the bushing.

If you have a spare seal kit, which includes a spare HP bushing, you can replace the bushing yourself. Follow the above directions for disassembly and replace the bushing. Prior to replacing the piston, you will need to polish it with the enclosed Scotchbrite. You are using the Scotchbrite to remove the bronze particles, not to make it completely smooth.

*WARNING: Ensure that the scotchbrite does not contact the HP head, valve plate or the Reed valve.

* WARNING: Every last trace of the bronze must be removed from the piston. If any amount is left behind, the piston will score the HP bushing again and the booster will stop working.

*WARNING: THE BABY BOOSTER IS A DELICATE, HIGHLY TECHNICAL PIECE OF MACHINERY! DO NOT DROP, BUMP OR JAR IT IN ANY WAY. IF YOU MANAGE TO MARK IT IN ANY WAY, YOU HAVE TREATED IT TOO ROUGHLY!!!!

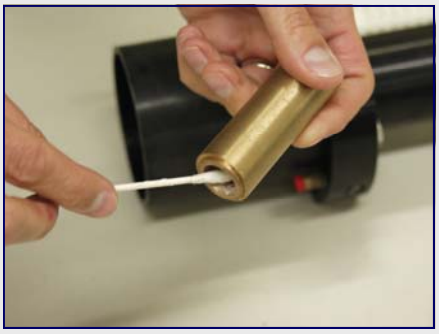
DROPPING, BUMPING, JARING THIS BOOSTER CAN THROW OFF THE ALIGNMENT OF THE INTERNAL PARTS WHICH CAN CAUSE THE PISTON TO SCORE THE HP BUSHING, WHICH WILL RESULT IN THE BOOSTER BEING UNABLE TO OPERATE!!!!!!

IF YOU HAVE DROPPED IT, OR YOU SUSPECT THAT IT MAY HAVE BEEN DAMAGED WHILE TRAVELLING, YOU WILL NEED TO DISASSEMBLE THE BOOSTER AND REASSEMBLE IT, ENSURING THAT ALL PARTS ARE CORRECTLY ALLIGNED AND APPROPRIATELY FASTENED!

Full Reassembly

Start with the bronze HP bushing. If the HP seal has been replaced, apply a small amount of oxygen compatible lubricant to the edges of the seal and insert, spring side down. Be very gentle when inserting as the spring expander can pop out of it's groove. If this happens, chances are the seal will need to be replaced. When this seal is installed correctly, you should not be able to see the spring. Once the HP seal is in place, apply a small amount of oxygen compatible lubricant to the inside of the bushing (see photo below) and using a swab, distribute the lubricant through out the inside of the bushing, then set aside.

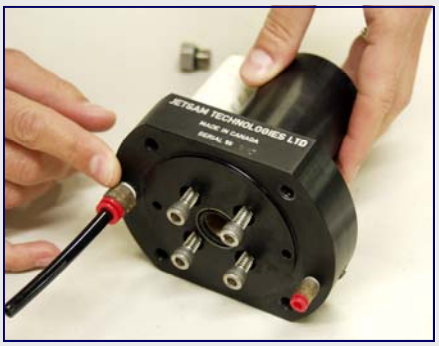




Next, insert the guide bushing into the JETSAM plate as shown in the photo below. Apply a small amount of oxygen compatible lubricant to the inside of the bushing and distribute evenly.



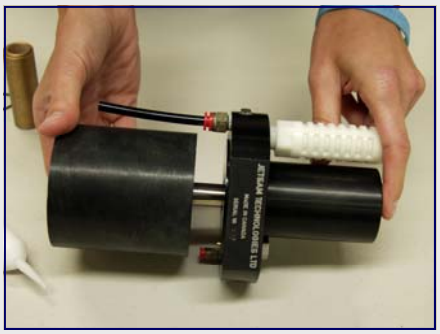
To reassemble the HP cylinder, first ensure that the cylinder is positioned so that the two screws on the HP head end are at the bottom and the single screw is at the top, as in the photo below. This is not essential, but will ensure that the fill whips end up in the proper position.

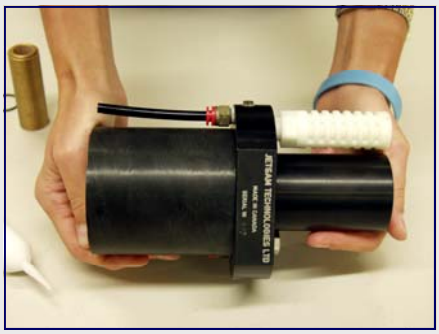




After ensuring that PV-2 is clean and that the O-ring has been lubricated, drop it back into the hole, insert the spring and then fasten the plug using a wrench. There is no need to over tighten this plug, as the O-ring creates the seal.

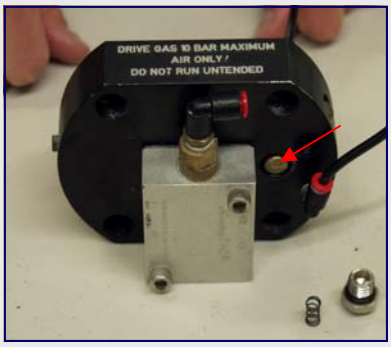
An awkward part of reassembling the booster is inserting the large piston back into the composite tube as the "V" seal needs to be pushed into the bore without damaging the edge of the seal. First, lightly lubricate the first inch of one end of the bore. This is the end where you will insert the piston. Also lightly lubricate the V seal. Insert the small end of the piston into the bore. When you get to the wide end of the piston gently twist it into the bore while holding onto the Teflon ring and V seal. Ensure that you do not pinch the V seal between the piston and bore. Do not force it.

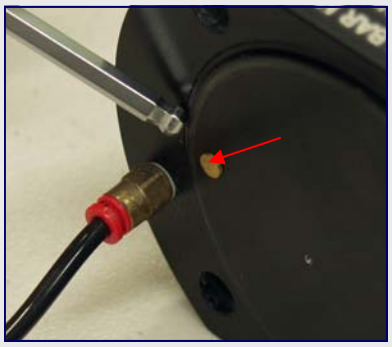
Next, push the composite tube and piston onto the JETSAM plate. The small end of the piston is inserted into the guide bushing on the HP cylinder. The piston should move freely when pushed with one finger. If it doesn't, something is binding. Once done, set aside.

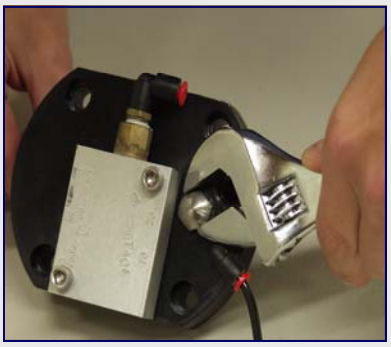




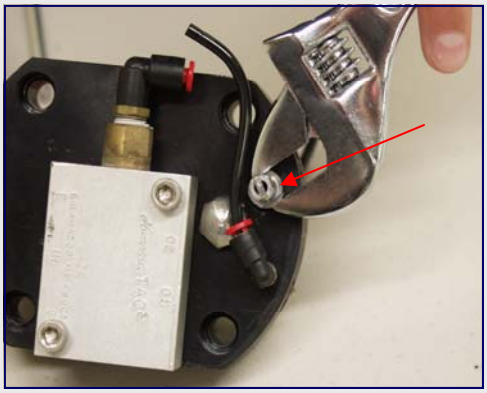
To reinstall PV-1, apply a small amount of oxygen compatible lubricant and ensure that the valve hole is clean and insert the valve. As the O-rings are a tight fit into the hole, you will need to push PV-1 into position. Once installed, the stem of the valve will protrude by about 1 mm above the surface of the plate. Tighten the plug. Do not over tighten; the O-ring is what makes the seal.



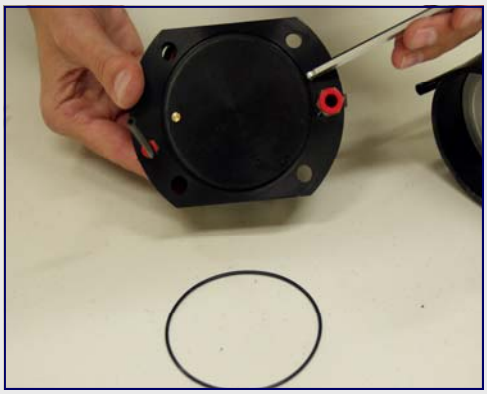


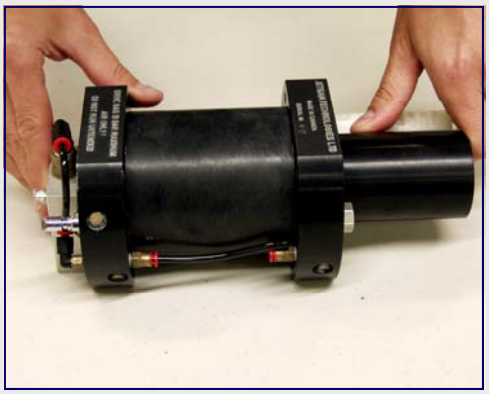


Next, install the LP inflator nipple. This also has an O-ring seal and should not be over tightened. Then, reattach the tube going to the Humphrey valve.

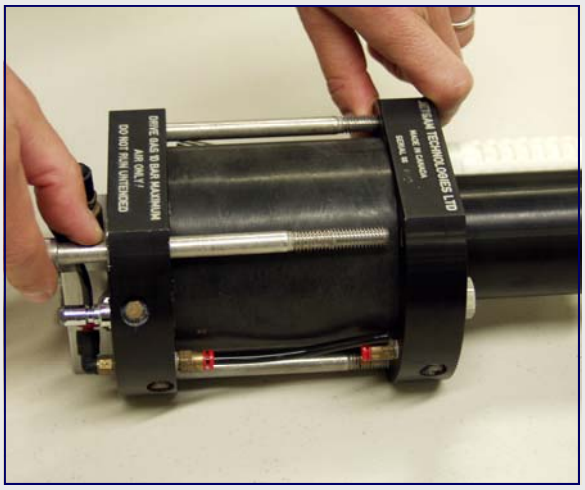


When you have the various components reinstalled on the DO NOT plate, apply a light amount of lubricant to the 041 O-ring, ensure that it is not damaged and reinstall it on the plate. Then push the plate up against the rest of the booster.

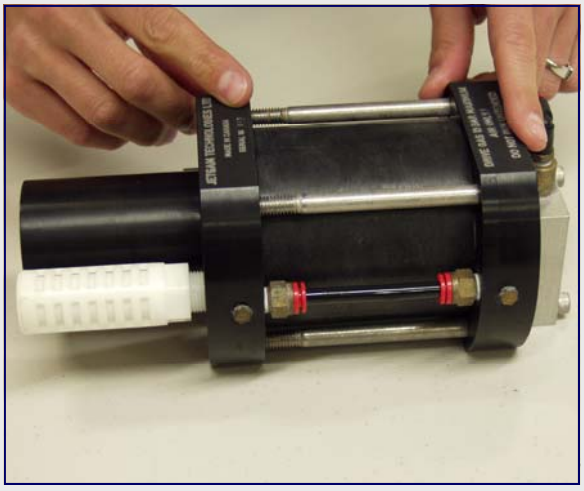


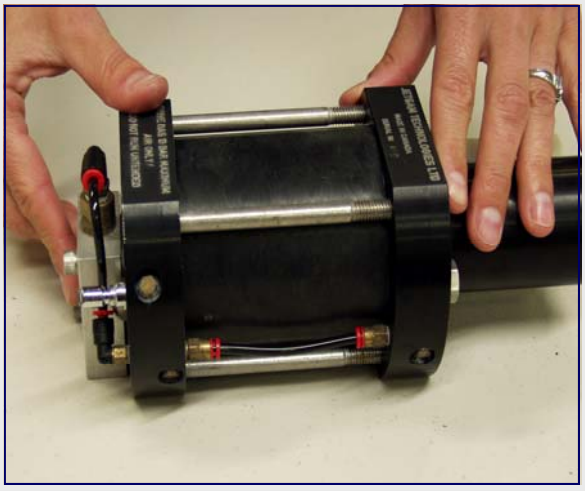


Use the 5 inch screws to secure. Remember to tighten the screws evenly. Placing the booster on a flat surface will keep the two plates in alignment.

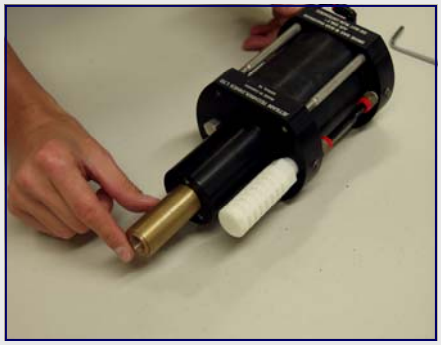


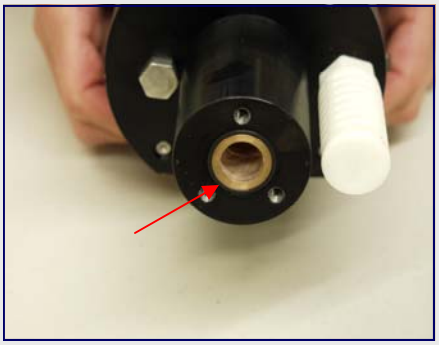
Reattach the thin hoses on either side of the booster.



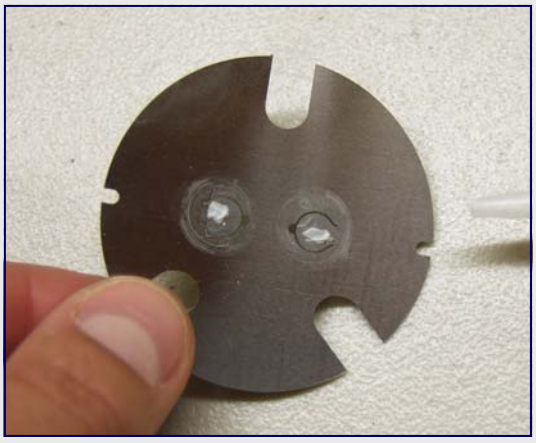


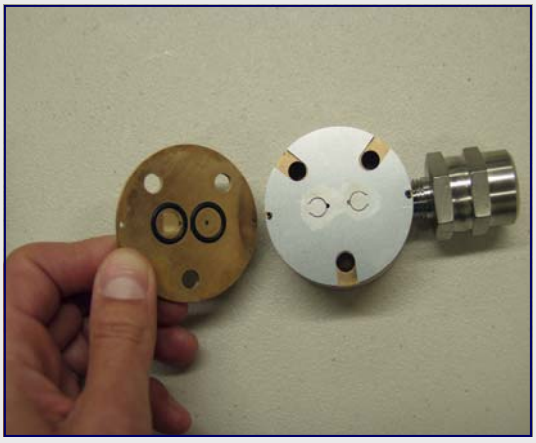
Push the HP bushing back inside the HP cylinder, with the HP seal going in first. Reinstall the 020 O-ring against the top of the cylinder after applying a light coat of lubricant.

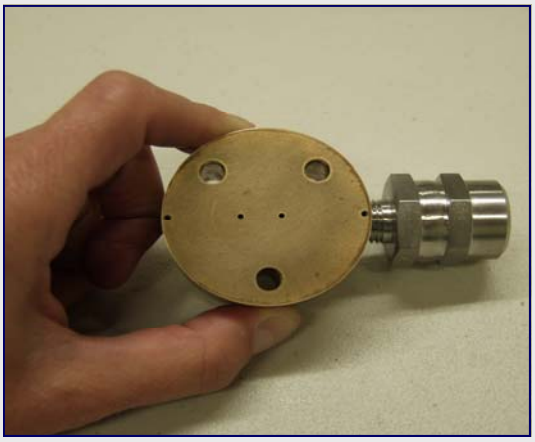




When reassembling the HP head, apply a small amount of oxygen compatible lubricant to both sides of the Reed valve, in the centre of the valves and spread it around with your fingertips. Place the Reed valve onto the head, against the O-rings and then place the valve plate on top of it. The O-rings from the valve plate should be against the Reed valve, also.







While holding the HP head together, push the 1.75 inch screws through the holes and then place against the booster and secure. Remember to tighten the screws evenly and firmly.