Care and Maintenance

CYLINDERS

by Keith Cardwell

It may be because cylinders (tanks) are so heavy and cumbersome that many divers consider them to be less vulnerable to damage and can be less than gently handled. For many divers too, they are lumped in with the weight belts as other big heavy things rented at the dive site and not something to own. And that's a very common 'for instance' at diving destinations we don't call 'home'.

But this belief that cylinders are less vulnerable to damage is not so. They must be treated far more gently than their appearance leads some of us to believe because it's not just the cylinder we should be concerned about. It's also the valve that's inserted in the top of the cylinder, and the contents that's pumped into it.

And in that order, let's look at these three things: cylinder, valve and air fill.

Cylinders are manufactured essentially from single billets of either steel or aluminium. Samples from batches so produced undergo quality testing to ensure that the cylinders manufactured meet required safety standards. The most significant of which are for the cylinders to be able to withstand massive internal pressures and external shock. As we should all know, the spontaneous release of air from a pressurised vessel such as a scuba cylinder would be catastrophic. Many of us have either heard or told these stories during diver training courses so I won't labour the point. Even so, cylinders do weaken and sometimes have to be destroyed earlier than expected after having had their regular visual or hydrostatic test.

Cylinders can withstand massive pressures because of their metallurgical properties and the thickness of the material from which they are constructed. There's little we can do about the properties of the material but we can do a lot to ensure that the thickness of the cylinder walls stay intact. The little we can do to maintain the integrity of the cylinder material is to avoid constantly overfilling and keeping away from unduly high temperatures. And we can make sure the walls aren't made thinner through careless handling and use. This means avoiding physical or chemical damage to the cylinder walls either internally or externally.

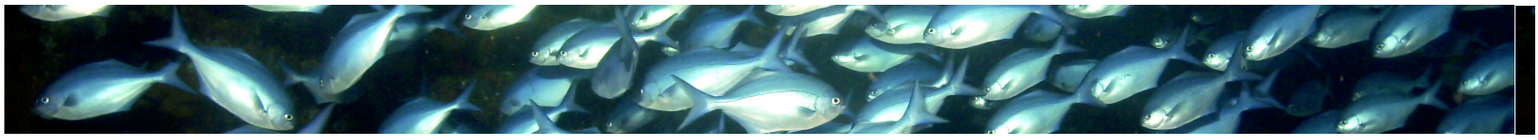
Storing and/or moving cylinders away from, and clear of sharp objects, can do a lot towards avoiding physical damage and for those that regularly transport cylinders in their cars, there are many commercially available, and modestly priced cradles made just for this purpose. Either that, or pack dive bags around the cylinders so they don't move about.

But the real insidious damage can be through chemical damage. And the commonest chemical that can cause damage to our dive gear is in the stuff we love to dive into. It can be a real cylinder killer. Salt water. It's a chemical cocktail containing a fair bit of sodium chloride and an assortment of other trace goodies. This stuff likes to react with bare metals especially when there's a bit of oxygen around and the most obvious problem we can recognise is rusting. And that's fairly easy to spot with steel cylinders.

But rust can go sight unseen even with steel cylinders if we're not careful. Steel cylinders, due to the nature of the manufacturing process, have rounded bottoms, and often plastic or rubber boots are used to allow the tanks to be stood upright. These boots need removing occasionally to ensure that there is no entrapped water chewing away at the cylinder's wall and reducing its life span.

But with cylinders made of aluminium, the effects of rusting often remains even more unseen and it's also more often than not the belief that it doesn't happen much, if at all. Well, it can, and it does. Most of us are probably well aware that when aluminium reacts with oxygen it forms

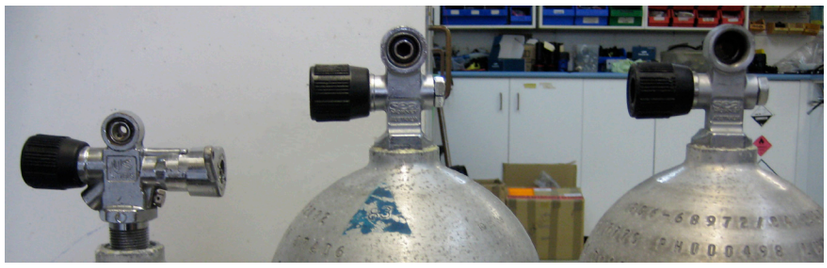
far left: Visual internal inspection.
left: Transport cylinderes in a purpose-built cradle or pack dive bags around them.
above: Steel cylinders showing damaged bottom and the boot that could be hiding it



aluminium oxide, a tough compound that inhibits further oxidisation. That's the good news. But what often isn't so obvious are the possible effects of moisture at the point where the valve and cylinder threads meet. And that's inside the cylinder.

Avoiding this problem obligates us to prevent water getting inside it. A good way to help us with this is to always keep a small amount of pressure in the cylinder, ensuring that we don't have an open pathway for water to get inside to do its stuff.

Your first best defence is to have regular visual as well as hydrostatic tests done. If anything looks dodgy before the prescribed dates are due, get the cylinder/s serviced by a qualified agent. It's often the case too that valves are not serviced when tanks are tested. That's just daft. Take the opportunity while the tank's getting looked at.



All three valves side by side: K, J and DIN

Valves We know these as K, J or DIN (Deutsch Industrie Norm) valves and they turn air on and off to our regulators. As a refresher, a K valve is a simple off/on valve, a J valve has a reserve mechanism and recognised by a lever on the side opposite the main on/off handwheel, and a DIN valve has recessed threads to which DIN adapted regulators are screwed into.

Cylinder valves are often made of brass that's chrome plated so that they look more aesthetically appealing and, over time, and repeated removal of the valve, some of the chrome plating often gets worn off the valve threads. This exposes them to the bare aluminium of the cylinder. When the bare brass and aluminium meet in the presence of water and oxygen, an electrolytic reaction takes place forming a variety of complex compounds that can further work away at damaging the internal threads. That spells disaster for the future of both the cylinder and valve.

Question: 'Why did you condemn my tank?'
Answer: 'Are you serious?'
And he was!

Much of the concern over cylinder care and maintenance talked about in classrooms is often about what might happen if the valve is unprotected and bashed up against anything, or having cylinders left standing where clumsy divers can knock them over and cause extensive damage to valves, toes and teak decks. Rarely a thing is said about how we often move cylinders around by hand. And that's usually by hoisting them up by the handwheel.

The handwheel of whichever valve you use rotates a small diameter spindle to the seat inside the valve that turns the air off and on. But when it's used in this way as the main lifting device for the tank, it may bend the spindle and after several uses, make the valve hard to open and close. So, when moving the tank about, watch that grip!

Now for the air If you get your tank filled from a reputable air source, this should generally pose no problems. But in situations where the air source is obtained from a remote and/or questionable location, it may be prudent to challenge the fill station on how they filter their air and when they last had an air purity test performed.

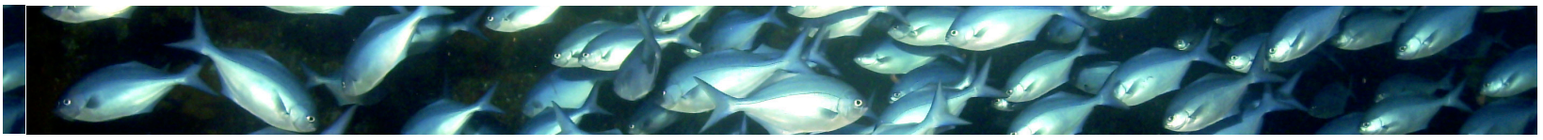
If you can, try and get a slow fill to the working pressure. Getting over-fills so you can spend that extra five or 10 minutes underwater will only increase the stress load on the tank and possibly reduce its working life. If it's better time underwater you want, get a refresher on buoyancy control and get back to the gym to improve that aerobic fitness!

left to right:

Incorrect tank lifting.

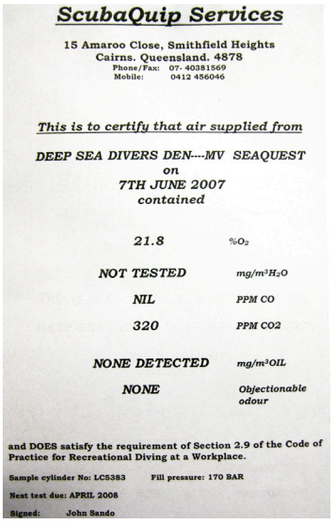
Bent spindle.

A better tank grip.



above l-r: Cap and tape.

below l-r: Air purity test sheet; Air Quality Test Certificate.



ScubaQuip Services

15 Amaroo Close, Smithfield Heights
Cairns. Queensland. 4878
Phone/Fax: 07- 40381569
Mobile: 0412 456046

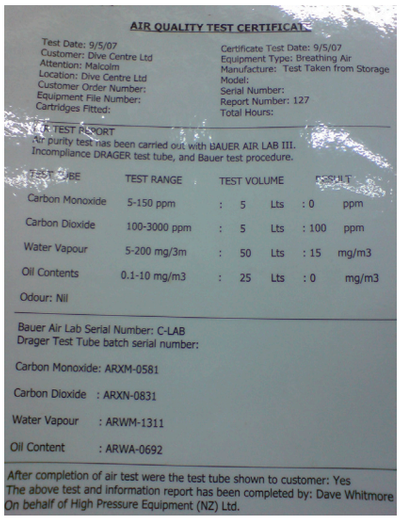
This is to certify that air supplied from

DEEP SEA DIVERS DEN----MV SEAQUEST
on
7TH JUNE 2007
contained

21.8	*%O_2*
NOT TESTED	*mg/m³H_2O*
NIL	*PPM CO*
320	*PPM CO2*
NONE DETECTED	*mg/m³OIL*
NONE	*Objectionable odour*

and DOES satisfy the requirement of Section 2.9 of the Code of Practice for Recreational Diving at a Workplace.

Sample cylinder No: LCS383 Fill pressure: 170 BAR
Next test due: APRIL 2008
Signed: John Sando



AIR QUALITY TEST CERTIFICATE

Test Date: 9/5/07
Customer: Dive Centre Ltd
Attention: Malcolm
Location: Dive Centre Ltd
Customer Order Number:
Equipment File Number:
Cartridges Fitted:

Certificate Test Date: 9/5/07
Equipment Type: Breathing Air
Manufacture: Test Taken from Storage
Model:
Serial Number:
Report Number: 127
Total Hours:

TEST REPORT
Air purity test has been carried out with BAUER AIR LAB III.
Incompliance DRAGER test tube, and Bauer test procedure.

TEST TUBE	TEST RANGE	TEST VOLUME	RESULT
Carbon Monoxide	5-150 ppm	: 5 Lts	: 0 ppm
Carbon Dioxide	100-3000 ppm	: 5 Lts	: 100 ppm
Water Vapour	5-200 mg/3m	: 50 Lts	: 15 mg/m3
Oil Contents	0.1-10 mg/m3	: 25 Lts	: 0 mg/m3

Odour: Nil

Bauer Air Lab Serial Number: C-LAB
Drager Test Tube batch serial number:

Carbon Monoxide: ARXM-0581
Carbon Dioxide : ARXN-0831
Water Vapour : ARWM-1311
Oil Content : ARWA-0692

After completion of air test were the test tube shown to customer: Yes
The above test and information report has been completed by: Dave Whitmore
On behalf of High Pressure Equipment (NZ) Ltd.

Although not seen much on charter boat operations, but almost as standard practice at land-based filling stations, when cylinders are filled, tape is often placed over the valve orifice. That's usually put there to keep the o-ring in place, stop dust getting in and indicates that the cylinder's full. Tape's a problem. Just before the regulator is put in place, the tape is often placed on the shoulder of the tank and can get rubbed off underwater. That's rubbish where it shouldn't be, so please be careful to place the tape in a suitable receptacle before the dive. Better still, if you own your own cylinders, keep your local dive store in business and buy an attachable dust cap for each cylinder. Then you don't have to worry about tape at all.

It's a case of doing a few basics to keep those cylinders living longer

1. Always keep up with visual and hydrostatic tests when due. If you have doubts about the cylinder's integrity in the meantime, possibly from something like a deep scratch, get it checked.

2. Store with a small amount (low pressure) of air. Don't store full for long periods of time. This over-stresses the cylinder unnecessarily.

3. Rinse cylinders and valves after each day of diving. Get that corrosive salt water off them and let them drip dry.

4. Store and transport them safely so that they don't roll, fall over or are placed in such a way as to be hit by passing objects (or people). During the diving day, avoid leaving cylinders upright especially when the boats rocking!

5. Protect the valves from damage and place caps over them (full or not) when in storage to prevent damage.

6. When you take the cylinders in for their service, get the valve serviced at the same time.

7. Have a few spare o-rings for the cylinder valve/s.

8. Don't drop one on your toes!

Thanks to Brad from Cairns Scuba Air, Rosco from Deep Sea Divers Den and Malcolm from The Dive Centre for the photos in this article. And yes, someone really did wonder why their cylinder didn't pass its hydro!