Absorbent canisters By Kevin Gurr periodical ref 1.012

Absorbent canisters come in many shapes and sizes but fall into 3 primary categories;

1. Axial
2. Cross flow
3. Radial

The absorbent material can vary from a granular absorbent to the newer 'solid fill' cartridges. The efficiency of a particular granular absorbent may vary dramatically based on its chemical makeup. The actual size of the granule also has an affect as less large granules will fit in a given canister, hence potentially reducing the absorbent surface area and the absorbents duration.

Solid pack canisters adopt the same chemical properties but in an 'air filter' style package. While they offer potential for the future, currently they are not as efficient as their granular counterpart.

Manufacturers batch test their product and it is vital that if you intend to use a product which differs from the manufacturers recommend one that you confirm with the new absorbents manufacturer that it performs to the same duration standard. This is normally found by testing a small sample but can only be achieved with sensitive CO2 monitoring and flow control equipment.

Each canister type has advantages and disadvantages but the main issues are;

1. Pack down percentage and hence channelling possibility
2. Breathing resistance
3. Duration
4. Water handling

1. Common axial canister have a long 'bed length' or amount of absorbent in the breathing path. This not true of doughnut shaped axials such as the USN MK15/16 series but is true of all current recreational units. Radials generality have a short bed length.

Absorbent when added to a canister will 'pack down'. That is to say the granules will move into position as they are vibrated and fill up the gaps. In a long axial canister this could be as much as 10% of the length. If the canister is then not topped up and turned sideways then a gas channel appears across the top.

Radials are generally filled at right angles to the bed length hence the pack down height is small. If the same pack down percentage occurs as in the axial this may be a few millimetres compared to many in the axial. The resulting gap is unlikely to occur especial if spring compression plates are used to keep the absorbent compressed.

In short of axial canisters are not topped up and tapped down they are prone to channelling. Radials with compression plates can often be pack to a prescribed level and the spring plate takes care of the rest.

2. Longer bed lengths mean more resistance in the breathing circuit. Put simply axial canisters have more breathing resistance this is also a function of granule size. The smaller the granule the more resistance. The trade off is that smaller granules are often more efficient.

3. The rule of thumb formula for estimating an axial canisters duration is approximately 1kg of absorbent equals almost an hour of life at a CO2 generation rate of 1l/min in 4 degrees centigrade water temperature in 15m of water. I mention depth because canister significantly reduces with gas density and currently available axial canisters typically have a greater efficiency reduction with depth. An 80% efficient canister in 15m can turn into a 50% efficient

canister in 40m. Radial canisters, if designed correctly, are generally greater than 20% more efficient than axial canisters carrying the same absorbent load.

4. Water handling is the last issue. This is a straightforward mechanical problem. Axial canisters tend to sit in a 'bucket' arrangement the inhale hose entering the space at the base. If a small flood occurs this space fills until it is unbreathable.

Radials either breathe from the inside out or the outside in. So if water enters the middle, due to the swim position it tends to spread out in a triangle between the 7 and 4 O'clock positions on a clock face. The more water the wider the triangle around the clock. However it takes an extreme flood to make all the absorbent unbreathable. There is nearly always a gas path.

So if radials are potentially so good, what are the issues? The big problem is design. There is currently no way of modelling canister design. It is pure trial and error and while the axial concept discussed of 1kg equals 1 hour this does not holed true for radials. A small change in the dimension of a radial canister can significantly increase or reduce its duration. Hence they are significantly more difficult to develop so people don't try.