

## O2ptima CCR Dive Checklists

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[n2diving@fillexpress.com](mailto:n2diving@fillexpress.com) Last revised 18-Mar-08

To err is human; to forgive, divine. – Alexander Pope

If you are human, you will make errors. Errors of omission in rebreather diving are not always forgiven. Currently the best solution to prevent errors of omission is to use checklists, and I emphasize the use of checklists in my instruction. Over time, I've developed and refined a system of checklists to address the issues I've observed with myself, my students and other O2ptima divers.

Each of the several checklists is used at different times. Typically, O2ptima divers assemble and check their unit prior to transporting it to the dive site. The diver can use the factory manual and factory checklist to perform the assembly and post assembly checks. This article discusses the "Pre-Dive" and the "Pre-Breathe" checklists that are performed at the dive site after the rebreather has been transported and immediately before entering the water.

The two O2ptima CCR specific check lists that follow are only for education purposes. They cover the basics and primarily focus on listing the major items. With the guidance of your instructor, you will need to modify these checklists as appropriate for your own needs. The most important consideration is that any check list is better than none. Whatever your checklist, for your safety please *use* a written checklist before every dive. Always have your checklist with you during preparations. Many people laminate them, but I like to laser print the two check lists and then use clear packing tape to seal them on to front and back of a leaf in my executive slate. This simple solution has proven to be very durable.



## O2ptima PRE-DIVE

- Empty breathing loop
- View stack life timer on secondary
- Evaluate scrubber/battery duration
- Set Secondary SP to planned PO2
- Set Primary Dil and Open-Circuit
- Open Oxygen and Diluent valves
- Evaluate both PSIG are sufficient
- Evaluate loop negative re-test
- Add Diluent / Evaluate PO2
- Add Oxygen / Evaluate PO2
- Add Diluent until OPV releases
- Configure dive computer
- Check external bailout
- Evaluate loop positive re-test
- Set Primary SP for entry
- Evaluate solenoid operation
- Complete Other Pre-Dive Prep

The purpose of this checklist is to make your O2ptima rebreather itself ready for use by the diver. The Pre-Dive checklist is performed after the O2ptima has been loaded on the boat or is sitting on the picnic table (as the case may be) and secured. I recommend it be performed at the earliest opportunity after you have settled in for the day's activities. This provides the maximum amount of time to diagnose and correct any issues that arise from running the checklist. The Pre-Dive checklist must be performed before the first dive of the day, or whenever a cartridge or cylinder is changed, or if there is any concern regarding the integrity of the rebreather. These checks must be performed in the sequence listed.

**Empty breathing loop** – Pull a negative on the loop, in the same manner as if you were performing a post assembly check. Proceed immediately to the next step.

**View stack life timer on secondary** – Press one of the buttons on the secondary handset to activate and automatically display the stack life timer. If the handset is already on, then step through the menu to view the stack life timer. Failing to reset the stack timer after a fresh cartridge is loaded can result in a false alarm during the dive.

**Evaluate scrubber/battery duration** – Referring to whatever system you use to account for the usage of your absorbent and batteries, ask “Is the remaining absorbent life and battery life adequate for the current dive plan?”

**Set Secondary SP** – Select either the entry or bottom set point, according to your preference. Setting the SP on the secondary handset is important for proper PO2 status display on the HUD if the DIVA Mode is configured for User Set Point. Regardless of DIVA Mode setting, the secondary SP is required for proper handset system status display.

**Set Primary Dil and Open-Circuit** - On the primary handset, select your diluent gas and verify the handset is in OC mode. This may have already been done as part of the assembly, however if the battery was just installed these settings reverted to defaults. Since at the surface there is no handset indication of the gas selection, always setting the diluent at this point is good practice.

**Open Oxygen and Diluent valves** – Open both the valves approximately one and one-half to two turns. Once these valves are opened in this step, *do not turn them off*.

**Evaluate both PSIG are sufficient** -- Take readings of both the oxygen and diluent gauges. Ask yourself “Is the remaining gas adequate for the current dive plan?”

**Evaluate loop negative re-test** - Look at the loop hoses and evaluate how well the loop is holding a negative pressure. This check validates the loop integrity has not been affected by transport, such as a damaged hose. Keep in mind that overly tight restraints and/or fixtures pressing on the canister body while the unit is secured can cause transient leaks that disappear once the restraints are released or the rebreather is repositioned.

**Add Diluent / Evaluate PO2** – You will need to alternately press the two counter lungs back and forth a few times to cause the gas to mix and reach the sensors. Although it shortens the life of the sensors, I prefer to leave the O2 in the loop following post assembly calibration. In this case, when diluent is added the loop PO2 is much greater than the diluent and the displayed PO2 will drop sharply. Some divers flush the loop with diluent after calibration, in order extend sensor life. If the loop PO2 is the same or close to the diluent, there should be little or no change. The precise PO2 value is not as significant as the change and its direction. This check validates that the diluent valve is open, the dil manual addition valve is working, and the gas itself is not strongly hyperoxic.

**Add Oxygen / Evaluate PO2** - When you add O2, watch the handset sensor display closely. The loop PO2 should rise and should do so at about the same time on all three sensors. Again, you will need to alternately press the two counter lungs back and forth a few times to cause the gas to mix and reach the sensors. As with diluent, the precise PO2 value is not as significant as the change and its direction. This check validates oxygen valve is open, the O2 manual addition valve is working, and the gas itself is strongly hyperoxic. It also validates the oxygen sensors are responding normally to the presence of oxygen. If the response of one cell lags substantially behind the other two, the reliability of the slow sensor is a concern.

**Add Diluent until OPV releases** - This will inflate the counter lung and validates the OPV will release. It also lowers the PO2 in the loop. With a bit of practice, the diver can learn to make this and the two previous gas additions such that the loop is full and the PO2 in the loop is slightly under the primary entry set point; this is helpful in a later step.

**Configure Dive Computer** - If you use an ancillary dive computer, configure its set points and gases as appropriate. If you are using it to monitor a 4<sup>th</sup> cell, verify the 4<sup>th</sup> cell reading matches the other three displayed by the O2ptima handset.

**Check external bailout** – You should open the external bailout cylinder valve and observe the cylinder pressure. Depress the purge on the second stage for a moment and then take a couple of breaths from the bailout regulator while you observe the gauge. This validates the bailout is working properly. Stow the regulator hose and set the bailout cylinder valve open or closed according to your preference.

**Evaluate loop positive re-test** -- Once you have evaluated the positive pressure test, turn the OPV until completely open. Then depress the OPV and squeeze as much gas out of the counter lungs as possible. Although it is not as thorough as the post assembly check when the OPV was defeated, it gives us some further confidence regarding loop integrity and validates the OPV is open.

**Set Primary SP for entry** - Select the desired set point you intend to use when entering the water at the beginning of the dive. As you press to confirm the set point, observe the counter lungs and listen carefully.

**Evaluate solenoid operation** - You must see the counter lungs inflate as a result of the oxygen injection. Depending on ambient noise you may also hear the solenoid activate. The PO2 readings on the handset should rise until the set point is reached. As before, you will need to alternately press the two counter lungs back and forth a few times to cause the gas to mix and reach the sensors. If the loop PO2 was substantially below the selected set point, the solenoid will activate several times, inflate the loop until full and may continue activating indefinitely. In this case, depress the OPV and squeeze as much gas out of the counter lungs as possible. I prefer emptying the counter lungs regardless, in order to make the rebreather easier to don.

**Complete Other Pre-Dive Prep** -- Your O2ptima rebreather is now prepared for use and you may perform other preparations as appropriate. Do not change anything on the rebreather as this can invalidate the safety checks. While on the surface, *never* close either the diluent or oxygen supply valves unless you will repeat the entire Pre-Dive check list. This is also a good time to review appropriate safety protocols with your buddy, particularly if they are on a different type of rebreather or open-circuit.

The Pre-Dive checklist takes less than ten minutes to complete. Often this is the time other divers, curious about your O2ptima, will approach and begin asking questions. It's tempting to want to be polite and answer, but don't let yourself get distracted. Make note of where you are in the checklist, then explain you must complete the "safety checks" without interruption. Offer to answer all their questions at the completion of your checks or during the surface interval and immediately return to your checklist. When you are done with the Pre-Dive checklist, relax until it's about 15 minutes before you wish to enter the water. Then it's time to begin the Pre-Breathe checklist.

## O2ptima **PRE-BREATHE**

Activate Handsets  
Don rebreather and off-board bailout  
Breathe on-board bailout regulator  
Operate BC power inflator  
Operate the BC dump valve  
Begin respiration on breathing loop  
Empty breathing loop  
Open ADV inline valve  
Evaluate ADV operation  
Evaluate HUD operation  
Continue Pre-Breathe  
Observe PO2 maintained at SP  
Ready to Dive

*Always know your PO2*

The purpose of the Pre-Breathe checklist is to make the diver ready to safely enter the water with their rebreather. Often this is accompanied with time pressure to start the dive. Don't let time pressure cause you to shorten or skip these checks, they are critical to your successful dive. The list is designed to be quick, as much as possible all the other setup and checks have been placed in the Pre-Dive checklist. *The Pre-Breathe checklist must be run before each and every dive.*

**Activate Handsets** – Both the handsets should be activated before donning the rebreather as they may have auto shutdown. Many divers have the auto shutdown timer configured for much longer than the 2 minute default to avoid having them auto shutdown during the Pre-Breathe.

**Don rebreather and off-board bailout** – Completely don the rebreather, handsets and also don the off-board bailout, any other equipment such as instruments, lights and reels. Verify you can reach the off-board bailout cylinder valve and second stage.

**Breathe on-board bailout regulator** – If an on-board bailout system is present, this validates the on-board bailout is available and operating.

**Operate BC power inflator** - This validates the inflator is available and operating.

**Operate the BC dump valve** - This validates the dump is available and operating. If you prefer to have the BC partially inflated when you enter the water, reverse the order of dump and inflator checks. These checks verify the inflator, dump and on-board bailout are not out of position, trapped, obstructed or entangled in the off-board bailout or other gear.

If need be, you may pause at this point in the checklist, before beginning respiration on the breathing loop. A pause is desirable if the predicted entry time is delayed while waiting for a team member or the entry point to become available.

**Begin respiration on breathing loop** – Exhale fully, place the mouthpiece in your mouth, open the DSV and inhale through your mouth. You may find it works best to don your mask at this point in order to reduce the likelihood of inhaling through your nose.

**Empty breathing loop** -- Exhale out your nose, inhale through your mouth. Repeat until you feel resistance when inhaling.

**Open ADV inline valve** -- Reach up and pull the ADV inline slide valve down to open. This verifies the ADV valve is available and is open.

**Evaluate ADV operation** -- Make a normal inhalation, you should hear and feel the ADV inject diluent into the loop. For divers using a Trimix dil, you may wish to again empty the loop and add dil from the ADV or manual addition valve.

**Evaluate HUD operation** -- You should see the appropriate color blinking light in the HUD. In bright sunlight you may need to cup your hand over the HUD and your facemask. If you cannot see the blinking light, verify the secondary handset is activated.

**Continue Pre-Breathe** -- Exhale through your nose as necessary to establish ideal loop volume. Remain on the loop and continue breathing normally for at least three minutes, longer if cold water diving. Avoid going off the loop to talk, but if you must, be sure to exhale as fully as possible before going off and exhale again before going back on the loop.

**Observe PO2 maintained at SP** -- Monitor your PO2 and confirm that it is hovering around set point and the solenoid is activating. You must do this long enough for the solenoid to activate several times to verify oxygen is flowing normally to the solenoid. You should feel the counter lungs inflate each time the solenoid activates. While monitoring my PO2, I take one last look at the bottom of the checklist and put the slate away in my pocket.

**Ready to Dive** -- When you are certain the set point is being maintained, you are ready to enter the water. *If the rebreather will not maintain set point, do not begin the dive.* When you make your entry, don't let task loading of the entry and descent allow you to be distracted from continuing to monitor your PO2.

*Always Know Your PO2*