KISS REBREATHERS

ORCA SPIRIT - SPIRIT LTE - SPIRIT SIDEWINDER MANUAL

READ THE MANUAL!!!!

IN ORDER TO FULLY UNDERSTAND YOUR NEW REBREATHER, THE COMPONENTS, HOW THEY WORK, HOW TO HANDLE AND TREAT THEM, YOU MUST READ THE MANUAL IN FULL, FOR YOUR REBREATHER.

ORCA SPIRIT OWNERS SHOULD READ THE OS MANUAL; SPORT KISS OWNERS SHOULD READ THE SPORT KISS MANUAL; KISS CLASSIC, & KISS CLASSIC EXPLORER OWNERS SHOULD READ THE KISS CLASSIC EXPLORER MANUAL; HOLLIS EXPLORER OWNERS SHOULD READ THE HOLLIS MCCR CONVERSION MANUAL, AND USE IT IN CONJUNCTION WITH THEIR HOLLIS MANUALS. ANY DIVER WHO HAS UPGRADED COMPONENTS TO THEIR REBREATHER SHOULD BECOME FAMILIAR WITH THOSE COMPONENTS, AND RECEIVE TRAINING.

THIS SHOULD BE DONE PRIOR TO DIVING OR SERVICING THIS UNIT!!! SPECIAL ATTENTION SHOULD BE PAID TO ALL NOTES &/OR WARNINGS; THEY MUST BE READ AND UNDERSTOOD!!!! FAILURE TO DO SO, MAY CAUSE SERIOUS INJURY OR DEATH!!!!

YOU MUST BE A LEGAL ADULT IN THE AREA IN WHICH YOU LIVE IN ORDER TO PURCHASE AND DIVE A KISS REBREATHER.

As with all scuba diving equipment, your KISS rebreather components should be serviced annually by a trained technician. For those diving frequently, servicing may be required more often.

ALL INFORMATION IN THIS MANUAL IS SUBJECT TO CHANGE.
Please visit our website, www.kissrebreathers.com
for updated manuals.

THIS IS NOT A JOKE!!

Participation in rebreather diving can result in serious injury or death to you, the diver!

The warning on the KISS Orca Spirit rebreather is not a joke. Before beginning your dive, you must consider the risks involved. The KISS OS consists of many parts. All of these components will eventually fail. Careful maintenance, assembly, and testing will not prevent this from happening. At best, it will delay the failure. The KISS OS is not automatic in any way. It requires constant monitoring, a complete awareness of the potential problems likely to be encountered, and full knowledge of how to deal with whatever problems may occur. If you do not have adequate training, equipment, physical conditioning, and a proper mindset, do not get in the water.

The diver, YOU, has the final responsibility for his or her own safety and actions while using this rebreather. All components of the KISS OS must be in good working order and be properly assembled and tested to reduce the risk of failure. Regardless of the training and experience of the diver and the reliability of the rebreather the risk of serious injury and/or death can never be reduced to zero.

This manual is not a complete text on the maintenance and operation of the KISS OS. The diver must complete a proper training course covering the maintenance, testing and operation of the rebreather before diving this equipment. The rebreather can malfunction while diving even when properly assembled and having passed all pre-dive tests. Only carrying adequate bailout gas and having the training and skills necessary to utilize the bailout system can reduce, but never eliminate, the risk of equipment failure.

Photo’s by Jim Abernethy and Doug Ebersole

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SPECIFICATIONS: KISS ORCA SPIRIT

- Weight of the unit completely assembled with wing & harness, and full scrubber canister's is 42 lb/ 19 g. The travel weight (no absorbent deduct 5.3 pounds/2.4 g) is about 37lb/16.7g.
- The weight of the unit without the cylinder and no absorbent is 28lb/12.7g. This would be the weight of the system for flying without the cylinder.
- The height of the unit ready to dive is 23 inches/58.4cm. If the crossbar was removed for travel, then the height measures 20inches/50.8cm.
- The widest part of the unit is the cylinder which is 13.4 inches/34 cm. The width of the unit with the cylinder removed is 10 inches/25.4 cm. This is the width of the top plate which is the widest point.
- The depth of the unit with the scrubber canisters secured to the frame is 5.5 inches/14 cm. If the cylinder is included in measuring the depth, then the depth is 6 inches/15.25 cm. Those that wish to know the packing depth, add 3 to 4 inches (7.6 to 10.16 cm) for the wing and harness.
- PLEASE SEE OUR PARTS LIST ON THE NEXT PAGE FOR A FULL LIST OF WHAT IS INCLUDED AND WHAT IS NOT.
- It is a mechanical rebreather which adds O2 continuously by a feed orifice and manually as needed.
- Compatible with Trimix.
- Scrubber holds 6.2 lb (2.8 kg) of Sofnolime 408 grade absorbent (different brands may have different weights)
- The cylinder is 14cuft and holds 3000 PSI of pressure.
- The KISS Orca Spirit is a closed circuit rebreather designed for recreational and technical sport diving to the depth of 300 feet (91 meters). Proper training, outside the basic KISS rebreather course is required for any deep or technical diving. For some types of diving, extra gear must be carried or alternate gear configurations will be required. Ensure you have the proper training, gases and gear to conduct your planned dive.
- A bailout system is required for all dives. The bailout system should be appropriate for the dive that is planned. KISS Rebreathers strongly recommends that a second stage regulator is attached to the bailout first stages, using a LP hose. KISS does not recommend using quick connects on regulator hoses, which have a regulator attached.

Parts List

1 KISS Orca Spirit - BASIC includes:

- 1 stainless steel stand which includes: 3 Fastex clamps, 2 wing attachment bolts, 2 Fender washers with nuts, manifold with adjustment set screw, 1 off board accessory whip rebreather side, 1 ADV LP hose with elbow, 1 wing inflation LP hose.
- 1 cylinder side off board accessory for the diluent cylinder.
- 1 gas addition scrubber head which includes: 1 scrubber head elbow, 1 automatic diluent valve (ADV), 1 hose attachment quick connect tower, 1 indexing mark, 1 threaded ring, 4 springs.
- 1 sensor scrubber head which includes: 1 port for the main display, 1 port for a secondary display, 1 hose attachment quick connect tower, 1 indexing mark, 1 threaded ring, 4 springs, 1 sensor attachment plate, 1 bronze nut, 1 exhaust valve, 3 display wire sets with molex pins and plug.
- 2 scrubber canisters which include for each canister: Base with attached screen, top screen.
- 2 loop hoses
- 1 Manual Add Valve (MAV) set which includes: 1 MAV & filter, 2 oxygen rated LP hoses.
- 1 KISS OS cylinder and valve.
- 1 KISS OS cover - options available are the skeleton (SS frame), black ABS, or the 1/2 size industrial cover (SS).
- 1 Wing & harness system
- Counterlung
- 1 delrin plug for the oxygen first stage.
- 2 quick connect hose stubs with 2 hose clamps (to secure loop hoses to towers)
- 1 thumb drive with manuals and information

DISPLAY OPTIONS

- No display, no display cable, no Fischer cable.
- Fischer cable only. This is hardwired to the Sensor head.
- Fischer cable and Shearwater PPO2 only display. (Cable is hardwired to the scrubber head and display is fitted to cable via a Fischer connector.
- Fischer cable and Shearwater computer
- Shearwater HW PPO2 display and cable. (All hardwired; no Fischer's)
- Secondary display options may include PPO2 display, computer or HUD.

Not included :

- Display system and cable. See above for options.
- Mouthpiece (BOV), LP regulator hose, 2 quick connect hose stubs, and 2 hose clamps
- Stainless steel ballast rings for the loop hoses. Our rings are .13 lb each for a total of 1.04 lb's when using our recommended 8 rings.
- Oxygen first stage and OPV
- Sensors
- Swivel elbows, HP & LP
- Spare parts such as O-ring kits. See the back of the manual for a list of recommended spare parts.
- Diluent/bailout regulator set
- Diluent/bailout cylinder
- Pressure gauges

KISS Orca Spirit BASIC Rebreather Kit

INFORMATION & INSTRUCTIONS FOR KEY UPGRADE COMPONENTS.

As rebreather's are becoming more and more main stream in the dive industry, we are seeing many new dealers and divers interested in our products. One of the popular requests that we get is - can I buy a KISS rebreather without the mouthpiece? Another one is - can I buy a KISS rebreather without the first stage? Well, the answer is YES!!

Based on customer comments and requests we have setup the KISS OS pricing structure so that dealers and divers may personalize their units! The KISS OS BASIC, is a bare bones system. Dealers and divers can now add on the KISS components they wish to buy, and supply the balance of the kit themselves!

This means that dealers can now personalize the units for their customers and provide their own first stages, LP & HP hose's, & BOV's (rebreather mouthpiece).

Should dealers and divers wish to purchase some of the components from us, they can pick and choose what they would like. See the KISS OS price sheets for a complete list.

***NOTE: The upgrade prices are prices that are discounted from the regular parts pricing. This pricing is only valid at the time the rebreather is ordered, and must be included on the original invoice for the rebreather.**

***NOTE: The Dealer's KISS instructor must be authorized to assemble the KISS OS BASIC kit. If the shop has a KISS Instructor on staff, the Sales Agent may authorize this instructor.**

If the shop does not have a KISS instructor on staff, then the shop must have a KISS Rebreather Instructor who is authorized to assemble the KISS OS BASIC kit or Sales Agent on retainer in order to properly assemble the unit before use.

REQUIRED READING

***WARNING: It is extremely important that dealers and divers who opt to purchase a KISS OS BASIC rebreather kit, understand the importance of the various components that they must add on to their system in order to make it complete. Failure to do so, may cause injury or death.**

The sections covered in the following two pages are for the BOV (rebreather mouthpiece), the loop hose ballast rings, and the oxygen first stage regulator. These pages are required reading for all KISS OS BASIC rebreather purchasers.

BOV - BAILOUT VALVE

The BOV, or rebreather mouthpiece, is a key component on the KISS OS diving system. Should divers choose to source their own BOV, it is extremely important that they choose a product from a reputable company and that it comes fitted with a bailout 2nd stage regulator. The integrated 2nd stage regulator is a key safety component for the diver.

Should the dealer or diver choose not to use a bailout type rebreather mouthpiece, the warranty on that diving system will be revoked. We can't stress enough the importance of this feature.

Required Parts:

The KISS OS BASIC will ship with the loop hoses, as well as the parts to attach these hoses to the scrubber head's. The customer will need to purchase a BOV & parts with which to secure the mouthpiece to these hoses.

It is important that when choosing a method to secure the loop hoses to the BOV, that the BOV can be removed easily. This is important as the BOV mushroom valves (valve disks) must be inspected prior to every dive.

LOOP HOSE BALLAST RINGS

The ballast rings may seem like an insignificant part of the rebreather but in reality they are an important part of the diving system. Having either too much or too little weight on the loop hoses will cause much discomfort and stress to divers.

When the ballast is supplied by KISS Rebreathers, 8 rings, 4 per side, are used. The total weight of our ballast rings are 1.04lb; or .13lb each. This is important information as other SS rings on the market, while looking very similar, are actually a lighter weight. If you choose to use these rings, ensure that you know what the total weight will be and that you purchase enough of them.

There are also other ballast systems on the market. Again, be certain that you know what the total weight of those systems will be.

Good features to watch for in a ballast system is the ability to move the weight up or down the hoses, while underwater. This is why SS rings work so well; they are easily moved during the dive. It is important to be able to move them during the dive as this is the only time the diver will truly know if the weight is properly positioned. Moving the rings up or down slightly can make a difference in the comfort of the diver.

OXYGEN FIRST STAGE REGULATOR

The oxygen first stage regulator is located on the bottom of the rebreather and is secured to the on board cylinder.

Dealers and divers that choose to use their own first stages must choose a first stage from the approved list below.

Prior to final assembly of the rebreather the oxygen first stage must be modified. The top ring of the first stage must be removed, the environmental plug and seal removed and the KISS delrin plug with O-ring inserted. To do this:

- Loosen the top ring of the first stage.
- Tip the first stage over and the environmental plug will fall out.
- The top ring has a seal inserted into it; use your fingers to push it out and remove it.
- Lubricate the O-ring with oxygen compatible grease, and ensure it is secured to the delrin plug.

- Push the delrin plug firmly into position.
- Secure the top ring to the first stage body. While turning the top ring in, you will need to push the centre of the delrin plug to hold it firmly in position. If you don't do this, the delrin plug will want to push up and out making it difficult to secure the ring.
- Ensure that the ring is properly secured.

Once the delrin plug has been installed, an OPV will need to be inserted into one of the low pressure ports. The OPV is an important part of the first stage regulator and divers should not dive the KISS OS without one present.

It is important that both the delrin plug and the OPV be properly installed on the oxygen first stage. ***If the delrin plug is not installed the oxygen delivery system on the OS KISS will not work properly!***

Approved first stage regulator's:

- Dive Rite - RG1208 ICE with environmental kit
- Apeks - DS4 with environmental kit

***WARNING: IT IS VERY IMPORTANT THAT THESE INSTRUCTIONS ARE CAREFULLY FOLLOWED. THE PROPER BOV MUST BE SELECTED FROM A REPUTABLE COMPANY WHICH HAS AN INTEGRATED 2ND STAGE FOR BAIL OUT. AS WELL, THE APPROPRIATE AMOUNT OF BALLAST FOR THE LOOP HOSES MUST BE SECURED. THE DELRIN PLUG MUST BE PROPERLY INSERTED INTO THE OXYGEN FIRST STAGE. OPV'S MUST BE SECURED TO THE OXYGEN FIRST STAGE. FAILURE TO DO ANY OF THESE, MAY CAUSE INJURY OR DEATH!**

Unpacking & Disassembly

Congratulations! You have just received your KISS Orca Spirit; the first thing to do is ensure that all the parts you ordered, are included in the box. As you know, the KISS OS can be shipped either as the BASIC unit or with various components added. Please see the previous parts page for a list of what is included with the BASIC kit, and what the optional extras are. Go through the box and ensure that everything that you ordered has arrived. Small items can be lost in bubble wrap so ensure that you look carefully in the packing material also.

The OS ships with all the O-rings installed and the unit is assembled. The following instructions are for disassembling the OS.

- Remove the back cover. Remove the wing/harness from the front of the unit, by loosening the fitting's, and setting them aside. The counterlung's will slide through the slots and stay attached to the unit.

- You will see that the Sensor Head is secured to the Scrubber Canister using a threaded ring. Loosen the Sensor Head by turning the ring left. Once the ring has been disengaged, pull the head up to free it from the scrubber canister. The ring will spin freely once clear of the threads.

- On the Gas Addition Head you will see that there is a LP hose attached to an elbow secured to the Automatic Diluent Valve - ADV. Loosen & remove the elbow from the ADV, and then loosen the ring from the Scrubber Canister and pull the head up to remove it.

- Inside the Scrubber canister you will see the securing screens. Pull them out and lay them aside.

- Loosen & remove the first stage regulator from the cylinder. (if ordered)

- Loosen the Fastex clamp which is securing the cylinder and remove the cylinder.

- You will see that 2 black circ clips are secured to the cross bar, and attached to each other by a length of twine. Pull the circ clips out of their slots and set aside.

- The crossbar can now be pulled free from the bottom of the scrubber canister. While holding the canister firmly, pull the bar straight down.

- The counterlung's are secured to the crossbar. Turn the CL rings to loosen the lungs and pull them off the bar. Set aside.

- Lay the OS down, scrubber side up. Loosen the Fastex clamps securing the canisters and remove them.

- The BOV will be packaged separately (if ordered), along with the loop hoses.

- The display will be packaged separately (if ordered), however if the cable is ordered, it will be secured to the scrubber head.

The unit is now disassembled. Further sections of this manual will discuss, assembly, scrubber packing, sensor installation & displays, and trouble shooting.

Assembly

This section will discuss the full assembly of your KISS OS; It assumes your scrubber canister has been filled and is ready to dive. The next section will discuss scrubber packing.

O-Ring Installation:

As mentioned earlier in the manual, all the O-rings for the KISS OS have been installed. As each section is discussed, O-ring placement will be mentioned when required. At the back of this manual you will find a recommended spare parts sheet. There you will find a list of the O-ring names and what kit configurations are available.

As with any piece of scuba diving equipment, the various components and O-rings should be checked annually, and serviced as required. For those doing extensive diving, the various components and O-rings should be checked more frequently. Servicing of your KISS OS can be done by you, your dealer, or the parts can be returned to us.

***NOTE: ALL O-RINGS SHOULD BE LIGHTLY LUBRICATED!! DO NOT USE EXCESS AMOUNTS OF LUBRICANT; THE O-RINGS SHOULD ONLY BE SLIGHTLY SHINY.**

Inspect:

With the unit stripped, first inspect all LP hoses, fittings, the manifold, and components attached to the frame of the unit. Ensure that they are in proper working order, that the LP hoses are not damaged, all connections are tight, threaded rods are straight and clean and nothing is damaged.

Manifold:

You will see the manifold located in between the 2 scrubber canister's on the back of the unit. During assembly the manifold and LP hoses need only to be inspected prior to diving.

If you are required to change one of the LP hoses, the scrubber canister's will need to be removed from the unit so that the area is accessible. In order to make it easier to work with these hoses a set screw has been placed which locks the manifold in place. You can see the set screw on the front of the plate when the wing/harness is removed. See photo.

Simply loosen the set screw slightly and the manifold can be moved. Be certain to slide the manifold back to its original position, and to tighten properly when finished.

The LP hoses secured to the manifold are as follows:

- Bottom: This is the Off-Board Accessory which is connected to the side mounted diluent (bailout) cylinder. This LP hose is 30 inch.
- Top of manifold, back right: ADV, 9 inch
- Top of manifold, back left: Wing inflation, 30 inch
- Top of manifold, front centre: BOV, 32 inch (included when BOV is ordered from KISS)

Canisters:

- At this point, your scrubber canisters are full, with the heads secured. (see the scrubber filling section for filling & head placement instructions)

- Slide the Gas Addition head & canister through the right Fastex clamp; this will be on the divers right side when wearing the unit. This is the Exhale side. Note where the Indexing Mark is located. Turn the canister until this mark is lined up facing the other canister. Place canister a few inches higher than where it will likely sit. Tighten the Fastex clamp to secure the canister in this position; it will be properly positioned after the crossbar is secured.

*NOTE: The two Indexing marks should face each other. This will ensure that the towers on the scrubber head are properly situated for loop hose placement.

*NOTE: The right side Gas Addition Head is the Exhale side; the left side Sensor Head is the Inhale side.

- Slide the Sensor head & canister through the left Fastex clamp; this will be on the divers left side when wearing the unit. This is the inhale side. Note where the Indexing Mark is located. Turn the canister until this mark is lined up facing the other canister. Again, place the canister higher then where you feel it should sit.; it will be properly placed once the cross bar is in place. Tighten the Fastex clamp to secure the canister in this position. Ensure that the exhaust valve is tightened all the way.

Counterlung's:

- Inspect the counterlung's. Most divers (very few will use a different size) will be using a 4&4 liter counterlung. Ensure that they have been properly cleaned and are ready to use.

1. First wipe and clean the sealing area on the inside of the lung. Then apply a very light amount of lubricant to this area.
2. Next wipe and clean the counterlung attachment which is secured to the crossbar. While you have inspected the crossbar in the above procedure, you should inspect the O-rings areas again prior to installation of the lungs. Apply lubricant to the O-ring's. While applying the lubricant, double check that the O-rings are not damaged or indented. If you feel an indent or other damage while applying the lubricant, change the O-ring for a new one.

***NOTE: FOR EASE OF ATTACHMENT, A VERY SMALL AMOUNT OF LUBRICANT CAN BE APPLIED TO THE INSIDE OF THE COUNTERLUNG OPENING.**

3. Push the counterlung onto the counterlung attachment; you will need to push firmly. As you push the lung in place, you will feel a circular flange which is at the perimeter of the lung opening. Push firmly on this flange. It is important that they are pushed all the way on and are straight. When this is done correctly, the retaining ring will easily engage the threads on the lung. Ensure that the lung's are facing the correct direction; visualize the bar attached to the unit; the lungs should wrap towards the outside/front of the unit. The attachment ring's should spin freely to secure the lung's in place. When the ring's are secure there should be an 1/8 inch gap in between the ring and face of the counterlung, and the gap should be evenly spaced.
4. For those divers using 2&4 liter counterlung's, the larger lung should be on the right side and the smaller lung on the left side. Do not apply excess force when tightening the ring. It is not required and the ring will break. Using a tool to tighten this ring usually results in damage or breakage to the ring.
5. Place the crossbar & counterlung assembly on the back of the unit, where it will sit, and feed the counterlung's through the slots on the wing assembly. At this point the crossbar is not yet secured to the unit; you are only positioning it and ensuring the counterlung's are properly placed and positioned. Following this procedure will ensure that no fabric is caught when securing the lungs to the crossbar. This could happen if the crossbar was first secured to the canister's and then the lungs attached.

**NOTE: KISS OS divers who are familiar with the KISS Classic diving system should be aware that the counterlung sizes used on the Classic will not be the same as on the OS.

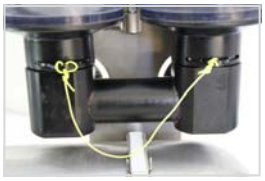
- □ Divers that used a 2&4 liter set on the Classic will use a 4&4 liter set on the OS.
- □ Most divers that used 2&2 liter on the Classic will use a 4&4 liter set; with a small minority requiring 2&4 liter set on the OS.
- □ Most divers that used a 4&4 liter set on the Classic will likely still be able to use a 4&4 liter set, however those who have an exceptionally large lung volume may need a 4&6 liter set on the OS.

Divers need to understand that the rib wrap lung system on the OS is different from back or shoulder mounted lung's on other units. Diver's are easily able to personalize the size of their 4&4 ltr lungs simply by loosening or tightening the strap system and should be prepared to make adjustments. They should never be too tight so as to restrict breathing.

Diver's may require the smaller lung set of 2&4 liter due to the size of the lungs wrapping around the divers torso. A very small person may not be able to properly fasten the 4&4 liter lungs. This is why they would use a 2&4 liter configuration. If the 4&4 counterlung set can be properly secured to the diver, and the lung volume is not to small, then this is what we recommend.

***WARNING: IT IS IMPORTANT THAT THE LUNGS ARE PROPERLY SECURED TO THE CROSS BAR & THEN PROPERLY THREADED THROUGH THE WING. THEY MUST ALSO BE PROPERLY SECURED USING THE CLIP AT THE DIVERS WAIST. IF THE LUNGS ARE NOT SECURED, THEY WILL FLOAT UP AND BREATHING WILL BE DIFFICULT. ENSURE THAT THE LUNGS ARE PUSHED ON STRAIGHT AND THAT THE RINGS ARE NOT OVER-TIGHTENED AS THEY WILL SPLIT!!**

Crossbar:



- The cross bar may be installed either before the cylinder is secured or after. Note that it is easier to install the crossbar AFTER the cylinder is secured as it will give you a reference point and aid in the installation.
- Inspect the crossbar to ensure that it is not damaged. Also, ensure that it is clean and ready to install on the unit. There is a double O-ring seal where the bar secures to the bottom of the canister.

1. First wipe and clean the sealing area on the bottom of the scrubber canisters. Then lubricant the sealing area well.
2. Next wipe and clean the O-ring areas on the crossbar. Then lubricate the O-rings well. While applying the lubricant, double check that the O-rings are not damaged or indented. If you feel an indent or other damage while applying the lubricant, change the O-ring for a new one.
3. Insert the cross bar into the bottom of the scrubber canister's. The proper technique is to push up on the crossbar, pushing it into the bottom of the canisters, and while doing this insert the circ clips.
4. If you secured the cylinder first, then it is easier to attach the cross bar. The procedure for this is that after you insert the crossbar into the bottom of the canister's, you may push down on the canister's which will cause the crossbar to push against the cylinder enabling you to easily insert the circ clips. To do this, ensure that the Fastex clamps are loose.

5. Once the crossbar has been secured to the canister's and the lungs are sitting correctly, the canisters may moved to their final position. Loosen the Fastex clamp's, if they are not already, and position the canister's properly. If the cylinder is not already in place, you may wish to wait; It will be much easier to properly place the assembly. Re-attach the ADV LP hose to the gas addition head. This may be finger tight or may be lightly secured with a wrench.

Cylinder:

- This step outlines how to secure the oxygen cylinder to the unit. Prior to this the diver should ensure that the cylinder has been filled, and that the gas has been analyzed and confirmed to be oxygen. Diver's should always analyze their own gas so they are certain they know what they are diving.

- The cylinder placement area is at the bottom of the stainless steel stand. It is designed to work with a SS Fastex clamp. The Fastex clamp is similar to a hose clamp but is much easier to use. The size of the clamp is pre-set at the warehouse. To open and close the clamp, simply use the lever. If for any reason you need to adjust the size of the clamp, use either a nut driver or screw driver to make the adjustment; see photo.

1. Slide the filled cylinder into the Fastex clamp at the bottom of the unit, with the cylinder valve facing the right.
2. Turn the cylinder so that the valve opening is facing the divers back . This ensures that the first stage will sit properly and the hoses are correctly aligned.
3. Secure the first stage to the cylinder.
4. Open cylinder and double check the pressure on the pressure gauge. Close cylinder.
5. Double check that the scrubber canister's and cross bar are properly positioned, and adjust as necessary. Also double check that the counterlung's are still properly situated and not bunched up or twisted in anyway. Double check that the ADV LP hose has been secured to the gas addition head.

Wing & Harness:

- The final step is to secure the wing & harness system. Due to the design of the KISS OS Rib Wrap counterlung's, we highly recommend the use of the KISS OS wing & harness system. It is important that the wrapped counterlung's are correctly positioned and not constricted in any way.

1. First note where the 2 threaded rods are located on the front of the stand. You will see that there are several holes in which the rod may be secured. If this is the first time you are diving the KISS OS you may need to secure the wing & harness and then try the rig on to determine if the unit needs to be moved up or down. Ideally the top of the unit should be just at or above your shoulders.
2. If you need to move the threaded rod, this must be done prior to assembling the unit as both the canisters and cylinder must be removed to do this. You loosen the rod by using an Allen key, accessed on the scrubber side of the unit. Place the rod's where you wish them to be and then tighten securely.
3. Slide the wing & harness over the threaded rod, pulling the counterlung's and the off board gas accessory whip through the slots and ensuring they are properly situated. You will see that the wing can be slid up or down; place it where it suits you and then place a fender washer over the rod and finally secure with the nut. Tighten securely. Note those that are using a soft back plate will need to secure the stabilizing plate on top of the harness. It is required to make the harness fit firmly to the rebreather.
4. Once the wing & harness have been attached, ensure that the lungs are flat and smooth, where they slide through the slot. Also ensure that they are not tangled in the harness. See photo.
5. Ensure that the threaded rod is not damaged in anyway. If it is, the wing and harness may not be secure, causing a failure. Be certain to inspect these parts prior to diving, and replace as required.

***WARNING: IT IS IMPORTANT THAT ALL KISS OS O-RINGS ARE IN GOOD CONDITION, THAT THE COMPONENTS DISCUSSED PRIOR AND AFTER THIS WARNING, ARE NOT DAMAGED AND THAT THE SEALING AREAS ARE CLEAN. IF THEY AREN'T, THE O-RINGS MAY LEAK CAUSING THE REBREATHER TO FLOOD. THIS MAY LEAD TO SERIOUS INJURY OR DEATH!!!**

Loop Hose Ballast & Mouthpiece Placement:

While the purchase of the loop hose ballast system is optional when purchasing your rebreather, they are required to dive the KISS OS. They are available for purchase from KISS. The KISS system uses 8 SS rings; 4 per loop hose. Our rings are .13 lbs each which makes a total weight of 1.04 lbs. If you choose to source your ballast rings from another company, be certain that you know the weight of their rings. They are not all the same, and many rings from other companies can be up to 50% less in weight, which would require you to purchase a many more then if using the KISS ballast.

If you have purchased your ballast rings from KISS, they will be installed on your hoses prior to shipping.

The type that we use can be moved up and down the hoses underwater for proper placement. With the loop hoses properly adjusted with no twists, and the ballast properly placed, the BOV will be weightless underwater

The ballast rings should be placed fairly close to the mouthpiece. Attach the mouthpiece to the hoses, and then lift it so that it is level with the top of the unit. Look at the loop hoses; they should have a gentle curve. If they are twisted, adjust them by turning the end of the hose by the mouthpiece. These steps are important. If this isn't done, then the mouthpiece will be uncomfortable.

The ballast rings will need to be adjusted again, once in the water. Positioning will be different for every diver. While in the pool, your instructor will demonstrate neutral mouthpiece buoyancy. Ideally the mouthpiece will float neutrally in front of the divers face, if the rings are placed properly and the loop hoses are not twisted. If when doing this skill, the mouthpiece is not floating in the desired area, ensure that your hoses are not twisted and adjust your ballast rings. To adjust the hoses underwater, simply hold the mouthpiece with one hand, and gently turn the hose with the other. Again, once the rings are properly placed, they do not need adjusting again.

These steps are important. If this isn't done, then the mouthpiece will be uncomfortable.

If you feel that the mouthpiece is excessively buoyant even with properly placed ballast weight on the loop hoses, you may secure a loop of bungee to your shoulder straps and slide the loop hose through this when securing to your towers. The bungee loop will assist in holding the loop hoses in place. As the BOV has an excellent work of breathing, it also has a large air space which makes the mouthpiece more buoyant then other models.

***NOTE: For the mouthpiece to be comfortable, the above instructions must be followed. If you feel the mouthpiece either pulling up or down while diving, adjust it by holding onto the mouthpiece and gently turning the hose by holding the end with your other hand.**

DETERMINING THE CORRECT COUNTERLUNG SIZE:

To determine if the counterlung's are a suitable size, you must first put the unit on and secure the lungs. The amount of gas that the lungs hold can be adjusted by simply tightening or loosening the lung waist strap. If when doing the test below, the lungs are too small, loosen the strap and try again. If they are too large, then you can tighten down the strap to adjust.

First, put the mouthpiece into your mouth, open the loop and inhale the gas into your lungs and then out of your nose until the loop is completely empty. When the loop is empty, close the BOV without allowing any air to enter. Then, take a large breath, as much as you can hold, put the BOV into your mouth, open the loop and exhale all your air completely into the loop and then close the BOV.

Ideally, the lung size should be as evenly matched to your own lungs as possible. If you find that when doing this test you can get more than one full breath into the loop before it is full, then cinch down the straps. Never use counter-lung's where the volume is smaller than your own! Very small people may require a 2&4 liter to ensure proper placement, while most people will use 4&4 liter lungs. Those with very large lung volumes may require 4&6 liter lungs.

In matching your tidal volume to the counterlung volume, you will find that your buoyancy in shallow water can be exceptional. Only KISS divers can hold their position in water that is only 3 to 4 feet deep. If you are finding buoyancy difficult in water this shallow, this is due to either being new on the rebreather or the counterlung's are too large.

While doing this test at the surface, remember that underwater your required volume won't change. If you find that your surface test went well, but it feels like the lungs are too small underwater, you probably have too much gas in the loop. To correct this, exhale some of the gas out of your nose. Or, you failed ensure that the lungs weren't twisted when threaded through the wing, then this will cause either a decrease in lung volume &/or will increase the work of breathing. See the work of breathing pages for more information.

***NOTE: The closer you can match the counterlung volume with your own, the better your buoyancy will be. Diving the KISS OS with counterlung with the straps FULLY open will result in greater buoyancy changes. This can cause the user to lose control of their buoyancy which can lead to injury or death!!**

AUTOMATIC DILUENT VALVE (ADV):

The ADV is located on the top of the gas addition scrubber head. The ADV will add diluent gas to your breathing loop after the loop volume has been reduced by either descending or "breathing down" the volume of oxygen. The diver will get the feeling that there is no more air in the loop to breath. All the diver needs to do is suck hard to trigger the ADV and it will feed him more gas. This is how a second stage regulator works.

The ADV has been setup "tight" enough that it doesn't add diluent without the diver being aware. But it adds enough gas so that a reasonable descent rate can be maintained. As you can see, there is an adjustment knob on the ADV regulator. It is very important that this knob is always tight, and turned all the way in. The ADV on the KISS OS has been designed to be easier to activate then past ADV designs. As such, diver's must be aware of body position at all times and understand that a head-down position will cause the ADV to activate more rapidly then usual. If the diver is in this position, then he must be prepared to vent the loop and change to a horizontal position. This will aid in preventing a buoyancy issue, which is may cause an unwanted ascent.

***WARNING: THE ADJUSTMENT KNOB ON THE ADV REGULATOR MUST ALWAYS BE TIGHT AND TURNED ALL THE WAY IN. ALSO, THE DIVER SHOULD BE AWARE THAT IN A HEAD-DOWN POSITION THE ADV MAY TRIGGER MORE RAPIDLY, CAUSING A RAPID ADDITION OF GAS. THIS WILL CAUSE BUOYANCY ISSUES WHICH MAY CAUSE THE DIVER TO HAVE AN UN-CONTROLLED ASCENT, WHICH MAY LEAD TO INJURY OR DEATH!**

Anytime the ADV triggers you need to check your PPO2. you have either descended and compressed the gas in the loop or you have consumed enough oxygen to reduce the PPO2 significantly . This may also have caused you to lose buoyancy and descend.

The position of the diver will effect the ADV. If the diver is horizontal or face down, the ADV will trigger easily. If the diver is vertical, then it is more difficult to trigger. (A well fitting harness is important; this will greatly reduce the difficulties of being vertical in the water).

Diluent can also be added to the breathing loop via the mouthpiece. Simply go to open circuit mode, take a breath and then open the loop again and exhale the gas into the breathing loop.

Another way to add gas to the loop via the mouthpiece is to close the loop only a 1/4 inch, for a second. You may need to lightly push the purge button on the front of the 2nd stage. A small amount of gas will blow directly into the breathing loop.

Quick Disconnects:

The KISS OS is shipped with a quick connect system for the loop hoses. You will see that the towers on the scrubber heads have a lip in which the quick disconnect hose stubs are secured. The unit is shipped standard with 2 hose stubs which will be fitted to your loop hoses with hose clamps, prior to shipping.

If you choose to order your unit with the BOV, then 4 hose stubs will be included with your kit. These extra 2 hose stubs/hose clamps are for securing the loop hoses to the BOV which also uses our quick disconnect system.

If you choose to source your own BOV, then you will need to also source an attachment method for that BOV.

***NOTE: THE TOWERS ARE THREADED INTO THE SCRUBBER HEADS AND SEAL WITH AN O-RING. WHILE THE TOWERS ARE DESIGNED TO BE DIFFICULT TO TURN, IT IS STILL IMPORTANT THAT THEY ARE NOT ACCIDENTLY UNSCREWED WHILE REMOVING OR INSTALLING THE BREATHING HOSE. A LOOSE TOWER WILL LEAK!!! CHECK THE TOWERS PRIOR TO DIVING TO ENSURE THEY ARE TIGHT.**

The procedure to install the hoses stubs to the loop hoses are as follows:

1. First soak the ends of the loop hoses in hot tap water, for several minutes. This will soften the rubber on the hoses making it easier to install the hose stubs. Some dives may find that they need to soak the hose ends in water that has been boiled. This will certainly make it easier.
2. Shake the water from the hose, and then apply silicone grease to the inside of the loop hose. It is best to use a thicker lubricant for this, rather then a thin oxygen type lubricant. Apply lubricant to the outside of the hose stub.
3. Working quickly so the hose remains soft, push the hose stub onto the loop hose. Push it on as far as it will go, but leave a few millimeters of space so it doesn't touch the side of the stub and restrict the movement of the ring.
4. Secure the hose stub using a hose clamp; ensure that the hose clamp is properly tightened.
5. Ensure that the O-ring area on the hose stubs are clean and then apply lubricant.
6. Push the hose stub onto the tower/BOV, lining up the lip on the tower/BOV with the space on the hose stub.
7. Turn the ring to secure.
8. Inspect the area to ensure that all the O-rings are properly seated and not pinched.
9. To remove the hose stub, push in on the stub, and then turn the ring. This is a similar method to opening and closing a child proof medicine bottle.

***SERVICE: THE O-RINGS ON THE HOSE STUBS AND THE CORRESPONDING SURFACES ON THE BOV ADAPTERS AND HOSE ATTACHMENTS SHOULD BE LUBRICATED ON A REGULAR BASIS. PRIOR TO DIVING, ENSURE THAT HOSES HAVE BEEN PROPERLY ATTACHED TO THE TOWERS AND TO THE BOV!!! FAILURE TO DO SO COULD CAUSE INJURY OR DEATH!!!**

Manual Add Valve - MAV:

The MAV is the component that will add oxygen to your unit continuously and will also allow you to push a button to add gas as required.

Further on in this manual you will find a MAV trouble shooting & service section. For the purpose of gear assembly, the valve is ready to go. Once the unit is assembled and the wing/harness system in place, bring the MAV over the right shoulder of the harness and thread it through the D-ring. Alternatively, you may use a small bungee loop which is tied to the D-ring and slide the MAV through that. Securing the MAV in this manner will keep the valve in the proper position allowing the diver to find it easily.

An alternated method of placing your MAV is to have it come around the right side of your waist, and then secure the MAV to a ring on your waist strap using bungee and a clip. The diver must be certain that the MAV is properly secured and is easily accessible during any part of the dive. This method is for those who do not wish the hoses to come over the shoulder.

For those that wish to run the MAV around the waist, simply swap the position of the 2 oxygen hoses. To do this, first remove the shortest LP hose from the MAV and filter. Leave the filter secured to the MAV. It is very important that one wrench is placed on the nut closest to the plastic housing to hold it in place; it must not move! Then put another wrench on the end of the LP hose you wish to remove. Turn this wrench while holding the first wrench secure. The nut you are holding secure must not spin. If it does the threads on the plastic housing will be stripped. Once this is done, the short hose will still be secured to the scrubber head, but the MAV will no longer be attached to it. Remove this LP hose from the head.

Remove the longer LP hose from the MAV, following the above instructions. Then remove it from the first stage.

Swap the position of the LP hoses; the longer one should now be secured to the scrubber head (turn the elbow so it is facing down), and the shorter LP hose should be secured to the first stage.

The shorter LP hose from the first stage should now be attached to the filter on the MAV. Be certain to secure it to this port, as it is important that the incoming gas is filtered. The Longer LP hose from the scrubber head should now be attached to the other port on the MAV, (no filter port). Follow the same instructions as above to properly tighten the hoses. A wrench must be placed on the nut closest to the plastic housing to hold it secure while you tighten the hose fitting. Please see the MAV trouble shooting and service section for photos and more instructions. If in doubt, please call KISS for advice.

Diluent Cylinder and the Off-Board Gas Accessory:

The diluent cylinder on the KISS OS is side mounted and doubles as the diver's bailout gas. In this configuration the diluent cylinder is referred to as off board diluent gas as the cylinder is not secured to the main rebreather. The advantages of this are that diver's may customize the system to suit their diving needs. It also keeps the main rebreather small, light, flexible, and easy to travel with.

KISS recommends that a minimum of 40 cuft should be used as the diluent/bailout cylinder when diving recreationally. Diver's must be certain that the cylinder they choose has the proper amount of gas for diluent, wing & drysuit inflation,

and also for bailout. Those doing any sort of technical and/or decompression diving must carry a larger cylinder(s) and ensure that it is appropriate for the dive that they are planning.

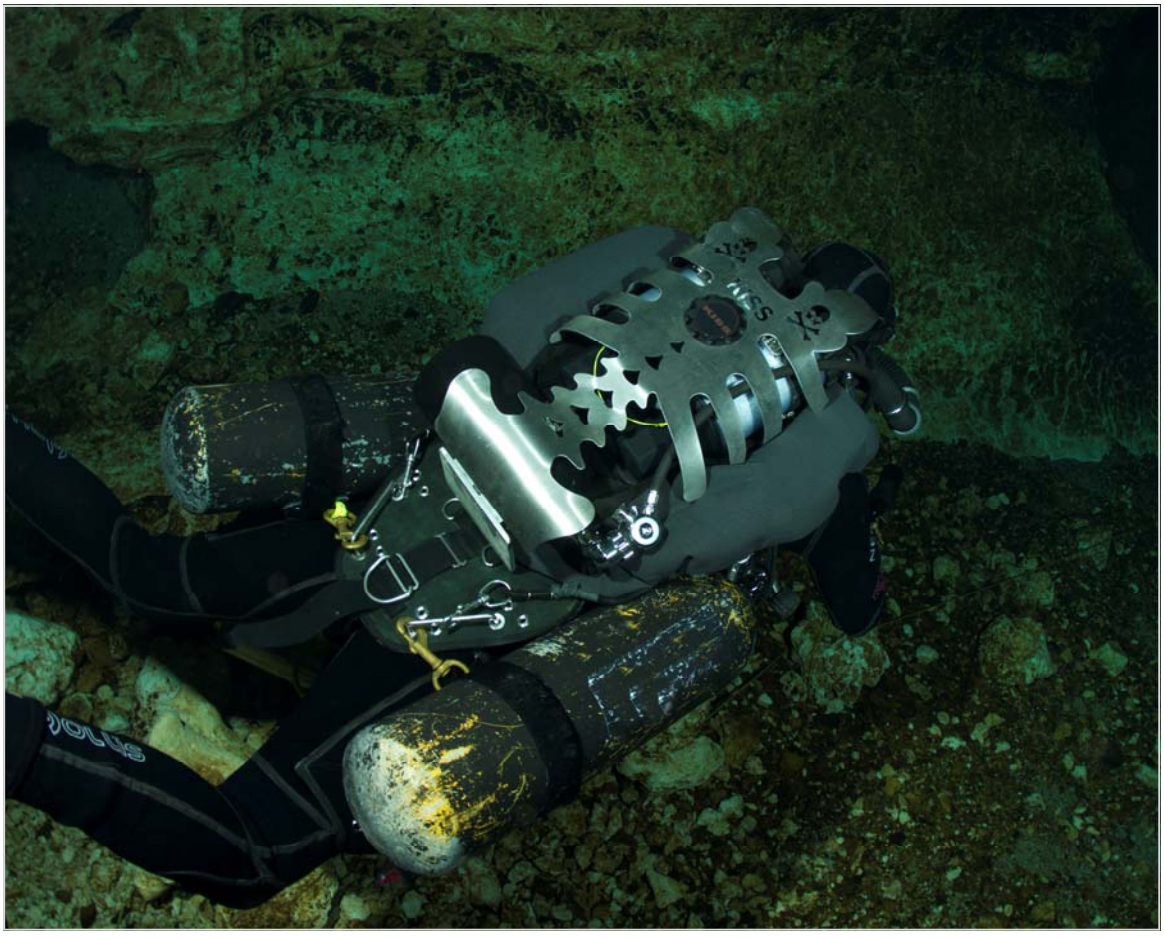
The KISS OS BASIC includes one full set of the off-board accessory. This accessory is used to plumb the diluent/bailout gas into the rebreather via the manifold. The kit includes the rebreather side whip and the diluent cylinder side whip.

The off-board accessory rebreather side includes, 1 30 inch LP hose, 1 check valve with quick disconnect male. The off-board accessory cylinder side includes, 1 6 inch LP hose, 1 quick disconnect female.

The cylinder side whip should be secured to the diver's first stage on the diluent/bailout cylinder.

Those divers that wish to carry more then one diluent/bailout cylinder may purchase a second cylinder side whip. This would allow both diluent cylinder's to be open throughout the dive. When the diver swaps the main off-board whip from the first cylinder to the second, the check valve will prevent any water from entering the system.

AS WITH ANY NEW DIVING EQUIPMENT, USING THIS ACCESSORY WILL REQUIRE THE DIVER TO LEARN NEW SKILLS AND CREATE NEW MUSCLE MEMORY.




AQUATICA
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Filling the Scrubber Canister

The KISS OS has a bi-axial scrubber design, which is resistant to channelling. It has 2 independent canisters that can each be removed/replaced and filled independently of the other; this makes for quick and easy filling! It also makes for easier storage of canisters due to the size and weight. Spare canisters may also be purchased for those who wish to have spares. This is a similar design to an earlier KISS rebreather, but this is a much better and more efficient design. Tests have shown that the area of the scrubber canister that does the most work is the scrubber face. As the KISS OS has dual canisters, this means that this area is doubled, which makes this system very efficient.

The KISS OS scrubber canisters hold a total of 5.3 pounds of absorbent. We use Sodasorb HP from diverssupplyinc.net. Please see the Scrubber Duration page for more information on duration testing and recommended dive times. Sodasorb HP is the brand of adsorbent that we used for testing and it is what we recommend.

The procedure to fill the scrubber canisters is as follows:

- Remove the ADV LP hose which is secured to the gas addition scrubber Head. This will allow the gas addition scrubber head to be removed from the canister.

- On each canister, loosen the threaded ring which secures the head's to the canister's.
- Loosen the Fastex clamp's which secure the canister's to the rebreather; pull the canister's off the head's and set aside. (if the crossbar is still attached, remove it)
- If there is absorbent in the canister's, dispose of it properly and follow the cleaning instructions in this manual to prepare for filling.
- At the bottom of each scrubber head, there is a double O-ring seal. Inspect the area, and wipe away any debris. Use a clean towel for this. It is recommended that the O-rings be left in place and not removed each time for inspection. Constantly removing and replacing the radial O-ring's may cause a leak if they are not seated properly. It is best to carefully wipe this area clean.

- In order to prevent spillage or confusion, it is recommended that one canister is filled at a time and then secured to one of the scrubber heads.
- Fill the first canister half way, and then tap the side with a screwdriver handle or something similar. This is required to settle the absorbent properly.
- Next add more absorbent, using the bottom thread on the top of the canister as a fill line.
- Press the top screen into place, and while pushing down on the screen with steady pressure, tap the side of the canister again to settle the absorbent; using a screw driver handle or similar. It is best to tap a couple of times while pressing, spin the canister slightly and repeat. Turning the canister slowly while tapping ensures that the top screen is properly placed and flat and also ensures the absorbent is properly settled. The screen needs to be lined up with the bottom thread on the top of the canister.

- Note that the tapping does not need to be hard!
- Once the canister is filled, the screen in place and properly positioned, take a clean cloth and wipe off the scrubber dust from the top and inside edge of the canister. Ensure this area is clean; it is your sealing surface!
- Apply lubricant to the inside edge and top edge of the canister. You should lube these area's very well!
- Double check that the O-ring areas on the scrubber head are still clean, wipe if required, and then apply lubricant to them. These area's should also be lubricated very well!
- While holding the canister firmly, gently push and rock the scrubber head into place. This should keep the radial O-ring from becoming dislodged. If you push the canister on crooked, this O-ring may pop out of position. This is most likely to happen when the O-ring is first installed. Once the canister has been in place for several hours or a few dives it is unlikely that this O-ring will easily be dislodged. If this O-ring does get pinched, you may need to change it, as the indentation could cause a leak! Inspect the area to ensure that the O-ring has not been pinched.

- Tighten the ring to secure the head to the canister. The action of the ring turning will tighten the head to the canister and pull it down into place.
- Slide the canister through the proper Fastex clamp, and position it so that the Indexing Mark is facing the opposite canister. This ensures that all hoses will be properly oriented. Tighten the threaded ring then secure using clamp.
- Repeat the procedure with the other canister.

Duration:

Cold water, 10°C/50°F : 2 hours
Warm water, 24°C/75°F: 3.5 hours
The Spirit is not recommended for use in water colder than 10C / 50F.

***WARNING: Diver's have been known to travel great distances with their rebreather's assembled and the scrubber canister's packed. A word of warning; the great the distance traveled the more likely the absorbent can settle with the large and small granules separating. This could cause channeling, which in turn could cause a problem with Carbon dioxide, which could cause serious injury or death. How to avoid this? Travel shorter distances only. Also it is far less likely to happen if you travel with the rebreather in a vertical position rather then having it lay flat, as laying it flat will increase the chances of the absorbent settling. If the rebreather must be laid flat, then remove the canister's from the unit and keep them vertical. After the car or boat ride (or both!) visually check the canister's. The Orca Spirit canisters are clear and you are easily able to visually inspect them prior to a dive. If you see large granules and air spaces at the top, and smaller granules and dust at the bottom, then you know this has happened. If you see this, prior to diving you must pour out the absorbent and repack the canister's. When arriving at your dive destination, either by car or by boat, it is very important that diver's pre-breathe their units for at least 5 minutes. This is not to warm up the absorbent, but rather to ensure that everything is working as it should! Remember, this can happen on any rebreather! With the KISS Orca Spirit you have the advantage of being able to visually inspect the canister's as they are clear.**

*NOTE: The scrubber assembly, gas addition head, & the sensor head are key parts of the rebreather and care should be taken to ensure that they are not damaged and are working properly.

*WARNING: IF CANISTER O-RING IS PINCHED AND THERE IS A LEAK, YOU WILL HAVE A SERIOUS FLOOD!!! THIS COULD CAUSE SERIOUS INJURY OR DEATH!!

POSITIVE / NEGATIVE TESTING:

Once the KISS OS has been completely assembled you are ready to do the positive and negative pressure tests. While these tests will give you the best indication of any leaks in the system, it is still a good idea to do a quick bubble check when you enter the water. That's where buddies come in handy.

*WARNING: IT IS VERY IMPORTANT THAT THE POSITIVE/NEGATIVE PRESSURE TESTS ARE COMPLETED AND THAT THEY ARE DONE PROPERLY. ANY LEAKS THAT ARE PRESENT ARE MOST LIKELY TO BE CAUGHT WHILE DOING THESE TESTS!! WHEN DOING YOUR TESTS, YOU SHOULD BE VERY CERTAIN THAT THEY PASS. IF YOU HAVE ANY DOUBT AND ARE UNSURE THAT THE TEST PASSED, YOU PROBABLY HAVE A SMALL LEAK. FIND IT!! THE KISS UNITS HOLD VERY GOOD POSITIVE AND NEGATIVE TESTS.

To do the negative test, first ensure the plug is secured to the male end of the off board accessory. All gases should be off, the unit fully assembled, exhaust valve closed. Then put the BOV into your mouth, turn the knob and inhale the gas from the loop into your lungs and exhale it out of your nose until it is impossible to inhale any further. When the loop is empty, there should be no leakage into the rebreather and you shouldn't feel any extra gas sneaking into your mouth. If you don't feel any extra gas, close the loop while inhaling. The breathing hoses should be tighter as there is

a vacuum in the loop. This will cause the BOV to sit higher than usual and the ridges on the hoses to be close together. If you watch the hoses while you are drawing the gas out of the loop, you will see how they constrict. Also, look at the counterlung's. They should be completely flat. Once you close the mouthpiece, watch the hoses and lungs closely. Don't look away. You need to notice if anything changes, such as a slight droop in the hoses and/or the mouthpiece dropping or the lungs shift slightly showing that gas might be going back into them. Leave the loop closed for a few moments, 60 seconds is adequate, to see if the vacuum holds and then open the loop to let air back in. (Longer is not necessary and will damage the diaphragm.)

The next most important part of doing your negative test (watching the lungs and hoses is the first) is when you release the pressure and open the mouthpiece. You should hear a "whoosh" as pressure is released. If you don't hear this sound, you have a leak! Or if the "whoosh" isn't as strong as it usually is, you have a leak. After diving the unit for a while, you will learn what sound to expect when releasing the pressure. When you hear that sound, you will feel confident that you did a good test. If you have any uncertain feeling, then you may have a small leak.

***WARNING - It is important to not leave the vacuum in the loop for more than a few moments as this will cause damage to the diaphragm. If this happens, the ADV will not work properly. It will either stop working altogether or will continuously feed the diver diluent. It will certainly allow water to leak into the ADV.**

***NOTE: When doing your test, it is VERY important to not suck so hard that you are damaging the diaphragms. When you do the negative test, suck until you get a good seal, and then immediately close off the BOV. if you suck so hard that you feel the pressure building in the back of your throat/neck area, your ears pop, or you feel your face turning red for exertion, this is way too hard. There is no need for this and it will damage the valves and diaphragms. Suck just until you feel that pressure, then close the valve.**

Our BOV has a larger bore and has an excellent work of breathing. In order to get that good work of breathing, the valves are more flexible. This means that with this, we need to ensure that we have good testing habits. Those divers who learned the testing procedures years ago, have to understand that the equipment has now changed, and that our habits must also change.

Also ensure that the area where the Mushroom valve seal's is clean. build up in this area will cause the diaphragm to leak.

To do the positive test, tighten the exhaust valve by turning it fully clockwise. Put the BOV into your mouth, turn the knob and exhale into the loop until you hear the exhaust valve release and then quickly close the BOV without letting any air escape the loop. The counterlung's should be expanded to their maximum size. Listen carefully for any air leaks and ensure that the counterlung's remain firm for several minutes. The oxygen tank valve and mouthpiece should be closed during these tests. After the test is complete and you open the BOV again you will hear the sound of the pressure being released. This is important!


KISS

Sensor Installation, the Sensor Head, & Display Options

The KISS OS is a diving system where the display's may be customized to suit each individual diver. The KISS OS can be configured with a KISS PPO2 display either hardwired completely or with a Fischer connector between the wrist display and cable. This may be combined with one of the Shearwater computers or a Shearwater HUD. Alternatively diver's may choose to use either 2 KISS PPO2 display's or 2 Shearwater computer's; whatever suits them. The Fischer cable which we hardwire into our sensor head is compatible with both our KISS FC PPO2 display and the Shearwater computer's. This means that diver's who choose the KISS FC PPO2 display to start off with, may easily upgrade to a Shearwater computer at a later date. Our option's are:

- Shearwater HW PPO2 display: the display is hardwired to the display cable & the sensor head. There are no Fischer connectors in this system.
- Shearwater FC PPO2 display: the display is connected to the cable via a Fischer connector. The other end of the cable is hardwired to the sensor head.
- Shearwater computer: The computer will connect to the unit via a Fischer cable that is hardwired to the sensor head. The Fischer connector is between the cable end and the computer. The computer may also be hardwired.
- HW HUD: the HUD is hardwired to the sensor head. There are no Fischer connectors in this system.

Utilizing the above option's, the KISS OS may be customized for each diver. The KISS OS has two display ports machined into the sensor head. Option's that diver's may choose include the following:

- No display's, No Fischer display cable's.
- Fischer display cable's hardwired into both ports.
- HW PPO2 display in both ports. (no Fischer connector, all hardwired)
- Fischer display cable hardwired into main port only.
- HW PPO2 display in main port only. (no Fischer connector, cable is hardwired)
- Fischer display cable hardwired into main port and HUD hardwired into secondary port.
- HW PPO2 display hardwired into main port and Shearwater HUD hardwired into secondary port.
- Fischer display cable hardwired into main port and Fischer plug hardwired into secondary port (for use with Fischer HUD or dual ended Fischer cable).
- HW PPO2 display hardwired into main port and Fischer plug hardwired into secondary port (for use with Fischer HUD or a dual ended Fischer cable.)

KISS Rebreather LLC recommends that all divers, recreational or technical, dive with 2 fully independent displays. As you can see above, there are options for no display and also for keeping the secondary port empty. We have offered these options so that our customers may have the head wired by another source and utilize a display system that we don't sell.

Those that choose to dive the KISS OS with only 1 display, must limit their diving to recreational no-stop diving as the bailout procedure for a failure is to end the dive and ascend. We strongly recommend that those doing technical diving have both display ports wired with displays for redundancy.

Should a customer choose to have their sensor head wired by another source, they must choose a facility that is qualified to do this type of work.

***WARNING: Diver's choosing to purchase the unit without the display system's wired to the sensor head must ensure that they have the display port's wired properly by a qualified**

facility prior to diving. Also, KISS Rebreather LLC strongly recommends that both display ports are wired with displays for redundancy. Those that choose to dive the KISS OS with only one display system should limit their diving to recreational no-stop diving.

***WARNING: THERE ARE VARIOUS DISPLAY SYSTEMS AVAILABLE FOR THE KISS REBREATHERS. THEY INCLUDE, BUT ARE NOT LIMITED TO THE KISS REBREATHER DISPLAY, SHEARWATER COMPUTERS, AND SHEARWATER HUD. As with all electronics, these components must be treated with care and respect. This includes taking care to not drop, bang, or roughly handle them. Also, do not leave these components in a hot environment, such as a car or direct sunlight. The heat &/or sun, can and will damage any electronic components.**

***WARNING: Do not mix sensor brands in your rebreather! There are various sensor brands available for purchase. If you mix brand "A" with brand "B", they will not work properly. As the response times are different for each brand, most electronics will not calibrate properly. If they do calibrate, they may not work correctly while diving as the different response times could cause an error reading.**

The KISS display's and the Shearwater products all use the KISS Rebreather sensor, K-22D. The KISS OS BASIC does not include the sensors. Many of our dealers stock the KISS K-22D sensor and are available directly from them. Should you wish to order them with your unit, please let us know your wish to add this product.

Prior to installing them, it is best to open the bags and let them sit for at least 24 hours prior to calibration as they need to go through a "wake up" period. Ideally, open the bags about a week prior to use, if possible. New sensors will read low when first installed and will creep up slightly over the course of a week or so. After that, they seem to be stable for months on end.

Don't waste time calibrating the sensors if they are reading within a 1/2 percent. These sensors should be changed annually, sooner if they are damaged or abused. Oxygen sensors work on the same basis as a battery. The more that they are used, the more often they will need to be replaced.

An easy way to remember your sensors anniversary date is to write the date on the bag when you open it, and keep the bag in safe place. Also, use a Sharpie black marker to write the date on the top lip of the sensor. The K-22D sensors are safe to dive if the millivolt reading is between 9 and 13, AND they can be calibrated in both air and oxygen. Both the KISS display and the Shearwater computers will read the millivolts of the sensors or a volt meter can be purchased at your local hardware or electronics store.

***WARNING: It is extremely important that the sensors millivolt readings are in the correct range, and that they can be calibrated in both oxygen and air. If even just one of these 3 items doesn't comply, DO NOT DIVE!!!! Failure to ensure that the sensors are working properly, can result in serious injury or death!!!**

***WARNING: On the following pages are the calibration instructions for the displays systems. It is essential that the calibration procedures are followed properly. Failure to do so can cause injury or death!!**

- To install the sensor's, first remove the Sensor Scrubber head from the canister.

- Secured to the threaded rod, you will see a bronze nut; remove it and set it aside.
- The carrier plate is now loose; remove it from the head.
- Remove the O-ring from the threaded end of each sensor; it is not required and will give the sensors better placement inside the head. Thread the K-22D sensors on to the carrier plate. Secure all 3 sensors.
- Thread the carrier plate with the sensor's attached onto the threaded rod, with the connection ends facing the inside of the scrubber head. Push the white molex plugs onto the sensor's. Push firmly to ensure that they are properly attached. Do not stress the wires while you are doing this!

- Gently push the plate and sensors into position. The plate will rest on the ledge, just on the inside edge of the housing. You will see that there is only one position that this plate can sit, due to other components on the inside of this head. See the top photo with the red arrow as an example. The top outer curve of the sensor holder should be oriented towards the tower opening. Ensure that the wires are not pinched or stressed while you are doing this.
- Replace the bronze nut; ensuring it is properly secured, but not over tightened.
- Inspect the 4 press-fit springs located on the edges of the underside of the head. Ensure that they are all properly in place. Should you need to insert the springs, push them all the way in, and turn counter clockwise.
- Using a clean cloth, wipe any debris from the O-ring area on the underside of the head. Ensure this area is clean and ready for lubricant.
- Turn the head over and inspect the exhaust valve. It should be in good working order and tightened all the way.
- Follow the instructions in the scrubber filling section and ensure that the top and inside edge of the canister is clean and properly lubricated. This area should be lubricated very well!
- The O-rings on the underside of the head should also be very well lubricated!
- Place the head on the canister, pushing and rocking gently until the head is in place. Inspect to ensure you do not see a pinched O-ring then position the head so that the indexing mark is facing the other canister; secure the threaded ring.

***WARNING: It is important that the display cables are properly wired. Failure to do so, may cause serious injury or death! Also, It is important that the sensors are properly installed. If the sensor O-ring is left on, or they are not turned all the way into the head, response times may be delayed!! Ensure that the O-rings are in good condition, that the area is clean and the components are not damaged. Lastly, if the wires are pinched under the plate, the scrubber head will not be water tight. Water damage in this area will ruin the sensors and/or the electronics. If the wires do get pinched, inspect them for damage!!**

SENSORS

When you open up your new K-22D sensors, they will have a millivolt reading between 9 and 13 millivolts. As long as they are in that range, they are safe to use.

***WARNING: You also need to ensure that they can be calibrated in Oxygen and that they read correctly in air. This is very important. Even if a sensor is reading in the proper range, as it ages you may no longer be able to calibrate it properly. Sensors should not be used for more than 1 year.**

*****IF THIS HAPPENS, THE SENSOR MUST BE DISCARDED. FAILURE TO USE A PROPER SENSOR WILL CAUSE SERIOUS INJURY OR DEATH!!!!!!!!!!**

In diving applications the sensor will last 1 year, depending on how often you dive and how they are stored. Sensors should be allowed to dry out after your day of diving, especially if you are diving in a humid environment. This means that you need to leave the loop hoses or scrubber canister off overnight to allow air to circulate through the scrubber head. Leaving the unit sealed up will not allow the condensation to evaporate.

*****If the KISS OS has moisture in the head from diving or from being in a humid environment, and it is then sealed up tight, the wires from the end of the display will start to corrode!!!! If this happens, whatever display or computer you are using, will not work properly!!!! It is extremely important that the head is allowed to dry out if the unit is to be sealed up. This means that after a dive trip, don't just drop the unit on your work bench and walk away from it!!! At the very least, drop the canister's off and let the head's dry. This will help keep your wires in good working order.**

Sea water on the sensors will probably cause them to fail.

As your sensors start to age you will notice that they are harder to calibrate, slower to react and will drift more after calibration.

Electrolyte, which is a gel like substance is inside the sensors. If you notice this substance leaking out of the sensors, do not touch it as it is caustic. Do not dive with a leaking sensor. The readings will be high!!!!

Calibration

The following procedures are for preparing the KISS OS for calibration. The steps outlined here must be done first, in order for the calibration to be accurate.

The displays should be calibrated with oxygen. The procedure for this, is as follows:

1. Ensure that the diluent and oxygen cylinder valves are closed. If the diluent cylinder is not attached to the off board accessory whip, then be certain that the sealing cap is attached to the whip.
2. Draw all of the gas out of the loop. Do this by putting the BOV into your mouth, open the loop, inhale the gas into your lungs and then exhale it out of your nose. When the loop is flat, close the BOV switch without allowing any gas to leak back into the loop.

***Note: it is important that you do not exhale any gas back into the loop while doing this.**

3. With the loop closed, open the oxygen tank and press the manual add valve button, adding oxygen into the loop until the exhaust valve burps. (the exhaust valve should be fully closed)
4. Repeat steps 2 & 3 until the loop has been completely flushed with oxygen. This usually takes 3 to 4 flushes.
5. Once the loop has been completely flushed, close the oxygen cylinder and open and close the mouthpiece quickly to bring the gas in the loop to ambient pressure. With the loop closed, calibrate to 1.00.

***Note: once the above procedures have been completed the calibration procedures for the display that is being used, must be followed.**

The readings should be verified with air. To verify with air, first ensure that both tank valves are turned off. Then, remove the loop hose which is attached to the exhaust side of the mouthpiece. Put the mouthpiece into your mouth, open the loop and breathe. This will draw fresh air through the loop and eliminate the pure oxygen which you flushed the loop with. It will take a few minutes for the oxygen percentage to drop.

The KISS rebreather should be flushed with oxygen prior to every dive to ensure that the displays are reading correctly, and re-calibrated every time the absorbent is changed.

DISPLAY WARNING

Never risk your life on only one source of information. Use a second computer or tables. If you choose to make riskier dives, obtain the proper training and work up to them slowly to gain experience.

All display system's will fail. It is not whether it will fail but when it will fail. Do not depend on it. Always have a plan on how to handle failures. Automatic systems are no substitute for knowledge and training. No technology will keep you alive. Knowledge, skill, and practiced procedures are your best defense. (Except for not doing the dive, of course.)

KISS PPO2 Display - Crystal Monitor 1

Some of the basic Crystal information is included here. This information has been obtained from the Crystal manual. Please note that this information is subject to change; for full and current information on this product, diver's should download the most current manual from the KISS website.

The Oxygen Monitor is designed to be a very basic and easy to use instrument for your rebreather. It has very few operations or pieces of information other than the PPO2 read out of oxygen from 1, 2, or 3 sensor cells while in Dive Mode and the ability to calibrate the sensors while in Surface Mode. There is only 1 diving screen which will display the individual output of each cell along with the battery level. This is not a diving computer, it has no other purpose other than to read oxygen levels.

There are 2 operational modes available to you when you turn it on. Surface Mode and Dive Mode. Dive Mode only allows you to see the oxygen level display. Surface Mode allows you to calibrate, change settings, and run diagnostics.

Basics:

Turning On:

- 5 to 10 taps on the cable side

Turning Off:

- Dive Mode: 3 taps on the cable side (followed by 2 taps outside, then cable side)
- Surface Mode: Rotate (outside taps) through to the OFF screen and select.

Calibration:

- Select Surface Mode, rotate to Millivolt Screen.
- Flush with either air or oxygen, 2 cable side taps to initiate
- 1 pt calibration: Automatic detection of either air or oxygen
- 2 pt calibration: Do a successive flush with opposite gas and recalibrate.
  - 2pt calibration is automatic
  - Sensor Linearity is displayed
- Adjustments (Humidity, Altitude): Manual in Setup Mode

Battery:

It will run on either 4 AAA batteries or 1 9volt battery. The battery type can be selected in the setup menu but that only affects the battery level display.

CARE FOR YOUR FISCHER CONNECTOR AND THE CABLES

Having Fischer connectors on a rebreather display system is a convenience that many divers enjoy. While a lot of maintenance is not required, some care is important in order to ensure that they operate properly.

The Fischer connector port is watertight and any water that gets in to the port cannot harm your head, computer, or HUD. However, should sea water get inside the port or the ends of your linking cable, flush them with fresh water as soon as possible afterwards then leave them to dry completely BEFORE refitting the cap.

Regular maintenance should include:

1. Inspect the connectors and look for any signs of corrosion; parts will start to turn green.

2. If you see green/corrosion, rinse the connectors briefly with white vinegar and use a fine toothbrush to remove the build-up. Rinse well and let dry completely before refitting the protective caps.

3. Keep the inner O-ring lubricated by either applying a SMALL amount of grease on the metal end of the cable end that slides into the computer Fischer connector to lubricate the inner O ring of the bulkhead connector. Filling the connector with food grade mineral oil once a year will also work. This will serve to improve the seal and make the connection more reliable. If you have a sensor which is reading erratically, this could be a solution.

4. If you use the mineral oil, drain any excess prior to replacing the caps.

5. Use the protective caps. The caps will help keep your connectors clean, keep the lubricant in and any debris and water out.

Remember, the cleanliness of the contacts is essential to the integrity of the link. Following these simple steps will ensure that your system works properly. Look after your cable and connectors and they will look after you.

Also, be certain that you are using the correct Fischer cable for the computer that you are diving. There are some that are not compatible with all computers.

Shearwater Computers

Some of the basic Shearwater information is included here. This information has been obtained from the Shearwater manual. Please note that this information is subject to change; for full and current information on the Shearwater computers, diver's should download the most current manual from the Shearwater website.

SHEARWATER PRODUCT CONFIGURATION

Shearwater Research Inc. designs and builds both computers and HUD's (Heads Up Display) for rebreather diving. These systems may be fitted to your rebreather by hardwiring a cable into the scrubber head, or utilizing a Fischer connector. For further information on any Shearwater product, please contact your local Shearwater dealer.

Buttons:

MENU button - Left

- From the default display, pressing MENU brings up the menu.
- Once in the menu system, MENU moves to the next menu item.
- If the current function is an edit, pressing MENU increments the current display.

SELECT button - Right

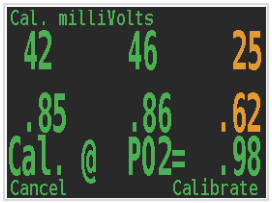
- In the menu system, the select button saves the current value or executes the command.
- Out of the menu system, the select button brings up information displays.

BOTH BUTTONS

- When the computer is off, pressing MENU and SELECT at the same time will turn the computer on.

Calibrate

Start by following the procedures on the calibration page. These instructions must be followed in order to ensure the unit is properly flushed with oxygen. This is an important step which is required to ensure the calibration will be accurate.



Once the unit is properly flushed with oxygen, push the left MENU button unit you see "Calibrate" on the computer. Push the right SELECT button and the confirmation message will display. On the top line, the millivolt reading will show. Good sensors should be in the range of 35- 60 mV at sea level in 100% oxygen. The valid millivolt range for calibration is 30- 70 mV. This scales with percentage of oxygen and barometric pressure.

Pressing the MENU button will prevent the calibration. Pressing the SELECT button will calibrate the sensor displays. The displays should now all read .98. If any display shows FAIL, the calibration has failed because the mV reading is out of range.

The system defaults to a calibration gas of 98% oxygen. This is to compensate for the difficulty in completely filling the loop with 100% oxygen and also to allow for water vapour. If you are using a calibration kit with no water vapour and 100% 02, you can set the calibration gas to 100. It can also be set to other values if pure oxygen is not available.

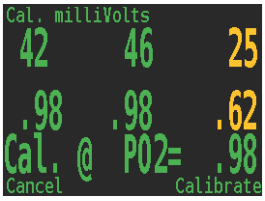
The calibration takes into account the altitude at which the computer was turned on. For example, if the altitude was 885 mBar or .87 ATA, then with a 98% calibration gas, the sensors would calibrate to .85.

The "Calibrate" menu item will not display during a dive.

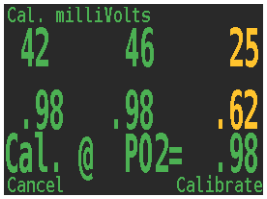
Calibration Problems:

Here are some examples of common calibration problems.

In this display, one sensor is flashing. This shows that the sensor is voted out. If it comes back within range, it will be voted back in, stop flashing and return to green.



A failed sensor is a different situation. In this case, the sensor failed calibration. Changing the sensor won't make it register again. Once a sensor has failed calibration, the only way to bring it back is to successfully calibrate. If the computer were to display a value with a new sensor, it would be a meaningless value without calibration.



This display indicates a faulty sensor. It is not within the normal range for a sensor in oxygen. Most sensors are designed to output 10 mV +/- 3 mV in air. If the output is linear, then that translates to a range of 30 to 70 as valid mV readings in 98% oxygen. The computer will refuse to calibrate outside that range.

Three sensors all showing FAIL is usually caused by an accidental calibration in air, or a calibration with the cable unplugged. Plugging the cable back in won't change anything. Failed calibrations can only be fixed by successful calibrations.

HUD

INTRODUCTION TO THE HUD

In order to explain the logic behind the design of the HUD (originally designed & built by Shearwater Research Inc.), we have included the original Shearwater introduction in this write-up. The logic of the HUD is as follows:

The first point to consider is, there are “bad” alarms and “good” alarms. For example a fire bell is a bad alarm. It is bad because the absence of a ringing bell doesn’t mean there is no fire. It just means the alarm isn’t ringing. The fire bell may not be ringing because the battery is dead, the smoke detector isn’t in the right place, the installer screwed up the installation, there is a foreign object stuck in the ringer, etc. It doesn’t mean that everything is ok.

A good alarm is one where there is an obvious difference between the lack of function and the lack of an alarm. A solid green light doesn’t do that.

The second point to consider is, there are integrated HUD’s and redundant HUD’s. Integrated HUD’s can notify you for features such as deco ceilings and distance from set-point. But they can’t do that and be redundant also. If you wish to have redundancy, then the HUD needs to be calibrated separately and it can’t display “deco” information unless it has a separate decompression computer with its own set of tissues, gases, etc., built into it.

The third point to consider is that there are HUD’s that just display the set-point or PPO2 of the gas in the rebreather. This version is very useful for scootering, low visibility, filming, and manually maintaining set-point.

With the HUD, we tried to find the best of all worlds. It displays the PPO2 only, which makes it a redundant PPO2 meter. Since it uses three LED's simultaneously, it can display them quickly. A typical 1.3 takes about 2 seconds to read. After a few dives, many divers have said that they do not need to consciously "read" the displays; they look at the display and their brain recognizes the number of flashes.

When there is a problem with a sensor, it is noticeable immediately as one of the LCD's flashes different from the others. As the diver knows what to expect, when something different happens it really jumps out at them.

The HUD does not display continuously; there is usually 5 seconds between the displays. Also, as the PPO2 gets farther from 1.0, the light DENSITY gets higher. If you are more than 0.50 away from 1.00, the power is turned up to the high intensity LED's; so they get brighter! At 0.20 you have three very bright red LED's flashing just about continuously in the corner of your eye.

OPERATION

The HUD has a single button on the box, which is used for powering on/off, and calibration.

Power On/Off:
One push of the HUD button will turn the HUD on, while one subsequent push will turn the HUD off.

Calibration:
The Shearwater HUD calibrates only to oxygen; 0.98 to be exact. This allows for imperfect oxygen flushes and water vapour.

To calibrate, push the HUD button three times within 1 second. This may take a little practice, but it is intended to prevent accidental calibrations. Once you successfully do the calibration sequence, all three lights will come on bright red for 5 seconds. If this doesn't happen, then you didn't do the calibration command successfully; try again.

DISPLAY DESCRIPTIONS

After calibration, each of the sensors should be flashing one orange. That means the PP02 is between 0.95 and 1.05. Remember, the actual value it uses for calibration is 0.98.

If a sensor fails calibration, it will flash one red and one green. It can be useful to look at the millivolts on your alternate display to see why a sensor didn't calibrate. In these two example pictures, sensor one has failed and is alternating between red and green

GENERAL FLASH PATTERN:
The number of green flashes is the number of tenths above 1.0. Therefore, 3 green flashes is 1.3 PPO2.
The number of red flashes is the number of tenths below 1.0. Therefore, 2 red is 0.8 PPO2

Example:

0.80 is RR_____ RR_____ RR_____
0.20 is RRRRRRRR__RRRRRRRR __RRRRRRRR__
1.3 is GGG_____GGG_____GGG_____

You will notice from the above example's that the farther away from 1.0, the shorter the interval between flash sets.

BATTERY WARNING:
When you turn the HUD on, if it flashes orange for 30 seconds, this indicates a low battery.

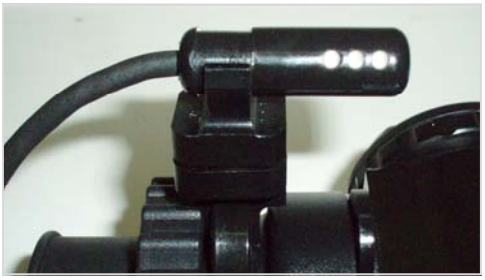
The battery is contained in the box with the processor. To change the battery, you will need to remove the top cover. Replace the battery with a 3.6 volt Lithium - Saft 14500. Ensure when replacing the cover that the O-rings are properly secured, cleaned and lubricated.

It would be beneficial to carry a spare battery in your spares kit, as they aren't available in some remote areas. This should not be a cause for concern as the battery should last many months, even years.

REBREATHER ATTACHMENT

The box should be attached to the loop hose, behind the divers head. Use the enclosed Velcro for this. In this location it will not be in the way and it is also possible to reach the button.

Attach the HUD tie to either side of the BOV. It is handy to attach it to the left side so that dumping the right loop hose after a dive isn't effected.



Wrap the cable for the HUD around the loop hose, and then snap on to the attachment.

The HUD attachment consists of 2 pieces; one part attaches to the BOV with the tie and the other the HUD snaps into. The two parts are joined by magnets. These are extremely strong magnets! Slide magnets apart and back together only.

Manual Add Valve/Metering Orifice

The manual add valve is for adding oxygen to the loop. The O-rings should be changed annually or if the flow rate changes, more the orifice. All components in the add valve must be clean, oil free, with the O-rings lightly lubricate frequently. The inlet of the valve is protected by a 15 micron filter. This filter will NOT stop seawater from contaminating the orifice. All components in the add valve must be clean, oil free, with the O-rings lightly lubricated with oxygen compatible grease.

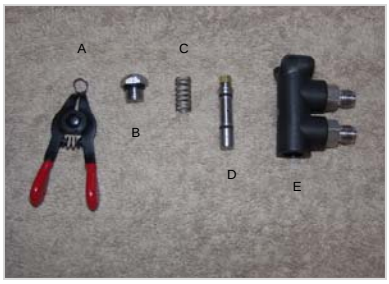


The tools required to disassemble the valve are a wrench or Allen key, small snap ring pliers and a jewellers screwdriver. First, insert the snap ring pliers into the snap ring on the button end of the valve and remove.



Remove the nut with either the wrench or Alan key, depending on which nut you have; pull out the spring. The spool and orifice are all that is left inside the valve.





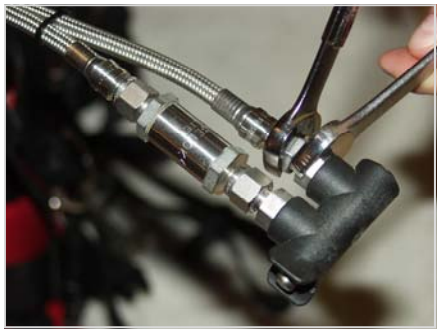
DO NOT SCRAPE OR GOUGE THE BORE!!!!!!

To remove the spool and orifice push in the button using a jewellers screwdriver. This will force the spool and orifice out the other end. When you have the spool removed, cut the old O-rings away with a sharp knife and replace them with new V75-008 O-rings which have been lubricated with an oxygen compatible lubricant such as Christolube. Do not scratch the O-ring grooves. The orifice does not need to be removed unless it is damaged or plugged.

The parts in the valve are: A. snap ring; B. nut; C. spring; D. spool & orifice; E. valve body

***WARNING: When reassembling the valve, ensure that you do not over-tighten the nut. Remember, when screwing any metal screws into plastic use only two fingers on the wrench. If you over-tighten the nut, it will strip the threads and the valve will leak.**





When attaching the valve to the filter and the hoses, it is very important that you use a second wrench to hold the nut next to the valve body in place. Do not allow this nut to spin as it will over-tighten and strip the plastic. This will cause the valve to leak. The valve body is not a substitute for a wrench.

Older KISS units were shipped with the Swagelok SS/Teflon hoses. New units are shipped with the Miflex hoses. When attaching the manual add valve to these hoses, remember that the inlet port is the one nearest the add button. The hose which is attached to the oxygen first stage is attached to the inlet port.

***NOTE: The oxygen delivery system attaches to the rebreather via the elbow on the side of the scrubber head. Please note that the male end of the elbow which screws into the head is NPT, or pipe thread. This is a tapered thread, NOT a straight thread. If you screw a fitting with a straight thread, such as a swivel elbow, into this port, it will damage the rebreather head! If this happens, it is NOT repairable.**

***NOTE: The Miflex hoses are tested and rated for oxygen use. As they have standard regulator hose fittings, they can be replaced with other rubber LP hoses. If you do so, please ensure that the hoses you use are rated for oxygen use!!**

Also, all low pressure hoses on the KISS should be inspected periodically to ensure that they are not damaged and in good working order. This includes the oxygen hoses, diluent hose, BOV 2nd stage regulator hose, ADV hose.

The KISS rebreather's are mechanically controlled. The oxygen manual add valve houses a orifice which allows oxygen to flow into the loop at all times. In the event that more oxygen is required, the button on this valve will need to be pushed. The difference between diving a KISS rebreather manually and other rebreather's is that the constant flow of oxygen keeps our divers from getting too busy underwater. Diving other rebreather's manually means that the only way oxygen gets into the loop is by pushing the button.

What does this mean to the diver? It means that when you get to your maximum depth, you will adjust your PPO2 and then unless you are working hard or going up and down in the water column, you will only be pushing the button every 10 to 20 minutes. This depends also on where the constant flow has been set. If you find yourself pushing the button all the time, then you need to increase the flow. If you find that your oxygen is creeping up during normal diving activities, then you will want to decrease the flow.

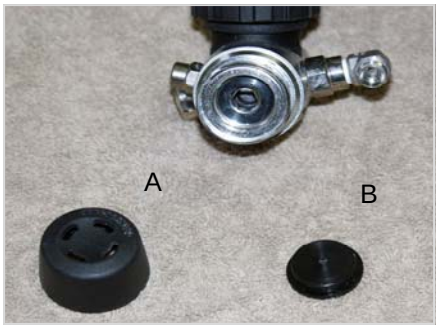
Adjusting the O2 Flow Rate

The oxygen injection rate can be adjusted to suit each individual diver. The required flow rate depends on the physical size of the diver and the degree of exertion used during the dive. If the flow rate is too high the PP02 will climb to dangerous levels and the breathing loop will have to be purged to reduce the oxygen partial pressure to a safe level. If the flow rate is set too low oxygen will have to be manually added more often during the dive.

TOO LOW IS BETTER AS IT IS QUICKER TO ADD OXYGEN TO THE LOOP, THEN TO FLUSH IT!!

To adjust the flow rate, disconnect the oxygen delivery line where it attaches to the stainless steel elbow on the side of the scrubber head. Attach a 0-1 litre per minute flow meter (Dwyer VFB-60-SSV or equivalent) to this line.

Disconnect the manual add valve supply line where it attaches to the add valve filter and connect a 0-300 psi gauge between these fittings.



Remove the clamp ring from the oxygen regulator, (A) and lift the black plastic plug, (B) out of the regulator cap. Connect the regulator to an oxygen cylinder which has at least 800 psi remaining. Slowly (oxygen, remember) open the oxygen valve. Note the gauge pressure and flow meter reading. The relationship between the pressure setting and the O2 flow rate should match the table on the following page.

For those of you using the Miflex hoses. The following photos show how the flow system can be checked and which parts you need. All parts can be purchased through one of your local fittings suppliers. This is just one method that can be used.
First, remove the Miflex hose from the filter and attach an IP gauge. Determine where the IP is set, before you make any changes. After you record that information, reattach the hose. Then remove the miflex hose which is attached to the plug side of the valve. Attach your flow meter and short LP hose (see above photo). As per the instructions on the next page, adjust your flow. Once you have adjusted the flow, you can remove the flow meter and hose, and reattach the IP gauge. This will allow you to verify your flow reading with the IP of the first stage, using the chart on the next page.

NOTE: IT IS VERY IMPORTANT THAT TWO WRENCH'S ARE USED WHEN REMOVING HOSES OR FITTINGS FROM THE MANUAL ADD VALVE!!! ONE MUST BE USED TO ENSURE THAT THE FITTING ON THE VALVE DOES NOT SPIN!! SEE THE PHOTOS AT THE TOP OF THE PREVIOUS PAGE WHICH SHOW HOW TO DO THIS PROPERLY.

0.0035 orifice

8.0 Bar (117.6 psi)	0.520 LPM
8.5 Bar (125 psi)	0.550 LPM
9.0 Bar (132.3 psi)	0.570 LPM
9.5 Bar (139.7)	0.600 LPM
10.0 Bar (147 psi)	0.630 LPM
10.5 Bar (154.4 psi)	0.660 LPM
11.0 Bar (161.7 psi)	0.70 LPM
11.5 Bar (169 psi)	0.730 LPM
12.0 Bar (176.4 psi)	0.770 LPM
12.5 Bar (183.8 psi)	0.800 LPM
13 Bar (191.1 psi)	0.830 LPM

Note that some of these pressure settings are beyond the recommended adjustment range of the regulator and may result in erratic performance. Use at your own risk!

These figures are typical but not absolute due to slight variations in the accuracy of the gauge and the tolerance of the metering orifice. If your flow rates are more than 15% different than these, see the troubleshooting guide to determine the problem.

To change the pressure use a 6mm hex key to turn the regulator adjustor under the black plastic plug. Clockwise increases the pressure, counter clockwise reduces the pressure. Turn the wrench slowly and do not insert it too far into the regulator or it will hit the diaphragm and cause the pressure to surge.

So where should the flow rate be set? 0.75 LPM is a good starting point. If you find you have to constantly add oxygen, try increasing the setting by 0.05 LPM. The PP02 should slowly rise when you are hanging motionless in the water but you should have to add 02 at regular intervals during the dive when maintaining a constant depth. The metering orifice flow rate will decrease as the depth (ambient pressure) increases. The amount it decreases depends on the upstream pressure (regulator pressure setting) versus the downstream pressure (depth). This is not a fault, it is physics.

WARNING!

The oxygen injector is a convenience. It is not a controller in any way. The only device regulating the oxygen partial pressure is your brain. The automatic oxygen add does not reduce the need to monitor the three partial pressure displays. It only reduces the number of times you have to press the oxygen add button. The displays should be checked constantly during the dive. The oxygen regulator can fail and stop delivering 02 or it can fail and increase the flow drastically. The orifice can become plugged and stop delivering oxygen. The add valve O-rings can fail and increase the amount of 02 being added to the breathing loop. Any of these things can kill you but any of these problems can be overcome if you are aware of the conditions in the breathing loop.

The manual oxygen addition valve is a key component of the KISS diving system; care should be taken to ensure that it is not damaged, serviced as required and is functioning properly.

DIVER SHOULD BE CHECKING THEIR PPO2 DISPLAYS EVERY MINUTE.
KNOW YOUR PPO2 AT ALL TIMES...*OR YOU WILL DIE!!*

Manual Add Valve Troubleshooting

If the flow rate is lower than it should be in relation to the pressure, one of the following things has happened:

- The filter has become clogged and should be replaced.
- The orifice has become partially plugged and must be replaced.

DO NOT TRY TO CORRECT A LOW FLOW RATE BY INCREASING THE REGULATOR PRESSURE!

If the flow rate is higher than it should be in relation to the pressure one of the following things has happened:

- The orifice has become loose where it screws onto the valve.
- The valve O-ring is worn or damaged.
- The spring is broken or weakened and is not holding the valve closed.

The oxygen first stage will have a plastic plug installed to prevent the pressure from increasing with depth and increasing the oxygen flow rate. If the pressure is inconsistent the high pressure seat or diaphragm may be damaged. The regulator should be serviced regularly and maintained in an oxygen clean condition.

***WARNING: It is very important that this valve is in good working order, with proper flow rates and good O-rings. Ensure that you rinse your gear after diving in salt water, and if you flood your rebreather, and you think water has gotten into the valve, service it!! If you pay attention to how often you usually add oxygen to your rebreather during a typical dive, it will be easier for you to notice a problem.**

Exhaust Valve, ADV & Work of Breathing

In this section, you will find information about the exhaust valve, ADV and work of breathing. We have helpful hints and trouble shooting. The Apeks exhaust valve and the ADV work in harmony. If you are having difficulties with either one, it makes sense to check both.

BUBBLING APEKS EXHAUST VALVE

There are several things that can cause this problem. Over the next few pages, 6 situations are listed and described.

1. ***The exhaust valve is not tightened down all the way or there is debris in the valve.*** To tighten the valve, simply turn the dial clockwise. To remove debris, open the valve all the way and rinse well. If you need to take the valve apart, see the instructions below.

***NOTE: Please take care to not have any loose absorbent sit on the top canister cover. If this happens, and you go upside down, the absorbent granules will likely find their way inside your Apeks exhaust valve which will cause a leak!!**

2. ***Counterlung's are cinched down to tight or are the wrong size (too small).*** The loop volume is at its maximum so the counterlung's are completely full. As oxygen or diluent is added, the exhaust valve will purge. This could happen if the counterlung volume is too small for the diver. The counterlung volume should be as close to your own lung volume as possible, but never any smaller! Ensure that you have the lungs properly adjusted and have the correct lung size!!

It should be noted that if the lungs on the unit are full, and you then open the mouthpiece and start breathing while on the surface, you will find that the air is difficult to exhaust through the exhaust valve. If this happens, it will feel like you can't properly inhale or exhale fully. This generally happens after a diver does his pre-dive testing and pre-breathe and the unit's lungs are inflated. To solve this problem, simply exhale gas out of the loop through your nose. Underwater, the exhaust valve will dump the gas for you.

3. ***Stretch the valve's spring.*** If the valve is clean and it was tightened all the way, you may need to stretch the valve spring. To do this, turn the valve counter clockwise as far as it will go. Do not force it. When you can not turn it anymore, stop. There is a tab which must be lifted in order to allow the valve to be opened. It is the small tab on the side of the valve. Very carefully lift the tab with a dental pick and then carefully continue to turn the valve counter clock wise. The tab will only need to be lifted while you turn the valve past it. Then it can be released and you can continue to open the valve. This is easiest to do if the bottom of the valve is pushed into the side of your knee. Then as you lift the tab, push on the top of the valve while continuing to turn it counter clock wise. Be very careful to not break the tab!! If you do, the entire valve is garbage.

Once the valve is open, you will see a small white button sitting on top of the spring. Carefully remove the button and set it aside (remember which way it came out). Remove the spring and stretch it out a slight amount and then replace it. Re-insert the button, replace the top of the valve and tighten.

As you are tightening, push in on the valve as you turn it. This will aid in turning the valve past the tab. If required, use the dental pick to lift the tab slightly. When you pass the tab, you will feel it click. Tighten all the way and ensure that the valve is working properly by pushing down on the top. Look inside the valve. You should see the spring compressed with the white button sitting evenly. Then, unscrew the valve; ensure that it stops turning when it reaches the tab. Your valve is now ready to be replaced on your diving system.

4. ***ADV problem.*** If your counterlung volume is correct and the exhaust valve is in good working order, and you still have a leaking exhaust with the feeling of too much gas in the loop, you could have a problem with your ADV adding too much gas into the system. If this is happening you will also notice that your PPO2 is reading lower than usual and that your buoyancy is off. This could be caused by a stretched, damaged or torn ADV diaphragm, or a problem with the other components of the ADV. Inspect the diaphragm for damage or fault.

   To determine if this is the problem, shut off the diluent gas. First you will notice your PPO2 stabilize and stop dropping. Also, the lungs will stop filling up all the way and the exhaust valve should stop purging.

   The diaphragm is simple to check. Open the cover and pull the assembly out. It should be fairly flat, and not damaged. You may need to look quite closely for small tears or holes. Sometimes holding it up to the light and gently pulling the rubber will help.

5. ***Check the IP on the diluent first stage.*** It should be between 8 (117.6 psi) and 10 bar (147 psi).

6. ***First stage needs to be serviced.*** If the first stage is not functioning properly, it could have a leak, which could cause excess diluent gas to flow into the rebreather's loop.

***NOTE: A damaged ADV assembly will either deliver too much diluent gas, or none at all.**

***NOTE: It is important that the proper installation procedures are followed for the ADV assembly and diaphragm. Only those with proper training should service this regulator. Those with no experience should take it to their local KISS dealer or send it to KISS head office for servicing. The exhaust valve is a key component of the KISS diving system; care should be taken that it is not damaged and properly maintained.**

ADV IS DIFFICULT TO TRIGGER

The position of the diver will effect the ADV. If the diver is horizontal or face down, the ADV will trigger easily. If the diver is vertical, then it will be a bit harder. (A well fitting harness is important; this will greatly reduce the difficulties of being vertical in the water). Also, rolling to your right side, while horizontal, will assist in triggering the ADV.

If preferred, diluent can be added via the mouthpiece. Turn the knob about a 1/4 inch and diluent gas should flow into the loop. Depending on where your IP is set, and which second stage you are using, you may need to lightly hit the purge button.

Lastly, check the IP on the diluent first stage. Ensure that it is in the correct range. Remember, the ADV is not meant to be easy to trigger. It was designed this way so that the diver would know when they were triggering it. If it was too easy, then diluent gas could be fed into the breathing loop without the diver being aware of what was happening.

WORK OF BREATHING

There are several things that can cause a high work of breathing.

1. ***Too much gas in the loop.*** This can happen if the loop has gas in it, the mouthpiece is closed and then the diver puts the mouthpiece in his mouth and blows more gas into the loop. The exhaust valve will probably not release any gas if the diver is on the surface. It will feel like you can not get a full breath and the breathing will be difficult. Dump part of the loop (exhale out of your nose). If this is the cause, you will notice the difference immediately. Also, if this happens, it won't be possible to trigger the ADV. This can also happen if the ADV is faulty and it is leaking diluent gas into the loop.

2. ***Twisted counterlung's.*** If the counterlung's are twisted, or bunched up, they will not be able to expand properly and breathing will be restricted.

3. ***Counterlung's not pulled through wing/harness properly.*** If the counterlung's are not properly routed, it is likely that they could be restricted in some manner. This will cause the breathing to be restricted.

4. ***Waist strap is too tight.*** If the waist strap is cinched down to far, it will restrict the lungs from properly inflating. Loosen the adjustment strap on the lung's and they will properly inflate.

MOUTHPIECE DISASSEMBLY

Dive Rite or Apeks Second Stage

The KISS bailout mouthpiece can go from closed circuit mode to open circuit, with a turn of the switch. It provides divers with an alternate method of adding diluent gas or even an alternate diluent depending on the connection and if the off-board accessory is being used. It offers an easy way to purge the rebreather for verifying the sensor readings. If the need for a sanity breath or emergency bailout arises, this mouthpiece will provide the diver with a fast, simple way of getting a breath.

The mouthpiece is in closed circuit mode when the bar on the switch is horizontal.

First the hose attachments should be removed. Do this by removing the circ clips, then pull the hose attachments away from the body.

Next, the switch will need to be removed. Remove the screw which holds the switch in place; pull the switch off. Then unscrew the attachment plate and pull the inner barrel out. Alternatively you may leave the switch secured to the inner body and simply unscrew the attachment plate and remove the entire assembly.

Finally, the mushroom valve carriers can be removed. From the inside of the body, using either a blunt instrument or your finger, carefully push on the EDGE of the valve carrier. (not the valve!) DO NOT PUSH ON THE CENTER AS IT WILL DAMAGE THE CARRIER.

IF THE MUSHROOM VALVES ARE DISTORTED OR DAMAGED THEY MUST BE REPLACED!!! When attaching (or removing) the mushroom valves BE CAREFUL!!! PULL ON THE STEM GENTLY & ONLY HOLD THE STEM WHEN REMOVING THE VALVE.

THESE VALVES ARE EXPENSIVE; TAKE CARE TO NOT DAMAGE THEM!

MOUTHPIECE PARTS LIST

Dive Rite or Apeks Second Stage

1. Body
2. Inner barrel
3. Switch
4. Switch screw
5. Front cover
6. Hose attachments (2)
7. Plastic circ clips (2)
8. Mushroom valve carrier (2)
9. Mushroom valves (2)

O-rings:

Mushroom valve carrier, 1 per side

Inner barrel, side port, 2 per barrel

Inner barrel, end, 2 per barrel

Hose end, 2 per side

UNLESS OTHERWISE SPECIFIED, O-RINGS SHOULD ONLY BE LIGHTLY GREASED.
INSPECT ALL O-RINGS FOR CRACKS AND OTHER DAMAGE REGULARLY.
DISINFECT ALL BREATHING LOOP PARTS REGULARLY.

MUSHROOM VALVES SHOULD BE TESTED PRIOR TO EVERY DIVE AND AFTER REASSEMBLY. WITH THE MOUTHPIECE IN YOUR MOUTH THE GAS FLOW IS FROM LEFT TO RIGHT. SUCK IN AND THE LEFT SIDE VALVE OPENS AND EXHALE AND THE RIGHT SIDE VALVE OPENS.

DO NOT POSITION THE MUSHROOM VALVES IN ANY OTHER DIRECTION!!!!

MOUTHPIECE REASSEMBLY

Dive Rite or Apeks Second Stage

- Inspect the mushroom valve carriers and the mushroom valves for damage. Ensure that they are clean, washed and disinfected, and remove any debris. IF THE MUSHROOM VALVES ARE DISTORTED OR DAMAGED THEY MUST BE REPLACED!!! When attaching (or removing) the mushroom valves BE CAREFUL!!! PULL ON THE STEM GENTLY & ONLY HOLD THE STEM WHEN REMOVING THE VALVE.
- Ensure that the mushroom valve carrier O-rings are clean, free of debris and in good condition. Lubricate the O-rings and insert them onto the carriers. These O-rings need only LIGHT lubrication.
- Clean, disinfect and inspect the mouthpiece body. Hold the body with the rubber mouth bite towards you and the port for the 2nd stage regulator facing down. Position the right side mushroom valve carrier with the valve facing out. This is the exhale side and you will notice that this valve does not have a stem showing. Position the left side mushroom valve carrier with the valve on the inside of the carrier. You will notice that the left side valve has the stem facing out. Ensure that the O-rings do not extrude out of their grooves when you push them into place. Push the carriers all the way in, until you feel them push against the body. These mushroom valves have a higher cost then those for the older KISS mouthpiece; be gentle with them!
- Clean, disinfect and inspect the inner barrel and the inner barrel O-rings for damage. There are 2 side port O-rings and 2 end O-rings. Lubricate these O-rings, place them in their grooves, and then apply a touch more lubricant. If upon testing small leaks are apparent, applying silicone grease to the inner barrel O-rings could solve this problem. Apply lubricant only to the O-ring areas; clean off the excess from the surrounding areas. Lubricant on the non O-ring areas of the inner barrel will make it difficult to turn the switch!
- To make the inner barrel easier to insert, the switch can be pushed onto the barrel stub. Insert the barrel, twisting it slightly to ensure the port side O-rings do not move out of their grooves. Push and turn the barrel so it moves properly into position. Watch the O-rings while you do this, to ensure that they stay in position.
- Replace the front cover, ensuring that it is securely attached, but not over tightened. If it is over tightened, it will be difficult to remove.
- Replace the switch. Once the switch is attached, rotate it from open to closed circuit mode and back, several times to ensure correct action of the O-rings. Do this while looking into the second stage port to ensure that the O-rings stay in their grooves.
- Clean, inspect and re-fit the 4 hose attachment O-rings; there are 2 per side.
- Clean, disinfect and inspect the 2 hose attachments and secure them to the mouthpiece using the 2 plastic U-clips. To attach, push the hose attachments all the way against the body, and then push the clip into the slots. The hose attachments have a tight fit. When pushing them into position, be certain that the O-rings are not dislodged from their grooves. Applying a touch of lubricant to the inside sealing area of the hose attachment may help in pushing it into position.

***NOTE: when attaching and removing the mouthpiece from the loop hoses, the quick disconnects should be used. Do not use the hose attachments and plastic clips for this.**

Clean, disinfect and inspect the rubber mouth bite. Attach it to the body using a zip tie and remove the sharp edges.

MOUTHPIECE TEST

In closed circuit mode, cover the right (exhale) side and the LP hose inlet, and blow (gently!!) into the mouthpiece. The mushroom valve should seal and no gas should exit out of the second stage port or the front switch plate.

Problems:

- Mushroom valve on the left could leak. Remove the carrier and inspect it again.
- 2nd stage port leak. Remove the inner barrel and inspect/replace the 2 side port O-rings.
- Front switch plate leak. Remove the inner barrel and inspect/replace the 2 barrel end O-rings.

In closed circuit mode, cover the left (inhale) side and the LP hose inlet, and suck (gently!!) into the mouthpiece.

Problems:

- Mushroom valve on the right could leak. Remove the carrier and inspect it again.
- 2nd stage port leak. Remove the inner barrel and inspect/replace the 2 side port O-rings.
- Front switch plate leak. Remove the inner barrel and inspect/replace the 2 barrel end O-rings.

Other leaks. Cover both the inhale and exhale sides of the mouthpiece, as well as the LP hose inlet to the 2nd stage, while gently blowing into the mouthpiece. Also do this test while gently sucking from the mouthpiece. These tests will determine if the rubber mouthpiece has a leak or if the 2nd stage regulator a fault. The 2nd stage adapter O-ring could also be causing a leak.

CLEAN AND INSPECT THE MOUTHPIECE AND SECOND STAGE AS REQUIRED. SERVICING OF THE SECOND STAGE SHOULD BE DONE BY A QUALIFIED SERVICE TECH.

Mouthpiece Servicing & Troubleshooting

***Warning: Your KISS mouthpiece or BOV (including the 2nd stage) is a key component of the KISS diving system and should be serviced yearly or more often if required. When to service depends on how often you dive, the environment you dive in and also how well it is cleaned after every dive. It is important that it is kept clean and the knob should always turn smoothly. Keeping your BOV clean is important as grit inside the moving parts can score the plastic. Your local KISS dealer can assist you with servicing the BOV if you prefer not to do it. Care should be taken to ensure that it is in good working order and not damaged.**

Also, be aware that if you wash your BOV with a powerful hose, the valve disks may be blown off!! After cleaning, be certain to inspect your gear and follow all the pre-dive check's!!!

IF THE MUSHROOM VALVES ARE DISTORTED OR DAMAGED THEY MUST BE REPLACED!!! When attaching (or removing) the mushroom valves BE CAREFUL!!! When attaching (or removing) the NEW valves, PULL ON THE STEM GENTLY & ONLY HOLD THE STEM WHEN REMOVING THE VALVE. DO NOT CARRY THE VALVE OR VALVE CARRIER BY THE STEM!

TROUBLESHOOTING

BUBBLING SECOND STAGE

First determine if the diluent first stage IP is creeping. If it is, you will probably have to replace the HP seat in the first stage. Once you know that your first stage is in good working order, check to see where the IP is set. Ideally it should be around 8 to 10 bar, with 10 bar (147 psi) being the maximum.

Once the IP has been set, you will want to ensure that the 2nd stage is adjusted properly. Turn the adjustment knob on the second stage so that it is in the middle position. (If there is an adjustment knob). Remove the LP hose opposite of the knob. The adjustment screw is on the inside on the 2nd stage where you removed the LP hose. Use a screw driver to adjust the flow. Your adjustments should be minimal; only a millimeter or so at a time. Most 2nd stages are very sensitive and require a light touch. After each adjustment check to see if your second stage is still bubbling and adjust as necessary. Once the bubbling has stopped and the flow has been adjusted to your liking, you can dive the unit with the adjustment knob on the left turned all the way in. This will also limit the chances of the regulator free flowing. When you want to breath on the 2nd stage, you will just need to dial it out to where you find it comfortable.

If after all that you still have a bubbling 2nd second stage the problem could be with the seat, inhale diaphragm, exhale diaphragm or it could be debris. Your local dive shop should be able to service the 2nd stage for you.

***NOTE: When doing your negative pressure test, it is possible to damage the exhaust diaphragm in the second stage. If your inhalation is extremely hard, for an extended period of time, this can happen. Also, on the new BOV, the 2nd stage exhaust diaphragm can be distorted if the negative is too hard causing the test to fail.**

WATER INTRUSION

First determine if the water is sea water (from diving) or fresh water (if you are not fresh water diving, this could be condensation).

If it is sea water, service your BOV and ensure that the O-rings are all in good shape. Also clean and lubricate at this time.

Inspect the inhalation and exhalation diaphragms on the second stage. Look for any tears or punctures. You may need to hold these parts up to the light and gently pull on the rubber to check for damage.

Check your rubber mouth bit for damage and for a proper fit onto the mouthpiece. They generally come in a variety of attachment sizes. Ensure that the one you choose fits properly. There are some specialized rubber mouth bits which while a pleasure to dive, just do not fit properly on our mouthpiece. Seacure is one of them and after time it will always leak.

Also check for a tear underneath the zip tie which holds the rubber mouth bit in place. Damage here will also cause water to leak into the system.

Many cases of water into the loop come from torn or damaged rubber mouth pieces.

Loose lips.

IT SHOULD BE NOTED THAT A LEAK ON THE MOUTHPIECE, INCLUDING THE RUBBER MOUTH BIT, WILL NOT BE DETECTED ON THE POSITIVE AND NEGATIVE TESTS!! THIS IS WHY IT IS VERY IMPORTANT TO KEEP YOUR MOUTHPIECE PROPERLY SERVICED AND CLEANED. ALSO, ALWAYS CARRY A SPARE RUBBER MOUTH-BITE. MOST MOUTHPIECE LEAKS ARE FROM THIS!!

Pre-dive Checklist's

This pre-dive checklist is a combination of the KISS checklist, and what some of the A.N.D.I. instructors are using. The instructors and divers who use this checklist have reported that their skill level on the rebreather increased quicker and that they understood their units better, which made them more organized and safe divers.

I have edited the check list to make it work for a KISS diver to use for every dive. The first part of our new check list, are items that must be addressed and/or confirmed prior to suiting up for the dive. Those that are using this tool, usually keep several blank copies in a small binder with their dive gear.

The second part of the check list are items that are usually checked shortly before a dive. This list can also be printed out, but other options are to copy it onto a dive slate or wet-notes in a permanent ink marker.

A point worth noting is that all pilots have a check list which they go through every time they fly. Diving a rebreather should be no different. While rebreather diving doesn't necessarily take more preparation or clean up time than open circuit diving, there are very specific things that need to be checked and confirmed prior to getting into the water.

Using this check list will only add a few seconds more time to your preparation, but could make all the difference in having a pleasurable time in the underwater environment. It certainly assists in creating competent, happy divers.

**One part of the 2nd check sheet is worth discussion. That is the 5 minute pre-breath that is required prior to diving. Note that this pre-breath is NOT to warm up the scrubber. It is to determine if the scrubber and the rebreather are working properly. It gives you a chance to monitor your display system to ensure that it is working. And most importantly, to determine how you feel during and after the pre-breath. It will help you determine if your scrubber has been properly packed, if you forgot to change the absorbent, or if the canister is completely empty!!! Also if your mouthpiece valve disks (mushroom valves) are in place and working properly. While some of these things may sound silly, very experienced divers have jumped into the water with either no absorbent, or with completely used up absorbent. The pre-breath is a minimum of 5 minutes as this much time is required for our bodies to tell us that something is wrong. The bottom line is that this 5 minute pre-breath confirms your system check has been done and that all is working.

DIVERS SHOULD FOLLOW THE PRE-DIVE CHECKLISTS BEFORE EVERY DIVE AND KEEP A COPY OF THE CHECKLIST WITH THE KISS REBREATHER AT ALL TIMES.

Predive Checklist

NAME: _____ DATE: _____

DIVE LOCATION: _____ PLANNED DEPTH: _____

PLANNED SET POINT: _____ TODAY'S DIVE NUMBER: _____

INITIALS ↓

____ I have checked my diluent/bailout system and it is in perfect working order.

____ My bailout system is appropriate for the dive depth I am planning of, _____feet/meter.

____ My sensors are _____ months old.

____ The millivolt readings on my sensors is: _____; _____; _____.

____ My PPO2 display uses _____ batteries and they have _____ hours left on them.

____ I have analysed my O2 cylinder and it has _____% O2

____ I am diving with _____ diluent in my main diluent/bailout cylinder. I have analysed it and have confirmed what percentage of O2/Helium/Nitrogen it contains.

____ I am diving with _____ mix in my secondary bailout cylinder. I have analysed it and have confirmed what percentage of O2/Helium/Nitrogen it contains.

____ I am diving with _____ mix in my third bailout cylinder. I have analysed it and have confirmed what percentage of O2/Helium/Nitrogen it contains.

____ If I am using more cylinders I will also write down the mixture and ensure that I have analysed them and have confirmed what percentage of O2/Helium/Nitrogen they contain.

____ My absorbent has been used for _____ hours, which means that I have _____ hours left on it.

____ My dive computer is in perfect working order.

____ The battery voltage on my computer is _____.

____ My buddy and I have practiced bailout procedures and understand what to do in an emergency.

____ My surface interval before this dive is _____.

____ My CNS before this dive is _____.

____ I am using _____ lb/kg of weight.

This pre-dive check should be done after your unit has been assembled, your scrubber canister filled, lungs attached, all fittings/hoses checked & secure, etc. It should be done prior to entering the water.

INITIALS ↓

____ I have ensured that the Valve Disks (mushroom valves) on the Valve Plates are flat and smooth. I have done a BOV/DSV positive and negative diaphragm test to ensure that they are sealing properly. I have also ensured that they have been installed correctly and the gas flow is going in the correct direction, left to right.

____ I have done a breathing hose positive and negative pressure test to ensure that my loop hoses are not damaged.

____ I have done a negative pressure test on the fully assembled KISS rebreather and it maintains full vacuum pressure.

____ I have done a positive pressure test on the fully assembled KISS rebreather and it maintains full pressure. I have ensured that the counterlung's are properly positioned and not twisted or restricted in any way.

____ I have turned my displays on.

____ I've connected my diluent/bailout cylinder to my rebreather. I have verified that the cylinder is full. It has_____ PSI/BAR in it. I've checked the pressure gauge for any sign of leakage of diluent in the system. I've ensured that the ADV and the bailout regulator are working correctly. (The diluent gas I am using is appropriate for the dive that I am planning)

____ I've opened the oxygen valve and checked that the cylinder is full. It has _____ PSI/BAR in it. I've ensured that the manual add valve is working by pushing the button and watching the displays, while breathing on the unit. Also, I've ensured that the constant flow is working by listening for the flow.

____ I've calibrated the sensors in oxygen. I have verified the sensor readings in air.

____ I've ensured that the size of my bail-out gas cylinder is adequate for the dive that I am planning, that it is full and that the regulator is working correctly. I have also ensured that my wing and drysuit inflation are working correctly.

____ I have pre-breathed my KISS rebreather for at least 5 minutes before entering the water.

____ I will double check that my oxygen and diluent cylinders are open, that my displays are on, and my computer is properly programmed before I enter the water.

____ Once in the water, I will do a bubble check with my buddy to double check that there are no leaks in my system.

The diluent tank is NOT an adequate gas supply for emergency situations.

POST DIVE CHECK LIST - OS DISASSEMBLY

After diving the KISS OS, your diving system will need to be disassembled and cleaned. Follow the disassembly procedures at the front of the manual; follow with the cleaning instructions below.

- Rinse the rebreather, wing & harness fully with fresh water. Be certain to rinse the first stages, valves and any regulators very well.
- The loop components should be rinsed and sanitized after diving. In order to disinfect the components, a product such as Virkon must be used. Virkon is a product that comes in powder form which must be mixed with water. Follow the package directions for use.
- After sanitizing, rinse all components in fresh water. Set out to dry. Counterlung's can easily be dried by turning them partially, inside out.

Once your components are dry, the unit may be stored for future use.

Warranty

The KISS Rebreather, LLC. Rebreather's, boosters, displays and mouthpieces are warranted for the period of 1 year. All warranty and service work should be returned to our warehouse.

- The warranty applies to the original owner only.
- Mistreatment or neglect of the products will void the warranty.
- Parts not covered by the warranty are batteries and sensors.
- Circuit boards and meters sold separately (without the case) are not covered under the warranty.
- Warranty cards shipped with rebreather's, boosters, displays and mouthpieces must be completed and returned to KISS for the warranty to be valid.
- Completed liability waivers must be on file for the rebreather warranty to be valid.
- Modifications to the KISS rebreather will void the warranty. Only approved modifications are allowed.
- We are unable to determine if the parts are covered by the warranty until they have been inspected.

PROCEDURES FOR WARRANTY & SERVICE WORK

Prior to shipping, please email info@kissrebreathers.com to inform us of your shipment. You will need to print out the warranty/service form, fill it in and ship it with your item. This form can be obtained from the KISS website at www.kissrebreathers.com

Your product should be returned to us with the following items:

- A copy of your original purchase receipt.
- The warranty/service form.

Carefully box up the items being returned. KISS Rebreathers, LLC. is not responsible for any damage incurred during shipping. Ensure that the items are properly padded and shipped in a strong box, and also that it is well sealed. (Don't forget to insert the above mentioned paperwork!) Please write in large clear letters, WARRANTY RETURN, MADE IN USA on the outside of the parcel and on any paperwork. This is important as otherwise USA Customs will charge us a brokerage fee and duties, which we pass on to you.

The parcel may be shipped via the post office or a courier. All shipments must be prepaid and insured. Any fees that KISS Rebreather LLC. incurs must be paid for by the shipper. This includes duties and brokerage fees for the item re-entering the USA. Note that if you ship via a courier such as UPS or Federal Express, there will be a brokerage fee, even if there are no duties. While there may be no charges for the warranty work, this brokerage fee must be paid for by the shipper.

INFORMATION SHEET

KISS Rebreather LLC - Information Sheet For New Divers

What is KISS doing to ensure that divers understand how to safely use their products?

KISS Rebreathers has been building and selling diving systems since 1998. For over 20 years KISS has been dedicated to building rebreathers that are simple, safe, and reliable. During this time, we have watched our industry change from a handful of manufacturers' that wouldn't give each other the time of day, to a group of companies and individuals that are dedicated to the growth of our industry, as well as ensuring the education and safety of our divers.

It is the duty of all rebreather manufacturers to ensure that when a diving system is sold, our clients are able to confidently choose a Training Agency and Instructor that will fulfill the training requirement.

In our goal to help divers become the best rebreather diver's possible, KISS has a Training Quality Assurance program (TQA), which outlines our standards and expectations.

As a KISS rebreather owner, there are some things we would like you to know:

1. KISS Rebreathers has 2 private Facebook groups, KISS Rebreather Divers, and KISS Rebreather Instructors. We strongly recommend that all KISS rebreather owner's join the KISS divers' group, and all instructors join the KISS instructor group. While these lists may not be terribly active, it is where we release important information such as manual updates, issues, recalls, etc.

   KISS rebreather owners should search Facebook for, KISS Rebreather Divers – Official Page. KISS rebreather instructors should search for, KISS Rebreather Instructors – Official Page. If anyone is having difficulty finding these pages, please email us at, info@kissrebreathers.com for help.

   Upon asking to join, you will be asked a few questions. Upon receipt of your request and answers, your membership will be granted.

2. You will find a copy of the KISS Rebreather LLC minimum training standards in the back of your manual. We have published it here as we feel it is important for all KISS divers to understand what the minimum training requirements are for each level of training. KISS approved training agencies are able to add to these standards, but not take away from them.

3. Also, in the back of your manual are copies of the KISS Rebreather course evaluation forms. There are 4 forms, one each for each level of training. As you can see these forms list all the required skills, and your score. At the completion of the program, all students and instructors are required to sign off/date this form. Your instructor will email the final copy of the form to KISS Rebreathers.

   Again, we have published these forms so that all KISS owners know what to expect in their training program. As a KISS diver, you have made an investment in a specialized piece of diving equipment, and in a specific training program. As such, you deserve to receive the equipment as promised, and all the training that you have paid for. If at any time you feel that this hasn't happened, please contact us directly at, info@kissrebreathers.com.

4. Anyone that purchases a KISS rebreather, must have the appropriate training. Those that purchase a KISS Classic Explorer, KISS Spirit LTE, or KISS Orca Spirit, are required to do the standard KISS training program.

Those that hold this certification (or new KISS divers) that wish to purchase a KISS Spirit Sidewinder, or KISS Sidekick must do either a cross over or take the full course.

5. The KISS Rebreather LLC Training Quality Assurance (TQA) information is listed on our website www.kissrebreathers.com. Here you will find copies of the minimum training standards, course evaluation forms, Instructor Registration forms, and other information.

6. As a number of our sales go through our dealers, we don't have contact information for all our divers. We ask that all KISS rebreather divers ensure that they are registered with us, so we are able to reach you should the need arise. As mentioned, we do publish information on our private Facebook groups, and in other places, but having your name and email address (at a minimum) on file with us would help insure that we can reach you in the event that we have important information. Ideally please email us your: full name, address, phone number, email address, the name of the unit you are diving, and your serial number. This information can be sent directly to, info@kissrebreathers.com.

As a rebreather manufacturer, KISS Rebreather LLC has a duty to their clients to ensure that KISS divers understand how to safely use their products. We take this very seriously. If anyone ever has a concern, comment, observation, we would love to hear from you. Our goal is to be the best that we can, and feedback from our clients will help us achieve that. Any feedback may be emailed directly to us at, info@kissrebreather.com.

Orca Spirit LTE - Addendum

The KISS OS LTE is the second unit in the Spirit series of rebreathers. The LTE, while very similar to the standard OS, does have some unique characteristics. The KISS OS LTE Addendum will outline the differences between the LTE and standard OS.

The Orca Spirit LTE package includes most of the component's required to dive this system. The low price includes:

- the ABS stand/plate
- gas addition scrubber head
- sensor scrubber head
- 2 scrubber canisters with protective black coating
- counterlung
- oxygen manual addition valve
- HOLLIS bailout mouthpiece
- 1 full off board gas accessory for adding the diluent gas
- Wing
- harness with crotch strap
- oxygen first stage with delrin plug
- 2 , loop hoses

Not included with this kit:

- Oxygen cylinder
- Diluent/bailout cylinder & first/second stage
- PPO2 display and/or computer
- Pressure gauges
- 3, K-22D sensors.

KISS OS LTE - INFORMATION & INSTRUCTIONS

ABS PLATE/STAND:

The Orca Spirit LTE has a light weight, yet durable attachment plate and stand which is made from an ABS material. It takes the place of the stainless steel stand on the original unit.

As the Orca Spirit LTE is not designed to use a cover, any size cylinder may be used with this stand. Heavier and larger cylinder such as aluminum 20 cuft or stainless steel 27 cuft cylinders are appropriate, should the diver wish to have a larger supply of oxygen.

The photo to the right shows the correct lung positioning.

Webbing Cylinder Straps:

The Orca Spirit LTE ships with webbing cam straps for securing the canister's and cylinder. The advantage of these straps is that they fold down flat when not in use. This is ideal for travel.

HOLLIS BOV:

The OS LTE includes the new HOLLIS BOV. This BOV is highly regarded for it's small size, incredible light weight, and ease of breathing. When using this BOV on the OS LTE, no ballast rings are required on the loop hoses.

***Warning: Your KISS mouthpiece or BOV (including the 2nd stage) is a key component of the KISS diving system and should be serviced yearly or more often if required. When to service depends on how often you dive, the environment you dive in and also how well it is cleaned after every dive. It is important that it is kept clean and the knob should always turn smoothly. Keeping your BOV clean is important as grit inside the moving parts can score the plastic. Your local KISS dealer can assist you with servicing the BOV if you prefer not to do it. Care should be taken to ensure that it is in good working order and not damaged.**

Also, be aware that if you wash your BOV with a powerful hose, the valve disks may be blown off!! After cleaning, be certain to inspect your gear and follow all the pre-dive check's!!!

IF THE MUSHROOM VALVES ARE DISTORTED OR DAMAGED THEY MUST BE REPLACED!!! When attaching (or removing) the mushroom valves BE CAREFUL!!! When attaching (or removing) the NEW valves, PULL ON THE STEM GENTLY & ONLY HOLD THE STEM WHEN REMOVING THE VALVE. DO NOT CARRY THE VALVE OR VALVE CARRIER BY THE STEM!

Wing, Harness, & Lung Positioning:

The OS LTE package includes a wing and harness system. It is important that the KISS LTE wing and harness system is used with this unit as lung placement is critical.

When securing the wing/harness system to the rebreather, first place the wing so that the bolt holes are over the holes on the plate. Then place the harness on top of the wing, securing with the bolts. Once secured, pull the counterlung's through the slots on the wing and ensure that they sit on the inside of the harness shoulder strap. Ensure that the lungs are not restricted or entangled in any way.

***WARNING: IT IS IMPORTANT THAT THE LUNGS ARE PROPERLY SECURED TO THE CROSS BAR & THEN PROPERLY THREADED THROUGH THE WING. THEY MUST ALSO BE PROPERLY SECURED USING THE CLIP AT THE DIVERS WAIST. IF THE LUNGS ARE NOT SECURED, THEY WILL FLOAT UP AND BREATHING WILL BE DIFFICULT. ENSURE THAT THE LUNGS ARE PUSHED ON STRAIGHT AND THAT THE RINGS ARE NOT OVER-TIGHTENED AS THEY WILL SPLIT!!**

Automatic Diluent Valve (ADV):

The ADV on the OS LTE diving system works in the same manner as that on the standard Orca Spirit. However the actual component is different. The ADV on the Orca Spirit is a Mikron second stage while the ADV on the OS LTE is the original KISS version. The KISS ADV system is comprised of the ADV diaphragm and ADV valve stem. This is a popular system as it has few parts which decreases the possibility of failure.

The ADV will add diluent gas to your breathing loop after the loop volume has been reduced by either descending or "breathing down" the volume of oxygen. The diver will get the feeling that there is no more air in the loop to breath. All the diver needs to do is suck hard to trigger the ADV and it will feed him more gas. This is similar to the action of a second stage regulator.

The ADV has been setup "tight" enough that it doesn't add diluent without the diver being aware. But it adds enough gas so that a reasonable descent rate can be maintained. Anytime the ADV triggers you need to check your PPO2. you have either descended and compressed the gas in the loop or you have consumed enough oxygen to reduce the PPO2 significantly . This may also have caused you to lose buoyancy and descend.

The position of the diver will effect the ADV. If the diver is horizontal or face down, the ADV will trigger easily. If the diver is vertical, then it is more difficult to trigger. (A well fitting harness is important; this will greatly reduce the difficulties of being vertical in the water). Also, rolling to your right side, while horizontal, will assist in triggering the ADV.

Diluent can also be added to the breathing loop via the mouthpiece. Simply go to open circuit mode, take a breath and then open the loop again and exhale the gas into the breathing loop.

Another way to add gas to the loop via the mouthpiece is to close the loop only a 1/4 inch, for a second. You may need to lightly push the purge button on the front of the 2nd stage. A small amount of gas will blow directly into the breathing loop.

In the **Exhaust Valve/ADV/Work of Breathing** section of this manual, you will see information on the ADV. Some of this information is relevant to both styles of ADV, while other information is specific to the component. For ease, we have repeated the ADV section of **Bubbling Apeks Exhaust Valve** here, along with other relevant information to this style of ADV.

Bubbling Apeks Exhaust Valve:

If your counterlung volume is correct and the exhaust valve is in good working order, and you still have a leaking exhaust with the feeling of too much gas in the loop, you could have a problem with your ADV adding too much gas into the system. If this is happening you will also notice that your PPO2 is reading lower than usual and that your buoyancy is off. This could be caused by a stretched, damaged or torn ADV diaphragm, a ADV valve stem which is damaged and, also if the seating area of the ADV valve stem has debris in it. Inspect the diaphragm and valve stem for damage or fault.

When reinserting the ADV valve stem, clean the underside of the valve's head and apply a small amount of lubricant to it. This will keep it in good condition and help it to seal. Also thoroughly clean the seating area.

***NOTE: ensure that the seating area of the valve stem is clean and debris free!! If there is the slightest amount of dirt in this area, the valve stem will leak!**

To determine if this is the problem, shut off the diluent gas. First you will notice your PPO2 stabilize and stop dropping. Also, the lungs will stop filling up all the way and the exhaust valve should stop purging.

The diaphragm is simple to check. Open the cover and pull the assembly out. It should be fairly flat, and not damaged. You may need to look quite closely for small tears or holes. Sometimes holding it up to the light and gently pulling the rubber will help.

HAVING SAID THAT THE DIAPHRAGM IS EASY TO CHECK, IT IS ALSO WORTH NOTING THAT IF YOU ARE NOT HAVING A PROBLEM WITH THE DIAPHRAGM ASSEMBLY, DO NOT DISSEMBLE IT. WITH PROPER USE, THE DIAPHRAGM WILL LAST FOR YEARS IF NOT DISTURBED.

***NOTE: A damaged ADV assembly will either deliver too much diluent gas, or none at all.**

***NOTE: It is important that the proper installation procedures are followed for the ADV assembly and diaphragm; the directions are on the following page. The exhaust valve is a key component of the KISS diving system; care should be taken that it is not damaged and properly maintained.**

ADV IS DIFFICULT TO TRIGGER

The position of the diver will effect the ADV. If the diver is horizontal or face down, the ADV will trigger easily. If the diver is vertical, then it will be a bit harder. (A well fitting harness is important; this will greatly reduce the difficulties of being vertical in the water). Also, rolling to your right side, while horizontal, will assist in triggering the ADV.

If preferred, diluent can be added via the mouthpiece. Turn the knob about a 1/4 inch and diluent gas should flow into the loop. Depending on where your IP is set, and which second stage you are using, you may need to lightly hit the purge button.

Lastly, check the IP on the diluent first stage. Ensure that it is in the correct range. Remember, the ADV is not meant to be easy to trigger. It was designed this way so that the diver would know when they were triggering it. If it was too easy, then diluent gas could be fed into the breathing loop without the diver being aware of what was happening.

SEE BELOW FOR INSTRUCTIONS ON REINSTALLING THE ADV DIAPHRAGM.

Note that proper assembly procedures must be followed. Prior to removing the ADV diaphragm, it would be good to have a spare diaphragm handy as reinstalling an old diaphragm can be tricky if it is stretched.

***NOTE: A damaged ADV diaphragm assembly &/or valve stem will either deliver too much diluent gas, or none at all.**

***NOTE: It is important that the proper installation procedures are followed or the diaphragm will leak!! It is also important that proper testing procedures are followed so that the diaphragm is not stretched out!!!**

Installing the ADV diaphragm:

When you are ready to attach either the original diaphragm or a new one, first inspect it. If you are reinstalling the original one, this is very important. If the diaphragm has stretch marks by the screw holes, it would be best to use a new one instead. A diaphragm in this condition is very difficult to reinstall. The stretch marks are a result of doing long negative tests on the unit. Remember, a negative test should only be about 1 minute long. Please see testing section for the proper testing instructions. Again, if you are planning on opening up the diaphragm area, I would strongly suggest that you have a new diaphragm on hand.

Insert the screws through the ADV cover until one or two threads are showing and then push the diaphragm through the screws. Carefully place the assembly against the scrubber head and hold it firmly in place with one hand, while turning the screws with the other. If while placing the assembly against the head, the diaphragm shifts, start again. It must be aligned properly.

Turn each screw only a half turn or so before alternating to another screw. Watch carefully and stop turning as soon as the bottom of the screw touches the plastic cover. There will be no gap between the underside of the screw and the cover, but the screws will not have started getting more difficult to turn yet. Look at the diaphragm and ensure that it looks proper. It should not be twisted. Turn the screws another 1 to 2 mm. Then turn them another 1 mm. Remember not to over tighten the screws. If the screws are over tightened, the diaphragm will leak. If you are having a problem in this area, do a positive pressure test and then back the screws off slightly until the leak stops. The adjustment will be very slight.

We have tested this method both with and without lubricant on the diaphragm holes. We have found that it is better to NOT use lubricant in this area, as it can make it more difficult.

If you are using a new diaphragm, ensure that when you attach the plastic button and screw to it, that you do not over tighten this assembly. Again, this is a case where over tightening can cause a leak. On the other hand, if the button assembly is loose, air can leak through this area.

***NOTE: Severely over tightening the ADV diaphragm screws can damage the threads on the KISS head!!!**

KISS Spirit Sidewinder—Addendum

The KISS Spirit Sidewinder is the newest diving system from KISS Rebreather LLC. The Sidewinder has many similarities to the earlier units in the Spirit series, but does have some unique characteristics. The KISS Spirit Sidewinder Addendum will outline the differences between the LTE and the Sidewinder.

The Spirit Sidewinder package includes most of the component's required to dive this system. The low price includes:

Gas addition scrubber head
Sensor scrubber head
2, scrubber canisters with protective black coating
4, scrubber canister hose clamps, 6 snap bolts, and black cord.
Counterlung
Oxygen manual addition valve, with 2 x LP oxygen compatible hoses
DSV mouthpiece
1, full off board gas accessory for adding the diluent gas
Oxygen first stage, with delrin plug & OPV
2 , retractable loop hoses with 8 x ballast rings
1 x Fischer cable, hardwired to the sensor head
1 x harness adapter plate

Not included with this kit:

Sidemount harness
Oxygen cylinder
Diluent/bailout cylinder & first/second stage
PPO2 display and/or computer
Secondary display system
Pressure gauges
3, K-22D sensors

It is important that the general procedures in this manual are followed. As mentioned, this section outlines the unique components for the Sidewinder. Covered in this addendum:

1. Prepare the sidemount harness and secure adapter plate (if required).
2. Secure the hardware to the scrubber canisters, and clip to the sidemount harness/adapter.
3. Counterlung preparation, placement and use.
4. Positioning of the scrubber head towers (canisters should be filled and ready to dive).
5. Mouthpiece, DSV/BOV positioning
6. Oxygen manual add valve routing.
7. Waist belt and shoulder strap positioning
8. Final adjustments.

SIDEMOUNT HARNESS & ADAPTER PLATE:

The KISS Spirit Sidewinder must be fitted with a sidemount harness. Harness systems that are approved include the HOLLIS, Dive Rite, Halcyon, OMS, and XDeep. Depending on which harness you choose, an adapter plate may be necessary.

If you wish to use a system that is not on yet on our list, please contact KISS Rebreathers prior to ensure that it is appropriate for this rebreather. It is worth noting that the fit of the sidemount harness is critical to the set up and comfort of the Sidewinder. If this is done correctly, the balance of the fitting and adjusting of the Sidewinder will be simpler.

***NOTE: It is important that the sidemount harness used is properly fitted to the diver. This is the starting point of ensuring that the KISS Sidewinder diving system has been properly set up.**

There are 3 adapter plates available at this time.

1. The original 11 inch bolt hole plate is required for those that use the HOLLIS SMS 75, Halcyon, OMS, and some of the Dive Rite systems.
2. The 2 inch webbing plate is required for those that use the XDeep system.
3. The Katana plate is for those that use the HOLLIS Katana system.
4. The HOLLIS SMS 100 does not require an adapter plate.

To secure the adapter plate to the rebreather, first position the plate so that the underside is facing the harness. The Original 11" plate is secured using the bolt holes; the wide end is on the bottom. Secure using the sex bolts. The 2" webbing plate is secured using the webbing straps and attaching them to the harness. The Katana plate is secured with Velcro. The Katana system has a soft pad on the inside of harness held on by Velcro. The Sidewinder adapter plate has Velcro on both sides and goes in between them.

SCRUBBER CANISTER RIGGING:

Included with your rebreather are 4 hose clamps, 6 snap bolt's, and a generous length of black cord.

The proper steps in securing the hardware is as follows:

- The hose clamps should be positioned so that the screw assembly is to the side of the counterlung opening. The rubber sleeve should cover the end of the clamp, to prevent entanglement. See photo to the right.
- The cord will be looped around the rubber, with the clip secured to it. The clips should be positioned so that they are inline with the counterlung opening. A generous length of cord has been supplied with the rebreather. The proper length will be determined during your training class, with your instructor. See photo to the right.

- The third clip will be on a bungee. The ends are knotted and secured under the hose clamp at about a 90 degree angle from the counterlung opening and the other clips, positioned on the top hose clamp. The length of this bungee will also be determined during training, with your instructor. See photo to the right.
- Secure the two clips that are inline with the counterlung opening, to the side of the harness, with the third clip attached to the front outer side of the shoulder strap. The canister should fit snuggly to the harness.
- The sidemount bungees should be pulled behind the scrubber canister - in front of the wing, and clipped to the top shoulder D-ring.

Once the clips have been secured to the canisters, they are dedicated to being a left or right canister. They are not interchangeable. This is due to the long bungee with the snap bolt that goes to the front of the harness. When wearing the unit, the left canister is the exhaust and Fischer cable canister, and the right is the ADV canister.

***WARNING: IT IS CRITICAL THAT THE SIDEMOUNT HARNESS AND THE SIDEWINDER DIVING SYSTEM ARE PROPERLY RIGGED. THIS MUST BE DONE WITH A QUALIFIED INSTRUCTOR. FAILURE TO DO SO, COULD RESULT IN INJURY OR DEATH!**

COUNTERLUNG:

The KISS Spirit Sidewinder has 2 different counterlung's available. The lungs have approximately the same volume; the difference is shape. In order to determine the correct lung for each diver when a unit is ordered, we ask for your T-shirt size. The standard lung will suit those who take a small, medium, or large shirt, and the "large" lung will suit those who wear an XL shirt or larger. This is about body shape, not counterlung volume. Most divers will use the standard lung.

The Sidewinder utilizes a single counterlung which is approximately 10 litres. The volume will vary depending on how tight the harness fits, and how the unit is rigged. On this unit, minimum loop volume is critical.

Inspect the counterlung, and ensure that all the parts have been properly cleaned, are not damaged, the vacuum break is in place, and it is ready to use.

1. First wipe and clean the sealing area on the lung. Then apply a very light amount of lubricant to this area, including the O-rings. See photo to the right.
2. Next, wipe and clean the counterlung attachment which is secured to the canister. See photo to the right.

3. Inspect the components again, and also the O-rings areas prior to installation of the lung. While applying the lubricant, double check that the O-rings are not damaged or indented. If you feel an indent or other damage while applying the lubricant, change the O-ring for a new one.

***NOTE: FOR EASE OF ATTACHMENT, A VERY SMALL AMOUNT OF LUBRICANT CAN BE APPLIED TO THE INSIDE OF THE OPENING ON THE CANISTER.**

3. Lay the harness/plate adapter assembly down with the plate side up. Position the lung over the adapter plate with the attachment's facing down, and positioned so they are at the bottom, furthest away from the top of the shoulder straps. See photo to the right. The counterlung is floating, and is not attached to anything. For proper positioning, go by feel and what is comfortable. With this system, the position does not effect the work of breathing; it can be positioned higher or lower.

4. Push the counterlung attachment on the canister, onto the counterlung; you will need to push firmly. As you push the lung in place, you will feel a circular flange which is at the perimeter of the lung opening. Push firmly on this flange. It is important that they are pushed all the way on and are straight. When this is done correctly, the retaining circ clip will easily snap into the groove.

After diving, the counterlung should be sanitized, rinsed and allowed to dry. There is no need to open the counterlung cover.

***WARNING: THE COUNTERLUNG ASSEMBLY INCLUDES THE LUNG, COVER, VACUUM BREAK, AND ATTACHMENTS. DO NOT REMOVE THE COUNTERLUNG FROM THE COUNTERLUNG COVER. THERE IS A PROCEDURE TO ENSURE THAT IT IS INSTALLED PROPERLY. FAILURE TO INSTALL IT PROPERLY MAY CAUSE THE LUNG TO BE PINCHED, AND IT WILL NOT WORK PROPERLY.**

SCRUBBER TOWER POSITIONING:

Once the scrubber canister's have the hardware attached, and they are secured to the harness, you will need to ensure that the scrubber head towers are facing the proper direction.

With regards to the tower indexing, (placement), the photo to the right shows how they should sit. However, the actual position on the canister will vary from person to person, due to body shape, and lung placement. This requires the assistance of your instructor to help ensure that the position is similar to this photo. Once you determine where the tower's are supposed to sit, the diver should put a mark on the canister to ensure they rig it the same each time.

***WARNING: THE SCRUBBER TOWER'S MUST BE POSITIONED CORRECTLY. PROPER PLACEMENT WILL BE DETERMINED DURING THE SIDEWINDER TRAINING COURSE WITH THE AID OF YOUR INSTRUCTOR. FAILURE TO PROPERLY RIG AND SET UP THE SIDEWINDER COULD RESULT IN INJURY OR DEATH.**

DSV—MOUTHPIECE:

The unit includes a standard rebreather mouthpiece. The mouthpiece on this system is a Dive Surface Valve (DSV) and does not include a bailout system as other rebreather mouthpieces do. Servicing of this item should only be done by a qualified KISS instructor or service technician. An upgrade is available for those that wish to use a standard BOV.

Secure the loop hoses, and attach the DSV. To ensure that it is properly situated, turn the hose attachments so that when holding up the DSV the rubber mouth-bite faces your mouth. It will look similar to the photo on the right, when not in the divers mouth.

The loop hoses will each have 4 ballast rings attached, for a total of 8 rings on the breathing loop. They should be positioned so that the loop hoses are neutral, and the mouthpiece is not pulling in your mouth.

***WARNING: THE MOUTHPIECE IS A KEY COMPONENT OF THE KISS DIVING SYSTEM; CARE SHOULD BE TAKEN TO ENSURE THAT IT IS NOT DAMAGED, SERVICED AS REQUIRED , AND IS FUNCTIONING PROPERLY.**

MAV AND DISPLAY CABLE POSITIONING:

The oxygen manual add valve, oxygen first stage, and the oxygen rated LP hoses will sit on the divers right side. If possible, the MAV and LP hoses should be run through the D-rings on the right shoulder strap. If this is not possible due to the style of harness used, then small loops of bungee should be used to secure the hoses to the right shoulder strap. Securing the valve is important so that it does not move around, and is easy to find.

The Fischer cable will sit on the divers left side. This cable may be run through the inflator hose retainer on the left shoulder. Alternatively, small loops of bungees may be used to secure it comfortably. The cable should be loose enough so that it does not restrict the divers arm movement, and also tight enough so it is not an entanglement hazard.

PUTTING IT ON:

At this point, you should have a fully assembled KISS Spirit Sidekick, and verified all procedures using the 2 predive check sheets.

Lay the unit out flat and ensure that the waist and shoulder straps are inside of the secured scrubber canisters. The unit may either be laid flat prior to putting it on, or propped up against a wall or bench. Your instructor will assist you in determining the best method. This procedure should be personalized for the diver, so that they are taught a method that suits them.

A key part to ensuring that the KISS Spirit Sidewinder is comfortable, is ensuring that the sidemount harness used is the correct size and properly fitted. If it is not, it will likely be impossible to properly position the rebreather.

**** WARNING: THE KISS SPIRIT SIDEWINDER IS A UNIQUE DIVING SYSTEM AND IT IS IMPERATIVE THAT PROPER INSTRUCTION HAS BEEN RECEIVED PRIOR TO DIVING THIS UNIT. THE RIGGING AND ASSEMBLY PROCEDURES UNIQUE TO THIS SYSTEM MUST BE LEARNED FROM A QUALIFIED AND APPROVED INSTRUCTOR. FAILURE TO DO SO MAY CAUSE INJURY OR DEATH.**

CCR DIVER

INTENT

The CCR Diver program provides divers with the knowledge and training necessary to independently plan and conduct unit specific no decompression closed-circuit rebreather (CCR) dives to a maximum depth of 30 meters/98 feet, using a manufacturer approved CCR unit with air as diluent utilizing CCR Diving procedures with a dive buddy diving on a rebreather or diving open circuit.

REQUIRED INSTRUCTOR RATING

An active status unit-specific CCR Instructor or higher may conduct the unit-specific CCR Diver program.

TEACHING RATIOS

- The maximum number of students for CCR training is 3:1
- The maximum number of students for no-decompression CCR training where one (1) student is making a crossover or doing a refresher is 4:1

These ratios should be reduced as required if the situation and/or environmental conditions call for it.

STUDENT PREREQUISITES

- Nitrox certification
- Have logged 20 open water dives
- Minimum age: 18
- For KISS Sidekick CCR only:
  - Student must have some level of technical diver training. At a minimum advanced nitrox or recreational trimix or equivalent.
  - Students must be able to rig a sidemount rebreather as well as 2 cylinders.

DURATION

- Recommended hours for course completion: 40
- Minimum number of days: 4
- Minimum number of hours for Academics and Dry practical: 8

MATERIALS AND EQUIPMENT

The minimum required student and Instructor equipment for this program includes:

A complete KISS CCR Unit that:

- Is compliant to local laws, is approved by the training agency and is properly functioning
- Has no non-manufacturer approved modifications
- Depth gauge & bottom timer, or dive computer
- A single off-board bailout gas suitable for a safe return to the surface from the planned maximum depth including all safety and decompression stops in the event of an emergency
- For Open water and lake environments with the exception of cave/overhead environments a Delayed Surface Marker Buoy (DSMB) and a spool / reel appropriate for the planned dive depth.
- cutting device
- Access to an appropriate gas analyzer

The minimum required student and instructor materials for this program includes:

- KISS Rebreather unit specific user manual
- Agency student training manual or online training course
- Agency instructor manual (electronic instructor manuals meet this requirement)

- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)
- Manufacturer's sign off sheet/course completion document

All skills must be demonstrated by the instructor on the specific unit being trained

REQUIREMENTS FOR COMPLETION

Academics

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Practical mechanics of a CCR
   - Assembly and disassembly specific to KISS rebreather being used. Use unit specific manual as a guide
   - Unit Specific Check list
   - Design and overview of the KISS unit
   - Insert O-rings where required
   - O-ring location and condition
   - Absorbent canister
   - Breathing loop
   - Automatic Diluent Valve: automatic and manual use
   - Manufacturer's supported add-ons: BOV, etc
   - KISS Sidekick: understand risk of high work of breathing & importance of securing unit, cylinders

2. Loop volume - minimum / optimum
   - Determine the correct counterlung size, & understand how to attain and maintain proper loop volume

3. Gas Physiology
   - Oxygen risks, Hypoxia, Hyperoxia
   - Carbon dioxide (CO_2) toxicity, Hypercapnia
   - Nitrogen absorption

4. Proper scrubber filling; in accordance with KISS recommendations
   - Manufacturer's recommended scrubber medium, & procedures according to KISS user manual

5. Electronic or Manual or Mechanical Systems Design and Maintenance
   - Oxygen (O_2) metabolizing calculations
   - Oxygen Sensors, limitations, care and replacement regime
   - System electronics functionality and calibration procedures
   - KISS manual gas addition valve design and function. (raising and lowering of constant flow; determining correct flow rate for each individual)

6. Dive Tables
   - Constant partial pressure of oxygen (PPO_2) theory
   - Central nervous system (CNS) and Oxygen Tolerance Unit (OTU) tracking and awareness

7. Dive Computers
   - Mix adjustable

- Constant PO_2
- Decompression conservatism / Gradient factor selection
- Oxygen (O_2) integrated

8. Dive Planning
   - Operational planning
   - Gas consumption
   - Scrubber duration
   - Gas requirements including bailout scenarios
   - Oxygen limitations
   - Nitrogen limitations

9. Emergency Procedures
   - Flooded loop
   - Cell warnings
   - Battery warnings
   - Electronic failures

Skills

1. Pre-dive checks
   - Specific Unit Checklist
   - Verify diluent and oxygen (O_2) cylinder contents using gas analyzers
   - Unit build-up
   - Scrubber canister filling
   - Breathing loop check including mouthpiece one way valves and positive and negative check
   - Sensor calibration in oxygen, with verification in air
   - 5 minute pre-breathe
   - Bailout bottle/stage cylinder rigging
   - KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging/rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures including
   - Limits based on system performance
   - Limits based on oxygen exposures at chosen PO_2 levels
   - Limits based on nitrogen absorption at planned depth and PO_2 set point
   - Appropriate selection of decompression conservatism / gradient factors for the planned dive
   - Thermal constraints

3. Underwater verification
   - Stop at 3-6 meters/9-19 feet on descent for leak bubble check
   - Counterlung & Over Pressure Valve adjustment, if necessary

4. Mouthpiece familiarity skills
   - BOV: switch between open and closed circuit
   - DSV: switch to bailout system

5. Adding diluent gas/ADV familiarity skills
   - ADV: Adding diluent gas and understand how it works
   - BOV: Use BOV to add diluent gas to the loop – 2 ways

- Bail out second stage: Use to add diluent gas to the loop
- Dual button MAV: Adding diluent gas (if unit is shipped with this item)

6. Emergency procedures: demonstrate appropriate response to the following; each dive should have a minimum of 2 "diver emergencies" that the student must react to.
   - Practical bailout skills: including 2 open circuit ascents from approximately 18 meter/59 feet.
   - Gas shutdowns and loss of gas
   - Broken hoses
   - Flooded absorbent canister
   - Carbon dioxide (CO_2) breakthrough
   - Low oxygen drills
   - High oxygen drills
   - Flooding loop
   - Electronics, sensor, and battery failure
7. Practice transferring to open circuit bailout
8. Rescue skill session as outlined by the training agency
9. Use of a buoyancy control system
   - Buoyancy/trim control during dive
   - Buoyancy/trim control at safety stop
10. Controlling and monitoring for PPO2 levels:
    - Raising/lowering PPO2
    - Starting PPO2
    - PPO2 monitoring every minute
    - Manual Add Valve verification: static at constant depth, monitor change over several minutes
    - Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)
11. Electronic systems use:
    - Use and adjustment of Heads Up Display, position, brightness, colour
    - Use and adjustment of PPO2/depth/time display, position, brightness, colour
    - Use and adjustment of decompression computer, set up/gas switching, battery verification, etc
12. Use of lift bag / DSMB and reel (where relevant and applicable)
13. Mask removal and replacement
14. Proper execution of the dive within all pre-determined dive limits
15. Demonstration of safety stops at pre-determined depths (on all dives)
16. Constant loop volume management
17. Cell validation checks with appropriate use of diluent and oxygen
    - Oxygen sensor verification at depth
    - Linearity check of sensors at approximately 5 meter/16 feet on pure oxygen
18. Post dive clean of unit
    - Mouth piece and hoses
    - Clean and disinfect unit

- Inspect components of unit

19. Diver maintenance of unit
    - Cell removal and replacement
    - Mouthpiece care
    - Replacing or re-charging of batteries

EXTRA REQUIREMENTS FOR COMPLETION

- Demonstrate an adequate level of fitness by completing a minimum of a 50m/164 feet surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program.
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete a minimum of seven (7) training dives, including confined water skill development of at least one (1) hour, and six (6) core open water training dives with a minimum run time of 30 minutes each.
- Complete at least a minimum of 420 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of seven years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of seven years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

Dive logs and student-signed course completion form are to submitted to the manufacturer of the specific unit on request

DEPTH LIMITATIONS

- Open Water Training Dives shall be initially shallow, progressively increasing in depth.
- Two (2) dives must be deeper than 20 meters/65 feet for certification
- All dives must be conducted at a depth shallower than 30 meters/98 feet.

NOTES

- All training dives must be planned within the no-decompression limits of the Combined Air/EAN Tables or the student's personal dive computer or computer-generated decompression profiles.
- Bailout cylinder gas is to be based on a maximum PPO_2 of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a ppO_2 higher than 1.1 bar at the bottom.
- The maximum loop set point is 1.3 bar.
- It is recommended that the student finish the training course within 6 weeks of the starting date.
- It is recommended that the student have access to, or purchase a unit within 3 months of completing the training program.
- Only approved training agencies and instructors may teach a KISS rebreather course.

Diving in an overhead environment

This course shall not be conducted in an overhead environment. Subject to training agency approval certain dive sites can be deemed suitable for the CCR Diver course under the following conditions:

- The student must remain in the daylight zone where there is no need for the use of a dive light
- The student must never be a distance of more than 132 linear feet / 40 linear meters from the surface

SEQUENCE

Open Water Training Dives 1 and 2 may only be conducted after completing the equipment configuration section, the surface diver tow and all confined water sessions.

CERTIFICATION

The unit specific CCR Diver certification entitles the holder to dive with a buddy, diving on a rebreather or diving open circuit, utilizing CCR diving procedures to make non decompression dives to depths of up to 30 meters/98 feet, providing that dives are conducted in environments similar to those of the diver's training and experience.

CCR DECOMPRESSION DIVER

INTENT

The intent of the Decompression CCR Diver program is to provide divers with the training necessary to independently plan and conduct unit specific decompression dives using air or Trimix with a minimum of 20% oxygen and a maximum of 35% Helium, to a maximum depth of 40 meters/131 feet with air diluent or 45 meters/147 feet with Trimix, using decompression mixtures of up to 100% oxygen and utilizing CCR diving procedures with a dive buddy diving on a rebreather or diving open circuit.

Note: The CCR Decompression Diver with Trimix curriculum is near identical to the Air-diluent program. Air should only be used if Helium is not an option.

REQUIRED INSTRUCTOR RATING

An active status unit-specific Decompression CCR Instructor or higher may conduct the unit-specific Decompression CCR Diver program. The instructor must be qualified as a unit-specific CCR Trimix 45m Instructor or higher to conduct the Decompression CCR Diver program with Trimix (min 20% O_2 and maximum 35% He) as diluent.

TEACHING RATIOS

- The maximum number of students for CCR training is 3:1
- The maximum number of students for no-decompression CCR training where one (1) student is making a crossover or doing a refresher is 4:1

These ratios should be reduced as required if the situation and/or environmental conditions call for it.

STUDENT PREREQUISITES

- An advanced level of Nitrox understanding. This is to include but not limited to the use of gases up to 100% Oxygen for decompression, tracking of CNS and OTU's, gas planning and accelerated decompression.
- Have logged 40 open water dives
- Minimum Age: 18
- For KISS Sidekick CCR only:
  - Student must have some level of technical diver training. At a minimum advanced nitrox or recreational trimix or equivalent.
  - Students must be able to rig a sidemount rebreather as well as 2 cylinders.

OR

- CCR diver with minimum 20 dives / 20 hours on the specific unit
- Minimum age: 18
- For KISS Sidekick CCR only:
  - Student must have some level of technical diver training. At a minimum advanced nitrox or recreational trimix or equivalent.
  - Students must be able to rig a sidemount rebreather as well as 2 cylinders.

DURATION

- Recommended hours for course completion: 40
- Minimum number of days: 4
- Minimum number of hours for Academics and Dry practical: 8

MATERIALS AND EQUIPMENT

The minimum required student and Instructor equipment for this program includes:

A complete CCR Unit that:

- Is compliant to local laws, is approved by the training agency, is properly functioning and is appropriate for bailout and accelerated decompression diving
- Has no non-manufacturer approved modifications
- Depth gauge & bottom timer, or dive computer

- A single off-board bailout gas suitable for a safe return to the surface from the planned maximum depth including all safety and Decompression stops in the event of an emergency
- Backup OC/CCR computer for bailout in the event of a system failure
- For Open water and lake environments with the exception of cave/overhead environments a Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- A back up Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- cutting device
- Access to appropriate gas analyzers

The minimum required student and instructor materials for this program includes:

- KISS Rebreather unit specific user manual
- Agency student training manual or online training course
- Agency instructor manual (electronic instructor manuals meet this requirement)
- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)
- Manufacturer's sign off sheet/course completion document

All skills must be demonstrated by the instructor on the specific unit being trained.

REQUIREMENTS FOR COMPLETION

Academics

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Practical mechanics of a CCR
   - Assembly and disassembly specific to KISS rebreather being used. Use unit specific manual as a guide
   - Unit Specific Check list
   - Design and overview of the KISS unit
   - Insert O-rings where required
   - O-ring location and condition
   - Absorbent canister
   - Breathing loop
   - Automatic Diluent Valve: automatic and manual use
   - Manufacturer's supported add-ons: BOV, ADV, etc
   - KISS Sidekick: understand risk of high work of breathing & importance of securing unit, cylinders

2. Loop volume - minimum / optimum
   - Determine the correct counterlung size, & understand how to attain and maintain proper loop volume

3. Gas Physiology
   - Oxygen risks, Hypoxia, Hyperoxia
   - Carbon dioxide (CO_2) toxicity, Hypercapnia
   - Nitrogen absorption
   - Advantages of Trimix with 20% Oxygen and 35% Helium

4. Proper scrubber filling; in accordance with KISS recommendations
   - Manufacturer's recommended scrubber medium, & procedures according to KISS user manual

5. Electronic or Manual or Mechanical Systems Design and Maintenance
   - Oxygen (O_2) metabolizing calculations
   - Oxygen Sensors, limitations, care and replacement regime
   - System electronics functionality and calibration procedures
   - KISS manual gas addition valve design and function. (raising and lowering of constant flow; determining correct flow rate for each individual)

6. Dive Tables
   - Constant partial pressure of oxygen (PPO_2) theory
   - Central nervous system (CNS) and Oxygen Tolerance Unit (OTU) tracking and awareness

7. Dive Computers
   - Mix adjustable
   - Constant PO_2
   - Decompression conservatism / Gradient factor selection
   - Oxygen (O_2) integrated

8. Dive Planning
   - Operational planning
   - Gas consumption
   - Scrubber duration
   - Gas requirements including bailout scenarios
   - Oxygen limitations
   - Nitrogen limitations

9. Emergency Procedures
   - Flooded loop
   - Cell warnings
   - Battery warnings
   - Electronic failures

Skills

1. Pre-dive checks
   - Specific Unit Checklist
   - Verify diluent and oxygen (O_2) cylinder contents using appropriate gas analyzers
   - Unit build-up
   - Scrubber canister filling
   - Breathing loop check including mouthpiece one way valves and positive and negative check
   - Sensor calibration in oxygen, with verification in air
   - 5 minute pre-breathe
   - Stage cylinder rigging
   - KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging/rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures including
   - Limits based on system performance
   - Limits based on oxygen exposures at chosen PO_2 levels
   - Limits based on nitrogen absorption at planned depth and PO_2 set point

- Appropriate selection of decompression conservatism / gradient factors for the planned dive
- Thermal constraints

3. Underwater verification
   - Stop at 3-6 meters/9-19 feet on descent for leak bubble check
   - Counterlung & Over Pressure Valve adjustment, if necessary

4. Mouthpiece familiarity skills
   - BOV: switch between open and closed circuit
   - DSV: switch to bailout system

5. Adding diluent gas/ADV familiarity skills
   - ADV: Adding diluent gas and understand how it works
   - BOV: Use BOV to add diluent gas to the loop – 2 ways
   - Bail out second stage: Use to add diluent gas to the loop
   - Dual button MAV: Adding diluent gas (if unit is shipped with this item)

6. Emergency procedures: demonstrate appropriate response to the following ; each dive should have a minimum of 2 "diver emergencies" that the student must react to.
   - Practical bailout skills: including 2 open circuit ascents from approximately 18 meter/59 feet.
   - Gas shutdowns and loss of gas
   - Broken hoses
   - Flooded absorbent canister
   - Carbon dioxide (CO_2) breakthrough
   - Low oxygen drills
   - High oxygen drills
   - Flooding loop
   - Electronics, sensor, and battery failure

7. Practice transferring to open circuit bailout

8. Rescue skill session as outlined by the training agency

9. Use of a buoyancy control system
   - Buoyancy and trim control at safety stop
   - Buoyancy and trim control during dive

10. Controlling and monitoring for PPO2 levels:
    - Raising/lowering PPO2
    - Starting PPO2
    - PPO2 monitoring every minute
    - Manual Add Valve verification: static at constant depth, monitor change over several minutes
    - Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)

11. Electronic systems use:
    - Use and adjustment of Heads Up Display, position, brightness, colour
    - Use and adjustment of PPO2/depth/time display, position, brightness, colour
    - Use and adjustment of decompression computer, set up/gas switching, battery verification, etc

12. Use of lift bag / DSMB and reel (where relevant and applicable)

13. Mask removal and replacement
14. Proper execution of the dive within all pre-determined dive limits
15. Demonstration of safety stops at pre-determined depths
16. Constant loop volume management
17. Cell validation checks with appropriate use of diluent and oxygen
    - Oxygen sensor verification at depth
    - Linearity check of sensors at approximately 5 meter/16 feet on pure oxygen
18. Post dive clean of unit
    - Mouth piece and hoses
    - Clean and disinfect unit
    - Inspect components of unit
19. Diver maintenance of unit
    - Cell removal and replacement
    - Mouthpiece care
    - Replacing or re-charging of batteries
20. Decompression related in water skills
    - Demonstrate the ability to drop and retrieve one (1) bailout cylinder while maintaining position in the water column
    - Demonstrate appropriate reaction to gas hemorrhage from bailout valve, first stage, second stage or SPG
    - Demonstrate appropriate reaction to simulated free-flowing deco regulator
    - Demonstrate the ability to Buddy breathe from a decompression gas
    - Oxygen rebreather mode at less than six (6) meter/19 foot stop
    - Complete two (2) bailout scenario at depth to include decompression obligation on open circuit

EXTRA REQUIREMENTS FOR COMPLETION

- Demonstrate an adequate level of fitness by completing a minimum of a 50m/164 ft surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete a minimum of seven (7) training dives, including confined water skill development of at least one (1) hour, and six (6) core open water training dives with a minimum run time of 30 minutes each.
- Complete at least a minimum of 420 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of seven years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of seven years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

Dive logs and student-signed course completion forms are to submitted to the manufacturer of the specific unit on request

DEPTH LIMITATIONS

Air as diluent:

- Open Water Training Dives shall be initially shallow , progressively increasing in depth.

- Two (2) dives must be deeper than 30 meters/98 feet for certification
- All dives must be conducted at a depth shallower than 40 meters/131 feet.

Trimix as diluent:

- Open Water Training Dives shall be initially shallow , progressively increasing in depth.
- Two (2) dives must be deeper than 35 meters/114 feet for certification
- All dives must be conducted at a depth shallower than 45 meters/147 feet.

CREDIT

- Students upgrading from CCR Diver to CCR Decompression Air Diluent Diver need to perform an evaluation dive, plus a minimum of four (4) open water divers with two (2) dives greater than 30m/98 feet.
- Students upgrading from CCR Diver to CCR Decompression Diver with Trimix need to perform an evaluation dive, plus a minimum of four (4) open water divers with two (2) dives greater than 35m/114 feet.
- Students upgrading from CCR Decompression Air diluent diver to CCR Decompression diver with Trimix need to complete a minimum of two (2) dives deeper than 35m/114 feet.

NOTES

- Bailout cylinder gas is to be based on a maximum PPO_2 of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a ppO_2 higher than 1.1 bar at the bottom.
- The maximum loop set point is 1.3 bar.
- It is recommended that the student finish the training course within 6 weeks of the starting date.
- It is recommended that the student have access to, or purchase a unit within 3 months of completing the training program.
- Only approved training agencies and instructors may teach a KISS rebreather course.

Diving in an overhead environment

This course shall not be conducted in an overhead environment. Subject to training agency approval certain dive sites can be deemed suitable for the CCR Diver course under the following conditions:

- The student must remain in the daylight zone where there is no need for the use of a dive light.
- The student must never be a distance of more than 132 linear feet / 40 linear meters from the surface

SEQUENCE

Open Water Training Dives 1 and 2 may only be conducted after completing the equipment configuration section, the Surface Diver tow and all confined water sessions.

CERTIFICATION

The unit-specific Decompression CCR Diver (with or without Trimix) certification entitles the holder to dive with a buddy, diving on a rebreather or diving open circuit, on dives utilizing CCR diving procedures to depths of up to 40m /131 feet with air diluent and 45m/147 feet with Trimix and requiring staged decompression stops providing that dives are conducted in environments similar to those of the diver's training and experience.

TRIMIX CCR DIVER 60m

INTENT

The intent of the CCR Trimix 60m Diving program is to provide divers with the training necessary to independently plan and conduct unit specific multiple-stop decompression dives to depths of up to 60m/196 feet using trimix with a minimum of 16% oxygen and utilizing CCR diving procedures with a buddy diving on a rebreather or diving open circuit.

REQUIRED INSTRUCTOR RATING

An active status unit specific CCR Trimix 60m Diving Instructor or higher may conduct the unit specific CCR Trimix 60m Diving program.

TEACHING RATIOS

- The maximum number of students for CCR training is 3:1

This ratio should be reduced as required if the situation and/or environmental conditions call for it.

STUDENT PREREQUISITES

- Decompression CCR Diver
- Have logged a minimum of 50 CCR dives over a minimum of 50 hours, including at least 20 dives deeper than 30m/98 feet and at least ten (10) dives requiring staged decompression.
- At least 25 dives / 25 hours are required on the specific unit.
- Minimum Age: 18

DURATION

- Minimum hours for course completion: 40
- Minimum number of days: 4

MATERIALS AND EQUIPMENT

The minimum required student and Instructor equipment for this program includes:

A complete CCR Unit that:

- Is compliant to local laws, is approved by the training agency, is properly functioning and is appropriate for bailout and accelerated decompression diving
- Has no non-manufacturer approved modifications
- Depth gauge & bottom timer, or dive computer
- Two off-board stage cylinders, one for bottom bailout, one for decompression suitable for a safe return to the surface including all safety and decompression stops in the event of an emergency
- Backup OC/CCR computer for bailout in the event of a system failure
- For Open water and lake environments with the exception of cave, a Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- A back up Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- Backup mask
- Cutting device
- Access to appropriate gas analyzers

All skills must be demonstrated by the instructor on the specific unit being trained.

The minimum required student and instructor materials for this program includes:

- KISS Rebreather unit specific user manual
- Agency student training manual or online training course

- Agency instructor manual (electronic instructor manuals meet this requirement)
- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)
- Manufacturer's sign off sheet/course completion document

REQUIREMENTS FOR COMPLETION

Academics

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Gas Physiology
   - Oxygen (O_2) toxicity, Hypoxia, Hyperoxia
   - Central nervous system (CNS) tracking
   - Oxygen tracking units (OTU)
   - Oxygen (O_2) metabolizing calculations
   - Carbon dioxide (CO_2) Toxicity, Hypercapnia
   - Nitrogen absorption
   - Equivalent narcosis depth theory
   - Helium absorption
   - HPNS
2. Gas mixing
3. Formula Work
4. Manually controlled closed circuit rebreathers
5. Dive Tables.
   - Creation of custom dive tables appropriate to dive depths
   - Creation of lower percentage of oxygen (PO_2) diluent to support loop flushing and bailout at depth
6. Dive Computers.
   - Mix adjustable
   - Constant PO_2
   - Decompression Conservatism / Gradient Factor selection
   - Oxygen (O_2) integrated
7. Dive Planning
   - Operational planning
   - Scrubber Duration
   - Gas requirements including bailout scenarios
   - Gas consumption
   - Gas management
8. Decompression on a CCR
   - Oxygen limitations
   - Nitrogen limitations
   - Helium limitations

9. Unit Assembly
   - Loop configurations

10. Unit Specific Check list

11. Equipment Maintenance
    - Fuel cell management
    - Date stamps
    - Replacement

12. Additional fitted equipment and modifications
    - Auto diluent addition
    - Dual mode mouthpieces
    - Heads up display
    - Additional manual injectors
    - Integrating oxygen monitors for dive computers

Skills

1. Pre-dive checks
   - Specific Unit Checklist
   - Verify diluent and oxygen (O_2) cylinder contents using appropriate gas analyzers
   - Unit build-up
   - Scrubber canister filling
   - Breathing loop check including mouthpiece one way valves and positive and negative check
   - Sensor calibration in oxygen, with verification in air
   - 5 minute pre-breathe
   - Stage cylinder rigging
   - KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures including
   - Limits based on system performance
   - Limits based on oxygen exposures at chosen PO_2 levels
   - Limits based on nitrogen absorption at planned depth and PO_2 set point
   - Appropriate selection of decompression conservatism / gradient factors for the planned dive
   - Thermal constraints

3. Underwater verification
   - Stop at 3-6 meters/9-19 feet on descent for leak bubble check
   - Counterlung & Over Pressure Valve adjustment, if necessary

4. Emergency procedures: demonstrate appropriate response to the following; each dive should have a minimum of 2 “diver emergencies” that the student must react to.
   - Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
   - Gas shutdowns and loss of gas, correct choice and switching to off board gases
   - Broken hoses, catastrophic failure scenarios
   - Flooded absorbent canister
   - Cell errors

5. Demonstrate competence managing two (2) bailout cylinders, including drop and recovery while maintaining position in the water

column

6. Rescue skill session as outlined by the training agency
7. Use of Buoyancy control system
   - Buoyancy and trim control at safety stop
   - Buoyancy and trim control during dive
   - Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
8. Controlling and monitoring for PPO2 levels:
   - Raising/lowering PPO2
   - Starting PPO2
   - PPO2 monitoring every minute
   - Manual Add Valve verification: static at constant depth, monitor change over several minutes
   - Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)
9. Electronic systems use:
   - Use and adjustment of Heads Up Display, position, brightness, colour
   - Use and adjustment of PPO2/depth/time display, position, brightness, colour
   - Use and adjustment of decompression computer, set up/gas switching, battery verification, etc
10. Use of lift bag/DSMB and reel
    - Use of lift bag/DSMB and reel at depth, and mid water
    - Simulate failed lift bag/DSMB deployment
    - On two (2) of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
11. Mask removal and replacement
12. Proper execution of the dive within all pre-determined dive limits
13. Demonstration of decompression stops at pre-determined depths
14. Cell validation checks with appropriate use of diluent and oxygen
    - Oxygen sensor verification at depth
    - Linearity check of sensors at approximately 5 meters/16 feet on pure oxygen
15. Decompression related in water skills
    - Demonstrate proper understanding and implementation of team diving procedures to conduct bailout from a depth greater than 30 meters/98 feet.
    - Demonstrate ability to plug in and share off-board gas, including sharing/swapping of off-board bailouts
    - Oxygen rebreather mode in depths less than six (6) meters/19 feet
16. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices

EXTRA REQUIREMENTS FOR COMPLETION

- Demonstrate an adequate level of fitness by completing a minimum of a 50m/164 feet surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete at least six (6) training dives, including one open water skill development session of at least one (1) hour, and a

minimum of five (5) open water training dives, with a minimum runtime of at least 30 minutes each.

- Complete a minimum of 360 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of seven years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of seven years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

Dive logs and student signed course completion forms are to be submitted to the manufacturer of the specific unit on request

DEPTH LIMITATIONS

- Open Water Training Dives shall be initially shallow, progressively increasing in depth.
- Two (2) dives should be deeper than 30 meters/98 feet
- And an additional two (2) dives should be deeper than 50 meters/164 feet for certification
- All dives must be conducted at a depth shallower than 60 meters/196 feet.

NOTES

- Dives 1 and 2 must be planned within the no-decompression limits of the Combined Air/EAN Tables or the student's personal dive computer or computer-generated decompression profiles.
- The planned decompression obligation (total ascent time including all decompression stops) for training dives must not exceed 30 minutes for dives 3 and 4, and must not exceed 60 minutes for dives 5 and 6.
- At least one (1) dive must have a total run time in excess of 60 minutes.
- If environmental or water conditions make it unsafe or impractical to meet the cumulative time requirement in six (6) dives, additional training dives should be scheduled.
- Bailout cylinder gas to be based on a maximum PPO_2 of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a PPO_2 higher than 1.2 bar at the bottom.
- The maximum loop set point is 1.3 bar.
- The maximum END for the Diluent for the bottom part of the dive, cannot be greater than 30m/98 feet

Diving in an overhead environment

- All skills must be demonstrated in an open water environment prior to entering the overhead environment
- The Instructor must be an active status overhead instructor for the particular environment
- The Diver must hold the user level overhead certification for the particular environment

SEQUENCE

Open Water Training Dive 2 may only be conducted after completing the surface diver tow and all the open water skill development session.

CERTIFICATION

The unit-specific CCR Trimix 60m Diving certification entitles the holder to dive autonomously with a buddy, diving on a rebreather or diving open circuit, on dives using Trimix with a minimum of 16% oxygen, utilizing CCR procedures to depths of 60m/196 feet, and requiring unlimited staged decompression
stops with a maximum of two bail out gas mixtures, providing that dives are conducted in environments similar to those of the diver's training and experience.

TRIMIX CCR DIVER 100m

INTENT

The intent of the CCR Trimix 100m Diving program is to provide divers with the training necessary to independently plan and conduct unit specific staged decompression dives to depths of up to 100m/328 feet using hypoxic Trimix mixtures and utilizing CCR diving procedures with a buddy diving on a rebreather or diving open circuit.

REQUIRED INSTRUCTOR RATING

An active status unit-specific CCR Trimix 100m instructor or higher may conduct the unit-specific CCR Trimix 100m program.

STUDENT PREREQUISITES

- CCR Trimix 60m Diving certification or equivalent.
- Have logged a minimum of 100 CCR dives over a minimum of 100 hours, including at least 30 dives deeper than 30m/98 feet, at least ten (10) dives deeper than 50m/164 feet and at least 20 dives requiring staged decompression.
- At least 50 dives / 50 hours are required on the specific unit.
- Minimum Age: 18

TEACHING RATIOS

- The maximum number of students for CCR training is 3:1

This ratio should be reduced as required if the situation and/or environmental conditions call for it.

DURATION

- Recommended hours for course completion: 30

MATERIALS AND EQUIPMENT

The minimum required student and Instructor equipment for this program includes:

A complete CCR Unit that:

- Is compliant to local laws, is approved by the training agency, is properly functioning and is appropriate for bailout and accelerated decompression diving
- Has no non-manufacturer approved modifications
- Depth gauge & bottom timer, or dive computer
- Three (3) bailout stage cylinders, one for bottom bailout, all with 1-2 meter hose second-stage and SPG, low-pressure inflator hose or quick-connect compatible with the unit if applicable, Oxygen cleaned as required
- Backup OC/CCR computer for bailout in the event of a system failure
- Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- A back up Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- Backup mask
- Cutting devices
- Emergency spool
- Access to emergency decompression gas, by team sharing, staging, or from support divers
- Access to appropriate gas analyzers

All skills must be demonstrated by the instructor on the specific unit being trained.

The minimum required student and instructor materials for this program includes:

- KISS Rebreather unit specific user manual
- Agency student training manual or online training course
- Agency instructor manual (electronic instructor manuals meet this requirement)

- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)

REQUIREMENTS FOR COMPLETION

Academics

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Gas Physiology
   - Oxygen (O_2) toxicity, Hypoxia, Hyperoxia
   - Oxygen (O_2) metabolizing calculations
   - Central nervous system (CNS) tracking
   - Oxygen tracking units (OTU)
   - Carbon dioxide (CO_2) toxicity, Hypercapnia
   - Nitrogen absorption
   - Equivalent narcosis depth theory
   - Helium absorption
   - HPNS
2. Gas mixing
3. Formula Work
4. Manually controlled closed circuit rebreathers
5. Dive Tables.
   - Creation of custom dive tables appropriate to dive depths
   - Creation of lower percentage of oxygen (PO_2) diluent to support loop flushing and bailout at depth
6. Dive Computers.
   - Mix adjustable
   - Constant partial pressure of oxygen (PPO_2)
   - Decompression Conservatism / Gradient Factor selection
   - Oxygen (O_2) integrated
7. Dive Planning
   - Operational planning
   - Scrubber Duration
   - Gas requirements including bailout scenarios
   - Gas management
   - Gas consumption
8. Decompression on a CCR
   - Oxygen limitations
   - Nitrogen limitations
   - Helium limitations
9. Unit Assembly
   - Loop configurations

10. Unit Specific Check list

11. Equipment Maintenance
    - Oxygen Sensor management
    - Date stamps
    - Replacement

12. Additional fitted equipment and modifications
    - Auto diluent addition
    - Dual mode mouthpieces
    - Heads up display
    - Additional manual injectors
    - Integrating oxygen monitors for dive computers

Skills

1. Pre-dive checks
    - Specific Unit Checklist
    - Verify diluent and oxygen (O_2) cylinder contents using appropriate gas analyzers
    - Unit build-up
    - Scrubber canister filling
    - Breathing loop check including mouthpiece one way valves and positive and negative check
    - Sensor calibration in oxygen, with verification in air
    - 5 minute pre-breathe
    - Stage cylinder rigging
    - KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures including
    - Limits based on system performance
    - Limits based on oxygen exposures at chosen PO_2 levels
    - Limits based on nitrogen absorption at planned depth and PO_2 set point
    - Appropriate selection of decompression conservatism / gradient factors for the planned dive
    - Thermal constraints

3. Underwater verification
    - Stop at 3-6 meters/9-19 feet on descent for leak bubble check
    - Counterlung & Over Pressure Valve adjustment, if necessary

4. Emergency procedures: demonstrate appropriate response to the following; each dive should have a minimum of 2 “diver emergencies” that the student must react to.
    - Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
    - Gas shutdowns and loss of gas, correct choice and switching to off board gases
    - Broken hoses, catastrophic failure scenarios
    - Flooded absorbent canister
    - Cell errors

5. Demonstrate competence managing three (3) bailout cylinders, including drop and recovery while maintaining position in the water column

6. Ability to manage multiple failures in adverse conditions

7. Rescue skill session as outlined by the training agency

8. Use of Buoyancy control system
   - Buoyancy and trim control at safety stop
   - Buoyancy and trim control during dive
   - Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet

9. Controlling and monitoring for PPO2 levels:
   - Raising/lowering PPO2
   - Starting PPO2
   - PPO2 monitoring every minute
   - Manual Add Valve verification: static at constant depth, monitor change over several minutes
   - Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)

10. Electronic systems use:
    - Use and adjustment of Heads Up Display, position, brightness, colour
    - Use and adjustment of PPO2/depth/time display, position, brightness, colour
    - Use and adjustment of decompression computer, set up/gas switching, battery verification, etc

11. Use of lift bag/DSMB and reel
    - Use of lift bag/DSMB and reel at depth, and mid water
    - Simulate failed lift bag/DSMB deployment
    - On two (2) of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression

12. Mask removal and replacement

13. Proper execution of the dive within all pre-determined dive limits

14. Demonstration of decompression stops at pre-determined depths

15. Cell validation checks with appropriate use of diluent and oxygen
    - Oxygen sensor verification at depth
    - Linearity check of sensors at approximately 5 meters/16 feet on pure oxygen

16. Decompression related in water skills
    - Demonstrate proper understanding and implementation of team diving procedures to conduct bailout from a depth greater than 40 meters/131 feet.
    - Demonstrate ability to plug in and share off-board gas, including sharing/swapping of off-board bailouts
    - Oxygen rebreather mode in depths less than six (6) meters/19 feet

17. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices

18. Demonstrate of surface support/support divers in dealing with bailout scenario

EXTRA REQUIREMENTS FOR COMPLETION

- Demonstrate an adequate level of fitness by completing a minimum of a 50m/164 feet surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete at least six (6) training dives, including one open water skill development session of at least one (1) hour, and a

minimum of five (5) open water training dives, with a minimum runtime of at least 30 minutes each.

- Complete a minimum of 360 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of seven years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of seven years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

Dive logs and student signed course completion forms are to be submitted to the manufacturer of the specific unit on request

DEPTH LIMITATIONS

- Open Water Training Dives shall be initially shallow, progressively increasing in depth.
- Two (2) dives should be deeper than 40 meters/131 feet
- And an additional two (2) dives should be deeper than 70 meters/229 feet for certification
- All dives must be conducted at a depth shallower than 100 meters/328 feet

Local rules or regulations may dictate the maximum depth permitted. If so, the local rules would supercede any other standards.

NOTES

- Dives 1 must be planned within the no-decompression limits of the Combined Air/EAN Tables or the student's personal dive computer or computer-generated decompression profiles.
- The primary planned decompression obligation (total time of all decompression stops including deep stops, if used) for training dives must not exceed 30 minutes for dives 2, 3 and 4, and 60 minutes for dives 5 and 6.
- At least one (1) dive must have a total run time in excess of 60 minutes.
- If environmental or water conditions make it unsafe or impractical to meet the cumulative time requirement in six (6) dives, additional training dives should be scheduled.
- Bailout cylinder gas to be based on a maximum PPO_2 of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a PPO_2 higher than 1.1 bar at the bottom.
- The maximum loop set point is 1.3 bar.
- The maximum END for the Diluent for the bottom part of the dive, cannot be greater than 30m/98 feet
- Preliminary dives 1 and 2 must have a minimum run time of 30 minutes.

Diving in an overhead environment

- All skills must be demonstrated in an open water environment prior to entering the overhead environment
- The Instructor must be an active status overhead instructor for the particular environment
- The Diver must hold the user level overhead certification for the particular environment

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SEQUENCE

Open Water Training Dives 2 may only be conducted after completing the surface diver tow and the open water skill development session.

CERTIFICATION

The unit-specific CCR Trimix 100m Diver certification entitles the holder to dive autonomously with a buddy, diving on a rebreather or diving open circuit, on dives using Hypoxic Trimix and utilizing CCR procedures to depths of 100m,/328 feet providing that dives are conducted in environments similar to those of the diver's training and experience.

CCR DIVER CROSSOVER

INTENT

The intent of the program is to provide divers already certified on a unit with additional unit specific training to get certified on an additional unit, following RESA minimum training standards.

REQUIRED INSTRUCTOR RATING

An active status unit specific CCR instructor at the level the candidate is crossing over for

ADMINISTRATIVE REQUIREMENTS

- Course liability release and assumption of risk (in accordance with local laws)
- Health screening document
- Anything else as required by the Training Agency or manufacturer

STUDENT PREREQUISITES

- Be certified as a CCR Diver or Decompression CCR Diver from a RESA recognized training agency
- Show proof of 10 logged CCR dives in the last 12 months
- Minimum age 18 years

NOTE

- Crossover is not allowed for certifications on SCR or PSCR, or for CCR certifications that only allow a lesser dive depth: in all these cases a full course is mandatory
- Crossover applies to rebreathers of different brand/manufacturers
- Crossovers between similar units of the same brand/manufacturer may require an upgrade course as specified by the manufacturer
- Standard KISS CCR/KISS Spirit Sidewinder to KISS Sidekick CCR: minimum of 60 minutes of confined water time, with an additional 140 minutes of in-water time. Overview of the KISS Sidekick CCR operating system.
- Standard KISS CCR/KISS Sidekick to KISS Spirit Sidewinder CCR: minimum of 180 minutes of open water training, conducted over 3 open water dives. Overview of the KISS Spirit Sidewinder configuration, and unit setup.

MATERIALS AND EQUIPMENT

- As specified in the specific diver level course standard

DURATION

- Recommended hours for course completion: 16 to 24
- The number of classes, hours and sessions per day are set by the training agency.

REQUIREMENTS FOR COMPLETION

The crossover course will include:

- CCR assembly workshop.
- A 60 minute water skills evaluation in a confined skill session. All skills from the level the candidate is crossing over at must be demonstrated successfully prior to open water dives.
- Complete a minimum of 4 open water dives and a total accumulated dive time of minimum 240 minutes, demonstrating proficiency in all skills from the level the diver is crossing over at
- Complete a final exam with a passing score as specified by the Training Agency and the Manufacturer.

CCR Trimix 60m Diver

- A diver certified as a CCR Trimix 60m diver may crossover that rating on the new unit after successfully meeting the crossover requirements for Decompression CCR diver on the new unit.

All CCR Trimix 60m diver standards must be met except; Minimum of 120 minutes open water training to be completed over a minimum of 2 dives to a maximum depth of 60m/196ft

- Must demonstrate proficiency in all required academics and skills at the CCR Trimix 60m diver level

CCR Trimix 100m Diver

- A diver certified as a CCR Trimix 100m diver may crossover that rating on the new unit after successfully meeting the crossover requirements for CCR Trimix 60m diver on the new unit.

All CCR Trimix 100m diver standards must be met except: Minimum of 120 minutes open water training to be completed over a minimum of 2 dives to a maximum depth of 100m/328ft

- Must demonstrate proficiency in all required academics and skills at the CCR Trimix 100m diver level

KISS Rebreather LLC. – CCR Diver Course Evaluation Form

As per the KISS minimum required training standards, the course must be completed with the minimum required dives and minutes, along with discussion on required academic topics, and all required skills. The student must achieve a minimum score of 8 out of 10 points in all the following skill areas.

KISS minimum training standards may differ from approved training agency standards. As KISS minimum training standards are the minimum required standard, the approved training agencies may add to them. Instructors should check with the appropriate training agency to ensure that all standards have been met.

Student: _____ Instructor: _____
Course start date: _____ Course completion date: _____
KISS rebreather name & serial number: _____

Skills:

1. Pre-dive checks: Average score: ____
   - ____ Specific unit checklist
   - ____ Verify diluent and oxygen (O2) cylinder contents using gas analyzers
   - ____ Unit built up
   - ____ Scrubber canister filling
   - ____ Breathing loop check including mouthpiece one way valves and positive and negative check
   - ____ Sensor calibration in oxygen, with verification in air
   - ____ 5 minute pre-breathe
   - ____ Bailout bottle/stage cylinder rigging
   - ____ KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures: Average score: ____
   - ____ Limits based on system performance
   - ____ Limits based on oxygen exposures at chosen PO2 levels
   - ____ Limits based on nitrogen absorption at planned depth and PO2 set point
   - ____ Appropriate selection of decompression conservatism/gradient factors for the planned dive
   - ____ Thermal constraints

3. Underwater verification: Average score: ____
   - ____ Stop at 3-6 meters/9-19 feet on descent for leak bubble check
   - ____ Counterlung and Over Pressure Valve adjustment, if necessary

4. Mouthpiece familiarity skills: Average score: ____
   - ____ BOV: switch between open and closed circuit
   - ____ DSV: switch to bailout system

5. Adding diluent gas/ADV familiarity skills: Average score: ____
   - ____ ADV: Adding diluent gas and understand how it works
   - ____ BOV: Use BOV to add diluent gas to the loop – 2 ways

____ Bail out second stage: Use to add diluent gas to the loop
____ Dual button MAV: Adding diluent gas (if unit is shipped with this item)

6. Emergency procedures: demonstrate appropriate response to the following; each dive should have a minimum of 2, "diver emergencies" that the student must react to: Average score: ____
   ____ Practical bailout skills: including 2 open circuit ascent's from approximately 18 meters/59 feet
   ____ Gas shut downs and loss of gas
   ____ Broken hoses
   ____ Flooded absorbent canister
   ____ Carbon dioxide (CO2) breakthrough
   ____ Low oxygen drills
   ____ High oxygen drills
   ____ Flooding loop
   ____ Electronics, sensor, and battery failure

7. Practice transferring to open circuit bailout: Score: ____

8. Rescue skill session as outlined by Training Agency: Score: ____

9. Use of buoyancy control system: Average score: ____
   ____ Buoyancy and trim control at safety stop
   ____ Buoyancy and trim control during dive

10. Controlling and monitoring for PPO2 levels: Average score: ____
    ____ Raising/lowering PPO2
    ____ Starting PPO2
    ____ PPO2 monitoring every minute
    ____ Manual Add Valve verification: static at constant depth, monitor change over several minutes
    ____ Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)

11. Electronic systems use: Average score: ____
    ____ Use and adjustment of Heads Up Display, position, brightness, colour
    ____ Use and adjustment of PPO2/depth/time display, position, brightness, colour
    ____ Use and adjustment of decompression computer, set up/gas switching, battery verification, etc

12. Use of lift bag/DSMB and reel (where relevant and applicable): Score: ____

13. Mask removal and replacement: Score: ____

14. Proper execution of the dive within all pre-determined dive limits: Score: ____

15. Demonstration of safety stops at pre-determined depths (on all dives): Score: ____

16. Constant loop volume management: Score: ____

17. Cell validation checks with appropriate use of diluent and oxygen: Average score: ____
    ____ Oxygen sensor verification at depth
    ____ Linearity check of sensors at approximately 5 meter/16 feet on pure oxygen

18. Post dive cleaning of unit: Average score: ____

____ Mouthpiece and hoses
____ Clean and disinfect unit
____ Inspect components of unit

19. Diver maintenance of unit: Average score: ____
    ____ Cell removal and replacement
    ____ Mouthpiece care
    ____ Replacing or re-charging of batteries

20. Demonstrate an adequate level of fitness by completing a minimum of a 50 meter/164 feet surface diver tow with both rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program: Score: ____

21. Complete all academic sessions and unit specific assessments as specified in the training material of the training agency and the manufacturer: Completed: ____

22. Complete a minimum of seven (7) training dives, including confided water skill development of at least one (1) hour, and six (6) core open water training dives with a minimum run time of 30 minutes each: Completed: ____

23. Complete a minimum of 420 minutes of total in-water time (including confined water) on the applicable unit: Completed: ____

24. Be able to independently complete a dive plan: Completed: ____

25. Complete the final course exam as set out by the training agency with a required minimum pass rate of 80% with 100% remediation: Completed: ____

Student Signature: _____ Date: _____
Instructor signature: _____Date: _____

In order to complete the students KISS certification, this document must be completed in full, and emailed to: info@kissrebreathers.com.

PLEASE PRINT CLEARLY - IF WE CAN'T READ YOUR WRITING, WE CAN NOT PROCESS THIS FORM. THANK YOU!

KISS Rebreather LLC. – CCR Decompression Diver Course Evaluation Form

As per the KISS minimum required training standards, the course must be completed with the minimum required dives and minutes, along with discussion on required academic topics, and all required skills. The student must achieve a minimum score of 8 out of 10 points in all the following skill areas.

KISS minimum training standards may differ from approved training agency standards. As KISS minimum training standards are the minimum required standard, the approved training agencies may add to them. Instructors should check with the appropriate training agency to ensure that all standards have been met.

Student: _____ Instructor: _____
Course start date: _____ Course completion date: _____
KISS rebreather name & serial number: _____

Skills:

1. Pre-dive checks: Average score: ____
   ____ Specific unit checklist
   ____ Verify diluent and oxygen (O2) cylinder contents using gas analyzers
   ____ Unit built up
   ____ Scrubber canister filling
   ____ Breathing loop check including mouthpiece one way valves and positive and negative check
   ____ Sensor calibration in oxygen, with verification in air
   ____ 5 minute pre-breathe
   ____ Stage cylinder rigging
   ____ KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures: Average score: ____
   ____ Limits based on system performance
   ____ Limits based on oxygen exposures at chosen PO2 levels
   ____ Limits based on nitrogen absorption at planned depth and PO2 set point
   ____ Appropriate selection of decompression conservatism/gradient factors for the planned dive
   ____ Thermal constraints

3. Underwater verification: Average score: ____
   ____ Stop at 3-6 meters/9-19 feet on descent for leak bubble check
   ____ Counterlung and Over Pressure Valve adjustment, if necessary

4. Mouthpiece familiarity skills: Average score: ____
   ____ BOV: switch between open and closed circuit
   ____ DSV: switch to bailout system

5. Adding diluent gas/ADV familiarity skills: Average score: ____
   ____ ADV: Adding diluent gas and understand how it works
   ____ BOV: Use BOV to add diluent gas to the loop – 2 ways

____ Bail out second stage: Use to add diluent gas to the loop
____ Dual button MAV: Adding diluent gas (if unit is shipped with this item)

6. Emergency procedures: demonstrate appropriate response to the following; each dive should have a minimum of 2, "diver emergencies" that the student must react to: Average score: ____
   ____ Practical bailout skills: including 2 open circuit ascent's from approximately 18 meters/59 feet
   ____ Gas shut downs and loss of gas
   ____ Broken hoses
   ____ Flooded absorbent canister
   ____ Carbon dioxide (CO2) breakthrough
   ____ Low oxygen drills
   ____ High oxygen drills
   ____ Flooding loop
   ____ Electronics, sensor, and battery failure

7. Practice transferring to open circuit bailout: Score: ____

8. Rescue skill session as outlined by Training Agency: Score: ____

9. Use of buoyancy control system: Average score: ____
   ____ Buoyancy and trim control at safety stop
   ____ Buoyancy and trim control during dive

10. Controlling and monitoring for PPO2 levels: Average score: ____
    ____ Raising/lowering PPO2
    ____ Starting PPO2
    ____ PPO2 monitoring every minute
    ____ Manual Add Valve verification: static at constant depth, monitor change over several minutes
    ____ Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)

11. Electronic systems use: Average score: ____
    ____ Use and adjustment of Heads Up Display, position, brightness, colour
    ____ Use and adjustment of PPO2/depth/time display, position, brightness, colour
    ____ Use and adjustment of decompression computer, set up/gas switching, battery verification, etc

12. Use of lift bag/DSMB and reel (where relevant and applicable): Score: ____

13. Mask removal and replacement: Score: ____

14. Proper execution of the dive within all pre-determined dive limits: Score: ____

15. Demonstration of safety stops at pre-determined depths (on all dives): Score: ____

16. Constant loop volume management: Score: ____

17. Cell validation checks with appropriate use of diluent and oxygen: Average score: ____
    ____ Oxygen sensor verification at depth
    ____ Linearity check of sensors at approximately 5 meter/16 feet on pure oxygen

18. Post dive cleaning of unit: Average score: ____
    ____ Mouthpiece and hoses
    ____ Clean and disinfect unit
    ____ Inspect components of unit

19. Diver maintenance of unit: Average score: ____
    ____ Cell removal and replacement
    ____ Mouthpiece care
    ____ Replacing or re-charging of batteries

20. Decompression related in-water skills: Average score: ____
    ____ Demonstrate the ability to drop and retrieve one (1) bailout cylinder while maintaining position in the water column
    ____ Demonstrate appropriate reaction to gas hemorrhage from bailout valve, first stage, second stage or SPG
    ____ Demonstrate appropriate reaction to simulated free-flowing deco regulator
    ____ Demonstrate the ability to Buddy Breathe from a decompression gas
    ____ Oxygen rebreather mode at less than six (6) meter/19 foot stop
    ____ Complete two (2) bailout scenario at depth to include decompression obligation on open circuit

21. Demonstrate an adequate level of fitness by completing a minimum of a 50 meter/164 feet surface diver tow with both rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program: Score: ____

22. Complete all academic sessions and unit specific assessments as specified in the training material of the training agency and the manufacturer: Completed: ____

23. Complete a minimum of seven (7) training dives, including confided water skill development of at least one (1) hour, and six (6) core open water training dives with a minimum run time of 30 minutes each: Completed: ____

24. Complete a minimum of 420 minutes of total in-water time (including confined water) on the applicable unit: Completed: ____

25. Be able to independently complete a dive plan: Completed: ____

26. Complete the final course exam as set out by the training agency with a required minimum pass rate of 80% with 100% remediation: Completed: ____

Student Signature: _____ Date: _____
Instructor signature: _____Date: _____

In order to complete the students KISS certification, this document must be completed in full, and emailed to: info@kissrebreathers.com.

PLEASE PRINT CLEARLY - IF WE CAN'T READ YOUR WRITING, WE CAN NOT PROCESS THIS FORM. THANK YOU!

KISS Rebreather LLC. – Trimix CCR Diver 60m – Diver Course Evaluation Form

As per the KISS minimum required training standards, the course must be completed with the minimum required dives and minutes, along with discussion on required academic topics, and all required skills. The student must achieve a minimum score of 8 out of 10 points in all the following skill areas.

KISS minimum training standards may differ from approved training agency standards. As KISS minimum training standards are the minimum required standard, the approved training agencies may add to them. Instructors should check with the appropriate training agency to ensure that all standards have been met.

Student: _____ Instructor: _____
Course start date: _____ Course completion date: _____
KISS rebreather name & serial number: _____

Skills:

1. Pre-dive checks: Average score: ____
   ____ Specific unit checklist
   ____ Verify diluent and oxygen (O2) cylinder contents using gas analyzers
   ____ Unit built up
   ____ Scrubber canister filling
   ____ Breathing loop check including mouthpiece one way valves and positive and negative check
   ____ Sensor calibration in oxygen, with verification in air
   ____ 5 minute pre-breathe
   ____ Stage cylinder rigging
   ____ KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures: Average score: ____
   ____ Limits based on system performance
   ____ Limits based on oxygen exposures at chosen PO2 levels
   ____ Limits based on nitrogen absorption at planned depth and PO2 set point
   ____ Appropriate selection of decompression conservatism/gradient factors for the planned dive
   ____ Thermal constraints

3. Underwater verification: Average score: ____
   ____ Stop at 3-6 meters/9-19 feet on descent for leak bubble check
   ____ Counterlung and Over Pressure Valve adjustment, if necessary

4. Emergency procedures: demonstrate appropriate response to the following; each dive should have a minimum of 2, ”diver emergencies” that the student must react to: Average score: ____
   ____ Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
   ____ Gas shutdowns and loss of gas, correct choice and switching to off board gases.
   ____ Broken hoses, catastrophic failure scenarios
   ____ Flooded absorbent canister

____ Cell errors

5. Demonstrate competence managing two (2) bailout cylinders, including drop and recovery while maintaining position in the water column: Score: ____

6. Rescue skill session as outlined by Training Agency: Score: ____

7. Use of buoyancy control system: Average score: ____
   ____ Buoyancy and trim control at safety stop
   ____ Buoyancy and trim control during dive
   ____ Buoyancy and trim control hover at fixed position in water column without moving hands or feet

8. Controlling and monitoring for PPO2 levels: Average score: ____
   ____ Raising/lowering PPO2
   ____ Starting PPO2
   ____ PPO2 monitoring every minute
   ____ Manual Add Valve verification: static at constant depth, monitor change over several minutes
   ____ Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)

9. Electronic systems use: Average score: ____
   ____ Use and adjustment of Heads Up Display, position, brightness, colour
   ____ Use and adjustment of PPO2/depth/time display, position, brightness, colour
   ____ Use and adjustment of decompression computer, set up/gas switching, battery verification, etc

10. Use of lift bag/DSMB and reel: Average score: ____
    ____ Use of lift bag/DSMB and reel at depth, and mid water
    ____ Simulate failed lift bag/DSMB deployment
    ____ On two (2) of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression

11. Mask removal and replacement: Score: ____

12. Proper execution of the dive within all pre-determined dive limits: Score: ____

13. Demonstration of decompression stops at pre-determined depths (on all dives): Score: ____

14. Cell validation checks with appropriate use of diluent and oxygen: Average score: ____
    ____ Oxygen sensor verification at depth
    ____ Linearity check of sensors at approximately 5 meter/16 feet on pure oxygen

15. Decompression related in-water skills: Average score: ____
    ____ Demonstrate proper understanding and implementation of team diving procedures to conduct bailout from a depth greater than 30 meters/98 feet
    ____ Demonstrate ability to plug in and share off-board gas, including sharing/swapping of off-board bailouts
    ____ Oxygen rebreather mode at less than six (6) meter/19 foot stop

16. Show awareness of buddy and other team members through communications, proximity and team oriented dive practices: Score: ____

17. Demonstrate an adequate level of fitness by completing a minimum of a 50 meter/164 feet surface diver tow with both rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program: Score: ____

18. Complete all academic sessions and unit specific assessments as specified in the training material of the training agency and the manufacturer: Completed: ____

19. Complete a minimum of six (6) training dives, including confided water skill development of at least one (1) hour, and five (5) core open water training dives with a minimum run time of 30 minutes each: Completed: ____

20. Complete a minimum of 360 minutes of total in-water time (including confined water) on the applicable unit: Completed: ____

21. Be able to independently complete a dive plan: Completed: ____

22. Complete the final course exam as set out by the training agency with a required minimum pass rate of 80% with 100% remediation: Completed: ____

Student Signature: _____ Date: _____
Instructor signature: _____Date: _____

In order to complete the students KISS certification, this document must be completed in full, and emailed to: info@kissrebreathers.com.

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KISS Rebreather LLC. – Trimix CCR Diver 100m – Diver Course Evaluation Form

As per the KISS minimum required training standards, the course must be completed with the minimum required dives and minutes, along with discussion on required academic topics, and all required skills. The student must achieve a minimum score of 8 out of 10 points in all the following skill areas.

KISS minimum training standards may differ from approved training agency standards. As KISS minimum training standards are the minimum required standard, the approved training agencies may add to them. Instructors should check with the appropriate training agency to ensure that all standards have been met.

Student: _____ Instructor: _____
Course start date: _____ Course completion date: _____
KISS rebreather name & serial number: _____

Skills:

1. Pre-dive checks: Average score: ____
   ____ Specific unit checklist
   ____ Verify diluent and oxygen (O2) cylinder contents using gas analyzers
   ____ Unit built up
   ____ Scrubber canister filling
   ____ Breathing loop check including mouthpiece one way valves and positive and negative check
   ____ Sensor calibration in oxygen, with verification in air
   ____ 5 minute pre-breathe
   ____ Stage cylinder rigging
   ____ KISS Sidekick: unit rigging, diluent/oxygen cylinder rigging for best work of breathing/how to resolve incorrect rigging

2. Demonstrate correct pre-dive planning procedures: Average score: ____
   ____ Limits based on system performance
   ____ Limits based on oxygen exposures at chosen PO2 levels
   ____ Limits based on nitrogen absorption at planned depth and PO2 set point
   ____ Appropriate selection of decompression conservatism/gradient factors for the planned dive
   ____ Thermal constraints

3. Underwater verification: Average score: ____
   ____ Stop at 3-6 meters/9-19 feet on descent for leak bubble check
   ____ Counterlung and Over Pressure Valve adjustment, if necessary

4. Emergency procedures: demonstrate appropriate response to the following; each dive should have a minimum of 2, ”diver emergencies” that the student must react to: Average score: ____
   ____ Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
   ____ Gas shutdowns and loss of gas, correct choice and switching to off board gases.
   ____ Broken hoses, catastrophic failure scenarios
   ____ Flooded absorbent canister

____ Cell errors

5. Demonstrate competence managing three (3) bailout cylinders, including drop and recovery while maintaining position in the water column: Score: ____

6. Ability to manage multiple failures in adverse conditions: Score: ____

7. Rescue skill session as outlined by Training Agency: Score: ____

8. Use of buoyancy control system: Average score: ____
   ____ Buoyancy and trim control at safety stop
   ____ Buoyancy and trim control during dive
   ____ Buoyancy and trim control hover at fixed position in water column without moving hands or feet

9. Controlling and monitoring for PPO2 levels: Average score: ____
   ____ Raising/lowering PPO2
   ____ Starting PPO2
   ____ PPO2 monitoring every minute
   ____ Manual Add Valve verification: static at constant depth, monitor change over several minutes
   ____ Electronics systems monitoring for PPO2 levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available (when the unit is equipped with an on board decompression computer that monitors sensors)

10. Electronic systems use: Average score: ____
    ____ Use and adjustment of Heads Up Display, position, brightness, colour
    ____ Use and adjustment of PPO2/depth/time display, position, brightness, colour
    ____ Use and adjustment of decompression computer, set up/gas switching, battery verification, etc

11. Use of lift bag/DSMB and reel: Average score: ____
    ____ Use of lift bag/DSMB and reel at depth, and mid water
    ____ Simulate failed lift bag/DSMB deployment
    ____ On two (2) of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression

12. Mask removal and replacement: Score: ____

13. Proper execution of the dive within all pre-determined dive limits: Score: ____

14. Demonstration of decompression stops at pre-determined depths (on all dives): Score: ____

15. Cell validation checks with appropriate use of diluent and oxygen: Average score: ____
    ____ Oxygen sensor verification at depth
    ____ Linearity check of sensors at approximately 5 meter/16 feet on pure oxygen

16. Decompression related in-water skills: Average score: ____
    ____ Demonstrate proper understanding and implementation of team diving procedures to conduct bailout from a depth greater than 40 meters/131 feet
    ____ Demonstrate ability to plug in and share off-board gas, including sharing/swapping of off-board bailouts
    ____ Oxygen rebreather mode at less than six (6) meter/19 foot stop

17. Show awareness of buddy and other team members through communications, proximity and team oriented dive practices: Score: ____

18. Demonstrate of surface support/support divers in dealing with bailout scenario: Score: ____

19. Demonstrate an adequate level of fitness by completing a minimum of a 50 meter/164 feet surface diver tow with both rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program: Score: ____

20. Complete all academic sessions and unit specific assessments as specified in the training material of the training agency and the manufacturer: Completed: ____

21. Complete a minimum of six (6) training dives, including confided water skill development of at least one (1) hour, and five (5) core open water training dives with a minimum run time of 30 minutes each: Completed: ____

22. Complete a minimum of 360 minutes of total in-water time (including confined water) on the applicable unit: Completed: ____

23. Be able to independently complete a dive plan: Completed: ____

24. Complete the final course exam as set out by the training agency with a required minimum pass rate of 80% with 100% remediation: Completed: ____

Student Signature: _____ Date: _____
Instructor signature: _____Date: _____

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HOLLIS BOV (Bail Out Valve)

SPECIFICATIONS

Torques
Inlet Coupling 35 to 40 in-lbs (4-4.5 N-m)
LP Hose 35 to 40 in-lbs (4-4.5 N-m)

Intermediate Supply Pressure
Preferred 138 psi (9.5 bar)
Acceptable 137 to 139 psi (9.4-9.6 bar)

Opening Effort IP = 138 psi (9.5 bar)
Recommended Setup Range (Octopus) 1.5 to 2.2 inches of Water

TOOLS REQUIRED

Standard Tools

Inch Pounds Torque Wrench
3/4" Open End Wrench
1/8" Allen Key
Flat Blade (narrow) Jeweler's Screwdriver
1/4" Open End Wrench
11/16" Open End Wrench
3/32" Allen Key
Cotton Swab (Q-Tip)

Specialty Tools

Tribolube 71
Christo-Lube MCG 111
Intermediate Pressure Gauge
O-ring Tool Kit
In-line Adjustment Tool

BOV SPOOL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Failed mushroom valve checks	obstructed or damaged **mushroom valves (26), valve holders (22, 23)**, or **O-rings (24, 25)**	clean/replace **mushroom valves (26)**, **valve holders (22, 23)**, and **O-rings (24, 25)**
Leaking gas out of Breathing Loop	worn **O-rings (18, 24, 25, 29)**	replace **O-rings (18, 24, 25, 29)**
Rough **spool (16)** operation	dirty or damaged mating surfaces	clean/lubricate/replace **O-rings (18, 29)**, **housing (1)**, or **spool (16)**
Water **spool (16)**	1. **mouthpiece (27)** or **Ty-Strap (28)** damaged, loose, or missing 2. bad **O-rings (18, 24, 25, 29)** 3. Leak in Breathing Loop	1. replace **Ty-Strap (9)** and/or **mouthpiece (27)** 2. replace **O-rings (18, 24, 25, 29)** 3. see the "Breathing Hoses and Counterlungs" chapter

BOV MODES

Figure 1

The BOV has two modes that are alternated by moving the **lever (34)** *(Fig. 1)*:

- OC (Open Circuit Position) - used for bail out off of the rebreather
- CC (Closed Circuit Position)

BOV SPOOL DISASSEMBLY

NOTE: O-rings must be changed any time they show signs of decay or damage.

Figure 2

1. Using an 11/16" open end wrench, remove the LP hose end from the **coupling (2)** on the BOV *(Fig. 2)*.

NOTE: To avoid internal corrosion and damage, NEVER submerge the BOV assembly in liquid with the LP Hose removed from the COUPLING (2).

Figure 3

2. Slide the silicone hose clamp covers off of the Oetiker clamps.

3. Using Oetiker style pliers, remove the Oetiker clamps that retain the BOV hose adapters into the inhalation and exhalation breathing hoses *(Fig. 3)*.

4. Unscrew the breathing hose nuts, and remove the BOV breathing hoses and adapters.

Figure 4

5. Pinch the hose adapter O-rings to remove as shown *(Fig. 4)*. Inspect the O-rings and seating surfaces for deterioration and damage. If found, discard.

Figure 5

6. Peel back the exhalation **mushroom valve (6)**, gently hold it open. Then using the rubberized end of a pencil, wooden dowel, or other blunt instrument, insert the tool through the **exhalation valve holder (22)**, and gently push out the **inhalation valve holder (23)** assembly *(Fig. 5)*.

NOTE: DO NOT push on the center of the INHALATION VALVE HOLDER (23). ONLY push on the outer edge.

7. Turn the BOV over and press out the **exhalation valve holder (22)** in the same fashion as in step 6.

Figure 6

8. Remove the valve holder **O-rings (24, 25)**, and clean the **O-ring (24, 25)** grooves *(Fig. 6)*. Inspect the **O-rings (24, 25)** for damage. If found, discard.

9. The **mushroom valves (26)** may be removed by grasping them at the flange and pulling them straight out, snipping the retainer stem if necessary *(Fig. 7)*. Discard.

Figure 7

10. Examine the **valve holders (22, 23)** for cracks and other damage, discard if found. Otherwise, wash, sanitize, and remove any debris from the **valve holders (22, 23)**.

11. Snip the plastic **ty-strap (28)** that holds the **mouth- piece (27)**, and remove the **mouthpiece (27)**. Inspect the condition of the **mouthpiece (27)** to ensure that it is supple and free of any tears or corrosion. Discard if found.

12. Using a 1/8" L-shaped Allen key, remove the **lever screw (33)**, **lever (34)**, and **O-ring (35)** by turning counterclockwise *(Fig. 8)*. Inspect the **O-ring (35)** for any signs of decay. Discard if found.

Figure 8

NOTE: Be careful not to damage the sealing surface of the inner METAL SPOOL (16) and BOV HOUSING (1).

13. Using your thumbs, gently press the **spool (16)** out of the BOV **housing (16)** *(Fig. 9)*.

Figure 9

14. Remove the four **O-rings (18, 24, 25, 29)** from the grooves of the **spool (16)**. Discard the schedule A **O-rings (18, 29)**. Inspect the other **O-rings (24, 25)** for any signs of decay. Discard if found.

15. Inspect the spool (16), **O-rings (18, 24, 25, 29)** channels, the lever **O-ring (35)** mounting face, and inside the BOV **housing (1)** for damage (nicks, gouges, etc.) that would prevent the **O-rings (18, 24, 25, 29, 35)** from sealing properly. If damage is found, the damaged part must be replaced.

BOV SPOOL REASSEMBLY

1. Lubricate the O-ring channels for the 3 spool **O- rings (18)**, in the metal **spool (16)** *(Fig. 10)*. Then install the four O-rings **(18, 24, 25, 29)**.

Figure 10

NOTE: Using a syringe simplifies this task and reduces waste. Lubricating the 3 spool O-ring grooves directly also improves SPOOL (16) rotational movement.

2. Lightly lubricate the internal walls of the BOV **housing (1)**.

3. Being careful not to pinch any O-rings, press the **spool (16)** into the BOV **housing (1)** *(Fig. 11)*.

Figure 11

NOTE: Ensure that the holes for the installation of the LEVER (34) are aligned when installing the SPOOL (16).

4. Holding the **lever screw (33)** in one hand, place the **O-ring (35)** in the groove as shown *(Fig. 12)*.

Figure 12

5. Hold the **lever (34)** in place, and start the **lever screw (33)** by hand clockwise. Then continue tightening the **lever screw (33)** with a 5/32" L-shaped Allen key *(Fig. 13)*. **DO NOT** over-tighten.

Figure 13

NOTE: Be careful not to damage the sealing surface of the INNER SPOOL (16) and BOV HOUSING (1).

NOTE: If replacing the MUSHROOM VALVES (26), ensure not to place damaging stress on the VALVE HOLDERS (22, 23).

6. If removed, replace the mushroom valves (26) by gently pulling the retainer stem through the **valve holders (22, 23)**, while twisting, until the retaining flange is completely inside the **valve holders (22, 23)** and properly seated *(Fig. 14)*.

DANGER: DO NOT put lubricant on the MUSHROOM VALVES (26).

Figure 14

7. Lightly lubricate and refit the valve holder **O-rings (24, 25)**. Then press the **valve holders (22, 23)** back into place *(Fig. 15)*. Be careful not to pinch the **O-rings (24, 25)**.

8. Lightly lubricate and install the hose adapter O-rings onto the hose adapters.

Figure 15

9. Slide the hose nuts and silicone sleeves over the ends of the breathing hoses. Then install the BOV hose adapters onto the breathing hose ends *(Fig. 16)*.

Figure 16

10. Using Oetiker style pliers reattach the Oetiker clamps *(Fig. 17)*.

Figure 17

11. Slide the silicone hose clamp covers back into place *(Fig. 18)*.

Figure 18

12. Secure the **mouthpiece (27)** onto the BOV **housing (1)** with a new **ty-strap (28)**, positioning the locking tab of the **ty-strap (28)** towards the breathing hose.

13. Using an 11/16" open end wrench, tighten the LP hose end to the **coupling (2)** clockwise onto the BOV **housing (1)** *(Fig. 19)*.

14. Screw the hose nuts clockwise onto the BOV.

15. Install the HUD bracket and HUD to the exhalation hose nut. Attach an O-ring to the underside of the HUD bracket to secure it.

Figure 19

NOTE: To avoid damage, slide the HUD bracket over the hose nut from the side.

WARNING: Check for leaks and proper operation before use of the BOV.

DANGERS: Ensure the mushroom valves are installed correctly with gas flow from diver's left (inhalation side) to diver's right (exhalation side) as shown by the arrow *(Fig. 20)*.

Figure 20

SECOND STAGE TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Free flow or leakage present.	1. Excessive **lever (9)** height. 2. Excessive intermediate pressure from first stage. **3. Lever (9)** bent. 4. Damaged or worn **poppet seat (5)**. 5. Damaged **orifice (3)**. **6. Lock nut (11)** over-tightened onto shaft of **poppet (6)**. **7. Poppet washer (8)** bent or distorted. 8. Poppet **spring (7)** weakened, worn, or incorrect part. **9. Orifice (3)** incorrectly adjusted.	1. Adjust **orifice (3)** and **lock nut (11)** to arrive at correct spring load tension and **lever (9)** height. Refer to Tuning section. 2. Refer to First Stage Trouble- shooting chart. 3. Replace with new. 4. Replace with new. 5. Replace with new. 6. Replace with new and re-adjust. Refer to Tuning section. 7. Replace **Poppet washer (8)**, **spacer (10)**, and **lock nut (11)** with new. 8. Replace with new. 9. Turn in clockwise to adjust. Refer to Tuning
Excessive inhalation resistance.	**1. Lock nut (11)** over-tightened onto **poppet (6)** shaft, causing excessive **spring (7)** tension. **2. Lock nut (11)** insufficiently tightened onto **poppet (6)** Shaft, causing **lever (9)** slack. **3. Lever (9)** bent. **4. Orifice (3)** incorrectly adjusted. 5. Insufficient intermediate	1. Replace with new and re-adjust. Refer to Tuning section. 2. Tighten to correct spring load and **lever (9)** height. Refer to Tuning section. 3. Replace with new. 4. Adjust to correct contact. Refer to Tuning section. 5. Refer to First Stage Trouble- shooting chart.
Rattle heard inside Second Stage.	1. **Lever (9)** slack present.	1. Tighten **lock nut (11)** onto POPPET (9) Shaft. Refer to
Little or no air flow when Purge Button is depressed.	**1. Lever (9)** slack present. **2. Lever (9)** bent. **3. Orifice (3)** incorrectly adjusted.	1. Tighten **lock nut (11)** onto **poppet (6)** shaft. Refer to Tuning section. 2. Replace with new. 3. Adjust **orifice (3)** to correct contact. Refer to Tun-

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Water entering Second Stage.	1. Tear in **mouthpiece (27)**. 2. **Exhaust valve (13)** distorted or damaged. 3. **Diaphragm (21)** distorted or damaged. 4. **Cover ring (30)** not tight on **housing (1)**. 5. Cracked or damaged **housing (1)**. 6. Mouthpiece **ty-strap (21)** loose or missing.	1. Replace with new. 2. Replace with new. 3. Replace with new. 4. Tighten until secure. 5. Replace with new. 6. Tighten or install.

SECOND STAGE DISASSEMBLY

NOTE: Be sure to check and record the intermediate pressure prior to disassembling the Explorer BOV. Review the Troubleshooting section to better understand which internal parts may need replacing, and to better advise the customer of the service required.

1. Snip the plastic **ty-strap (21)** that holds the **mouthpiece (27)**, and remove the **mouthpiece (27)**. Inspect the condition of the **mouthpiece (27)** to ensure that it is supple and free of any tears or corrosion. Discard if found.

2. Remove the LP hose from the Second Stage, using an 11/16" open end wrench, while holding the Hex portion of the **coupling (2)** secure with a 3/4" open end wrench.

Figure 21

CAUTION: Ensure the Regulator is free of sand when removing the COVER RING (30).

3. Turning counterclockwise, remove the **cover ring (30)** *(Fig. 21)*. Then lift the **purge cover (31)** and **inner ring (32)** to expose the **diaphragm (21)**.

Figure 22

4. Grasp the **diaphragm (21)** by the raised edges of the center, and gently lift it out with a slight upward twist to remove *(Fig. 22)*. Inspect the **diaphragm (21)** to ensure it is supple and free of any tears, corrosion, or other distortion. Discard if found.

5. Depress the **lever (9)**. While holding it down, remove the **coupling (2)** in a counterclockwise direction using a 3/4" open end wrench (Fig. 23). Remove the coupling **O-ring (19)** from the **coupling (2)** and inspect for any signs of decay. Discard if found.


Figure 23

6. Using a narrow slotted blade screwdriver, remove the **orifice (3)** by turning it counter clockwise inside the **coupling (2)**. When it has disengaged completely from the threads, press it out with the use of a cotton swab. Use caution to avoid nicking or scratching the delicate knife edge of the **orifice (3)** as this is done. Remove and discard the orifice **O-ring (17)**. Inspect the **orifice (3)** carefully with the use of a magnifier to ensure that it is perfectly free of any scoring or nicks. If found, discard and **DO NOT** attempt to reuse it.

7. While tilting, lift the **poppet chamber (4)** and **poppet (6)** assembly out of the BOV **housing (1)** *(Fig. 25)*.

Figure 25

Figure 26

8. Place the **poppet chamber (4)** and **poppet (6)** assembly open end down on the workbench. Using a narrow flat blade jeweler's screw driver, hold the **poppet (6)** secure. At the same time, remove the **lock nut (11)** with a 1/4" open end or box wrench in a counter clockwise direction *(Fig. 26)*.

NOTE: There will be a sudden ejection as the poppet (6) disengages from the LOCK NUT (11). Ensure the open end of POPPET CHAMBER (4) and POPPET (6) assembly is facing down against a padded section workbench. This will prevent damage or loss of parts.

9. Remove the **poppet (6)**, **spring (7)**, **poppet washer (8)**, **lever (9)**, **spacer (10)**, and **lock nut (11)**. Discard the **lock nut (11)** and **poppet washer (8)**.

Figure 27

10. Examine the **lever (9)** and compare it with a new one to ensure that it is not bent or distorted in any way. Discard if distortion is found.

11. Examine the **spring (7)** with a magnifier and compare it with a new one to ensure correct tension and length. Discard if found to be weakened or corroded.

12. Remove the **seat (5)** from the **poppet (6)** with the use of a dental probe and discard *(Fig. 27)*. **DO NOT** attempt to reuse it.

Figure 28

13. Examine the internal threads of the **poppet chamber (4)** to ensure they are clean and in good condition. Refer to the Cleaning Section of the General Procedures (Doc. No.12-4025) for instructions regarding the cleaning of these threads.

14. Turn the **housing (1)** face down. Turning counter- clockwise, remove the exhaust cover **screws (15)** with a 3/32" Allen key *(Fig. 28)*. Then lift the **exhaust cover (14)** from the **housing (1)**.

15. Inspect the overall condition of the **housing (1)** and the **exhaust cover (14)** to ensure

they are free of any stress cracks, distortions, an are in good condition. Ensure that all threading on the **housing (1)** is in good condition. Discard either if any distortion or damage is found.

16. Using a soft probe, inspect the condition of the **exhaust valve (13)** to ensure that it is supple and free of any tears or corrosion, and that it seals completely around the seating surface of the **housing (1)**.

NOTE: If the EXHAUST VALVE (13) is in good condition, it is not necessary to remove it. The HOUSING (1) may be cleaned with it attached.

17. If the **exhaust valve (13)** requires replacement, it may be removed by grasping it at the flange and pulling it straight out, snipping the retainer stem if necessary. Discard.

NOTE: If replacing the EXHAUST VALVE (13) ensure not to place damaging stress on the HOUSING (1). Very little pressure is enough to crack one of the ribs in the EXHAUST VALVE (13) support.

Figure 29

18. It is not necessary to remove the **housing plug (12)** unless installing a right hand **poppet chamber (4)**. To remove the **housing plug (12)** release the locking tabs, and press the **housing plug (12)** out of the **housing (1)** *(Fig. 29)*.

WARNING: To change the hose outlet side it is necessary to change the POPPET CHAMBER (4) with a "right hand" version. The two parts are not interchangeable. Mounting one of the POPPET CHAMBER (4) on the wrong side would cause performance issues.

SECOND STAGE REASSEMBLY

NOTE: Prior to Reassembly, it is necessary to inspect all parts, both new and those that are being reused. Check to ensure that O-rings are clean and supple, and that every part and component has been thoroughly cleaned and dried.

WARNING: Use only genuine Hollis parts, subassemblies, and components whenever assembling Hollis products. DO NOT attempt to substitute another manufacturer's part for a Hollis part, regardless of any similarity in shape, size, or appearance. Doing so may render the product unsafe, and could result in serious injury or death of the user.

1. If removed, replace the **exhaust valve (13)** by gently pulling the retainer stem through the **housing (1)** until the retaining flange is completely inside the **housing (1)** and properly seated *(Fig. 30)*.

Figure 30

2. Replace the **exhaust cover (14)** onto the exhaust portion of the **housing (1)** by pressing it in place with the tabs and screw holes aligned. Then using a 3/32" Allen key, tighten the **screws (15)** clockwise until tight (Fig. 31). **DO NOT** over-tighten.

Figure 31

3. Replace the **poppet seat (5)** into the **poppet (6)** with the side that is perfectly smooth facing out. Ensure that it is completely seated, flush with the inner rim of the **poppet (6)**. **DO NOT** use adhesive.

4. Apply a light film of lubricant to each end of the **spring (7)** and place it into the **poppet chamber (4)**. Next fit the **poppet (6)** into **poppet chamber (4)**. Turn the parts over onto a clean ¼" drive ¼" deep wall socket with the same diameter as the **poppet (6)**. Then compress the **spring (7)** until the threaded portion of the shaft is completely visible. Hold it in this position.

NOTE: It is ideal to match the socket size so the socket walls match the metal rim of the POPPET without contacting the POPPET SEAT (5). It is possible to use another clean smooth surface object. Select wisely to prevent accidentally cutting the POPPET SEAT (5).

5. Place the **poppet washer (8)** over the threads of the **poppet (6)** and onto its shaft. Place the **spacer (10)** onto the **poppet (6)**. Thread the **lock nut (11)** clock- wise onto the **poppet (6)** threads with your fingertips.

6. Place the forks of the **lever (9)** over the **poppet (6)** shaft, between the **poppet washer (8)** and **spacer (10)**. Relax the **poppet (6)** and watch to ensure that the **lever (9)** is held in place.

7. Hold the **poppet (6)** stationary with a flat blade jewelers screwdriver. Then using a 1/4" open end wrench, tighten the **lock nut (11)** until 3 Threads are showing beyond the outer surface of the **lock nut (11)** *(Fig. 32)*. Remove the tools, and depress the **lever (9)** repeatedly to ensure smooth movement.

Figure 32

NOTE: Using a screwdriver that is wider than the slotted end of the POPPET (6) will damage the LOCK NUT (11).

8. Slide the **poppet chamber (4)** into the **housing (1)**, as shown *(Fig. 33)*.

Figure 33

9. Lubricate and install the coupling **O-ring (19)** onto the **coupling (2)**. Install the **coupling (2)** into the inlet tube of the **housing (1)** with the smaller opening facing in. Turn clockwise using a 3/4" open end wrench to a torque of 35 to 40 in-lbs (4-4.5 N-m) *(Fig. 34)*.

Figure 34

10. Lubricate and install the orifice **O-ring (17)** onto the **orifice (3)**. Lubricate the threads of the **orifice (3)** with a very light film of lubricant and insert the **orifice (3)** into the **coupling (2)** with the Knife Edge of the **orifice (3)** facing in.

CAUTION: Be careful to protect the delicate knife edge of the ORIFICE (3) as this is done.

11. Using a narrow shafted, slotted blade screwdriver, gently turn the **orifice (3)** clockwise into the **coupling (2)** until the knife edge is barely contacting the **poppet seat (5)**. **DO NOT** continue to turn the **orifice (3)** any further beyond this point, which will cause the **lever (9)** to drop. Doing so will also damage the **poppet seat (5)** requiring its replacement.

NOTE: For best sensitivity of touch during step 11, place your finger gently on the LOCK NUT (11) while slowly turning the ORIFICE (3). As soon as contact is made, you will feel the LOCK NUT (11) begin to turn. Hold the screwdriver by the shaft rather than by the handle.

12. Place the **diaphragm (21)** inside the **housing (1)** with the raised Center facing up, and ensure that it seats flush into the groove of the **housing (1)** *(Fig. 35)*. Set the **inner ring (32)** in place over the **diaphragm (21)**. Ensure that it sits flush.

Figure 35

13. Place the **purge cover (31)** into the **cover ring (30)**. Then install the **purge cover (31)** and **cover ring (30)** in a clockwise direction into the **housing (1)**. Ensure that the **cover ring (30)** is correctly seated on the threads. Hand tighten until secure *(Fig. 36)*.

14. Secure the **mouthpiece (27)** onto the **housing (1)** with a new **ty-strap (28)**, positioning the locking tab of the **ty-strap (28)** towards the LP hose.

Figure 36

TUNING THE SECOND STAGE

1. Prior to tuning the second stage, check the following items:
   a. The demand **diaphragm (21)**, **purge cover (31)** and **cover ring (30)** should be properly installed into the **housing (1)**, with the Front **cover ring (30)** tightened until secure.
   b. Connect an In-Line Adjustment Tool between the low pressure hose and **coupling (2)**.
   c. The **mouthpiece (27)** should be cleaned and disinfected with warm, soapy water.

NOTE: While pressurized, the slotted blade of the In-Line Tool will be held away from the ORIFICE (3) and will therefore need to be pushed inward and held while turning the ORIFICE (3) in either direction. Locate the slotted head of the ORIFICE (3) by touch before attempting any adjustment.

Clockwise turns of the In-Line Adjustment Tool turns the **orifice (3)** in toward the **seat (5)** increasing the opening effort. Counterclockwise turns of the In-Line Adjustment Tool turns the **orifice (3)** out away from the **seat (5)** reducing the opening effort.

2. Pressurize the regulator with a pure air source of 3,000 PSI (206 BAR) and listen to determine that a slight air flow is initially present.

3. Use the In-Line tool to turn the **orifice (3)** clockwise with very small fractions of a turn, just until airflow is no longer present, and pause to listen carefully for airflow or leakage after each adjustment. Adjust the **orifice (3)** as required to achieve the desired opening effort.

NOTE: Turning the ORIFICE (3) further than necessary to stop airflow will result in LEVER (9) slack and excessive spring load tension, impairing proper performance.
CAUTION: To avoid cutting the POPPET SEAT (10) with the knife edge of the ORIFICE (11), depress the PURGE BUTTON (31) while turning the ORIFICE (11) in or out.

4. Hold the Second Stage with the **mouthpiece (27)** facing directly down, and gently shake it up and down, listening carefully for any rattle that may be present, indicating **lever (9)** slack. If slack is indicated, the second stage must be disassembled and corrected.

5. Purge the Regulator of all air to remove the In-Line adjustment tool, and connect the LP hose directly onto the **coupling (2)** using an 11/16" open end wrench. Tighten to a torque of 35 to 40 in-lbs (4-4.5 N-m).

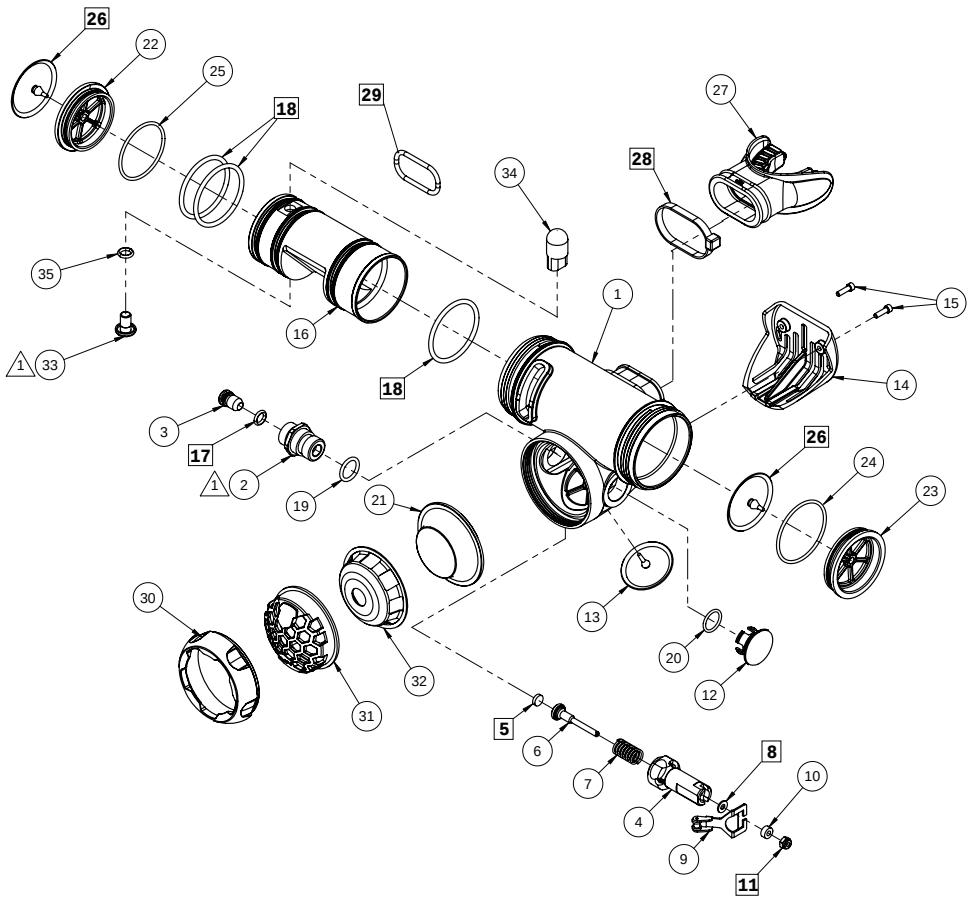
6. Pressurize the Regulator again with a pure air source of 3,000 PSI (206 BAR). Inhale lightly through the **mouthpiece (27)**. Air should flow easily and smoothly, without any hesitation or lag.

NOTE: If hesitation or lag is detected, refer to the Troubleshooting Section to determine possible cause and treatment.

7. Clean and disinfect the **mouthpiece (27)** in warm, soapy water before returning the BOV equipment to the customer.

BOV DIAGRAM

1 TORQUE TO 35 - 40 in-lbs



DIA.	CAT.	P/N	DESCRIPTION	NOTES
1	c	9220.XX.X	HOUSING	
2	c	25390	COUPLING	
3	c	6621	ORIFICE	
4	c	25394	POPPET CHAMBER	right hand version
5	**a**	**4340**	**SEAT**	
6	c	25391	POPPET	
7	c	5074	SPRING	
8	**a**	**5117**	**POPPET WASHER**	
9	c	4587	LEVER	
10	c	4335	SPACER	
11	**a**	**4336**	**LOCKING NUT**	
12	c	25398.XX	PLUG, HOUSING	
13	b	6326	EXHAUST VALVE	
14	c	25397.XX	EXHAUST COVER	
15	c	4787	SCREW	QTY: 2

DIA.	CAT.	P/N	DESCRIPTION	NOTES
16	c	9052	SPOOL	
17	**a**	**2.010**	**O-RING**	
18	**a**	**2.127.50**	**O-RING**	**QTY: 3**
19	b	3.906	O-RING	
20	b	2.014	O-RING	
21	b	6979	DIAPHRAGM	
22	c	25388	VALVE HOLDER, EXHALATION	
23	c	25389	VALVE HOLDER, INHALATION	
24	b	2.029	O-RING	
25	b	2.028	O-RING	
26	**a**	**7765**	**MUSHROOM VALVE**	**QTY: 2**
27	b	8616.XX	MOUTHPIECE	
28	**a**	**1978.07**	**TY-STRAP**	
29	**a**	**9136**	**O-RING**	
30	c	8996	COVER RING	
31	b	8997	PURGE COVER	
32	c	8998	INNER RING	
33	c	9049	SCREW, LEVER	
34	c	9053	LEVER, 2-POSITION	
35	b	2.010	O-RING	

RESA recommends, Dive Rebreathers safely by following this 10 point plan:

1. Be wary of "internet advice". Check the manufacturers and training agencies for best practise/configuration information and if you can't find the information you need, contact them.
2. Take time to learn your rebreather and practise using all the controls regularly.
3. Use a checklist before every dive, for assembly and pre-dive checks, ensuring that when you get in the water you haven't forgotten something stupid.
    - Ensuring everything is okay BEFORE you get in the water increases the chances exponentially of it being a successful, trouble free dive.
    - We're all human, we all forget things, but you're entering an environment where even trivial issues on the surface can be fatal underwater.
    - No matter what your experience level, it is stupid not to use a checklist system, whether it be electronic or paper – use a checklist.
4. Unless the manufacturer of your unit advises differently, change your oxygen sensors every 12 months — O2 sensors/cells are a consumable. Their useful life is much less in a rebreather than in a surface O2 analyser.
    - Several diving professionals have lost their lives over the past few years because they didn't change their cells in a timely fashion.
    - Understanding what current limiting is and what to do about it are important skills. Test for it on every dive by adding a little bit of oxygen to see whether the cell rises by 0.1 bar or not, and if not start reducing your setpoint down below 1.0 bar or more or bailout to open circuit.
5. Dive with a buddy. Be a buddy. Most rebreather divers are capable of diving alone but it is always useful to have a friend to help identify that your dry suit hose isn't connected yet or is on hand to help reach components. A good buddy is a good diver. A good diver is a good buddy.
6. Take your time. Take time to sit and think about the dive, about your equipment. Is everything connected? Is everything working properly?
7. Plan your bailout requirements
    - Ensure you have enough bailout gas for the planned dive
    - Ensure you can reach bailout.
    - Test your bail-out pre-dive and early in the dive
    - If your "emergency plan" is your open circuit bailout, make sure you use it. Too many divers die carrying bailout.
8. Use only the CO2 absorbent and grade recommended by the manufacturer, that is the grade tested in their machine and has known performance.
    - Some absorbents are totally unsuitable for diving, they just don't absorb CO2 quickly enough.
    - If you do use a different diving grade absorbent to that recommended, you MUST reduce the usage time. If the absorbent has a larger granule size than that in the recommended absorbent, reduce the usage time by at least one third.
    - Changing it early is much better than changing it late. Push the scrubber to it's limits and one day you will be caught out.
9. Don't be afraid to cancel a dive. You are part of the pre –dive analysis. If you don't feel right or have misgivings about the dive, just cancel it, walk away. The dive will be there tomorrow and the next day and the day after that. Be a good buddy, respect your buddy's wishes – if s/he wants to cancel then so be it, they're safer on the boat.
10. Do pre-jump tests & re-check with appropriate safety drills when you jump in:
    - Check PO2 on HUD and handset and continue to do so regularly during the dive
    - Check both tanks are on
    - Check buddy
    - Leak check prior to dive and always bubble check in the water

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