KISS GEM Sidekick SCR & KISS Sidekick CCR Manual

KISS Rebreather, LLC.
www.kissrebreathers.com

Introduction GEM Sidekick SCR

The GEM Sidekick SCR is the latest addition to the KISS rebreather family. Like all KISS systems, it is durable, reliable, easy to use, and economical. The Sidekick brings a few more bonuses to the table. The compact design allows the Sidekick to be used in a number of ways: Side-mount rebreather, Bailout rebreather or simple add on Gas Extender. The Sidekick requires no modification to fill all of these roles.

The KISS GEM Sidekick uses the patented KISS Gas Extending Mechanism (GEM). The GEM system will allow the gas in your cylinder to last three times as long as conventional SCUBA. Other benefits include small size, lightweight, fewer parts and less complexity than diving a fully closed circuit rebreather. The Sidekick still provides many of the benefits that rebreather diving offers: warm, moist gas to breathe, no noisy rush of bubbles to scare fish away, and the longer No-Decompression-Limits of diving Nitrox.

This manual describes the operation, assembly, breakdown and maintenance of your new KISS GEM Sidekick. There are sections for each system component. Later sections discuss some of the dive operations and troubleshooting.

To safely use any dive equipment, the diver must fully understand the equipment. That is why this manual is required reading. Not only does the longevity of your new Sidekick depend on your reading and understanding this manual, but your safety depends on proper understanding and operation of all your dive gear.

Information in this manual is subject to change.
Please visit our website, www.kissrebreathers.com for updated manuals.

Conventions

The warning signs and the simple icons shown here are listed in order for you to use this product safely and correctly as well as to prevent risk of injury to you and to others.

Warning	Indicates matters in which an imminent or possible risk of serious injury or death may arise as a result of incorrect operation.
Note	Indicates matters which must be closely considered as they affect the proper use and or maintenance of the equipment and could affect the safety of the diver.

Safety Guidelines

Warning	KISS GEM Sidekick diver's must read this manual. In order to fully understand the KISS GEM Sidekick Gas Extender, the components, how they work, how to handle and treat them, diver's must read this manual in full. This should be done prior to diving or servicing the unit. Pay special attention to all notes and warnings; they must be read and understood. Failure to do so may cause equipment damage, serious injury, or death. This manual contains a checklist of inspections and tests that must be performed prior to each dive. Do not dive unless you have completed this checklist. Do not dive unless the equipment has passed all of the tests. Failure to perform all inspections and tests, or ignoring a failure may cause serious injury or death. You must be 18 years of age in order to purchase and dive a KISS GEM Sidekick diving

	system. You must be properly trained to dive this equipment. Diving this equipment without proper training may cause serious injury or death. This manual in no way replaces the training required for diving this equipment. Proper training is extremely important as is gathering the proper experience. Only dive within the limits of your certification. This equipment should be serviced annually by a service technician. Service may be required more often if you dive frequently, or water has entered the equipment. Always monitor your PPO2 when breathing from this equipment. This should be checked once a minute at depth and continuously during an ascent. Do not breathe from this equipment while swimming on the surface. Do not breathe from this equipment at a depth less than 20 ft. During training this equipment may be used in a pool, but only with 40% Nitrox, and only under supervision. Do not use diving gasses outside the limits of your certification. All information in this manual is subject to change. Please visit our website, www.kissrebreathers.com/manuals.html for updated versions.

Assumption of Risk	The warnings & notes in this manual are not a joke! Participation in rebreather diving can result in serious injury or death. Before beginning your dive, you must consider the risks involved. The GEM Sidekick 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 GEM Sidekick 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 GEM 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 GEM Sidekick. The diver must complete a proper training course covering the maintenance, testing and operation of the semi-closed 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 gas and having the training and skills necessary to switch to open circuit gas, can reduce, but never eliminate, the risk of equipment failure.

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Unpacking the Sidekick

Unpack your GEM Sidekick using the parts list below, ensure that all components have been received and there hasn't been any shipping damage. If anything seems to be damaged from shipping, please contact either your dealer or the KISS Rebreathers offices in a timely fashion so that we may replace your damaged parts.

The KISS GEM Sidekick diving system you have purchased is for recreational diving and should be configured as instructed in this manual.

GEM SIDEKICK DIVING SYSTEM INCLUDES:

- 1 Scrubber Head: Includes 2 hose attachment towers, 1 exhaust valve, ADV system, 1 gas connection fitting, 2 scrubber canister O-rings (installed), and 2 counterlung O-rings (installed)
- 1 GEM Canister (granular): Includes threaded tube, base with O-rings (installed), spring, scrubber basket.
- GEM Canister – Cartridge Components (Included only upon request at the time of order): cartridge plug, gasket & circ clip installed inside custom machined canister tube.
- 1 Counterlung with Counterlung Cover: Includes 4 knurled attachment nuts, 2 rigging clips.
- 2 - retractable loop hoses
- 1 sensor holder and 1 sensor screen.
- 1 display cable with Fischer connector: Hardwired to the scrubber head and compatible with Shearwater computers, and other appropriate computers or displays.
- 1 mouthpiece (DSV) with 2 black circ clips: DSV and circ clips ship secured to the loop hoses for shipping.
- Quick Disconnect (QD) Female: Connects supply gas from your first stage regulator. (QD only, LP hose not included)
- 1 CD with manual. This will be in your envelope with your warranty card

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ADDITIONAL GEAR REQUIRED FOR DIVING:

- LP hose: required to secure the Female QD to your first stage. Consult dealer or Instructor to determine what length is correct for you.
- First stage with pressure gauge and second stage.
- Personal gear: mask, fins
- NITROX ready dive cylinder
- Buoyancy Compensator: suitable for the diving environment.
- Weights
- Exposure suit: suitable for diving conditions (suit, boots, gloves, hood)
- Dive computer/Dive timer and depth gauge
- 3 Oxygen sensors (K-22D recommended)

Theory of Operation

When the diver exhales into the GEM Sidekick mouthpiece, one third of the gas is diverted out of the vent holes in the mouthpiece and into the water. Two thirds of the breath passes through the exhale loop hose and into the exhale counterlung. When the diver inhales, the gas is drawn out of the counterlung, through the scrubber, up through the inhale loop hose, and back to the mouthpiece. The scrubber contains a material that chemically bonds with the Carbon Dioxide (CO2) in the exhaled breath and removes it. At the end of the inhale cycle the remaining gas volume is supplied by an Automatic Demand Valve (ADV) with gas from the SCUBA cylinder. This fresh gas replaces the Oxygen (O2) in the loop. The Oxygen level in the GEM Sidekick is measured by three Oxygen sensors located in the scrubber head.

The GEM Sidekick (like any rebreather) can be broken down into the follow functional parts:

- Mouthpiece
- Loop Hoses
- Counterlung
- Scrubber Canister
- Oxygen Addition
- Oxygen Monitor

As a Passive Semi-Closed Circuit Rebreather (pSCR), the Oxygen addition is achieved by venting a fraction of the diver's exhaled breath, and adding Nitrox to make up the vented volume. In this way each breath (on inhale) contains one third fresh Nitrox, and two thirds scrubbed exhaled gas.

Figure 1: KISS GEM Sidekick

Gas Selection

When diving the GEM Sidekick, each inhaled breath is composed of a fraction of fresh gas from the supply cylinder and the remainder of the gas is the diver's exhaled breath after being scrubbed of Carbon Dioxide (CO2). The fraction of Oxygen (O2) remaining in a diver's exhaled breath will vary based on workload, the diver's metabolism, & the diver's size. This means that a diver and his buddy may have different PPO2/FiO2 while using the same nitrox mixture.

The fraction of O2 inhaled will be less than the fraction of O2 in the supply cylinder. This is known as the Fraction of Inspired O2 or FIO2. There is no way to calculate exactly what this FIO2 will be as every person is unique. This is one reason it is very important to always monitor the Partial Pressure of Oxygen (PPO2) in the breathing loop.

While we do not know the exact percentage of O2 a diver will metabolize with each breath, we do know that the higher the fraction of O2 in the supply cylinder, the higher the FIO2 will be. We also know that the greater the ambient pressure (depth of the water) the higher the Partial Pressure of Oxygen (PPO2) will be for a given FIO2.

A low percentage of Nitrox combined with a high workload and shallow water can lead to a dangerously low PPO2 (Hypoxia). KISS testing has shown that diver's using a minimum of 32% nitrox will provide diver's with a safe breathing mixture. However this may not be true for all diver's in all situations. Be certain to know what you are breathing. The shallower the diver is, the lower the PPO2/FiO2 may drop. Also, it will drop quickly on the surface.

For this reason it is very important that level 1 Sidekick diver's use a minimum of 32% nitrox. Diving a lower percentage will likely provide the diver with a hypoxic mix on ascent and in shallow water. Those diver's that wish to use nitrox mixtures with a lower percentage of O2 must take level 2 GEM training. At this level they will be taught to use a secondary gas mixture which would enable them to have the appropriate mix for ascent and shallow water.

To prevent the risk of hypoxia in shallow water, diver's 20 feet or shallower should be breathing either open circuit or open loop. This should be done for both the ascent and decent. It is important that rebreather diver's always know what they are breathing. The PPO2/FiO2 should be checked every minute, and continuously on ascent.

Gas selection must also consider the fraction of Nitrogen (N2) in the inhaled breath. Since the diver metabolizes a fraction of the O2 with each breath, the fraction of N2 goes up as the fraction of O2 goes down. This increases the N2 absorbed in the diver's tissues, and reduces our No Decompression Limit. Again, a higher Nitrox percentage will reduce the N2 in the gas, but the diver must not exceed the MOD of the Nitrox.

Warning	The following Safety Guidelines must be followed to prevent serious injury or death: • Always know your PPO2! • Monitor your PPO2 once a minute during the dive. • Never breathe off of the Sidekick mouthpiece without monitoring the PPO2. • Always use the highest Nitrox percentage for the planned dive depth without exceeding the MOD. • The higher the mix the less chance of Hypoxia (the shallower the MOD); the lower the nitrox mix the greater chance of hypoxia (the deeper the MOD). • Never dive with less than 32% Nitrox. • Never breathe on the GEM Sidekick while on the surface, or swimming on the surface. • Switch to open circuit or open loop when shallower than 20 ft. • While performing system testing that involves breathing from the GEM mouthpiece, constantly monitor the PPO2. Especially during the five minute pre-breathe. • Never dive the GEM Sidekick outside your certification level. Decompression diving is risky and requires specialized training.
Warning	The following Safety Guidelines must be followed to prevent serious injury or death: • Never let the FIO2 drop below 21% • If the FIO2 drops below the planned level, switch to open circuit to reduce the risk of decompression sickness. • Never use the GEM Sidekick in a swimming pool without a minimum 40% nitrox in the cylinder AND also direct supervision by a GEM Sidekick instructor. • The GEM mouthpiece will not vent properly if the unit is not submerged in water, which means fresh nitrox will NOT be added, which could make the breathing mixture hypoxic.

Level 1 KISS GEM Sidekick divers are certified to use Nitrox mixtures from 32% Nitrox to 40% Nitrox in no decompression dives. As stated above, use the highest Nitrox percentage available without exceeding the MOD. KISS recommends 36% or higher.

System Components

The GEM Sidekick is composed of a number of component parts. Each component performs a discrete function as described in the Theory of Operations. This section discusses each component in more detail, including the parts, function, assembly and care.

Mouthpiece

The mouthpiece is the key to the GEM Sidekick diving system. The design allows a fraction of the gas to be vented from the breathing loop every time the

diver exhales. Whether relaxed and not breathing hard, or under a heavy workload, the mouthpiece will always vent the same percentage.

The mouthpiece is shipped fully assembled, tested and ready to dive. The black plastic circ clip's are used to attach it to the loop hose, hose attachment's. When you receive your GEM Sidekick, the mouthpiece will be attached to the loop hoses, with the circ clip's in place.

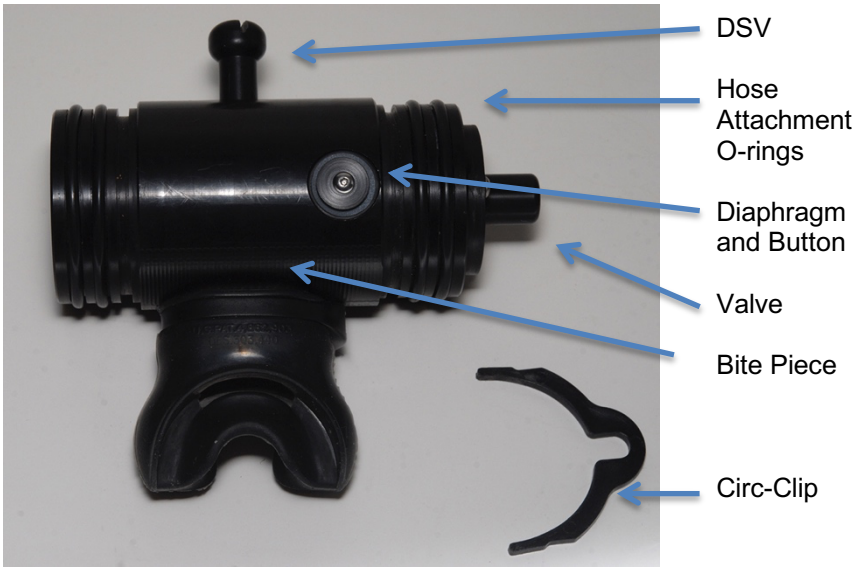

Figure 2: GEM Mouthpiece and Circ-Clip

Warning	Only a qualified GEM service technician should attempt to service the GEM Sidekick mouthpiece. Do not attempt to service the mouthpiece without the proper training.

When the mouthpiece discharges the gas, a small stream of bubbles will vent. These bubbles will come from the discharge ports on the mouthpiece. Since the diver can see the bubbles, it will be immediately obvious if there is a problem and no bubbles are venting. If this happens, the diver should also notice that the ADV is not adding gas. It won't add gas, as the volume in the system has not been depleted.

Warning	If the mouthpiece is not venting, the gas mixture you are breathing could drop to a dangerous level. This could cause injury or death, especially at shallower depths!

Dive Surface Valve (DSV)

On the front of the mouthpiece, also known as the Dive Surface Valve, is a lever that activates the DSV. In the up position, the valve is open and the diver's exhaled breath will enter the exhale loop hose and counterlung. In the down position the valve is closed, and the diving loop is sealed. In general, whenever the mouthpiece is not in the diver's mouth, the valve should be closed. This prevents water from entering the mouthpiece and the Sidekick. While underwater, always close the DSV before removing the mouthpiece from your mouth.

Purging the mouthpiece

Just like any other SCUBA mouthpiece, when it's been out of your mouth (particularly underwater) it needs to be purged before use. In this case that means you need to be purge the mouthpiece prior to opening the DSV. To do this, put the GEM Sidekick mouthpiece in your mouth and exhale forcefully. This will push the water out of the vent hole. You only need to do this for a few seconds as it is a minute amount of water. Once you see bubbles, the water is gone. After purging push the lever to the open position and then you may continue to breathe on the loop.

While doing the above exercise, be certain to not cover the vent hole with your hand as you move the lever. Covering the vent hole with your hand will prevent it from purging the water.

Diaphragms and Buttons

The Sidekick mouthpiece has 3 discharge port diaphragms and buttons. These allow the mouthpiece to vent a fraction of the diver's breath while preventing water from entering the mouthpiece. To perform this function properly the diaphragms must lay flat against their seat. If the attachment screws are too tight, or the diaphragm has been dislodged, it needs to be reseated prior to use. Diaphragms and buttons should be visually inspected prior to every dive to ensure that the diaphragms are sitting flat, and properly placed.

The discharge port diaphragms are an essential component of the mouthpiece. It is important that they are in good working order. When visually inspecting your mouthpiece, ensure that they are not torn or damaged in any way, and that they are lying flat. If they are not lying flat, either flip the diaphragm over or install a new one otherwise water can enter the breathing loop.

Prior to removing the screw and button that holds the discharge port diaphragm, note how tight the screw is. It is important that the screw is not over tightened when reassembling the mouthpiece. Watch closely when tightening this screw. If the diaphragm lifts at all, on any edge, back the screw off.

Note	If you have a failed discharge port diaphragm, it will bubble constantly. This may also allow excess water into the exhale hose.

Right side inner valve assembly & left side mushroom valve

The right side of the valve houses the inner valve assembly and the outer valve assembly. The inner valve assembly is the inner piece that moves back and forth. The outer valve assembly is the component that is screwed to the right side housing.

If the inner valve assembly starts to stick either open or closed, it is likely that the mouthpiece either needs to be cleaned or that some lubricant has worked its way into the area, If a single drop of lubricant is in that area in which the valve moves back and forth, it could cause the valve to stick.

If this happens, remove the outer and inner valve assembly. Using a perfectly clean cloth - there can't be any lubricant on it at all - carefully clean the inner part of the mouthpiece. All traces of lubricant must be removed. Clean the inner valve assembly and then reattach the outer assembly.

Figure 3: DSV Right Side Valve Assembly

When inserting the inner piston back into the inside of the mouthpiece, be certain that you put it in the correct way. It will not work if it is upside down! As per the photo, the inner piston should have the open area facing out. The open area needs to face the open area of the outer piston for it to work properly.

Warning	If the valve gets stuck, it could happen in the open or closed position. Also, be certain that if the inner piston is removed, that it is inserted correctly upon reassembly. If the inner piston is inserted upside down, the valve will not work!

Prior to diving, visually check the left side, or inhale mushroom valve and ensure that it is lying properly and not damaged. Also ensure that it is facing the correct direction with the gas flow going from left to right. Gently shake the mouthpiece to ensure that the right side valve components are moving freely back and forth. These parts must move freely for the mouthpiece to work properly. If they don't move freely the mouthpiece must be serviced. Having the mouthpiece serviced by a trained GEM service technician is important. If the servicing of the valve is not done properly, and lubricant is applied to the wrong parts, the valve will stick and not work. Lubricant in the right side valve area will cause the inner valve to stick either open or closed.

If the right side one-way valve sticks open, you will notice excess bubbles venting from the mouthpiece. The unit should not be dove in this manner as the gas is not flowing properly and could cause a problem with carbon dioxide. If the valve sticks closed, it would be difficult to exhale. A sharp exhale would dislodge it, but the proper action would be to end the dive and service the mouthpiece.

Warning	If the mouthpiece right side valve is sticking, do not dive the rebreather. Have the mouthpiece served immediately. Diving the GEM Sidekick with a mouthpiece that is not functioning properly could cause injury or death!

Warning	The KISS GEM mouthpiece is a key component to this diving system. Proper care and servicing is essential in order to maintain proper working order. Key areas of importance include, but are not limited to, ensuring the piston is moving properly, the mushroom valve is working as it should, and the discharge port diaphragms are sitting flat and not damaged. Improper use and/or care may result in serious injury or death!

Loop Hoses

The Sidekick loop hoses perform the simple task of connecting the mouthpiece to the scrubber head. Both hoses are of the same length, and are interchangeable. The ends of the hoses should be handled carefully to prevent damage to the O-rings and sealing surfaces. Inspect the O-rings and surfaces prior to assembly. Clean the surface and add a small amount of silicone grease to aid in assembly.

Figure 4: Loop Hoses with Ballast rings

The loop hoses are shipped fully assembled with the ballast rings, hose stubs and hose attachments in place. The ballast rings may be moved to suit each diver. The instructor will aid the student in ensuring the rings are properly placed.

The loop hose material will last a long time if properly maintained. As with all dive gear they should not be left out in the sun as it degrades the rubber. They should be rinsed regularly, and sanitized and rinsed after each dive day. They should be dried thoroughly before putting them away.

Warning	The loop hoses and quick disconnect hose stubs are important components on the KISS GEM Sidekick diving system. It is important that they be treated properly, cleaned and replaced if damaged. Diving the Sidekick with damaged hoses or damaged hose stubs can lead to serious injury or death.

Scrubber Canister and Scrubber Head Assembly

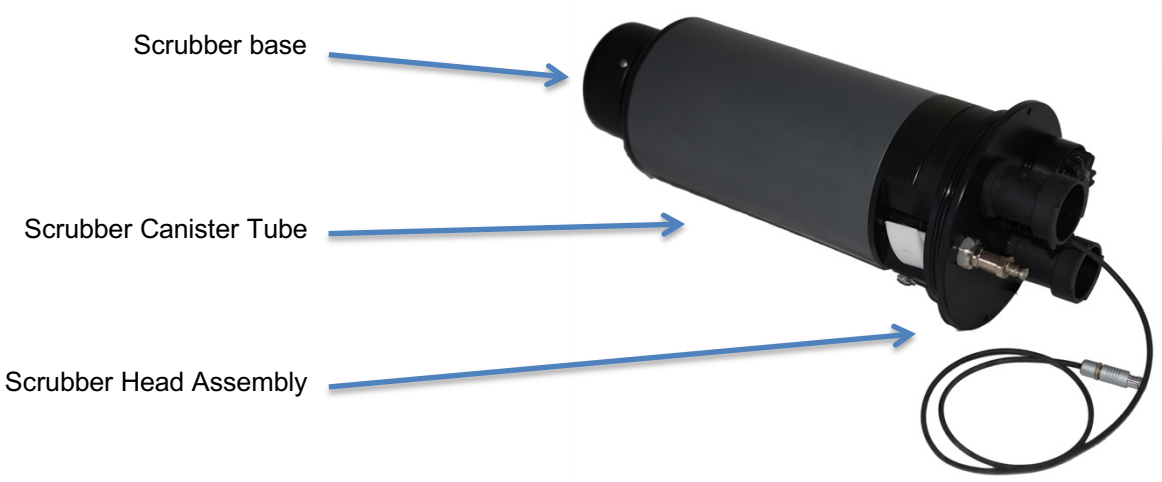

Figure 5: Scrubber Canister & Scrubber Head Assembly

The Scrubber Canister & Scrubber Head Assembly is the central hub of the Sidekick diving system. Many components attach to it, and many functions are performed by it. Let's identify all of the parts then describe each one in detail.

The Scrubber Canister consists of several components. There are two versions; the granular scrubber canister and the cartridge scrubber canister. The Sidekick is shipped standard with the granular scrubber canister assembly. The cartridge scrubber is no longer manufactured; the instructions are included here to support those that have this system.

Granular Scrubber Canister:

- Scrubber Canister
- Scrubber Base
- Scrubber Basket
- Spring
- Scrubber Head Assembly

Cartridge Scrubber Canister:

- Scrubber Canister with gasket and metal circ clip
- Scrubber Base
- Cartridge Plug
- Scrubber Head Assembly

Located on the top of the Scrubber Head Assembly are the following:

- Inhale and exhale loop hose attachment towers
- Over Pressure Valve (OPV) / Apeks exhaust valve
- Oxygen Display cable with a Fischer connector
- Male Quick Disconnect Gas Supply Connection
- Counterlung attachment holes

On the side of the scrubber head:

- Double O-ring seal for the counterlung
- Double O-ring seal for the scrubber canister
- Automatic Demand Valve (ADV) actuator paddle
- Vacuum Break

On the bottom of the Scrubber Head Assembly are the following:

- Sensor Holder

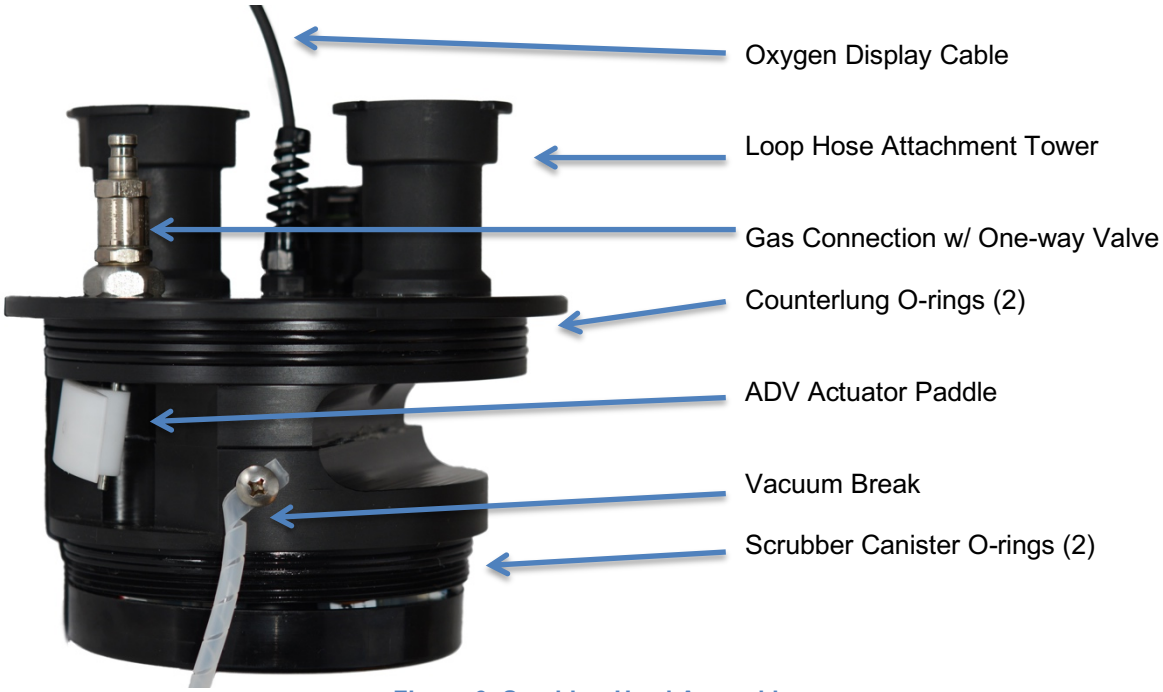

Figure 6: Scrubber Head Assembly

Scrubber Canister

The Sidekick scrubber canister is designed to take either a Micropore Extend Air Cartridge (EAC) or granular scrubber material. KISS Rebreathers recommends Sofnolime 408 as the preferred granular scrubber material. Presently, only the

granular version of the scrubber canister is manufactured. Cartridge instructions are in the manual to support those that have this system.

The Sidekick scrubber canister is unique as the absorbent is loaded into the bottom of the canister, not the top like our other KISS rebreather's. The proper action when using either the granular or cartridge version is to first secure the canister tube to the scrubber head, load the absorbent and then secure the base to the tube.

Cartridge Scrubber Canister components: This version uses a cartridge plug and a gasket with metal circ clip. These parts are unique to the cartridge version and are not used on the granular set up. The cartridge is a Micropore 5 inch large bore, part number SR-0801C.

Granular Scrubber Canister components: This version uses a scrubber basket, and spring. These parts are unique to the granular version and are not used for the cartridge set up.

The image below shows the granular components.

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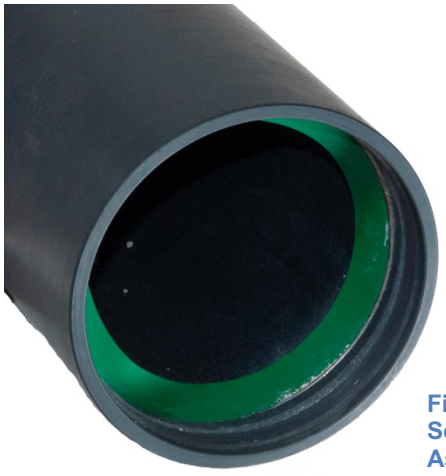
Scrubber basket, with base and spring

Figure 7: Granular Scrubber Parts

Cartridge Scrubber Canister: Unique on the inside of the scrubber canister you will see the rubber gasket that has been installed and secured with a metal circ clip. The gasket has been factory installed and will not require divers to remove it. This gasket seals to the Micropore EAC to prevent gas from passing between the EAC and the canister wall. This gasket is not needed if only granular scrubber will be used. When using the Micropore EAC, the gasket should be inspected to ensure it is clean, undamaged and in good working order. If a diver is switching between using the cartridge and the granular absorbent, the gasket should be left in place; it need not be removed.

When using a Micropore EAC, the cartridge plug should be inserted into the hole in the bottom of the cartridge before screwing on the scrubber bottom.



Scrubber Base attaches here

Figure 8: Cartridge Scrubber Canister Assembly

Granular Scrubber Canister: When using the granular scrubber canister the basket and spring are inserted prior to screwing on the scrubber bottom. The basket is placed securely on top of the absorbent and pressed into place. The spring is inserted into the base. The scrubber canister holds 5.2 lb (2.4 kg) of Sofnolime 408 grade of absorbent.

The System Assembly section will cover the full details on how to set up and prepare the scrubber canister. The above is a brief description only.

The scrubber canister is threaded onto both the scrubber head assembly and the scrubber base. Take care to prevent cross threading. Do not over tighten when securing the canister.

The scrubber base serves two functions. First it holds the scrubber material in place (either EAC or granular material). Second it acts as a baffle to keep water in the counterlung from entering the scrubber. Inspect and lubricate the O-ring prior to assembly.

Inhale and Exhale Towers

The inhale and exhale towers come preinstalled on the scrubber head assembly. They should not need to be removed unless damaged. The inner surface of the loop hose attachment tower should be cleaned and inspected before assembly. A light coating of silicone grease on the sealing area can make assembly easier, and extend the life of the sealing O-rings.

Over Pressure Valve (OPV)

The Sidekick uses an Apeks valve to prevent excess pressure from damaging the unit. The valve should always be in the fully closed (clockwise) position. This should be checked prior to each dive. The OPV should not vent gas under normal dive conditions. It is included to prevent excess pressure from damaging the counterlung or loop hoses. If gas escapes from the OPV during normal dive operations it should be inspected. See the Troubleshooting section for details.

Oxygen Display Cable

The oxygen display cable connects the three oxygen sensors to the Fischer connector. The cable can be removed from the top of the scrubber head assembly, but no user serviceable parts are inside. If you suspect a failure in the cable check the Troubleshooting section.

Gas Supply Connection

The gas supply connection is a male 3/8" quick disconnect (QD) with a one-way check valve. Included with your Sidekick is the matching female QD which will need to be secured to a LP hose on the diver's first stage regulator. Diver's will need to supply their own LP hose. Each diver will be able to configure the gear to suit themselves and how this is done will determine the length of hose required

For additional safety the QD connector has a locking ring that can only be engaged after the connection is made. It is not like the LP connecter on your BC or Drysuit. This locking ring will not move until the male connecter is engaged. Once connected, rotate the locking ring counter-clockwise until it stops. To unlock, rotate the locking ring clockwise until it stops, then pull the ring away from the scrubber head assembly to disengage. While rotating the locking ring you will notice smooth motion in the lock direction, and a distinct ratcheting in the unlock direction. This is intentional. It is to aid the diver when trying to work the QD only by feel.

Vacuum Break

The vacuum break is secured to the side of the scrubber head. The end of the vacuum break fits inside a bungee loop which is wrapped around the scrubber base. Using the vacuum break ensures that the counterlung will work properly. Not using the break may cause the lung to seal to itself. This may cause the ADV to not work properly.

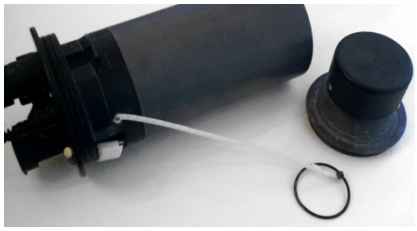


Figure 9, 10, & 11: Vacuum Break

Demand Valve (ADV)

On the side of the scrubber head assembly, in line with the gas supply connection is the automatic demand valve (ADV) actuator paddle. With the counterlung removed we can clearly see the actuator paddle, which consists of a white paddle on a metal shaft extending out of the scrubber head assembly. The actual valve seat is within the scrubber head assembly below the gas supply connection.

GEM Sidekick used as the main rebreather: For those using the Sidekick as the main rebreather, the ADV will work in a hands free manner. As the diver descends in the water, the gas in the loop will decrease as the depth increases and the lung will eventually be empty of all gas. As the diver inhales, the flat counterlung will push on the actuator paddle which will trigger the unit to add gas to the breathing loop. This is the same technology as any SCUBA second stage regulator. Gas will be supplied to the diver as long as he continues to inhale.

GEM Sidekick used as a bailout rebreather (BOB): For those using the Sidekick as a BOB, the ADV will keep the counterlung at ambient pressure. As the diver descends, the gas in the loop will decrease as the depth increases and the lung will eventually be empty of all air or flat. When this happens in BOB mode, the pressure will cause the counterlung to push on the ADV actuator paddle, causing gas to enter the unit. This will keep the air space on the inside of the counterlung at ambient pressure.

The position of the actuator paddle can be adjusted by loosening the setscrew that holds it to the metal valve shaft. Moving the paddle further away from the head assembly reduces the inhale resistance, and conversely moving the paddle closer to the head assembly increases the inhale resistance. Care should be taken before changing the paddle position. Too low a resistance may cause the ADV to activate inadvertently causing excess buoyancy. Most people find the factory setting to work just fine. Dive your Sidekick a few times before considering a change.

Gas may also be added manually to the Sidekick using the ADV. The counterlung case has a cutout that is located just above the ADV actuator paddle. By pressing the paddle with your finger, the ADV acts like the purge on a SCUBA second stage and supplies gas even though the diver is not inhaling through the mouthpiece. This is a useful function in both setting up the Sidekick, and in purging water from the counterlung. This will be covered later in under Dive Procedures.

Sensor Holder

The sensor holder can be accessed by removing the scrubber canister from the scrubber head assembly. Once the canister has been removed, turn the scrubber head over and lay it down on the tower's with the underside facing up. The sensor holder may now be pulled free from the head.

The sensor holder has positions for three K-22D Oxygen sensors. These sensors will be discussed in more detail under the Oxygen Monitor section. Right now we are concerned with the proper installation. Installation involves the following steps:

- Log the date and serial number of each sensor on the sensor bag. Keep in a safe place.
- Using a black Sharpie marker, write the installation date on the top lip of each sensor.
- Remove the scrubber canister tube from the scrubber head assembly.
- Pull the sensor holder free.
- Each sensor has an O-ring on it. Remove them; they are not necessary.
- Thread the sensor into the sensor holder until secure. Do not over tighten.
- Place the sensor holder into the base of the head; it will only fit in one way.
- Inspect the display wire's and Molex plugs; ensure they are clean, undamaged and the plugs properly secured to the wires.
- Push the Molex plugs onto the back of the sensors, and verify that they are secure; diver's should hear a click.
- Inspect the scrubber canister O-ring's on the scrubber head assembly and ensure that they are clean, undamaged and properly lubricated.
- Inspect the O-ring sealing area on the scrubber canister and ensure that they are clean, undamaged and lubricated.
- Screw the scrubber canister back onto the scrubber head assembly being careful not to cross the threads. Once the canister has been secured to the scrubber head, the sensor screen will remain in place.

Figure 12: Sensor Holder

Warning	Ensure that the display cable wires & molex plugs are in good condition and not pinched or damaged in any way. The display system and sensor components are a key component of the rebreather and care should be taken to ensure that the entire system is in good working order. Proper care should be taken when handling, cleaning and diving. Improper use &/or care may result in serious injury or death!
Warning	The scrubber head, canister, base and all the components attached to these parts are considered key parts and it is important that they be properly maintained, cleaned and repaired or replaced if damaged. Failure to maintain these parts in a proper manner could result in serious injury or death!

Counterlung and Counterlung Cover

Figure 14: Counterlung Cover Sealing Areas

Figure 15: Counterlung Cover & Head Alignment

Figure 16: Counterlung Cover, Head, & ADV Alignment

The GEM Sidekick uses a single counterlung that wraps around the scrubber canister and attaches to the scrubber head. The counterlung cover is a stainless steel mesh tube that protects the counterlung and scrubber canister of the unit. The counterlung and the counterlung cover are one piece with the lung secured to the cover.

At the top of the counterlung there is a ring that is secured to the counterlung using a stainless steel hose clamp. This ring also connects to and seals with the O-rings on the scrubber head assembly. It is held in place with four knurled nuts. The knurled nuts secure to the bolts which are attached to the top edge of the counterlung cover. On the side of the stainless steel cover is an access hole used to engage the ADV actuator paddle. This must be aligned with the ADV for proper operation.

On the bottom of the stainless steel counterlung cover is a support ring that provides an open bottom for easy access to the counterlung.

The counterlung material is very durable, however care should be taken to keep it clean and free of grit that may cause premature wear. The sealing surface along the inside of the top of the counterlung should be inspected prior to assembly. A small amount of silicone grease on this surface will aid with assembly and disassembly, while also adding to the service life of the sealing O-rings.

Warning	The counterlung cover is considered an important part of the KISS GEM Sidekick diving system. It is important that it is properly maintained and cleaned. It should be repaired or replaced if something is damaged on it. Failure to maintain this part could result in serious injury or death!

Oxygen Monitor

Oxygen monitoring is a vital part of all rebreather systems. The Sidekick uses three oxygen cells connected to a Fischer display cable. The Fischer display cable allows the diver to use any number of PPO2 display's or dive computer's that are compatible with this system.

KISS FC PPO2 Display - This shows the partial pressure of oxygen (PPO2) reading from each of the three oxygen sensors. The display connects to the Fischer connector on the end of the cable. On the bottom of the display are three wet contacts. These allow the diver to turn the display on and calibrate the sensors. The battery used in the KISS FC PPO2 display is a Saft LS14500. It has a life of 8 years or 2500 hours of time. There is a battery warning when it needs to be replaced. While the battery has a long life, we still recommend that diver's carry a spare.

Figure 17: KISS FC PPO2 Display

Shearwater GEM - Shearwater Research manufactures dive computer's for technical and rebreather diving. The Shearwater GEM is loaded with software specifically for Semi-Closed rebreather's. This software not only displays the PPO2, but it also calculates nitrogen loading in real time. This allows diver's see what their decompression obligations are based on the gas that they are breathing. Diver's that are using one of the Shearwater CCR computers must set the computer to semi-closed mode. See the Appendix for procedures on how to do this. It is important to read and understand the Shearwater manual prior to connecting it to the GEM Sidekick.

Warning	Ensure that the display, display cable wires & molex plugs are in good condition and not pinched or damaged in any way. The display system and sensor components are a key component of the rebreather and care should be taken to ensure that the entire system is in good working order. Proper care should be taken when handling, cleaning and diving. Improper use &/or care may result in serious injury or death!

Oxygen Sensors

The GEM Sidekick uses the KISS Rebreather sensor, K-22D. The sensors are not included with the unit, but can be ordered from your KISS dealer or with your Sidekick.

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, as long as they are not damaged or abused. Oxygen sensors work on the same basis as a battery. The more they are used, the more often they will need to be replaced.

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 should leave the loop hoses or the scrubber canister off overnight to allow air to circulate through the head. Leaving the unit sealed up will not allow the condensation to evaporate.

Warning	It is important that the wires in the rebreather head are allowed to dry out between dives and while the unit is in storage. If the wires are constantly damp from condensation they will eventually corrode which may cause the display to not read properly. This could cause serious injury or death. Sensors are safe to use as long as they are not older than 1 year, the millivolt reading is in the correct range, and they can be calibrated in both oxygen and air.

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 voltmeter can be purchased at your local hardware or electronics store.

Other points to consider are:

- Seawater in 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, 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.

Gear Attachment

The GEM Sidekick can be dived in several configurations. How the unit is attached to the diver's gear is dependent on which configuration is used, and the type of diving that he will be doing. Rigging clips are included with your Sidekick diving system. Consult with your dive instructor concerning the pros and cons of each method. Below are some of the possible configurations:

Figure 18 & 19: Rigging Clips

- Stage mounted bailout breather (BOB)
- Stage mounted primary rebreather
- Side mount (BOB)
- Side mount primary rebreather

Orientation - For optimum performance and ease of operation, the following is recommended:

Scrubber Head & ADV on the upper side – This allows the diver to easily activate the ADV manually through the access in the counterlung cover. Also the unit works best with the ADV toward the top of the unit. If the ADV is too low on the unit, the additional hydrostatic pressure can make it activate unexpectedly.

Horizontal orientation in the water - The Work of Breathing (WOB) is optimum with the unit located in a parallel position beside the diver and close to the diver lungs, with the diver horizontal in the water. The bottom of the unit should not be allowed to float up like an empty tank. If the unit is allowed to float up, it does not provide the proper WOB or GEM function.

Weighting - Based on the individual diver's tidal volume (lung capacity) weight may be needed in the bottom of the unit to counter act the buoyancy of the counterlung. While the stainless steel counterlung case will offset this buoyancy for most divers, larger divers, or those with a large lung capacity may need some additional weight.

Weight Attachment - There are two simple methods of weight attachment. First, a zip tie or cave line can be used to secure a hard weight to the inside of the counterlung case. The weight should be placed at the lowest part of the case in line with the OPV. Run the cave line through the mesh of the counterlung case to secure. A second attachment method involves threading a hard weight through a cam strap and securing the cam buckle around the counterlung case. This also allows for a clip to be placed on the cam buckle to allow for an adjustable attachment point.

Note that adding weight to the bottom of the Sidekick may cause the unit to drop below the diver. This should be taken into consideration when securing the weight and also the rigging clips. It is important that the clips are properly placed so this does not happen. Your GEM Sidekick instructor will aid you in properly securing your clips.

Clip Attachment – 2 stainless steel clips are included in your kit. As per the photo the clip at the top should be tied to the counterlung cover, by the ADV opening. The other clip should also be tied in the appropriate spot lower down on the counterlung cover. While the image shows the bottom clip on a cam strap, it isn't what KISS recommends. Using a cam strap works in some situations and not others. Attaching the clip directly to the counterlung cover will make the Sidekick more streamlined and less of an entanglement issue.

Warning	Diver's must work with their instructors to ensure that the Sidekick is properly rigged and secured to the diver in the correct position. Failure to do so may result in a high work of breathing which could cause serious injury or death.

System Assembly

This section covers the assembly and testing of the GEM Sidekick diving system. Whether assembling for the first time, or prior to the next dive, these steps prepare the GEM Sidekick for diving, and verify that it is in proper condition to dive. An important part of ensuring proper gear assembly and operation is the use of checklists. Only by the use of checklists can you be sure that every step has been properly addressed for maximum safety. It is recommended that the first time you assemble your new Sidekick you have the assistance of your instructor. This manual is not a suitable substitute for an instructor's experience.

Checklists

Using the provided checklists is easily one of the most important parts of preparing for a dive. The instructors and divers who use these checklists have reported that their skill level on the diving systems increased quicker and that they understood their units better, which made them more organized and safer divers.

The first part of the checklist are the items that must be addressed and/or confirmed prior to suiting up for the dive while assembling the unit. While it is an assembly checklist, divers must refer back to the manual for full details on how to assemble their rebreather. It is important that the full assembly procedures in the manual are followed. We recommend that diver's keep several blank copies in a small binder with their dive gear.

The second part of the checklist are the items that are usually checked shortly before a dive. This list can also be printed out and carried in a small binder in your dive bag.

A point worth noting is that all pilots have a checklist, which they go through every time they fly. A diving system such as the GEM Sidekick should be no different. While diving a GEM Sidekick 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 checklist 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.

Warning	Diver's must follow the pre-dive checklists before every dive and should keep a copy of the checklist with the rebreather. Failure to use the checklist's may cause serious injury or death to the diver.

Display Calibration

The GEM Sidekick has a number of display options. While the details of calibration may differ, the steps are the same: calibrate the display to air (21%) and verify the calibration against the Nitrox mix in the diving cylinder.

Warning	Following 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!
Warning	Divers must ensure that the sensors can be calibrated properly in air and also verified in nitrox. This is very important. Even if the sensors are reading the proper millivolts, as they age you may no longer be able to calibrate them properly. IF THIS HAPPENS, THE SENSOR MUST BE DISCARDED. FAILURE TO USE A PROPER SENSOR WILL CAUSE SERIOUS INJURY OR DEATH.

Calibrate to Air

- Ensure that the cylinder valve is turned off.
- Remove the exhale hose from the scrubber quick disconnect tower.

- Open the mouthpiece (DSV).
- Take several deep breaths from the mouthpiece.
- This will draw air through the loop into the sensor area, displacing any nitrox in the loop. Depending on the previous percentage of nitrox in the loop this may take a few minutes to get a stable reading.
- Once the reading stops dropping, calibrate the display to air (0.209) per the instructions for your display (see below).

Verify Calibration with Nitrox

- The Sidekick must be fully assembled and connected to a nitrox tank. Remember to reattach the loop hose to the exhale tower. Then perform these steps:
- Turn the cylinder valve on.
- Open the mouthpiece (DSV).
- Remove the gas from the counterlung, just like a negative test.
- Press the ADV actuator paddle to fill the unit with Nitrox from the cylinder.
- Depending on the percentage of Nitrox in the tank, this may take a minute to stabilize. This reading should stabilize close to the analyzed Nitrox in the tank. Often it will be slightly lower due to residual air in the loop.

KISS FC PPO2 Display Calibration

The KISS FC PPO2 display uses wet contacts to activate. They are also used to calibrate and to move through the display options. To use these contacts, the diver's fingers must be wet.

There are 3 wet contacts: Left (L), Center (C), and Right (R).

- To activate the display, push L and C together.
- To start calibration push L and C together and hold for 10 seconds. You now need to choose your calibration gas. Choose 21% for air. To choose the calibration gas percentage:
  - To increase the percentage, push C and R
  - To decrease the percentage, push L and C
  - To exit and to set calibration gas push L, C and R for 3 seconds.
- At this point the display will cycle through the millivolts for each sensor.
- To exit the millivolt reading and to save the calibration results push L and C for 3 seconds. The PPO2 Display is now calibrated to air and the display is ready to dive. Verify the calibration using the Nitrox in your dive cylinder.
- To exit the millivolt readying and NOT save the calibration results push C and R for 3 seconds.

Once calibrated, press C and R for 10 seconds to go to the surface display. After 10 minutes the display will start a 30 second countdown and then go into sleep mode.

Shearwater GEM Calibration

Read the Appendix "Configuring The Shearwater For Semi-Closed Operation".

- Flush the unit with air as described above.
- Push the left menu button until you see Calibrate. Push the right select button. On the top line you will see millivolt reading of your sensor.
- While on this screen, pushing the left menu button will prevent calibration and pushing the right select button will calibrate. Push the right select button to calibrate; the reading should be 0.209 for air. If the display shows the word FAIL, then the calibration has failed because the millivolt reading is not in the proper range.
- If you push the right select button and the word FAIL does not appear, you have successfully calibrated the computer.
- Now verify the reading with your Nitrox mixture as described above.

Note	For calibration in altitude and full calibration information, please refer to your Shearwater Research user's manual.

Packing the Scrubber

The KISS GEM Sidekick may be used with either a Micropore Extend Air Cartridge, or granular CO2 absorbent. The canister durations are listed in the Appendix. The Sidekick is configured with the granular scrubber canister option. Those that wish to use the cartridge must ask for that configuration to be added to the unit at the time they are placing the order. This is important as the scrubber canister requires customizing to accept the cartridge.

Loading the Micropore EAC

The Sidekick uses a Micropore 5" large bore cartridge, part #SR-0801C. Micropore has several different cartridges available which all have similar part numbers. Please be certain to use the correct cartridge, double checking the part number and ensuring that it is the large bore cartridge prior to use. If the carton does not say large bore on the side, do not use it – it will not fit properly into the canister!

- Inspect and clean the inside of the scrubber canister where the gasket is located. Ensure that the gasket is properly installed and that it is in good condition.
- Inspect and clean the scrubber head and ensure that it is ready for diving. Ensure that the scrubber canister O-rings are clean, undamaged and lubricated.
- Place the head on your work area with the towers down and the sensor area facing up.
- Ensure that the sensor holder is in place, wires in good condition, and molex plugs properly secured to the sensors.
- Inspect, clean and lubricate the top and inner edge of the canister tube. These are the sealing areas and require lubricant.
- Secure the scrubber canister tube to the scrubber head ensuring that the threads are not damaged and the canister is not over tightened.
- Open the container that holds the cartridge and slide the cartridge out and remove it from the plastic bag. Once out of the packaging, handle it only by the sides.
- First push the cartridge into the scrubber canister ensuring it is pushed all the way against the scrubber head.
- Push the cartridge plug onto the bottom of the cartridge. Ensure that it is inserted all the way.
- Inspect and clean the scrubber base and ensure that it is ready for diving. Ensure that the scrubber base O-rings are clean, undamaged and lubricated.
- Inspect, clean and lubricate the top and inner edge of the canister. These are the sealing areas and require lubricant.
- Ensure that the spring has been removed from the base. It is not needed when diving the cartridge.
- Screw the scrubber bottom into the scrubber cylinder. Be careful not to cross the threads. Do not over tighten. This is not a watertight seal; so only tighten until it is secure.
- Ensure that the bungee and vacuum break are properly secured to the scrubber base.

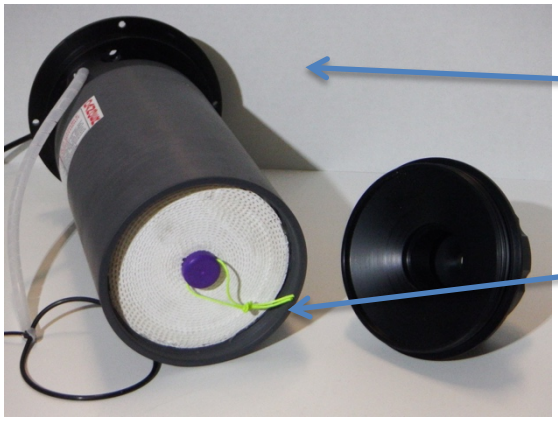


Figure 20: Cartridge Scrubber Canister

Warning	Take care to hold to hold the cartridge by the sides. The top and bottom ends are caustic and may burn your skin. There is more than one type of Micropore cartridge for recreational rebreather's. Ensure that you are using the correct cartridge! It must be the large bore cartridge. If the carton does not say large bore on the side, do not use it!

Loading Granular CO2 Absorbent

The scrubber canister holds 5.2 lb (2.4 kg) of Sofnolime 408 grade of absorbent. Sofnolime 408 is the recommended granular material. It is packed into the scrubber in the following steps:

- Inspect and clean the scrubber head and ensure that it is ready for diving. Ensure that the scrubber canister O-rings are clean, undamaged and lubricated.
- Place the head on your work area with the towers down and the sensor area facing up.

- Ensure that the sensor holder is in place, wires in good condition, and the Molex plugs properly secured to the sensors.
- Inspect, clean and lubricate the top and inner edge of the canister tube. These are the sealing areas and require lubricant.
- Secure the scrubber canister tube to the scrubber head ensuring that the threads are not damaged and the canister is not over tightened.
- Fill the scrubber canister one third full with the absorbent.
- Tap the side of the canister with the heel of your hand or a screw driver handle until the level stops going down
- Repeat the above procedure with the second third of the scrubber
- Fill to ½ inch from the bottom thread and place the basket on top of the absorbent.
- While pushing down on the basket, tap the canister until the level stops going down
- The level should be at ½ inch from the bottom thread.
- Inspect and clean the scrubber base and ensure that it is ready for diving. Ensure that the scrubber base O-rings are clean, undamaged and lubricated.
- Insert the spring into the scrubber base. Push it into the centre of base and turn counter clockwise to secure it.
- Inspect, clean and lubricate the top and inner edge of the canister tube. These are the sealing areas and require lubricant.
- Secure the scrubber base into the canister. The scrubber base secures the absorbent in the canister and also prevents any water that is in the counterlung from entering it. Be careful to not cross the threads or over tighten the canister, but do ensure that it is properly secured.
- Ensure that the bungee and vacuum break are properly secured to the scrubber base.

Figure 22: Granular Scrubber Canister Absorbent Height, with Basket, Base, and Spring

Figure 23: Basket inserted into Canister

Attaching the Counterlung and Counterlung Cover

Once the scrubber is packed, it can be inserted into the counterlung:

- Inspect the counterlung and stainless steel cover for any dirt or damage and ensure that are ready for diving.
- Inspect the scrubber head and canister assembly and ensure that it is clean and ready for diving and further assembly.
- Ensure that the scrubber head counterlung O-rings are clean, undamaged and lubricated.
- Inspect, clean and lubricate the sealing surface on the counterlung. This is the inside and top edge.
- Align the ADV access hole's on the stainless steel cover with the ADV actuator paddle.
- Align the counterlung attachment bolts with the holes in the scrubber head assembly.
- Carefully push the scrubber head assembly into the counterlung.
- Verify that the ADV access hole on the stainless steel cover is aligned with the gas connection on the scrubber head.
- Thread the knurled nuts onto the attachment bolts and tighten to secure. Since these do not affect the watertight seal, they should only be tightened until they are secure.

Figure 25: Scrubber Head, ADV, & CL Cover Alignment

Warning	The counterlung is a key component in the KISS GEM Sidekick diving system. Proper care should be taken with the care and maintenance of this component. It should be inspected regularly to ensure that it is in proper working order. Improper use &/or care may result in serious injury or death!

Mouthpiece and Loop Hose Connection

To attach the mouthpiece to the loop hoses, push the hose end with the hose attachment onto the mouthpiece. Be certain to lubricate the O-rings well first. Use standard silicone grease for these O-rings. The tolerances are tight between the hose attachments and the mouthpiece ends. Be certain that the hose attachment pushes all the way to the mouthpiece, so that the circ clip goes in smoothly. See photo below. Inspect to be certain that no O-rings were pinched. (The mouthpiece should be placed so that the diver sees the white arrow when wearing the unit. The mushroom valve is on the left and the moving piston valve is on the right.)

Once attached, insert the circ clip into the slots to secure.

Figure 26: DSV Circ Clip

Mouthpiece Positive and Negative Testing

It is essential that prior to every dive a mouthpiece positive and negative test is performed, along with a good visual inspection of the mushroom valve. The instructions for this procedure are as follows:

- Visually inspect the mouthpiece. Ensure that the mushroom valve and right side valve are undamaged and in good condition. Ensure that the left side Valve Disk is sitting properly and that you feel the right side valve assembly move freely.
- Attach the loop hoses to each side of the mouthpiece and put the mouthpiece in the closed position. Ensure the O-rings are clean, undamaged and properly lubricated.
- Blow into the left side loop hose, while holding the right side loop hose to your cheek. You should feel the air move freely through the mouthpiece and against your skin as it exits the right side hose.
- Suck gently on the same left side hose. You should feel the Valve Disk seal against the Valve Plate. Do not suck hard. It is not necessary and could damage the valve. These valves are expensive; take care of them. You should feel the valve seal. If there is a slight leak, rinse the mouthpiece in fresh water. Excess saliva or seawater in this area (from a previous dive) can cause the valve to leak. Rinsing will solve this problem.
- Suck on the right side loop hose and place the left side hose against your cheek. You should feel the valve assembly move and allow the air to move through the mouthpiece.
- Blow in the right side loop hose. You should feel the valve assembly seal and no air should pass through. It is important that the mouthpiece lever is in the closed position for the above tests. If left in the open position, the discharge ports will vent and the testing will fail.

Warning	The visual inspection is an important part of this testing; be certain to take your time when doing this to ensure the mushroom valve is not damaged. Failure to inspect the mushroom valve can cause serious injury or death.

Attach the Loop Hoses to the Scrubber Head

The loop hoses attach to the scrubber towers using a Quick Disconnect (QD) Hose Stub that has a double O-ring seal. Once the mouthpiece has been secured to the loop hoses, connect them to the scrubber head with the following steps:

- Inspect the O-rings on the hose stub's and ensure that they are clean, undamaged and lubricated.
- Inspect, clean and lubricate the QD towers and the sealing area on the scrubber head
- Position the Sidekick with the OPV furthest from you
- Connect the exhale hose stub to the exhale tower (right hand side)

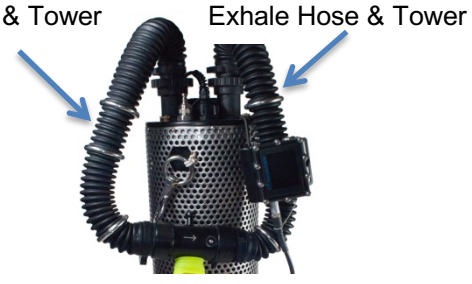


Figure 27: Loop Hose Attachment Points

- Connect the inhale hose stub to the inhale tower (left hand side)

Note	As the tolerances are tight on these fittings, it is important that the hose stub O-rings are properly lubricated! Be certain to properly lubricate the O-rings on all GEM hose stubs. After attaching the hose stub to the towers, take care to inspect the area to be certain that no O-rings were pinched.

Positive and Negative Test

Once the Sidekick is fully assembled, it needs to be tested to ensure that it was assembled properly. These tests verify that the system is airtight and watertight. Together these tests are referred to as the positive and negative test. If the unit fails the positive or negative test, then there is a leak in the system that must be located before the unit is safe to dive. The Sidekick may need to be disassembled to determine the cause. (Check the Troubleshooting section for likely causes.)

Any time the Sidekick is disassembled, a full positive and negative test must be conducted prior to diving. This means that anytime the Sidekick is assembled with fresh absorbent, a positive and negative test must be done. It also means that if any single component is removed from the diving system that a full positive and negative test must be done again. As well, a full positive and negative should also be done just prior to entering the water, when you do your final system checks. Whenever a seal is broken, test the unit. The instructions for these procedures are as follows:

- Connect the gas supply with the first stage turned off.
- Place the Sidekick upright on a table or on the floor; the loop hoses should be hanging freely.
- Place the mouthpiece in your mouth with the lever in the open position, and inhale. This creates a negative pressure in the loop. Draw all the gas out of the loop, until you cannot inhale any further, and close the mouthpiece. Do not inhale too hard as this could damage the valve disks. Be certain that when you close the mouthpiece that you don't allow any gas to leak back into the loop.
- Once you have closed the mouthpiece, let it hang down supported by the loop hoses. Watch its position. If there is a leak, the hoses will allow the mouthpiece to drop down further.
- After about 1 minute, open the mouthpiece. Listen for the sound of the gas rushing into the mouthpiece. This is important. Do not do this test for more than one minute as the pressure could damage some of the valves and diaphragms.
- Place the mouthpiece back in your mouth and exhale into it. Exhale until you see/feel the counterlung is full, and then close the mouthpiece while still exhaling. As you are exhaling, you will hear and feel the discharge ports vent. This is normal. Once the lever is in the closed position, the venting will stop.
- Once you have closed the mouthpiece, let it hang by the loop hoses, and watch its position. If there is a leak, they may move slightly or may move upward.
- After about 1 minute, open the mouthpiece. Listen for the sound of the gas rushing out of the mouthpiece. This is important.

If the Sidekick passes the positive and negative test, then proceed to the next step to prepare for diving.

If either the positive or negative test fails, then perform a quick inspection to verify that all components have been assembled and connected properly. Clean and inspect the hose and counterlung O-rings. If the test continues to fail, then check the Troubleshooting section for likely causes.

Note	When doing your test, it is VERY important to not inhale so hard that you are damaging the mushroom valve. When you do the negative test, inhale until you get a good seal, and then immediately close off the mouthpiece. If you inhale 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 from exertion, this is way too hard. There is no need for this and it will damage the valve. Inhale just until you feel that pressure then close the valve. The mouthpiece has a large bore. In order to get a good work of breathing, the mushroom valve used is very flexible. This means that diver's need to ensure they 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.

Note	A hard negative test can and will dislodge the mouthpiece discharge port diaphragms. It is not necessary to do a hard negative test to ensure that the Sidekick is properly assembled. If you feel this could be a problem, ensure that the diaphragms are properly secured and be gentle when doing a negative test. Once the diaphragms are not seated properly, they will need to be properly placed again.
Note	The Sidekick will not pass a negative test if connected to a first stage regulator with an Atomic 2nd stage. The Atomic 2nd stage has floating poppet, which will cause a vacuum leak.

Five Minute Pre-Breathe

One of the last steps prior to diving the Sidekick is to perform a five minute pre-breathe. This test is to determine if the scrubber and the rebreather are working properly. Some divers inaccurately believe this step is to warm up the scrubber material before entering cold water. While this may be a side benefit for divers in very cold environments, it is not the intent of the test.

The pre-breathe 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-breathe. 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 disk (mushroom valve) is in place and working properly. The pre-breathe 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-breathe confirms your system check has been done and that all is working.

To do a pre-breathe on the Sidekick, ensure that the cylinder is open, your display is turned on, and put the mouthpiece in your mouth and start breathing. To prevent accidently breathing through your nose, pinch your nose, or wear your dive mask. Also, have a timer handy so that you can be certain that you pre-breathe for at least 5 minutes. Plan to either wear the Sidekick or stand close to it, for good work of breathing.

The higher the nitrox mix to be used, the less likely it is that you will be breathing a hypoxic mixture while doing the pre-breathe. To be safe, you should plan on monitoring your PPO2/FIO2 gauge continuously while doing this test. In the event that the percentage falls below 21%, you should fully exhale out of your nose (don't inhale) and then draw fresh Nitrox into the breathing loop using the ADV stage.

The pre-breathe should be done on the surface in a safe environment. It should not be done while in the water or where you are in danger of falling in the water.

Warning	During the 5 minute pre-breathe, divers must follow the instructions and monitor the PPO2/FiO2 gauge continuously, venting the loop and adding fresh Nitrox if the breathing gas percentage falls below 21%. Depending on the Nitrox mixture in the cylinder, this may need to be done frequently or not at all. Every diver will metabolize oxygen differently.

Diving Procedures

Select the proper gas

The GEM Sidekick extends the tank duration by up to three times, while providing warm, moist breathing gas. This enables the diver to spend longer underwater. Higher percentages of nitrox also provide longer no decompression limits. For optimum dive time the diver should choose the highest nitrox percentage without exceeding the Maximum Operating Depth (MOD) or the diver's training. Please see the Theory of Operation for more details. Approved nitrox mixtures for level 1 GEM Sidekick diving is 32% to 40% nitrox.

Warning	KISS Rebreathers strongly recommends that Sidekick diver's use a nitrox percentage of 36% or higher. Diving lower percentages of Nitrox could be dangerous. Also be certain that you have personally analyzed your cylinder and know what mix you are diving.

Open Loop

Your Sidekick instructor will demonstrate the proper technique of breathing open loop, and the conditions where it should be used. When using open loop the diver inhales from the GEM Sidekick mouthpiece and exhales through their nose. Each inhale will provide 100% fresh gas from the supply tank. This is very similar to open circuit, except that the gas is passing by the O2 sensors and through the inhale hose.

Buddy Checks

When diving with a buddy that does not have experience with the Sidekick, it's always good the give them an overview prior to gearing up. Discuss buddy checks, diving plan and hand signals as well before the dive.

After completing the pre-dive checklist and donning dive gear, a diver should work with his buddy to perform checks of each diver's gear. These are performed just prior to the dive, and only take a few seconds.

After descending below 20ft, and switching to the GEM Sidekick, have your buddy do a bubble check. They should look around you for any bubbles escaping unexpectedly. It is best to find these bubbles while close to the surface, prior to descending to depth. Resolve the problem before continuing the dive.

Trim and Counterlung Adjustment

With proper weighting and trim a diver should be horizontal in the water. This position provides minimum resistance to water flow and more efficient motion.

For the lowest Work of Breathing (WOB), the counterlung of the GEM Sidekick should be located as close to the diver's lungs as possible. Side-mounting or carried like a stage bottle places the Sidekick out of the way, but parallel to the diver's body. This allows for the lowest work of breathing while keeping the diver streamlined. During the first few dives, the diver should try different positions of the attachment points. When the unit is parallel to the divers body and both are in the horizontal position, the hydrostatic pressure is kept at a minimum. The length and position of attachment points can be fine-tuned to optimize this configuration. Work with your instructor to achieve the best configuration for your diving conditions.

Breathing in Different Orientations

While the best Work of Breathing is achieved with the unit and the diver in a horizontal position (counterlung and mouthpiece at the same depth), the length of the counterlung allows for easy operation in most positions. The Sidekick should be secured so it is fairly tight to the diver and not dangling. Two positions are of special note.

- Sidekick below the diver who is horizontal in the water: If the unit is secured to the diver in such a manner that it is laying below him while he is in the horizontal position, the increased hydrostatic pressure on exhale will cause the GEM mouthpiece to vent more gas than normal. This can cause the diver to consume more gas than expected. Keep this in mind when planning a dive. Also if the bottom of the Sidekick is allowed to move around too much, the counterlung can also drop below the diver.

- Diver in a vertical, head down position with the Sidekick above the diver in the water: This position will cause a reduced hydrostatic pressure on exhale. This may cause the GEM mouthpiece to vent less gas and therefore cause the PPO2 to drop. In this position the diver should constantly monitor the PPO2, or switch to open circuit or open loop.

Warning	Do not continue to breathe from Sidekick if the mouthpiece is not venting properly.

If the diver is in a vertical head down position, the mouthpiece is significantly below the counterlung. Or if a sidemount diver rolls to one side with the sidekick up, the mouthpiece is again below the counterlungs.

Descent

Do not breathe the Sidekick on the surface. During descent from the surface to 20ft the diver should breathe open circuit or open loop. Below 20 feet switch to the Sidekick, and perform a bubble check.

Breathing the Sidekick on descent, the ADV will activate more than usual to make up the gas volume lost due to the pressure increase. Always pay special attention to the PPO2 monitor when changing depth.

If the Sidekick is being used for bailout, be sure the ADV is equalizing the pressure in the counterlung during descent. Failure to equalize the pressure could cause damage to the counterlung, rendering the Sidekick inoperable when it is needed. This is easily monitored as you will see upon descent that the lung is not flat and gas is being added.

Warning	Diver's must monitor their PPO2 display or dive computer, every minute of the dive.

At Depth

Once the diver is swimming at depth the PPO2 will stabilize based on the workload and also maintaining a constant depth. Roughly one third of each breath will be vented from the GEM mouthpiece with the ADV activating to replace this gas toward the end of the inhale cycle. A few points to keep in mind:

- Don't be distracted, or become complacent. Always monitor your PPO2.
- Observe the quantity of bubbles vented from the GEM mouthpiece. If this quantity changes, determine the cause and respond appropriately. If the bubble quantity slows, stops, or increases beyond what you normally see switch to open circuit or open loop, and then determine the cause.
- The diver's buoyancy control will be different when diving the Sidekick. Since the diver is only venting one third of each breath, the change in buoyancy is only one third as much as open circuit. For a diver switching from open circuit to the Sidekick, this transition can take a few dives to adjust to the change.
- Breathing is warmer. Many open circuit divers do not realize how much heat is lost when breathing the cold gas it generates. Breathing on the Sidekick the diver will be considerably warmer during the dive.
- The Sidekick can significantly extend your gas supply. Do not exceed your dive plan and exceed the No Decompression Limits. Rebreather training does not prepare the diver for decompression diving. Additional equipment, training, and experience are required for this type of diving.

Warning	if the ADV is not adding gas properly, then you will need to bail out to your back up regulator which is attached to the necklace around your neck (or alternatively located in the appropriate area as per open water training). Alternatively, bail out to your buddies second stage if necessary.

Ascent

As with any rebreather, the PPO2 must be closely monitored during ascent. There are two factors to consider during ascent. First, the PPO2 is dropping simply due to the drop in ambient pressure. Second, the gas in the loop is expanding.

During a normal ascent rate of less than 60 ft/min, this is not a large issue. Since the Sidekick vents gas with each breath, the expanding gas is expelled with the diver's exhale, and the PPO2 will drop slowly as the pressure drops slowly.

If the diver exceeds the normal ascent rate, the gas expanding in the loop can exceed the gas expelled by the mouthpiece. This can quickly become a critical issue. First the Sidekick will become positively buoyant, possibly accelerating the ascent rate. Second, the expanding gas will prevent the ADV from replacing the O2 in the loop. This can cause a drop in PPO2 below the expected value for the depth. The best response in this situation is to exhale each breath through your nose until the ascent is brought under control. This will vent all of the gas from the Sidekick while providing fresh gas from the supply tank.

Due to the larger pressure changes and lower ambient pressure, the diver should switch to open circuit or open loop while ascending from 20ft to the surface.

Warning	The Over Pressure Valve (OPV) on the Sidekick scrubber head is designed to prevent damage to the unit. It is not intended to vent gas on ascent while breathing on the unit, and cannot be relied upon to relieve excess loop volume on a rapid ascent. If the ascent is rapid or un-natural, the diver on the breathing system will feel resistance; like they are blowing up a balloon. Exhaling out of your nose will help to relieve the pressure. The OPV is NOT for the sole purpose of venting for you while diving. The GEM diving system should be dove with the OPV in a fully closed position. If it is not fully closed, you may be venting during the dive when you shouldn't be; this will cause you to use an excess amount of gas!

Warning	Fast ascent rates are dangerous to all Scuba divers, especially to rebreather divers. Divers should avoid situations that may lead to a fast ascent. Switch to open circuit under conditions where a fast ascent cannot be avoided.

Gas Switching

Regardless of the number of gasses used during the dive, the diver should be able to disconnect and reconnect the gas supply from the gas addition QD on the top of the Sidekick scrubber head. As described earlier, the QD has a locking ring that turns smoothly to lock and ratchets to unlock. While this is easy to feel with bare hands, it may be more difficult with the heavy gloves worn in cold water. Practice disconnecting and connecting the gas supply while wearing gloves, prior to gearing up to dive.

The procedure for gas switching should be covered in detail with your Sidekick instructor. The basic steps are as follows:

- Signal your dive buddy that you are switching gasses.
- Close the DSV and switch to an open circuit regulator.
- Grab the cylinder you are switching to.
- Verify it is the proper gas for the dive depth.
- If the cylinder is closed, turn it on.
- Pull out the off board gas whip with the female QD.
- Unlock and unplug the current off board whip from the QD on the top of the Sidekick.
- Connect the new cylinders QD to the top of the Sidekick and turn the locking ring.
- Switch to the Sidekick mouthpiece.
- Purge the mouthpiece and open it.
- Verify that the PPO2 of the new gas
- Stow the off board whip from the previous cylinder & ensure your bailout regulator is properly stowed.
- Give dive buddy an OK.

It is very important to switch to open circuit during the gas switch. Which tank feeds the second stage is dependent on your dive plan. The QD on the top of the scrubber contains a one-way valve. This will prevent water from entering the Sidekick as long as the ADV is not activated. If the diver were to inhale from the Sidekick while the QD was disconnected, water would be drawn into the unit.

Warning	Do not breathe from the Sidekick mouthpiece when the gas supply is not connected.

Flood Recovery

If water is inadvertently allowed into the mouthpiece, exhale loop hose and counterlung, it is possible to flush it out while underwater. Keep the unit in a head down tilt to prevent the water from entering the scrubber.

- Signal dive buddy that you are performing flood recovery.
- Close the DSV and switch to an open circuit regulator.
- Turn the OPV counter-clockwise until it stops (all the way open).
- Lift the mouthpiece and hoses above the scrubber head to drain the water from the exhale hose into the counterlung.
- Position the Sidekick so that the OPV is the lowest point.
- Press the actuator paddle of the ADV until the counterlung fully inflates and water is forced out of the OPV.
- Switch back to the Sidekick mouthpiece.
- Purge the mouthpiece and open it.
- Listen for gurgling in on exhale.
- Repeat if necessary.
- Fully tighten the OPV once flood recovery is complete.
- Give dive buddy an OK .

Warning	Performing a flood recovery will make the Sidekick very buoyant. This procedure should only be executed if the diver can prevent an unexpected ascent. If water intrusion is due to damage to the Sidekick then switch to open circuit and end the dive. Do not continue to breathe from the Sidekick if it is damaged. If water has entered the scrubber the Work of Breathing will increase significantly. Switch to open circuit and end the dive. Gurgling heard in the inhale loop hose, or during the diver inhale, indicates water may have entered the scrubber. Immediately switch to open circuit and end the dive.

Post-Dive Procedures

Whether planning another dive, or done for the day, there are several steps to perform after each dive.

Along with the procedures below, as part of your post-dive analysis, log any issues or thoughts you had during the dive. Some items to consider are:

- Gear Placement – did the Sidekick feel like it was too high or too low? Did the hoses sit properly?
- Weight – was the amount of weight carried the proper amount? Is more or less required? Once you know the amount of weight that is required, write this down in your log so that on future dives you can easily recall the number.
- Work of Breathing – did it feel normal? Did the ADV activate properly? Was the mouthpiece exhausting more than expected?
- Could you access the attachment points properly?
- Was your gas consumption what was planned?
- Was your PPO2 at depth what you planned?

Doffing

The first step should be to remove the PPO2 Display from your wrist. It is too easy to remove the Sidekick and set it down, forgetting that it is still tethered to you. This may put unnecessary strain on the connections and cable. Do not allow the display to swing on the cable and knock into other gear. A convenient option is to clip the display to the inhale loop hose just above the tower. This can be done before even exiting the water.

Disconnect the gas supply from the top of the scrubber.

Depending on your gear configuration, the Sidekick can now be unclipped and set down in a position where it cannot fall or roll. Again care should be taken to prevent ware or damage to the display, display cables and mouthpiece.

Between Dives

Even if you are planning another dive after your surface interval, there are few steps to perform.

- Note the dive depth and dive time in your dive log.
- Turn off the PPO2 display.
- Disconnect the exhale loop hose from the tower on the scrubber head. Holding the mouthpiece in one hand allow the loop hose to drain. A small amount of water can condense over a dive and is expected. A large amount of water should be investigated. See the Troubleshooting section.
- Lift the bottom of the Sidekick up at a 45 degree angle with the exhale tower as the lowest point. This should drain any water out of the counterlung. Again, a small amount of water may condense in the counterlung. Any more than a few drops should be investigated. See the Troubleshooting section.
- Reconnect the exhale loop hose to the scrubber head.
- Disconnect the inhale hose from the top of the scrubber head. Leave this hose disconnected during your surface interval. This will allow air into the scrubber head to dry some of the moisture near the sensors. This will also reduce the oxygen fraction in the scrubber head, thereby reducing the exposure to the oxygen sensors.
- Log the amount of time used on the absorbent. Based on your dive plan, determine if a scrubber change is called for.
- Go through the Pre-Dive checklist before the next dive.

Breakdown and Cleaning

A post-dive checklist can be found in the Appendix. Keep this in your dive gear container.

During disassembly and cleaning, be careful of the O-rings on the hoses, and mouthpiece. Special care should be given to the Fischer cable and connector.

Storage

As with all dive gear, the Sidekick should be clean and dry before storage. Store in a cool, dry place way from hydrocarbons and sources of ozone.

For long storage the unit should be disassembled. The scrubber head should not be attached to the counterlung and the loop hoses should be disconnected from the top of the scrubber and the mouthpiece. This will remove pressure from the O-rings and extending their service life.

Maintenance and Service

Note	It is recommended that all service for the KISS GEM Sidekick be done by your dealer or instructor. For those who feel that they would like to be able to install the spares, it is strongly recommended that instruction be taken from your dealer or instructor to ensure that the repairs are done correctly.

Hose Attachment Towers

The hose attachment towers have been secured using a tool. If a new tower or tower O-ring is required you may need a strap wrench in order to remove this part.

After you have removed the old tower, lubricate the O-ring for the new tower, place it around the threaded area, and turn the tower into the head. The tower must be properly secured. Be certain to securely tighten it. Use a strap wrench for this. The tower should not be easily removed by hand.

Warning	If the tower is not secured properly, the action of attaching the loop hose may cause the tower to turn unexpectedly. If this happens and you do not notice it, there will be a leak. This could cause serious injury or death!

Mouthpiece Discharge Port Diaphragms and Buttons

To change the discharge port diaphragm, center the diaphragm on the ridge and attach the button and screw. Turn the screw all the way in, and then back it off half a turn. Using either the Allan wrench or your fingers, rub the diaphragm gently to ensure that it spins freely and isn't caught or bound. Tighten screw down all the way.

The button should be positioned so that the wide area is at the top. This allows the diaphragm to move freely.

Ensure that the diaphragms are lying flat. If they are not flat, water may enter the breathing loop.

Care for your Fischer Connector and Cable

Having Fischer connectors on the GEM Sidekick 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 it operates properly.

The Fischer connector port is watertight and any water that gets in to the port cannot harm your rebreather or computer's. However, should seawater 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:

- Inspect the connectors and look for any signs of corrosion; parts will start to turn green.
- 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.
- Keep the inner O-ring lubricated by either applying a SMALL amount of grease on the metal end of the Fischer cable that slides into the wrist display/computer's 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 that is reading erratically, this could be a solution.
- If you use mineral oil, drain any excess prior to replacing the caps.
- 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.

Recommended Spare Parts

The following is a list of recommended spare parts and accessories:

- Spare: Scrubber head hose attachment tower, with O-ring
- Spare: Mouthpiece circ clips, 2
- Spare: Mouthpiece discharge port diaphragm and button set
- Spare: Display battery
- Spare: O-ring set:

    2 x scrubber canister head

    2 x scrubber canister base

    2 x scrubber counterlung

    2 x hose attachment tower

    4 x hose stub

    4 x mouthpiece hose attachments

- Spare: White mesh pad, diffuser plate and spring for the Granular Scrubber Canister.
- Spare: Base crosspiece for the Cartridge Scrubber Canister.

Troubleshooting

Failed Positive or Negative

Check the following if the Sidekick does not pass the positive or negative test:

- Inspect the O-rings on the loop hose QD hose stubs where the hoses go into the scrubber head towers. These can get pinched during assembly, or they may need to be lubricated. Check the sealing surface of the towers for dirt.
- Inspect, clean and lubricate the O-rings on the mouthpiece hose attachment ends. Verify that they are not getting pinched during assembly.
- Inspect, clean and lubricate the counterlung O-rings on the scrubber head assembly.
- Inspect, clean and lubricate the sealing surface of the counterlung.
- Verify that the hose attachment towers on the canister head are securely tightened.
- Verify that the OPV exhaust valve is closed all the way.
- If the OPV exhaust valve has been serviced recently, verify that the O-ring is properly installed and the spacer inserted correctly.
- Verify the head has been properly secured, and is firmly secured to the canister.
- If any sealing O-ring was previously pinched and has an indent, it will need to be changed.
- If the unit still fails a Positive test, try submerging the unit in water while performing the test. This can assist in locating the source of the leak.

Water in the Loop

If the Sidekick has passed the positive and negative yet still has water in the loop hoses or counterlung, there can be a number of causes. A small amount condensation is normal, and not a concern. The exact amount will depend on water temperature, the length of the dive, and diver workload. If over half a cup of water is found in the loop, then follow these steps to isolate the problem:

- Drain the water from the loop and perform a positive and negative test. If the test fails, then this is probably the source of problem. See the section on the positive and negative test.
- Divers new to rebreather's often have "loose lips". This occurs when water passes between the diver's lips and the mouthpiece, especially when turning the head to one side. On open circuit this excess water is purged from the second stage with each exhale. While using a rebreather the diver's exhale does not purge this water. Be conscious of keeping lips tightly sealed on the mouthpiece.
- Make sure that the mouthpiece is closed properly whenever the mouthpiece is not in your mouth.
- Inspect the mouthpiece discharge port diaphragms. They should sit flat against the mouthpiece housing. If they are not sitting flat, flip them over or replace. (Water will be in the exhale hose/lung.) It is recommended that the newest version of the diaphragm and button are being used.
- Verify that the mouthpiece lever is securely tightened. (Water will be in the exhale hose/lung.)
- Check that the rubber SCUBA mouthpiece (with bite tabs) is securely fastened to the Sidekick mouthpiece. Ensure that the one you are using is the correct size and not damaged in any way.

Bubbling OPV, Apeks Exhaust Valve

There are generally three issues that can cause this problem:

- Excessive gas in the counterlung. If the counterlung is full, the exhale will have to be forceful, and may cause the OPV to bubble.
- The exhaust valve is not closed all the way. Turn the OPV clockwise until it stops.
- Debris in the valve. 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	Do not spill anything down the inhale scrubber tower. If this happens, and you go upside down, the item may find its way inside your Apeks exhaust valve that may cause a leak.

Stretching the Exhaust Valve Spring

If the valve is clean and it was tightened all the way, but still bubbles, 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 cannot turn it anymore, stop. There is a tab that 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 clockwise. 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 clockwise. Be very careful to not break the tab. If you do, the entire valve must be replaced.

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 GEM Sidekick.

Figure 28, 29, & 30: Apeks Exhaust Valve

ADV Stiff in Triggering

If the ADV is difficult to trigger then the following steps should be performed. See also the Demand Valve (ADV) section on page 14 for more adjustment instructions.

- Verify that the vapor break is in place.
- Verify that the white paddle is in the correct position and that the securing set screw is tight.
- With the gas supply disconnected, check that the ADV valve shaft moves freely. Make sure the actuator paddle does not bind against the head assembly. If necessary move the paddle to prevent binding.
- Inspect the gas connection QD on the first stage and scrubber head for contamination.
- Check the IP on the first stage. Ensure that it is in the correct range, 135 to 145 PSI.

High Work Of Breathing

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

- Too much gas in the loop. This will result in a significant resistance on exhale, especially toward the end of the breath. Also, the ADV will not activate on inhale. This is easily resolved by venting the remaining breath through the nose. Do this until the ADV activates on inhale, and the resistance on exhale goes way. 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 cannot get a full breath and the breathing will be difficult.
- Check the position of the counterlung. The Sidekick should be attached so that its counterlung is parallel to the diver's lungs. With the diver in a horizontal position, the Sidekick should be tucked under the arm with the top of the unit just below the diver. If the attachment connections allow the unit to drop below the diver, (clips are too

loose or the bottom clip is too low on the diver) the work of exhale can become significant. It is important to spend time on the first few dives working out the best attachment for optimal work of breathing.

- Position in the water - As mentioned previously, the KISS GEM Sidekick will have the lowest Work of Breathing when the diver is in a horizontal position. The Work of Breathing will increase when in a vertical orientation. This will be most noticeable at the start of the training course. After several dives, most divers hardly notice the difference.

Display Troubleshooting

Oxygen sensors are analog devices, but they are connected to a digital computer/gauge for display. There are a few different issues that may be encountered:

Sensor will not calibrate in air

Check your dive computer manual for instructions on calibrating to air. If using a Shearwater computer, it must be set to Semi-Closed mode to calibrate with air. Check the Appendix for instructions.

Check the millivolts on each sensor. If the millivolts are out of range on the dive computer, then check the voltage with a voltmeter right on the sensor connections. Replace any sensors that are out of range.

If the sensor voltage differs between the dive computer/guage and the connector on the back of the sensor, then there may be an issue with the display cable, or Fischer connector. See the section on Caring for Fischer Connectors.

Sensor will calibrate in air, but the cylinder nitrox does not match

Keep in mind that the cylinder was analyzed with another sensor. If it was the shop's analyzer, then you do not know the accuracy. Additionally sensors in the Sidekick may read lower after the first dive. This is due to moisture on the sensor face, and is not uncommon. If the readings from the Sidekick sensors and the cylinder analysis are within 1%-2%, this should not be an issue.

Sensors do not match each other

The sensors should match within 1%-2%. Make sure they have been properly calibrated. A new sensor may have different readings than an older sensor. This is not unusual. However, they should still be close.

Sensors match on the surface, but not underwater

This is often an indication that one of the sensors is beginning to fail. If two of the sensors closely match, but the third is much lower, it may be "current limited". This sensor should be replaced immediately.

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.

Warning	It is important that all the skills covered in your training course are learned and mastered. Under no circumstances should anyone dive a KISS GEM diving system until they have completed an approved training course.

Appendix

Scrubber Duration

The durations for the KISS GEM Sidekick cartridge and granular absorbent are based on independent testing done at the Micropore Inc. test facility. The testing was done using the Micropore 5" large bore cartridge, part #SR-0801C. The granular absorbent tested is Sodasorb HP from diverssupplyinc.net. This is the granular absorbent that we recommend. Multiple tests were conducted. (If using a cartridge, ensure that you use the correct one; the part numbers on the various Micropore cartridges are very similar.)

Based on the various tests conducted, the diving durations for the KISS GEM Sidekick Micropore cartridge, and granular absorbent are as follows:

- Cold water, 4°C/39.2°F: 2 hours
- Moderate water, 10°C/50°F: 3 hours
- Warm water, 24°C/75°F: 4 hours

Sidekick Assembly Checklist

NAME: _____ DATE: _____

THIS ASSEMBLY CHECKLIST IS NOT A SUBSTITUTE FOR THE USER MANUAL. DIVER'S THAT CHOOSE TO USE THIS SHEET MUST BE CERTAIN THEY UNDERSTAND THE ASSEMBLY PROCEDURES LISTED IN THE MANUAL WITHOUT QUESTION.

- ☐ Ensure that the nitrox cylinder has been filled and then personally analyze the contents to verify the percentage of oxygen, pressure, & MOD. O2 _____% Pressure _____ PSI/bar MOD _____ft/m.
- ☐ Inspect the scrubber head and ensure that all components are properly secured, clean and not damaged.
- ☐ Secure 3 approved sensors to the sensor holder and install the holder onto the scrubber head.
- ☐ Ensure that the wiring and Molex plug's are not damaged, properly secured, and in good working order and then secure Molex plug's to the sensor's.
- ☐ Inspect, clean and lubricate the scrubber canister O-rings on the scrubber head.
- ☐ Lay the head on the towers, with the underside facing up.
- ☐ Inspect, clean and lubricate the canister tube sealing area and then secure it to the scrubber head.
- ☐ The canister may now be packed.
  Date packed _____ Material _____ Time used _____ Time left _____
- ☐ Configure the scrubber canister for either granular absorbent or for a cartridge.
- ☐ **For those using the granular absorbent:**
  - Fill the canister a third of the way & tap to settle, fill another third and tap to settle, and then fill to a ½ inch from the bottom thread. Place the scrubber basket onto the absorbent, While pushing down on the basket, tap to settle until it doesn't settle any further. When finished absorbent should be a ½ inch from bottom thread.
  - Inspect, clean and lubricate the sealing area's on the open end of the scrubber canister tube.
  - Inspect the scrubber canister base and ensure that it is not damaged and in good condition.
  - Inspect, clean and lubricate the scrubber canister base O-rings.
  - Insert the spring into the centre of the base, and turn counter clockwise to secure.
  - Thread the scrubber canister base onto the scrubber canister.
- ☐ **For those using the cartridge:**
  - Inspect the rubber gasket on the inside of the scrubber canister and ensure that it is properly secured, not damaged and clean.
  - Insert a new cartridge into the canister; ensure that it is not damaged.
  - Secure the cartridge plug to the bottom of the cartridge.
  - Inspect, clean and lubricate the sealing area's on the open end of the scrubber canister tube.
  - Inspect the scrubber canister base and ensure that it is not damaged and in good condition.
  - Inspect, clean and lubricate the scrubber canister base O-rings.
  - Ensure that the spring has been removed from the canister base; it is not required for use with the cartridge.
  - Thread the scrubber canister base onto the scrubber canister.

- ☐ Inspect ADV actuator paddle – verify that it does not bind on activation.
- ☐ Inspect the scrubber head and canister assembly. It should be undamaged, clean and ready for final assembly.
- ☐ Inspect the vacuum break and bungee and ensure that they are undamaged and properly secured to the assembly.
- ☐ Inspect, clean and lubricate the counterlung O-rings on the scrubber head assembly.
- ☐ Inspect, clean and lubricate the counterlung sealing surface.
- ☐ Insert scrubber assembly into counterlung.
- ☐ Ensure that the ADV is properly lined up with the ADV access.
- ☐ Attach knurled nuts to secure counterlung to scrubber head assembly.
- ☐ Inspect the mouthpiece mushroom valve on the left side valve plate. Verify that is flat and smooth and not damaged in anyway. Ensure that it is facing the correct direction so that gas flow is going from left to right.
- ☐ Inspect the mouthpiece right side valve assembly. Gently shake the mouthpiece; the inner valve should move freely.
- ☐ Verify that the discharge ports on the mouthpiece are venting properly and that the diaphragms are in good condition
- ☐ With the mouthpiece in the closed position, exhale into it to ensure that the vent hole is unobstructed and is venting properly.
- ☐ Inspect, clean and lubricate the loop hose mouthpiece attachment O-ring's and the mating sealing surface's.
- ☐ Attach loop hoses to mouthpiece and secure with circ-clips.
- ☐ Verify that mouthpiece attachment O-rings are not pinched

- ☐ Perform mouthpiece and loop hose positive and negative test to verify that the mushroom valve and the right side valve assembly are working properly.
- ☐ Inspect, clean and lubricate the loop hose QD hose stub O-ring's and tower sealing surface's.
- ☐ Attach loop hose QD hose stub's to scrubber head towers: with the OPV furthest from you, secure the exhaust loop hose to the right tower and the inhale loop hose to the left tower. The arrow on the mouthpiece should be on the top side pointing towards the exhaust hose.
- ☐ Verify that the hose stub's are properly connected and that the O-rings are not pinched.
- ☐ Verify that the mouthpiece is facing the correct direction
- ☐ Perform system positive and negative test
- ☐ Verify that mouthpiece discharge port diaphragms are lying flat; re-seat if necessary.
- ☐ Attach the first stage to your cylinder; leave the valve closed.
- ☐ Attach female gas addition QD which is secured to the first stage regulator, to gas supply male nipple on the scrubber head
- ☐ Inspect the display cable for damage
- ☐ Inspect the Fischer connector for damage, dirt and rust - clean and lubricate if necessary
- ☐ Turn on PPO2 monitor
- ☐ Check PPO2 monitor battery
- ☐ Flush the unit with air and calibrate PPO2 monitor to 21%.
- ☐ Turn cylinder valve on & then turn it off immediately. Watch the pressure gauge to verify there isn't a leak.
- ☐ Turn the cylinder back on.
- ☐ Inhale from mouthpiece and exhale out of your nose a few times to verify the ADV works as it should. Watch the PPO2 display while you are doing this. Ensure the PPO2 is reacting the way it should, based on the percentage of gas in the system. Leave the mouthpiece open when you are finished.
- ☐ Manually activate ADV to flush system with Nitrox in order to verify the sensor calibration. The percentage should be with in 1 or 2 % of the analyzed gas percentage.
- ☐ Turn the cylinder off and close the mouthpiece.
- ☐ Disconnect the gas supply from the scrubber head.
- ☐ Turn the PPO2 display off.

This completes the GEM Sidekick assembly checklist. This form can be used when assembling the diving system for the next dive. The unit is now assembled and ready to dive. Perform the Pre-dive checklist on the next page prior to each dive.

Warning	As diver's may assemble the Sidekick sometime before the dive, it is very important that the check sheets on the following pages are followed completely. Every item on the check sheet should be followed without fail and these checks should be done just prior to the dive. If the pre dive checks are done before reaching the dive site, either by car or boat, a positive and negative rebreather test, as well as the pre-breathe should be performed again just prior to entering the water. This is very important as during transit a component on the rebreather could have been damaged or the absorbent shifted which could cause channeling.

Sidekick Pre-dive Checklist

NAME: _____ DATE: _____

DIVE LOCATION: _____ DIVE NUMBER: _____

This pre-dive check should be completed after the assembly checklist, prior to entering the water.

Dive Planning

- ☐ Supply cylinder: Oxygen Percentage: _____% MOD: _____ft/m Pressure: _____ PSI/bar
- ☐ Surface Interval: ____:_____ Current CNS:_____% Current OTUs: _____
- ☐ Planned dive depth: _____ft/m Planned Bottom Time _____min
- ☐ PPO2 of supply cylinder gas at depth: _____ ata Planned CNS:_____% Planned OTUs: _____
- ☐ Gas required for the planned dive: _____cft/l Bailout gas: _____ cft/l Inflation gas:_____cft/l
- ☐ Verify that the planned dive depth does not exceed the MOD of the supply cylinder gas
- ☐ Verify that the dive depth does not exceed diver certification
- ☐ Verify that the final CNS does not exceed 80%
- ☐ Verify that the final OTUs do not exceed the daily limits.
- ☐ Verify that the supply cylinder has adequate gas for the planned dive, bailout and reserve

Dive Buddy

- ☐ Name:_____
- ☐ Review dive plan, emergency procedures and hand signals
- ☐ Review Sidekick operation, buddy check and bubble check procedures

System Check

- ☐ Verify that the unit is properly assembled as per the instructions in the manual
- ☐ Gently shake mouthpiece to verify right side valve is moving freely.
- ☐ Inspect the left side mushroom valve and ensure it is flat and smooth and not damaged in any way. Also ensure that it is properly installed so the gas flow goes left to right.
- ☐ Perform a mouthpiece & loop hose positive and negative test to verify that the mushroom valve and right side valve assembly are properly working.
- ☐ Verify that the mouthpiece discharge port diaphragms are properly venting by breathing on the mouthpiece and that the diaphragms are not damaged.
- ☐ Verify that the mouthpiece vent hole is unobstructed and is venting properly. Do this by exhaling into the mouthpiece with it in the closed position.
- ☐ Perform negative and positive pressure test's.
- ☐ Re-inspect the mouthpiece discharge port diaphragm's and button's; re-seat them if necessary.
- ☐ Turn on PPO2 monitor and calibrate/verify the display in air.
- ☐ Verify OPV is closed (clockwise)
- ☐ Visually inspect the assembled unit and display cable to ensure that all is in good working order.
- ☐ Plug the off board gas whip into the scrubber head.
- ☐ Open the cylinder and verify that the cylinder has adequate gas and log the pressure above.
- ☐ Close the cylinder and watch the pressure gauge for any leaks. Once complete, open the cylinder valve again.
- ☐ Verify that the ADV works: Inhale from the mouthpiece and exhale from your nose and ensure that it works as it should. Watch the PPO2 display as you do this and ensure that it is reacting accordingly.
- ☐ Test manual operation of ADV pushing on the lever.
- ☐ Flush unit with Nitrox from the supply cylinder (mouthpiece is open)
- ☐ Verify PPO2 monitor against supply cylinder Nitrox (close mouthpiece once nitrox mix is verified)
- ☐ Inspect the wing inflation and dry suit inflation system's and ensure they are working properly.
- ☐ Inspect the harness and side mount system.
- ☐ Verify bailout regulator is working properly and is easily accessible
- ☐ Perform the 5 minute pre-breathe & monitor the PPO2 constantly ensuring the percentage does not fall below 21%.
- ☐ Prior to jumping in the water, double check that the cylinder is open, the display is on, and any computer's properly programed. If the cylinder is secured to the diver prior to jumping in the water, double check that the gas is connected to the rebreather.

☐ Perform buddy checks
☐ If the cylinder is secured in the water, I will ensure that I have connected the off board gas whip to the rebreather and confirmed that it is working properly.

Warning	As diver's may assemble the Sidekick sometime before the dive, it is very important that the check sheets on the following pages are followed completely. Every item on the check sheet should be followed without fail and these checks should be done just prior to the dive. If the pre dive checks are done before reaching the dive site, either by car or boat, a positive and negative rebreather test, as well as the pre-breathe should be performed again just prior to entering the water. This is very important as during transit a component on the rebreather could have been damaged or the absorbent shifted which could cause channeling.

During the dive

- Use open circuit or open loop in the top 20 feet and then switch to the Sidekick.
- Perform bubble checks.
- Check PPO2 every minute during the dive.
- Monitor mouthpiece bubbles during the dive - bailout if the mouthpiece is not venting properly.
- Stay within the planned dive depth and bottom time.

Post Dive Check List - Sidekick Disassembly

After diving the KISS GEM Sidekick, your diving system will need to be disassembled and cleaned. The following procedures should be followed:

☐ Close supply cylinder valve
☐ Purge and remove the first stage
☐ Rinse regulator set in fresh water
☐ Disconnect the loop hoses from the scrubber head
☐ Remove the circ-clips, (put them someplace safe) from the mouthpiece and pull the loop hoses free
☐ Unscrew the knurled nuts from the scrubber head, and remove the scrubber canister assembly from the counterlung
☐ Remove the scrubber bottom and discard the used scrubber material (EAC or granular)
☐ Sanitize the mouthpiece, loop hoses and counterlung
☐ Rinse with fresh water and hang to dry

Your Sidekick components should be rinsed and sanitized after diving. In order to disinfect the components, a product such as Virkon must be used. Virkon is sold in powder form, which must be mixed with water before use. Follow the package directions for use.

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

Shearwater GEM Operation

Configuring the Shearwater for Semi-Closed Operation

Warning	The Shearwater diving computers are sophisticated components. They should be treated with respect. Proper care should be taken when diving, cleaning, and handling. Improper use &/or care may result in serious injury or death! The write-up in this manual is for informational purposes only. Divers must read and understand the user manual from Shearwater Research prior to diving this piece of equipment. For more detailed information on diving the Shearwater computers, please refer to the Shearwater Research user manual.

Those that purchase a Shearwater GEM computer will find that it ships with the computer in semi-closed (SC) mode. Those that are diving a standard Shearwater computer must put it into SC mode themselves.

1. Turn the computer on, by pushing both buttons. The left button is called the menu button and the right button is called the select button. You will use the left menu button to scroll through the various menu items and the right select button to accept the current choice. BE CERTAIN THAT YOU ARE SAVING THE SETTINGS YOU CHOOSE. IT IS IMPORTANT THAT YOU READ THE SHEARWATER RESEARCH USERS MANUAL TO FAMILIARIZE YOURSELF WITH THE PROPER PROCEDURES IN OPERATING THIS COMPUTER
2. Scroll through the computer menu items by pushing the left button. Go to System Setup. Push the right button to accept.
3. Again, scroll through these items using the left button until you see O2 Setup. It will be the fourth item in this section. Push the right button to accept.
4. You are now in the area that allows you to choose a diving mode: SC enable (semi closed), OC only (open circuit), and those who have a fully open computer can choose CCR mode.
5. Once SC is enabled, the computer will allow you to choose which display option you would like use while monitoring your oxygen; PPO2 or FiO2.
6. The System Setup menu is also where you will find the Calibration Gas sub menu setting. Prior to being able to calibrate the computer, you will need to set a calibration gas In SC mode, you will be able to calibrate the computer using any mix from air to oxygen. Shearwater recommends that you calibrate using air as it is a known gas. Then verify your nitrox mix afterwards. With the Shearwater computers, you need only set the calibration gas once; you will not need to re-enter this gas very time you calibrate. You only need to change it if you decide to calibrate using a different gas. If you do change the calibration PPO2, you will need to recalibrate your computer prior to diving. For calibration at altitude, refer to your Shearwater Research users' manual.

Note	Changing from semi-closed to closed circuit operation will only require recalibration, if you are going from semi-closed to closed circuit and the calibration PPO2 was below 0.70 ata. The closed circuit calibration PPO2 must be above 0.70 ata. Changing the display between PPO2 and FiO2 will not require recalibration. Remember that any changes to the System Setup menu, will discard your current calibration. If you enter this menu, be certain to re calibrate your computer!!

Divers should be aware that when the computer is in SC mode, it will require an oxygen sensor to operate. The external sensor cannot be disabled. This means that in order to use the computer in SC mode, it must be linked via the cable to the Sidekick diving system and sensor. Those who dive both the GEM and open circuit can move between SC and OC by changing the setting in the O2 Setup menu, as described in step 2 above.

Warning	BE CERTAIN TO MONITOR YOUR PPO2 DISPLAY OR COMPUTER, EVERY MINUTE OF THE DIVE!!

Warranty

The KISS Rebreather, LLC. Rebreathers, 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 us at info@kissrebreathers.com to let us know about the 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 Rebreather, 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 paperwork mentioned above!) 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 reentering 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.

Specifications

- The GEM Sidekick without absorbent weighs 17 lb (7.7 kg) fully assembled. With absorbent it weighs 22.2 lb (10.1 kg) ready to dive.
- The dimensions are: 21.25 inches (54 cm) long and 7.25 inches (18.4 cm) deep.
- Scrubber holds 5.2 lb (2.4 kg) of Sofnolime 408 grade absorbent. (different brands may have different weights).
- Please see our parts list for what is included with the GEM Sidekick and what is not.
- The GEM Sidekick is a mechanical rebreather. It is the mechanical design of the various components that both add and vent gas into the breathing loop; no manual gas addition is required. There are no electronics controlling the gas addition or venting.
- Compatible with Trimix.
- Scrubber canister holds 5.2 lb (2.4 kg) of Sofnolime 408 grade of absorbent.
- The Micropore cartridge is the 5 inch large bore cartridge, part number SR-0801C.
- The KISS GEM Sidekick is a gas extender that is designed for both recreational and technical diving. Proper training outside the level 1 GEM Sidekick course is required prior to doing any technical diving. For some types of diving extra gear must be carried or alternative gear configurations will be required. Ensure that you have the proper training, gas 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 first stages, using a LP hose. KISS does not recommend using quick connects on regulator hoses, which have a regulator attached.

Sidekick CCR – Addendum

The KISS Sidekick CCR is the newest diving system from KISS. The Sidekick CCR, while very similar to the standard GS SCR, is a fully closed system. The Sidekick CCR Addendum will outline the differences between these two units.

The Sidekick CCR components are almost exactly the same as the GEM Sidekick SCR. The differences are:

- Sidekick CCR ships with a standard closed circuit rebreather mouthpiece (DSV). The GS SCR mouthpiece is not included.
- The Sidekick CCR includes a manual oxygen addition system.
- The manual oxygen addition system low pressure hose must be secured to a first stage with the KISS delrin plug installed.

Not included with this kit:

- 3 K-22D sensors
- Diluent system which includes cylinder, first & second stages, pressure gauge
- Oxygen cylinder
- Oxygen first stage & pressure gauge

Warning	It is extremely important that dealers and divers who opt to purchase a Sidekick CCR 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.

MOUTHPIECE

The KISS Sidekick CCR 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.

Warning	The Sidekick 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.

MANUAL OXYGEN ADDITION SYSTEM

The manual oxygen addition system is comprised of several parts:

- 1 Manual Add Valve (MAV): this valve comes equipped with an orifice which bleeds a small amount of oxygen into the rebreather at all time.
- 1 filter secured to the MAV.
- 1 24 inch oxygen rated low pressure hose: this LP hose is secured to a first stage (customer supplies first stage; KISS supplies required delrin plug) and also to the MAV filter.
- 1 6 inch oxygen rated low pressure hose: this LP hose is secured to the MAV outlet and then to the GS CCR scrubber head.

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

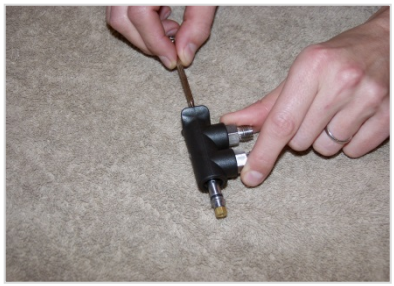
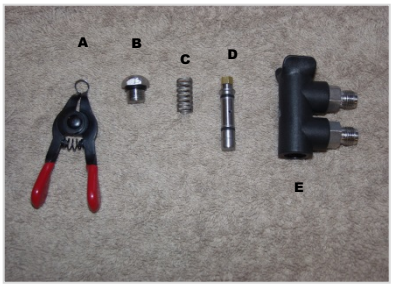
frequently. The inlet of the valve is protected by a 15 micron filter. This filter will NOT stop seawater from contaminating the orifice. All components in the add valve must be clean, oil free, with the O-rings lightly lubricated with oxygen compatible grease.



The tools required to disassemble the valve are a wrench or Allen key, small snap ring pliers and a jeweller's 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.

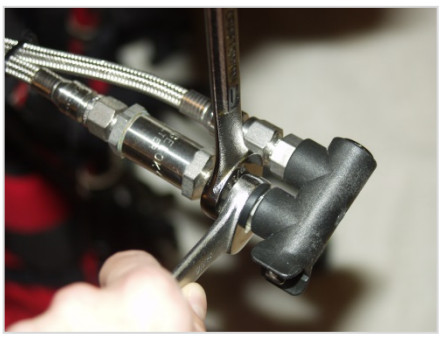
DO NOT SCRAPE OR GOUGE THE BORE!!!!!!

Figure 31: MAV Servicing

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.



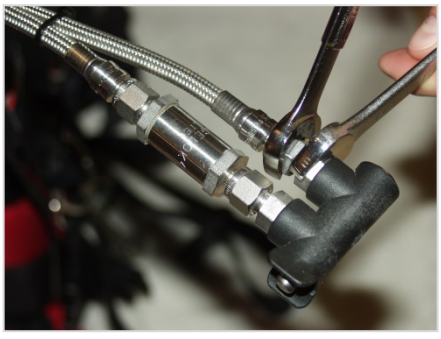


Figure 32: MAV Servicing

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 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!!

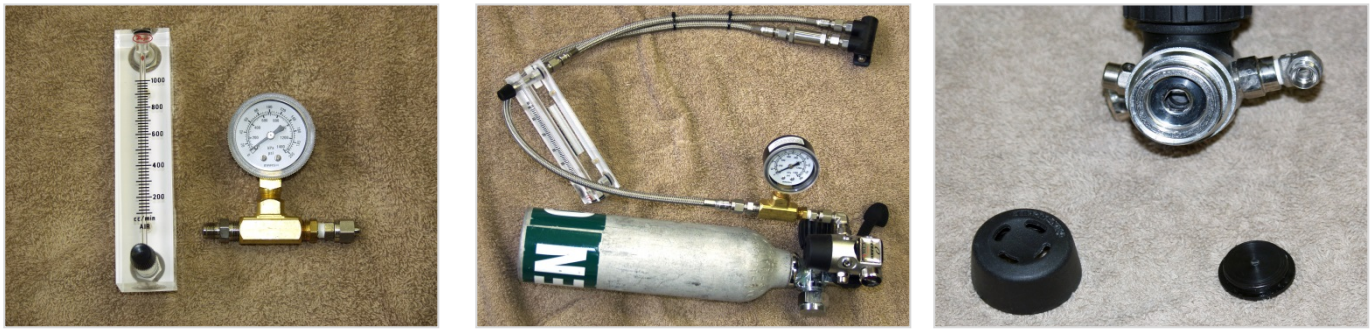


Figure 33: MAV Flow Rates

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 below.



Figure 34: MAV Flow Rates

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

Warning	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.

FIRST STAGE

The customer must supply an oxygen clean first stage. As our KISS delrin plug must be inserted, the first stage must be chosen from the list below:

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

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 KISS Rebreather, it will not work properly!**

Warning	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!

KISS MINIMUM TRAINING STANDARDS; COURSE EVALUATION SHEETS; RESA RECOMMENDS

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.

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

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: _____

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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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