Sentinel Rebreather Assembly and Check List

Introduction
Follow the procedure below (for a completely disassembled Sentinel) to enable cleaning, rebuilding and testing of a Sentinel Rebreather.

General notes on assembly

1. All O rings should only be lightly greased
2. Inspect all O rings for cracks and other damage regularly
3. Disinfect all breathing loop parts regularly having removed the oxygen sensors (Note; VR Technology Ltd recommend and supply Virkon)

Mouthpiece-assembly

- Clean the mushroom valve carrier O ring and the groove around the mushroom valve carrier. **Lightly** grease and refit the O ring.
- Inspect the mushroom valve and mushroom valve carrier for damage. Wash/disinfect and remove any debris from the carrier.
- Having cleaned and disinfected the mouthpiece outer; hold the mouthpiece in your hand with the rubber mouth-bite towards you and the second stage port facing down. Position the right hand side mushroom valve carrier with the valve facing out (on exhale side the mushroom valve has no tail) and the left hand side valve carrier with the valve facing into the mouthpiece (on the inhale side the mushroom valve has a tail). Ensure the O rings around the mushroom valve carriers have not extruded out of their grooves.
- Clean/disinfect and inspect the inner barrel and O rings for damage. There are four O rings. Two side port O rings and two end O rings. Refit the O rings.
- Insert the inner barrel, twisting it slightly to ensure the side O rings do not move out of their grooves.
- Replace the front cover and switch plate. Rotate the switch plate from open to closed circuit several times to ensure correct action of the O rings while looking into the second stage port to ensure the O rings stay in their grooves.
- Clean, inspect and re-fit the four (two each side) hose end O rings to the sides of the mouthpiece.
- Inspect and clean the rubber mouthpiece. Refit with a tight cable tie. Remove sharp edges.

Mouthpiece-primary test

- In closed circuit mode. Block the right hand (exhale) side and blow (do not apply excessive force) into the mouthpiece. The mushroom valve should seal and no gas should exit out of the second stage port or the front switch plate.

  Faults;
  - Mushroom valve (**left** hand side) leak. Remove the carrier and inspect again.

    - Second stage port leak. Remove the inner barrel and inspect/replace the side port O rings.
    - Front switch plate leak. Remove the inner barrel and inspect replace the two (larger) barrel end O rings
- In closed circuit mode. Block the left hand (inhale) side and suck into the mouthpiece.

  Faults;
    - Mushroom valve (**right** hand side) leak. Remove the carrier and inspect again.
    - Second stage port leak. Remove the inner barrel and inspect/replace the side port O rings.
    - Front switch plate leak. Remove the inner barrel and inspect replace the two (larger) barrel end O rings
    - Any other leak. Test (block both inhale and exhale ports on the mouthpiece and blow into the mouthpiece) and inspect the rubber mouthpiece.
- Clean and inspect the second stage bailout out valve (BOV) as required.
- Clean and refit the BOV adapter port O ring and groove.
- Refit the BOV adapter port and refit the wire locking spring.

Mouthpiece-secondary test

- In open circuit mode, with the second stage BOV attached. Block both inhale and exhale mouthpiece ports and the LP inlet to the second stage. Then suck from the mouthpiece.

  Faults;
    - If a leak is heard, inspect the BOV adapter port O ring, the second stage silicone diaphragm, second stage valve bladder or the second stage main body O ring. **If a fault is found, professional service of the second stage is recommended.**

Hose assembly

- Clean, inspect the hose end O rings.

Hose assembly-testing

- Block one end of the hose and blow into the other. Look for leaks. Repeat for the other hose.

Mouthpiece/hose-assembly

- Fit the hose with the red locking cover O rings to the left hand side (inhale) side of the mouthpiece. Refit the white U clip.
- Repeat for the right hand side (green) hose.

Mouthpiece/hose-assembly. Testing.

- In open-circuit mode. Immerse the mouthpiece. Block the exhale hose end (green) and blow into the inhale hose end (red).
    - If bubbles come out of the second stage mouthpiece. Inspect the mouthpiece barrel side and end O rings.

- If bubbles are seen anywhere else, inspect the relevant O ring.

Oxygen sensor testing

- Clean the oxygen sensor Jack connectors with a soft cloth (look for damage and corrosion). Refit the oxygen sensors. On the Secondary PO2 display. Hold in both buttons or press top button followed by holding in lower button to display the oxygen cell millivolts. **Ensure the sensors are fully exposed to ambient air**. The cell millivolt readings should be above 8 millivolts and below 13 millivolts.
  - Replace the oxygen sensors if they are outside of this range.
  - If the connectors are corroded, clean by immersing in white vinegar or using an ultrasonic cleaning system.
- If the sensor millivolt readings are good. Calibrate the Secondary display as per the instructions in the manual.
  - **Removing and refitting the oxygen sensors will automatically calibrate the Primary display. Confirm the readings are the same on the Primary and Secondary display and match the PO2 of the current altitudes ambient air reading.**

Flow cone-assembly

- Inspect, clean (use warm soapy water) and refit the Flow cone triple lipped CO2 seal.
- Ensure the seal fits right into the groove in the flow cone before re-inserting the locking ring.
  - To test the fit. **Gently** pull the seal to ensure it stays in place.

This is the most important seal in the system and should be regularly cleaned and inspected. It is vital in preventing CO_2 bypass.

- Clean, inspect and refit the Flow cone neck (at the top) O ring.

Canister Head-assembly

- Clean, inspect and refit the main head O ring (where it connects to the canister tube).
- Refit the **T**hermal Profile Monitor (TPM) link cable.
  - Inspect the connector at both ends for corrosion. Clean as per the oxygen sensor Jack plugs.
- Refit the flow cone, **being careful not to cross-thread it**, having cleaned/inspected the body O ring of the canister exhale hose end port, the connector where the right hand (green) hose end plugs into the canister head (green push button).
- Clean and inspect the counterlung port O rings (2).

Canister Tube-assembly

- Clean and disinfect the canister tube, paying special attention to both end O ring sealing faces.
- Refit to the Canister head.

Thermal Profile Monitor (TPM)-assembly

- Wash the TPM in warm soapy water to remove absorbent debris.
    - Inspect and clean the TMP electrical connector. Clean as per the oxygen sensor Jack plugs.
- Wash the spring carrier in warm soapy water to remove absorbent debris.
- Refit the TMP to the spring carrier and refit the locking nut on the underside.
- Inspect the white plastic spring tags (5) around the spring carrier for damage. Replace as required.
    - The length of an un-loaded spring carrier spring should be approximately 40mm. If it is less than 35mm they need replacing.

Absorber Carrier-assembly

- Disinfect as required.
- Wash the Absorbent carrier in warm soapy water to remove absorbent debris.
- Inspect the carrier for damage especially around the top sealing face.
- Inspect the upper and lower steel mesh for damage. Replace as required.
- Ensure the Absorbent carrier base plate moves freely in the absorbent canister tube.
- Inspect the Absorbent carrier top plate and ensure the spring lock releases are working.
- Assemble the absorbent carrier onto the TPM and spring carrier.
- Fill with CO2 absorbent (as per the manual and label) and refit the TPM top nut.

Canister Base-assembly

- Disinfect as required.
- Wash the Absorbent carrier in warm soapy water to remove absorbent debris.
- Flush the Canister Base Over Pressure Valve (OPV) with fresh water.
- Clean, inspect and refit the base head O ring (where it connects to the canister tube).

Complete Canister-assembly

- Having fitted the Canister Head to the Canister Tube. Load the Spring Carrier and TPM into the Canister Base as per the manual.
- Connect the TPM link cable.
- Fit the Canister Base to the Canister Tube ensure that the upper and lower locking pins are in the locked position.

Counterlung-assembly

- Disinfect and inspect the counterlung.

Counterlung-testing

- Attach the exhale hose of the mouthpiece-hose assembly (Green end) into the counterlung port.
- Fully inflate the counterlung to a maximum pressure of 100mb (until it is ‘drum’ tight.
    - Immerse and look for leaks.
    - If leaks occur where the counterlung port is screwed into the counterlung, simply tighten the fitting by hand. Being careful not to damage the counterlung.

Gas Block-assembly

- Remove the gas block knob being careful not to loose the spring
- Remove the inner valve
- Clean and inspect the inner valve O rings. **Refit in the same order**.
- Refit the inner valve to the gas block by rotating the valve as it is pushed in.
- Refit the spring and knob.

Gas Block-testing

Warning
Risk of injury if this test is not conducted correctly.

- **Secure the free ends of the left hand and right hand hoses so that they cannot move. Ensure the Shut-off slider is closed**. Slowly apply a low pressure (max. 11bar) source to the **middle LP** hose of the gas block.
- Immerse the Block and Shut-off in water and look for leaks. **If Leaks are noted isolate and bleed off pressure before continuing.**
    - If leaks appear around the Shut-off slider. Unscrew the slider from the block.
    - Unscrew the hose from the slider.
    - Slide off the outer sleeve.
    - Inspect and replace the O rings inside the outer sleeve.
    - Make sure there is no damage to the inner tube.
- Push the gas addition knob and ensure gas exits the hose.
- Activate the Shut-off slider and ensure gas exits the hose.
    - If no gas exits the hose, disassemble the Shut-off (as above) and ensure the gas paths in the inner tube are not blocked.
- Inspect all hose end O rings and clean/replace as required.

Warning
Hoses should not be repeatedly removed and refitted to the gas block. The thread is plastic and may become damaged.

Regulators-assembly

- Connect all hoses as per the manual
- **DO NOT apply excessive twists to the HP sensor cables**. These should be reassembled first prior to re-fitting the LP hoses.
    - Inspect and replace HP O rings as required. Fully tighten the HP sensor. **DO NOT apply tightening forces to the plastic body.**

Regulators-testing

- To test the regulator function. Fit a 0 to 15 bar (minimum) LP gauge to one of the LP ports. With the regulator pressurised the pressure should read between 10 and 11 bar. Leave pressurised and check in 15 minutes (**with the Sentinel turned off**).
    - If the pressure is higher than 10bar and climbing. There is a fault in the first stage and it should be serviced professionally. If the pressure exceeds 14 bar (approx), the first stage over pressure valve (OPV) will vent.

<u>Warning</u>
The first stage OPV's must remain fitted at all times. Do not apply gas to the Sentinel without the OPV's fitted.

    - If the pressure is lower than 10 bar, it needs adjusting and it should be done professionally.
    - If the OPV is venting below 12bar it may need professional adjustment.

Complete Sentinel-assembly

- Route the gas block hoses through the case. Fit to the regulators, Automatic Diluent Valve (ADV), Oxygen solenoid and their bypass lines.
- Fit the counterlung and counterlung securing clip (see manual).
- Fit the Canister Assembly to the case and attach the securing bands.
- Fit the gas block LP hoses to the regulators, Automatic Diluent Valve (ADV), Oxygen solenoid and their bypass lines. Use the colour matching on the hose ends.
- Fit wing and harness.
- Analyse, label and fit the oxygen and Diluent cylinders.
- Fit the second stage BOV.

Complete Sentinel-Test

- Follow the on-screen pre-dive sequence
    - If the unit fails the negative test and the fault is not easily recognisable.
        - Turn on all gases.
        - Make sure the solenoid and ADV sliders are open
        - Close the OPV
        - Close the mouthpiece (open circuit mode).
    - Fully immerse the unit (hoses, mouthpiece etc.) with the cover removed and look for leaks.
    - If no leaks are visible but the OPV slowly vents gas then suspect either the ADV or the solenoid.

- To test the ADV for leaks, close the gas block shutoff and see if the OPV stops leaking. Service as required.
- To test the solenoid for leaks, close the gas block shutoff and see if the OPV stops leaking. Service as required.

Finally, complete all on-screen pre-dive checks before diving.