BUILD YOUR OWN REBREATHER AND LIVE TO TELL YOUR FRENDS

By Dave the homebuilder

Towards the end of 1999 I came to the decision that I needed a rebreather to continue the type of diving that interests me, with the costs of helium getting out of hand for opencircut diving and the general limitations of this system I had a hard think about my options.

After looking at the types of commercially available rebreathers on the market and there price I came to the decision I could not afford one (buggar). So after doing some research in to how the machines work I summed up my resources and decided to build my own.

I have a lathe and mill in the back shed, which haven't been, used since the lawnmower broke last year, so the decision was made, start building.

The unit which I have called the "Dave-Rite mark one" took two months to build it cost $2000 Australian, and is working beyond expectations I have been diving with the unit consistly and done some orsome dives. The machine amazes me how well it works.

REBREATHER OVERVEW

There are a whole range and types of rebreathers and for what I wish to do I decided to go for a fully closed unit with twin counter lungs in an over the shoulder counter lung design similar to the inspiration. This design has the advantage if keeping the counter lungs close to your own lungs (hydro pressure center of gravity) "for lack of a better word" as well as reducing the amount of work needed to move gas through the loop. The twin counter lung design also increases the amount of time the gas takes to travel through the scrubber between breaths, which is a good thing.

The lungs

The lungs are made from surgical plastic, with welded seams, across the top, down one Side and across the bottom; this forms a tuff flexible bag 200 * 600 with a capacity of 4 liters each.

This large capacity gives the unit a good tolerance to flooding and a good degree of user friendyness. The exhalation bag has an over pressure valve in the bottom which also can be used to clear the loop of excess water if needed.

The lungs outer bags is made form tuff woven nylon with a Velcro zip, two straps are sown in to the top and bottom with plastic buckles on them which clip on to the back plate over the shoulder on to the waist belt.

There is a third strap that clips across the chest and keeps the lungs to gather in front of the body.

Lung fittings

The lung fittings are machined out of sold PVC bar, a nut and flange arrangement, the inside of the flange has a oring grove and oring which seals on the inside of the plastic bag. Hose fittings fit down in to the flange part of the fitting and screwed down with a nut they seal with a fully captured oring.

SCRUBBERS OVERVEW

There are two main types of scrubbers redial and axial, they both have advantages and disadvantages, I chose to build my scrubber on an axial design for compactness and ease of manufacture.

For practical use you should be able to dismantle a unit without tools.

Scrubber integrity

The scrubber housing needs to be able to with stand a far amount of abuse, it need to with stand positive pressure of 2.5 bar min with out flying a part. The sealing parts need to tolerate sand and other particles and still seal.

Material

The type of material you use is most important. I built my scrubber out of PVC for
Its low cost compared with other engineering plastics, its thermal properties, low water absorption PVC will absorb 5% of its mass total so you need to give consideration to allowances when designing mating parts, its has very good machining ability. PVC also has a high resistance to chemical attack PVC can also be glued using loctite 3801 epoxy adhesive.

Temperature considerations

Scrubbers need to stay worm in cold water the co2 absorbent is a chemical reactions like any other, if its gets to cold or to hot when you are diving its all over.

I based my design around using medical absorbent for its cost and ease of supply.

For example Baralyme (barium hydroxide lime) made by allied healthcare products

This product seams to work best around 40 to 50 C once it drops below 40 its ability to absorb high partial pressures of co2 becomes reduced. As the absorbent works it produces a small amount of water which is released as steam, the steam condense out in the upper air space of the scrubber, breathing tubs, counter lungs, so if the scrubber starts to loose to match heat in to the surrounding water the absorbent becomes saturated with condensation and fails big time

Construction

The scrubber is made in three main parts, outer casing, cap, and inner sleeve,

The outer casing is machined out of a piece of high pressure PVC pipe 160 OD * 140 ID

The bottom cap is machined from a solid piece and glued in to the pipe the cap and inner sleeve are both turned from sold bar. Inner sleeve internal volume is 1.5 liters 130 dia * 190 height. There is a gas space around the inner sleeve and outer casing, which acts as an insulator keeping the unit at near ideal operating temperature.

LOOP FITTINGS
Loop fittings are all machined out of solid PVC with fully captured orings they are all interchangeable, they screw together and can rotate through 360 deg when assembled.

ELECTRICTRONICS
This was the hardest part of the job the electrical housing is made form stainless steel with 6 mm lexes window, a fully captured oring seals on all parts except the cable glands which uses a oring compression system of my own design.

MISCELLANEOUS
Mouthpiece is a Dragar unit. O2 cells are Teledyne R22D. Hoses are boat deck filler hose 50mm * 400mm
And that’s about it GOOD LUCK