

**Jeisam
Technologies Ltd.**



Sport KISS Rebreather

by Curt Bowen

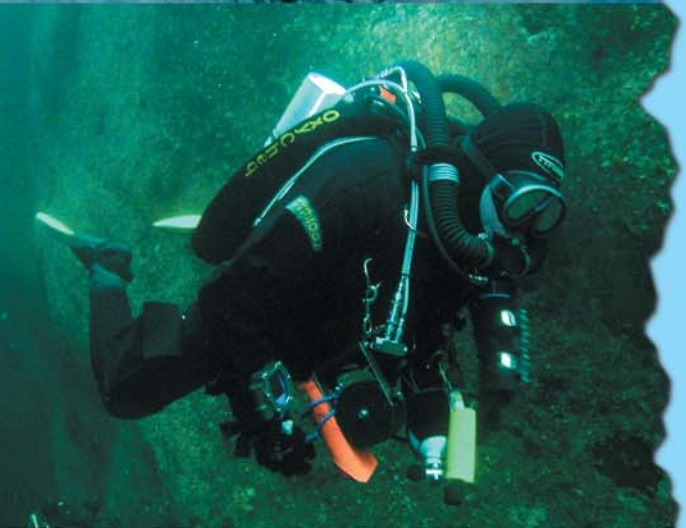
The Sport KISS rebreather is possibly the most unusual blend of simplicity and sophistication that one can find in a closed circuit rebreather. It comes standard with an automatic diluent valve (ADV), something that the more commonly known rebreathers have only recently incorporated into their design. It has an open circuit/closed circuit mouthpiece or "bailout mouthpiece," something that only the Cis- Lunar rebreather offered as standard. It uses a truly triple redundant O₂ monitoring system where each display is totally isolated in its own case, is powered by its own separate battery, and reads its own isolated Teledyne K1D sensor. Failure of any one display, battery, housing, or sensor will not affect the remaining displays. The individual displays can be easily replaced in a few minutes at a reasonable cost.

The oxygen control system is something that will make the Luddites of the computer age very happy. Rather than the current trend of multiple computer

processors with voting logic, semi-failsafe modes, injection rate algorithms, flashing, vibrating, honking, and squealing alarms, the KISS uses a simple thumb-operated oxygen valve with a built-in metering orifice that "leaks" oxygen into the breathing loop. It is a system that Henry Fleuss would have been comfortable using over 120 years ago.

The best description of this system is that it is a "buffered, manually operated CCR." In a completely manual system, the diver must replace all of the oxygen he consumes by pressing the oxygen add button. This can be a fairly busy proposition especially in shallow water and under high exertion conditions. In the KISS rebreather, the metering orifice is feeding oxygen into the breathing loop at a rate that is slightly below the average metabolic rate of the diver. Normally, the flow rate is set to a surface rate of around 0.7 liters per minute by adjusting the inter-stage pressure on the oxygen regulator. If you consume oxygen at the same





rate of 0.7 LPM, then as long as the depth is constant, you will never need to press the oxygen add button. If the workload is less than the 0.7 LPM rate, the PP02 will slowly increase. If the exertion rate exceeds the 0.7 LPM rate then the diver has to press the oxygen add button occasionally.

Because the metering orifice is a passive device and only adds oxygen at a fixed rate, it is not a controller in any way. The diver still has to monitor the oxygen displays every few minutes, decide if he believes what they are telling him (voting logic), and take appropriate action to maintain the desired set point. This isn't a lot different than monitoring the PP02 displays on a computer controlled rebreather. The only difference is that on the Kiss, you actually have to push the oxygen add button once in a while to adjust the PP02, while on the computer controlled rebreathers, you are just looking at the displays to make sure that the computer is still working and hasn't decided to go on strike (and try to kill you). Paranoia and self-preservation are absolutely the best tools we have for keeping the CCR diver alive.

The Sport Kiss uses a unique "biaxial" scrubber. All of the gas that the diver uses in each breath makes two complete passes through the scrubber bed. This results in very efficient CO2 removal partly due to the double pass of the gas but also because the entire scrubber is maintained at a higher temperature than in a normal axial scrubber. The breathing resistance is comfortably low due to the short distance that the gas has to travel through the scrubber on each inhale and exhale.

The scrubber is molded from polyethylene and has attachments on the bottom for the two counterlungs and attachments on the top for the breathing hose modules. These modules house the ADV and exhaust valve on the right side and the sensors on the left side. Emptying the scrubber is accomplished by removing the hose modules, removing the Velcro strap securing the scrubber to the counterlung case, lifting the scrubber and counterlungs out of the case, and dumping out the used scrubber. The scrubber can be filled outside of the counterlung case or reinstalled in the counterlung case and then filled through the large openings where the hose modules attach.

Since the hose modules attach with a simple 90-degree turn, it is also practical to have extra pre-filled scrubbers on hand and simply change the entire scrubber for a fresh scrubber. Extra scrubbers are available and come with a complete set of blanking plugs to keep them sealed until needed.

The counterlungs and scrubber are housed in a case, which can be supplied in either stainless steel or aluminum. Inside the counterlung case is an adjustable flap that is used to limit the expansion of the counterlungs. The position of this flap allows the total counterlung volume to be matched to the diver's lung volume. By matching these volumes, buoyancy changes caused by the expansion of the gas in the loop during ascent can be dealt with by one firm exhalation, which pushes all extra gas out through the exhaust valve. This greatly reduces the risk of a runaway ascent, since the diver then only has to deal with his drysuit or BC to maintain buoyancy.

Weight of the Sport Kiss is 45 pounds with a stainless steel counterlung case and 38 pounds with an aluminum counterlung case. Weights are with a full scrubber and full 13 cubic foot tanks. It does not include a harness or BC. Any suitable "tech" BC with 11-inch center boltholes will work. The 13 cubic foot tanks are attached with quick release mounts and at present the only other tools needed for normal dive preparation are a nut driver for the hose attachments and an Allen wrench and jewelers screwdriver for calibrating the sensors. These tools are supplied with the rebreather.

Sport KISS Rebreather Schematic

- a** DSV: Dive Surface Valve
- b** Oxygen Manual Add Valve with 15 Micron Filter
- c** ADV: Automatic Diluent Valve
- d** Exhaust Valve
- e** Scrubber Container: The scrubber container holds 5 pounds of 4 – 8 Sofnolime. It is rated for 2.5 hours in cold water.
- f** Counterlungs: The counterlungs are made from Urethane Coated Nylon and are available in 2 sizes. They attach to the scrubber container via quick release connectors.
- g** Sensor Housing: The sensor housing holds 3 K1D sensors.
- h** PPO2 Displays: The displays are triple redundant. Each has it's own housing, battery and sensor.
- i** Diluent Tank & First Stage: The Sport KISS is compatible with either air or trimix as a diluent gas. The first stage is an Apeks DS4. 13 cuft tanks are recommended.
- j** Oxygen Tank & First Stage: The first stage is an Apeks DS4. 13 cuft tanks are recommended.
- k** BCD Inflator Hose: The BCD inflator hose is plumbed to the diluent tank
- l** Bail-out Second Stage: The bail-out second stage is incorporated into the DSV. To switch from closed circuit to open circuit bail-out, simply close the breathing loop. The bail-out second stage is plumbed to the diluent tank. NOTE: The bail-out second stage is for getting a sanity breath only. Divers should carry a redundant bail-out system for emergencies.

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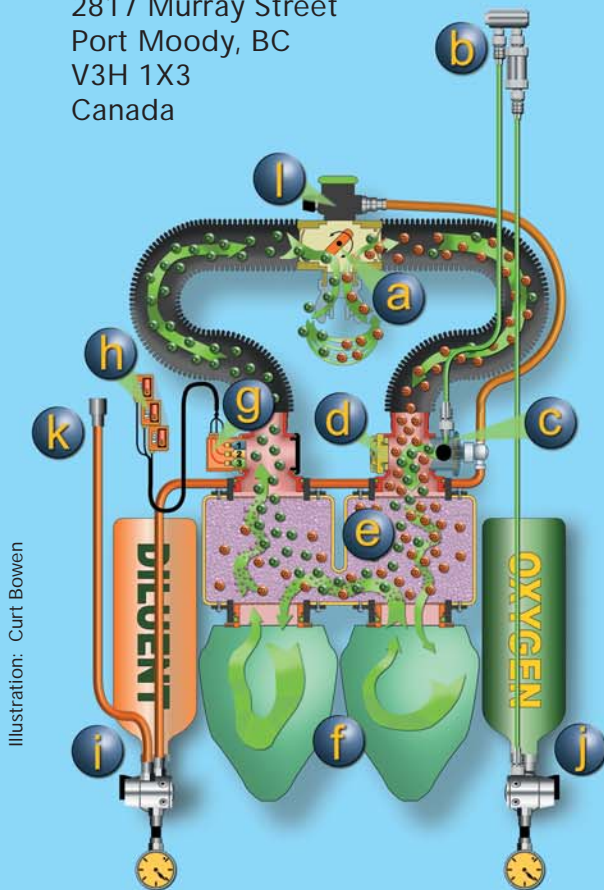


Illustration: Curt Bowen

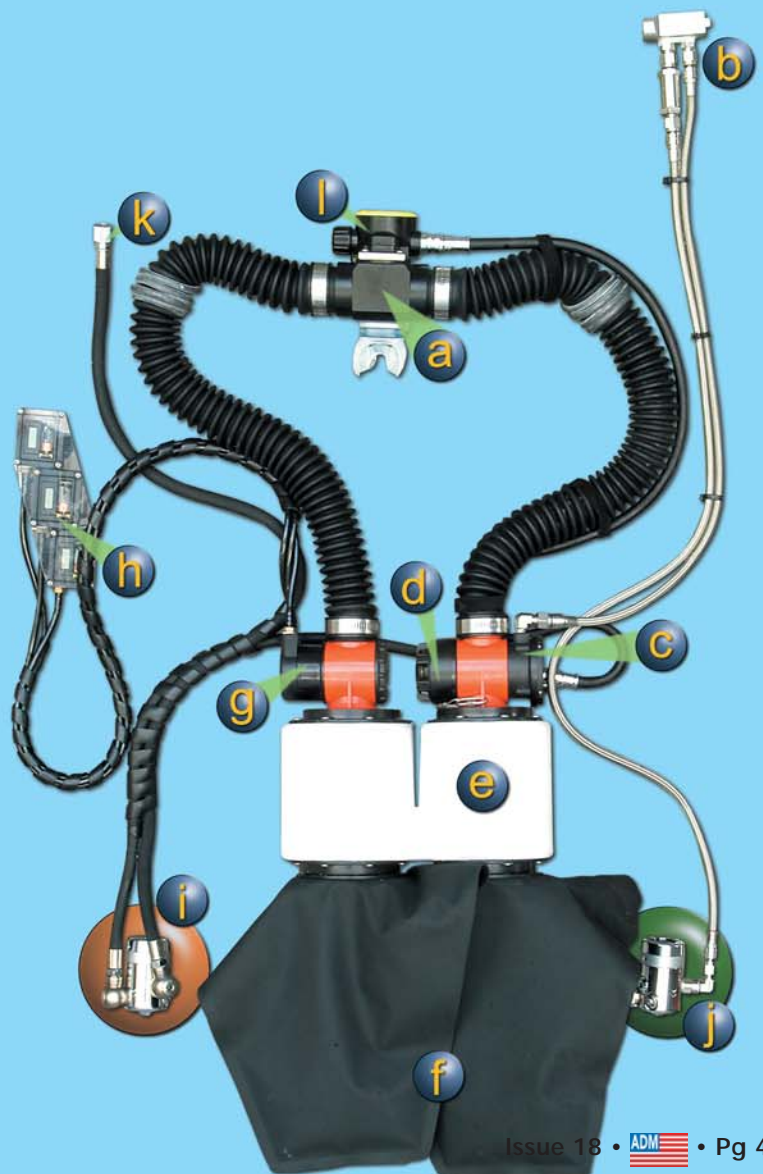


Illustration: C. Bowen