

How to spot a faulty cell

Dear All,

In an attempt to reinforce Tino's message on how to spot a failing cell, I wanted to outline my own experience which may prove helpful to others. The basic message is that all divers are taught to replace their cells on a regular basis and should do so, but I fell into the mistake of ordering spares and waiting until they started to fail before swapping them out which potentially could have led to a dangerous situation. By discussing the rules governing replacement of cells with my instructor and another diver I realised that I hadn't been paying attention to doing regular O2 flushes in order to verify that the cells weren't current limited, and this led me to re-examine the performance of my cells and the in water checks.

If you replace your cells when they reach 9-12 months or have proven regularly to be able to reach 1.5+ during O2 flushes then this won't be of interest; however the following is a brief description of my troubleshooting process.

1. I had noticed that from time to time cell 3 was showing 1.4 occasionally at set point when the other cells were showing 1.3ish. Although not sufficient to generate a cell warning I assumed that this cell was in some way faulty or was becoming moist during dives as initial calibration was always fine.
2. Later that day, during a deeper dive - cell 3 spiked to 1.6bar where cells 1,2 remained at 1.44, 1.45. A short dil flush cleared the problem and the set point returned to 1.3 across all cells. I assumed that this was a spike due to the solenoid firing during a brief descent
3. On the same day, on reaching the 6m deco stop I could not O2 flush the unit beyond 1.4 on cells 1,2 but cell 3 could reach 1.55 easily. The second day I could not O2 flush cells 1 and 2 beyond 1.23, 1.24 whereas cell 3 could reach 1.35 at 3.5metres deco stop. At this point I assumed that my O2 flushing technique was not working correctly, but decided to swap one of the two agreeing cells anyway.
4. On the next day, cells 2 and 3 agreed, whereas cell 1 (the oldest remaining) was looking out. This was replaced that evening, so that all three cells were new.

It was at this point that I realised that in fact cell 3 (newest) was right all along, and cells 1,2 even though they always agreed were most likely incorrect, and since voting logic determined that they agreed were driving the solenoid. The consequence of this was clear, I DID NOT KNOW MY PO2, and had possibly been diving on 1.4 or higher at times over a 10 day sequence.

Now I know that I can put myself up for criticism by explaining how I had strayed from the path of good common sense, but in the interest of reinforcing what everybody has learnt before and should not forget:

1. Cells degrade rather than break outright. I didn't see the degradation over a heavy sequence of dives until I really started 'looking'
2. Higher initial values shown during calibration don't necessarily relate to which cells are healthy, all cells seem different even when new
3. Regular O2 flushes, perhaps at 3m and 4.5m at first should verify your cells can reach higher values
4. Diluent flushes at depth can verify your cells accuracy and calibration, but perhaps not always whether they are current limited.
5. Check for cell decay as Tino recommended by flushing a closed loop with O2 and checking the cells over time
6. !! Two cells that agree are not always the two that are correct, laziness in verifying the facts could prove risky!!

If anyone else has got some suggestions for the 10 commandments of verifying cell health I'd be glad to hear, but as always, you learn from your mistakes!!

Take care all,

Steve

Good stuff Steve. My suggestions are:

1: Cell with the highest reading is more likely to be right, because when cells fail their voltage drops? so when there's a discrepancy between cells be suspicious of everything; but the low cell is the first suspect.

2. Always do an O2 flush at 6m on the ascent. If any (or all) cells can't make 1.6 don't use them ever again.

Tim

<<<<The Linearity test on Descent is like switching the torch on for a moment to test it then putting it back in your pocket.. You know its bright but will it be bright enough for long enough...>>>>

Better that than doing it at the end of the dive, finding a non linear cell at the end is deffo shutting the gate after the horse has bolted. But I guess if you are still there to do the test at the end of the dive your cells are probably ok right!!

The test for linearity at the beginning of the dive is only part of the picture, testing on the surface by calibrating and then flushing with air to make sure they read 0.21, making sure you don't use your cells for too long, buying them from AP, and drying the head after diving, checking the cell health by filling the loop with o2 and leaving it for a couple of hours to see if the cells decay are all tools to help detect dogey cells. One test on its own is probably not enough

Dave

From: inspiration-owner@lists.drogon.net [mailto:inspiration-owner@lists.drogon.net] **On Behalf Of** Tino de Rijk
Sent: 13 November 2005 13:24
To: inspiration@drogon.net
Subject: "How to spot a faulty cell?"

There is no hard, golden law, Steve.

One of my cells (in fact my wife's) failed a week ago. First sign was a veeery slow rise while doing the calibration. You then get suspicious, because eventually it WILL calibrate (but not always, depending on the mVolt it still outputs).

But next you breath in the loop, and expect the PO2 to drop fast. Not so on the suspected cell: it stayed high. So in this case (and in fact most cases) speed of change is the first give-away.

Another simple test is flush the loop at home with 100% O₂ (suck it empty, fill it manually with O₂, let it blow out a bit for a while through the over-pressure valve to ensure as close as possible to 100% O₂), close the over-pressure valve to reach an as high as possible pressure value in the loop (you should be able to reach 1,1 or something with the overpressure valve on "heavy".) Watch the cell values, and specifically their decay over time.

Leave it for an hour or so. Many faulty cels "die" over time when exposed to a high(ish) PO₂.

Best test however, and unfortunately only available in the pool or in open water, is a perfect flush (not so easy, but a good practice anyway) at 6 meter or so, seeing them rise to 1.6 - or not. This can also be easily combined with testing speed of change, by altering with dil flushes.

The bad news is: faulty cell = end of dive..... (at least in my book); hence the preferred tests at home on a regular base.

But speed of change is usually a pretty good indicator of a faulty cel.

so unfortunately the answers to both your questions is: Yes....

Hope this helps a bit...

(The REALY bad news last week was that my spare cell proved to be DOA..... Luckily APD will change it under warranty, but still an extra week without Turtlin'...)

ciao,

Tino DE Rijk (where DE happens to stand for Dutch Enforcer, as I learned last week.....)