MILITARY DIVERS
DIVING WITH OXYGEN

FEATURE **PATRICK VAN HOESERLANDE** PHOTOGRAPHY **SEDEYN RITCHIE**

Sports divers may not have an advantage when diving with oxygen, but military divers can exploit a tactical advantage if they use the gas in its pure form. Every military activity is a balancing act between risks and potential benefits.


FAST
mares

A few months ago, an article appeared on dolphins and divers. The journalist wrote, "In Vietnam, dolphins guarded the ports. If an animal detected a diver, it attached a buoy to the diver's oxygen tank to mark his presence."

As journalist-divers, we have developed a kind of sixth sense in spotting articles that claim that we dive with oxygen. There are many articles out there already explaining why we do not dive with oxygen, but those do not stop non-diving writers to commit this mistake. So, when the article was published, some colleague-divers wanted to contact and inform the journalist of his mistake, and ask for a correction. After all, we breathe air and do not (or rarely) dive with oxygen. But, was this a mistake? Time to do some digging.

NITROX

Admittedly, we sometimes use oxygen to enrich the air to lower the percentage of inert nitrogen in our tanks and to alleviate the decompression obligations. Although Nitrox can greatly reduce the deco time by 3 metres, it comes with a reduction in maximum dive depth. As with all mammals, our bodies are optimised for 21% normobaric oxygen and any deviation from this ideal situation has consequences.

On every diving course – in particular during nitrox courses – you get acquainted with the effects higher oxygen partial pressures have on the body. Certainly, the danger of oxygen poisoning from the central nervous system (CNS) or Paul-Bert in the short term, and that of the lungs or Lorrain-Smith in the longer run, are explained.

100% OXYGEN

Oxygen is a blessing and a curse for us divers. After all, we use this vital gas as a preventive measure against shock and to combat symptoms in the event of a decompression incident. Some of us also use the pure stuff on the shallowest deco stops for accelerated decompression after a long, deep dive. Of course, with due regard to the appropriate preventive measures.

Can we tell the world that divers do not dive with oxygen? We do not have oxygen tanks strapped to our backs, but air tanks. The 'air' (or nitrox) may not always have the same composition as on the earth's surface, but it remains a breathable mixture of oxygen and nitrogen. Was the reaction to the article on dolphins and divers necessary? Umm, no. Sports divers may not have an advantage when diving with oxygen, but military divers can exploit a tactical advantage if they use the gas in its pure form. Every military activity is a balancing act between risks and potential benefits.

The first group to have filled their tanks with oxygen are the Explosive Ordnance Disposal (EOD) divers. Certain sea mines are equipped with acoustic sensors that are sensitive enough to ignite the explosive charge upon hearing the noise of bubbles. As an EOD diver, you want to be far away when a mine explodes and so you absolutely want to avoid producing bubbles.

You cannot prevent bubbles when diving with an open scuba system like the one recreational divers use. Holding your breath is not a solution. To glide silently through the water, you must use a closed system. The 'Closed Circuit Rebreather' (CCR) was an early solution for this problem (in 1879 Siebe Gorman already dove with an oxygen rebreather based on the invention of Henry Fleuss). This system converts oxygen to carbon dioxide through combustion in our cells, there is no air in the bottle. This would only lead to an excess of nitrogen in the circuit in a very short time. The used oxygen needs to simply be replaced by pure oxygen. Although there are now rebreathers which

allow to dive with mixtures and despite the limitation, rebreathers with pure oxygen only remain popular with military divers.

There is a second group of divers who want to avoid bubbles: the combat divers, in particular, the Special Forces. An infiltration while leaving a trail of bubbles behind does not lead to success. Besides, the oxygen rebreather comes with several additional benefits. The control system is very simple and very robust. There is no need for an electronic control board. If there is one thing that soldiers like, it's simplicity. The more complicated, the greater the risk in which something could go wrong. Keep it as simple as possible. In addition to simple, such a device is also compact. You only need the volume of oxygen that you will consume. Compact means fewer transportation problems and it's easier to hide. Because the device is smaller, you can wear it on your front without hindering your movements which makes it possible to also carry a backpack. The lack of nitrogen means that there is no need for a deco stop. The final advantage is that breathing out in the counter lung, does not change buoyancy during a breathing cycle. You can therefore easily maintain your position in the water at all times. Another very tactical advantage.

The use of an oxygen rebreather requires discipline. Not only should you stick to the maximum depth, although this is deeper than for sports divers, certainly in case of tactical necessity, but you must purge or flush your system frequently. When a diver starts breathing from an oxygen rebreather, the fraction of inhaled nitrogen is zero. However, the diver's body contains litres of dissolved nitrogen and the pressure gradient ensures that this nitrogen goes back to the lung and into the counter lung. The oxygen is consumed, the carbon dioxide produced is mechanically removed, but the nitrogen remains and accumulates, whereby the percentage of oxygen in the opposing lung is gradually reduced with constant ambient pressure. This can lead to unconsciousness. Periodic purging of the system with pure oxygen overcomes this problem. Military divers need to flush every half hour if the tactical situation permits. After all, a flush releases a full lung volume of bubbles and gives up the diver's location. A flush has another disadvantage: the high partial pressure of the oxygen increases blood pressure and lowers the heart rate. However, these effects are small and reversible. Strictly following procedures, ensures safe operation.

As an example: the Belgian Defense is currently using the Aqualung Amphora (see photo above). This allows a diver, in good physical condition and with the necessary breathing discipline, to stay in the water for up to 3 or 4 hours with 2.1 litres of oxygen at 200 bar and 3 kg of breathing time. If the soldier must go deeper, then he or she can with the press of a button and a twist on the overpressure valve, turning the system into a "semi-closed circuit rebreather", whereby the maximum depth suddenly extends to 24 m.

RESULT

As divers, we must respond in a nuanced way to articles about diving with oxygen. In most cases, we will have to tell the poorly informed journalist or writer that there is air or a nitrox mixture in our tanks, but when it comes to military divers, we cannot immediately rule out the possibility that they indeed use pure oxygen.

This article was written with the assistance of Captain Philip Dekkers, commander of the Platoon Combat, Swimmers of the 11th Engineering Battalion.