SCUBA REGULATOR INFORMATION

03 April 2001

Few pieces of dive gear are as hotly debated by divers as the choice of regulator. Strangely enough, although frequently debated, few divers (or shop assistants for that matter) can actually explain in detailed, logical & technical terms the reason they bought what they use or what they recommend.

For many people new to diving, the choice of regulator is influenced by any number of factors such as:

- Shop recommendations
- Instructor recommendations
- Club recommendations
- "That's what I used when I learned to dive"

While most sources can be well meaning, the advice given is not always good and there may be ulterior motives, which you should be aware of. Dive shop assistants or owners are often the worst people to get advice from as their recommendations are often influenced by the margins that can be made on a particular product. Shop/Club equipment is often at the lower end of the market in terms of performance and durability due to cost constraints within the club. People will typically recommend what they use without necessarily even knowing the type of valve they are using (e.g. balanced vs unbalanced; piston vs diaphragm; upstream vs downstream). These three characteristics have an important bearing on the performance, reliability and failure mode of the valve.

Some considerations when buying a regulator:

A) The regulator is the single most important piece of equipment you will buy, as it is primary life support

B) They cost a fair bit of money, the wrong choice will be costly (it is because of this that people are so adamant that what they bought is right, they don't want to admit that they were wrong and don't want to splash out on a new one). The most expensive are not always the best (in fact, the most expensive certainly isn't the best).

C) An educated choice will mean that it will not need replacing for a long, long time. Buy one that will "grow" with you and will still be useful if you ever get into more adventurous/technical diving. It should be suitable for both single tank diving and, if you ever wish to progress to it, twin set diving. Not all regulators are suitable for twin-sets as the ports are not arranged suitably.

E) Avoid regulators with special fittings or non-standard parts. In the event of a problem, non-standard hoses or parts can be difficult to get hold of – especially if diving abroad. Some have unusual sized ports that make swapping things over difficult (e.g. a ½ inch LP port rather than the standard 3/8ths inch), others have the ports arranged so closely that it is very hard to get a spanner in to screw/unscrew them.

F) You should have logical reasons for what you buy – the regulator should meet certain criteria - in short, you are looking at the following characteristics:

1) Reliability & "pedigree" from a proven track record

2) Performance (work of breathing & volume of as delivered at varying depths and tank pressures)

3) Performance over time (some regulators perform well when brand new or just after servicing, but quickly lose "tune")

4) Ease of hose routing (both for a single tank and for twin set)

5) Simplicity of design & failure modes (does it fail shut or open)

6) Servicing cost & ease of "in field" repairs or adjustments (e.g. being able to unscrew the cover of the 2nd stage without tools to remove any debris)

7) Build quality

8) Price

Some Practical shopping Tips:

1) Know exactly what you want BEFORE you go into the shop.

2) Take little notice of the shop assistant's advice (this may sound shocking at first as we normally expect advice from shop assistants when buying things, after all, isn't that what they are paid for?) But consider that they may not have a broad base of experience. They may not have much experience or knowledge of regulators outside those they stock, they may not be a regulator technician, they may not have read around the subject, and they make have little real diving experience. What sort of diving have they done? Is their advice based on pooled knowledge, or is it just based on their individual experiences?

3) You may be encouraged to buy the very latest model, but has this stood the test of time?

4) Some models/brands have a higher profit margin and these may be "pushed" on you.

5) You may be told that you should not mix different brands of 1st stage & 2nd stage. There are some brands which should not be mixed (e.g. Poseidon), but others actually work exceptionally well together (e.g. Apeks & Scubapro). If you wish to understand why this is the case see the more technical section later.

6) Prices can vary from one shop to the next significantly.

7) Buy a 1st stage that has the DIN connection and buy the A-clamp adaptor (between £20 and £35) for the DIN regulator if you regularly rent tanks (see section on DIN vs A-clamp later). Remember that a DIN can be converted to be used on a non-DIN tank in a few seconds by using the adapter, whereas, an A-Clamp regulator needs to be taken apart by a technician and needs new parts to be used with DIN.

CHOICE OF 1ST STAGE

Many 1st stages can be discounted simply because they do not allow for clean hose routing – whether you are going to using it on a single tank or a twin set. The 1st stage may not have enough ports for use with a dry suit, or they be arranged in such a way that hoses come out at all sorts of angles (usually radially). You need a minimum of 4 low pressure (LP) and 1 high pressure (HP) port.

You want one that allows the hoses to be neatly arranged so that large loops of hose are not in your face or tempting entanglement. A large loop of hose can easily get hooked on a piece of wreckage and either damage the hose or pull the regulator from your mouth. Large loops of hose also create more drag in the water and can lead to jaw fatigue if swimming against the current or when scootering. Ideally, all hoses should point down thus minimising the risk of loops that will cause entanglements.

Various manufacturers have introduced ultra-light first stages that should be avoided. These are made from aluminium and are prone to breaking and internal corrosion over time.

The design of the 1st stage should be simple yet reliable. Experience has repeated shown that over-complicated deigns fail more frequently and go out of tune more readily. You are looking for quality of materials, workmanship & design.

Which 1st stage should I go for then?

There are few 1st stages that meet all the above requirements and the shortlist boils down to just two:

The Apeks DS4 (with DIN fitting)

This is a "balanced" diaphragm 1st stage with four 3/8th inch LP ports and 1 HP port (see Background section below for differences between diaphragm & piston 1st stages).

The "DS" stands for "Dry Sealed" as the 1st stage is completely environmentally sealed. There is no turret and so the LP ports do not swivel. This still allows proper hose routing and has one important advantage – it removes a failure point (the O-ring that is in the

joint between the swivel section and the rest of the first stage). If the turret fails on any regulator the result is a catastrophic loss of gas.

The Apeks 1st stages are some of the very highest performing on the market.

Apeks also make the DST first stage. The "DST" stands for "Dry Sealed Turret". This is the one that normally comes with a TX50 or TX40 second stage. They both have the same performance and internals except that the DS4 has no turret and so is safer & cheaper too. The DST also has a single stupid ½ inch LP port that causes compatibility problems with hoses (the others are the standard 3/8th inch).

Note that the DS4 is NOT the one that normally comes with an Apeks TX50 or TX40. You have to ask for it specially. The Apeks DS4 currently can be bought for between £90 and £100. This is cheaper than the DST, which sells for around £110.

Stay clear of the Apeks DS1 as it only has one LP port and 1 HP port and so is only good as an argon suit inflator regulator. The new Apeks first stage that comes with the TX100 may be all right but it has yet to pass the test of time.

The Scubapro Mark 20 (with DIN fitting)

Unlike the Apeks, the Scubapro is a piston 1st stage (see Background section for more detail). The Mark 20 has 5 LP ports and 2 HP ports. The big advantage that the Mk20 has here is that there is a port at the end of the regulator thus facilitating a wide variety of hose routings. The Mark 20 is also very high performing and the design is very robust. They do have a swivel turret and so they do have an extra failure point than the DS4.

That said, their record is good and they are the preferred choice for stage and decompression bottles. This is because a piston design can better withstand any water accidentally getting into the HP chamber than a diaphragm design. Water may get into the HP side either if you left the cylinder for a long time under water and the regulator got depressurised (e.g. left in a cave for a "set-up stage dive"), or if you had to unscrew and swap the 1st stages over underwater.

Avoid the Ultra-Light Version (Scubapro Mk20 UL) as this is made of aluminium and is more brittle than the normal brass ones and some have been known to corrode internally.

I, and many other people in my diving groups, have opted for the Apeks DS4 for cylinders that are back-mounted (benefit of no turret & sealed) but retain the Scubapro Mark 20's for cylinders that are side-mounted (simple robust piston design).

Which 2nd stages should I go for then?

Whether you are single tank diving or twin set diving, you will need two 2nd stages, one as a primary (the one you breathe) and one as a backup (the one you don't normally breathe).

The requirements of the backup and primary are quite different and so the characteristics you want are also different.

The Primary second stage

For the primary you want a reliable but high performance regulator. The Work of Breathing (WOB) should be low (inhalation & exhalation effort) so as to prevent respiratory stress and prevent CO2 retention. It should ideally be adjustable such that the cracking pressure can be adjusted to be harder or easier to suit conditions. For example, in a head down position whilst static in a flow, there is a tendency for the 2nd stage to leak a small stream of bubbles. In this situation you might increase the cracking pressure. On the other hand, when swimming hard against the flow/current, you want the breathing resistance & cracking pressure low.

Poor performance can lead to Co2 build up in your lungs and body. Co2 worsens nitrogen narcosis, heightens oxygen toxicity, is contributory to DCI and gives a headache, just to mention a few. High work of breathing actually increases gas consumption.

In order to get a high performing 2nd stage, it ideally needs to be "balanced" (I recommend reading the section later on balancing of 2nd stages). 2nd stages, such as the Scubapro G250 or Apeks TX50, where the cracking pressure is adjustable are of the "air-tube" design and are "balanced". These two 2nd stages have an extremely low WOB and have been extensively field tested over he last 8 or so years. The more recent Scubapro G500 and G600's may have slightly better WOB but they have both been subject to product recalls (as do many other brands) and the fronts do not unscrew easily. They also have fewer metal parts, which might reduce their cold water suitability.

Poseidon 2nd stages are "upstream" (see later section) and if the LP seat or spring fails they fail closed – this is shear stupidity when it comes to 2nd stages. There popularity among die-hards harks back to the days when they were a relatively good performer, alas, the rest of the world has overtaken them with higher performing & more reliable regulators.

It is also important that you are able to unscrew the front of the 2nd stage off, should debris get trapped in either the diaphragm or exhaust valve (mushroom valve). 2nd stages such as the Mares do not allow one to do this, nor is their breathing resistance adjustable.

The Apeks TX50 2nd stage sells for around £95, the G250 for around £120.

The back-up second stage

You do **not** want a very high performance, sensitive regulator that is **not** in your mouth because it will be more likely to freeflow.

You therefore want a simple "unbalanced" 2nd stage for the back up. Because it is unbalanced you won't get into that positive feedback loop whereby the air gushing out assists in opening the valve, and so the freeflow continues. When descending a shot line in a current (or diving in any current for that matter), the water flowing over the 2nd stage can trigger a reduction in pressure in the 2nd stage thus opening the valve causing a freeflow. The cracking pressure for the back-up should therefore be higher than your primary.

When considering all the contenders in the market, there aren't actually that many that are unbalanced, have the simple so-called "classic downstream" design, are compact and have a front which you can unscrew.

The Scubapro R380 does meet these criteria and being compact goes under the chin well without getting in the way. It has been extensively field-tested. It sells for around £80.

The R380, G250, TX50 and TX40 all run off the same Intermediate Pressure (between 9.0 to 9.6 Bar). The Mark 20 and Apeks 1st stages also operate in this range (but can be detuned – see later). They are therefore interchangeable and so you can have an R380 off of an Apeks 1st stage for example.

Summary Recommendation

The two systems that seem to fulfil all the above are therefore as follows:

1) Apeks DS4 1st stage with TX50 primary 2nd stage and Scubapro R380 back-up, or;
2) Scubapro Mark 20 1st stage with G250 primary 2nd stage and Scubapro R380 back-up

Preventing Freeflows

Freeflows are the most likely regulator problem an inexperienced diver will encounter. They result from a combination of bad technique, regulator set-up and regulator choice.

Fortunately there are some easy steps to avoid them:

1) ALWAYS pass a regulator to someone else with the mouth-piece facing DOWN.

2) Avoid repeated purging and breathing from regulator whilst either the 1st stage or 2nd stage is in the air (air temperature is usually lower than water).

3) Test the regulator once early on in the kitting up process and then leave it until you are submerged.

4) Lower the Intermediate Pressure (IP) to 8 Bar (120 psi). This makes the 2nd stage slightly less sensitive but will ensure that the force that the spring in the 2nd stage is working against is less and so the valve is closed more easily. This is certainly recommended for the backup regulator on the left post if using a twin-set.

5) Buy a regulator that is cold water protected. This might be the Thermal Insulation System (TIS) that Scubapro uses (cover parts with Teflon to prevent ice crystals forming), or better still, totally sealing the 1st stage off from the water. Note that if the 1st stage is fully sealed but the 2nd stage is set to be too sensitive, or the user keeps purging the 2nd stage before use, the regulator can still freeflow from the 2nd stage.

6) Keep your regulator serviced but check it out in the pool before using it in cold water.

7) Avoid taking a breath at the same time as either inflating your suit or stab jacket/wing (this causes less gas to rush from the 1st stage - as this gas expands it cools).

Explanation for 1) above: the difference in the water pressure from the diaphragm to the top of the mouthpiece (despite only being about 2cm to 3cm apart) is sufficient to open the valve.

So, if you pass a regulator with the mouth piece up, the pressure will be greater at the diaphragm than at the mouth piece and the valve will easily open as it is being assisted by the water pressure - possibly leading to a free-flow.

Whereas, if you pass a regulator with the mouth piece down, the pressure will be less at the diaphragm than the mouth piece and the valve will not open so easily because it is working against this pressure and thus less likely to free-flow.

Submersible Pressure Gauge (SPG) vs Console

When buying the regulator you will need to buy a contents gauge (Submersible Pressure Gauge - SPG). Most divers around the world use one of those large consoles that contain the SPG, a compass & perhaps a computer or depth gauge as well. Whilst this seems a good idea superficially (keep all those handy things in one place), it does have some serious drawbacks:

1) They are necessarily large and get in the way and drag along the bottom or catch on wrecks. How often have you seen a console get dragged along or clonk things? Diving in silty overhead environments with such consoles stirs up silt.

2) The computer is better suited to being on the wrist where it can easily be read whilst reeling in a DSMB on the ascent for example. The face & contacts of a computer are reasonable delicate and could do without being regularly clonked!

3) The rubber boot of the console covers the connection between the HP hose and the actual SPG. This has three distinct disadvantages :–

- Firstly, the rubber prevents grit, dirt and saltwater being properly washed off when the console is cleaned. Even a good soak in warm water fails to get rid of all this salt and grit as an inspection under the boot will bear testament. The little swivel pin that sits in the joint between the HP hose and SPG, has two small O-rings at either end, this will wear down faster if not cleaned properly as grit acts as grinding surface. With no rubber console it is easy to thoroughly clean.
- Secondly, should a small leak occur in this area, it would not be immediately obvious from exactly where it is coming. It takes time for the small bubbles to find their way out of the console and during this time you are descending deeper. With no rubber console any leaks are immediately visible and it is clear to see where they are coming from.
- Thirdly, should there be a more dramatic leak from the HP hose whilst on the boat/shore it is very easy to get access to the joint with a spanner when there is no rubber console and so the problem can very often be fixed there & then without missing the dive. With the rubber console in place this job takes much longer and may be impossible with cold hands.

What sort of SPG do I need then?

All you need is the SPG itself, the compass is better on the wrist or stowed in a pocket until needed. The depth gauge is part of your computer and should also be wrist-mounted. The SPG to try & get is the UWATEC "Master Diver Pressure Gauge" shown in website below.

http://www.uwatec.com/english/framem04.htm

To quote website:

"The Master Diver is also anti-magnetic with a chrome-plated, solid brass case, highly luminous dial face and a scratch resistant, chemically hardened, mineral glass lens. The spiral bourdon tube measurement system is accurate within +/-5 bar from 0 - 300 bar. Also available in 5000 psi."

Note that the 'Uwatec Submersible Pressure Gauge" (one below on the website) has a plastic face. Plastic is not as good as on deep dives as they flex & make the needle stick. Now you won't be diving to a 100m for a while but the glass face doesn't scratch like plastic and it is clearer to read. Furthermore, a brass case resists the water pressure at all depths better and so the gauge tends to be more accurate than the plastic cased SPG's.

Unfortunately, the above SPG is now very hard to get so you must look for alternatives. Try to find one with clear numbering, a brass case and, if possible, a mineral glass face.

The HP that you normally see in shops is in the region of 36 inches long. This is excessive as can be seen from all those holiday brochure photos, where it dangles down too far. Ideally the HP hose should be 24 inches long and clipped off to the left near the left hip using a large stainless steel piston clip. Here the SPG & HP hose is streamlined, it won't dangle and it is protected. Practice is needed so that you can quickly unclip it when needed. The piston clip should be held by a cable-tie and O-ring which provides a quick break-away if needed or should the HP hose accidentally get caught (will prevent excessive strain on HP hose).

BACKGROUND

The task of the regulator 1st stage is to deliver a constant Intermediate Pressure (IP) above ambient pressure regardless of depth and regardless of tank pressure (in the case a balanced 1st stage). In a non-balanced 1st stage the IP will either drop (as with "downstream" designs) or increase (as with "upstream" designs) as tank pressure drops.

In an "upstream" valve the seat (rubber/plastic surface that forms the seal) mechanism is upstream of the orifice that it is closing (can apply to both HP seat in 1st stage and LP seat in "2nd stage). If the valve fails it will generally fail closed.

In a "downstream" valve the seat (rubber/plastic surface that forms the seal) mechanism is downstream of the orifice that it is closing. If the valve fails it will generally fail open.

There are broadly two types of 1st stage mechanism:

Piston first stages

Here the water pressure and air pressure act on a piston that transmits the pressure to open & close the valve. If the piston is orientated perpendicular to the incoming airflow of the tank, then the tank pressure has little bearing on the force on the piston – this is how a piston 1st stage is "balanced". Pistons allow a large volume of air to be delivered and are simple and robust in design.

Because the piston has to be exposed directly to the water, you will always find little holes in the 1st stage allowing the water to act on the piston. These holes are the telltale sign that the 1st stage is of the piston type. Because this chamber is exposed to water, for diving in very cold water, the 1st stage has to be cold water protected in some way. For pistons this is achieved by either filling this space with silicone grease or by covering the moving parts with a non-stick compound to prevent ice crystals building up. Scubapro call this latter system TIS and use Teflon to coat the parts (as in the Mark 20).

Scubapro have specialised in the design of piston 1st stages since the early 1960's and have patented many of their clever design features. As a result, other manufacturers of piston regulators have struggled to achieve the same performance with the piston design. It will therefore come as no surprise to learn that the pinnacle of piston 1st stage design is the Scubapro Mark 20. It definitely has a long pedigree.

Piston regulators are almost without exception "downstream" in design and so, unless they are "balanced", the IP drops as tank pressure drops (when the tank pressure is high it has a tendency to assist opening the valve and so it takes a higher pressure in the LP chamber to close the valve to overcome this. When the tank pressure is low the spring closing the valve has an easier job as the pressure of the gas it is opposing has dropped and so the valve closes at a lower IP – easier to understand with a diagram!).

More importantly, because they are "downstream" in design, if the high pressure O-ring fails, the valve will be forced open and so HP air is allowed into the LP chamber and into your hoses and 2nd stage. This can cause a LP hose to rupture (they are designed for 10 bar not 200 bar!).

The disadvantage of the piston design is that for very cold water, or polluted water, it is nice to completely "environmentally seal" the 1st stage thereby allowing no water to the internals. A diaphragm design 1st stage can do this, a piston cannot.

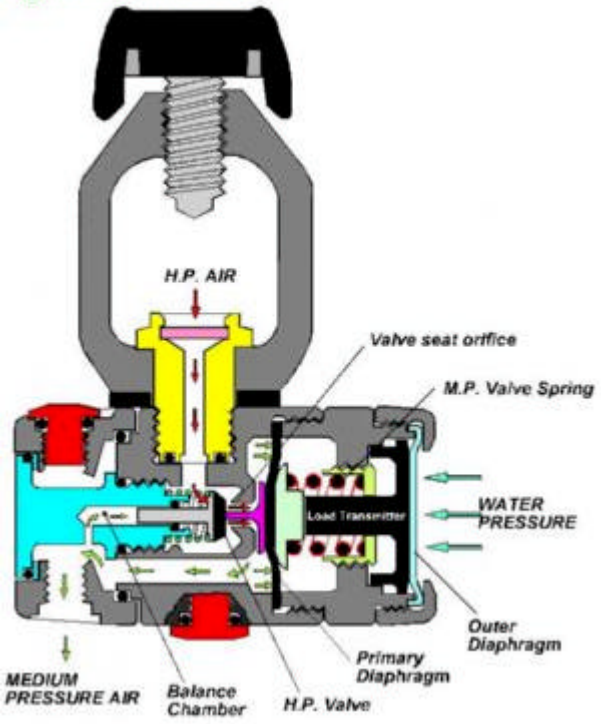
Diaphragm 1st stage

Here the HP valve seat is pushed forwards or backwards to close or open the valve via a small rod connected to a flexible diaphragm. This means that there is no need to have holes in the 1st stage and so these valves can be completely sealed making them ideal for polluted water or very cold water. All diaphragm 1st stages are "upstream" in design and so they fail closed.

Like the piston they can be "unbalanced" or "balanced". Unlike the piston 1st stage, the diaphragm 1st stage is balanced by allowing air to both sides of the HP seat. The IP of an unbalanced diaphragm will gradually increase as tank pressure drops (at high tank pressures the air assists in closing the valve, as the tank pressure drops the valve is held open longer and the IP creeps up). Note that this is opposite to piston 1st stages.

With diaphragm 1st stages you are looking for simplicity and regulators like the Apeks range, tend to have a static orifice and a moving seat (in theory you can have a moving orifice and a static seat and both types are common). The Apeks is robust in design and has some neat but simple solutions, such as the way in which they are balanced. They are also very easy to dismantle and adjusting the IP is a piece of cake. Apeks service kits are also cheaper than many other brands, yet their reliability & performance is probably the best of the diaphragms.

Fig 1. Inhalation Phase



The above diagram shows an Apeks DST 1st stage (with swivel turret & A-clamp unfortunately!)

Note that the air is allowed on both sides of the HP valve in the above diagram, so tank pressure has no bearing on Intermediate Pressure.

Common 1st stage Problems

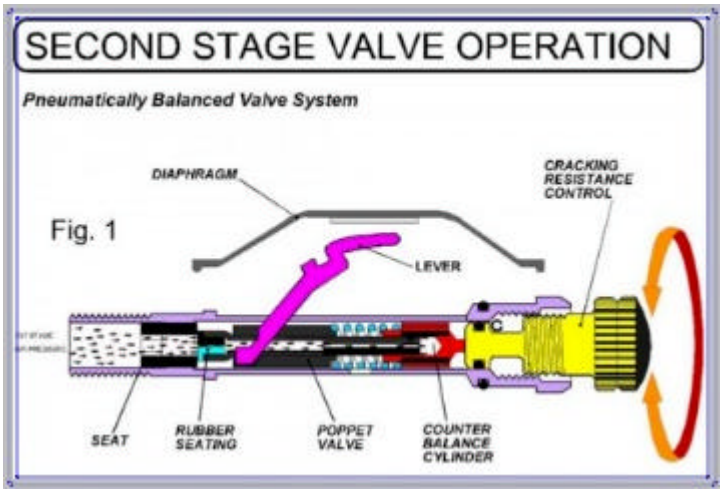
Most 1st stage problems relate to a "creeping" IP that causes the 2nd stage to eventually start dribbling bubbles. This is caused by the HP seat not quite seating properly and so HP air can leak into the LP chamber. The IP thus creeps up until it is too much for the 2nd stage LP seat to hold back and so a stream of bubbles results.

Apeks have a "forgiving" seat, that I, or any member of the email list, have never heard of leaking, other brands such as Poseidon have notoriously poor HP seats and commonly suffer from creep. The Poseidons I had from 1993 to 1995 crept on 3 separate occasions even with annual servicing.

“Balanced” vs “Unbalanced”

To get high performance out of a regulator, the 2nd stage has to be sensitive. That means the spring pressure that closes the valve (pushes low pressure seat onto a crown/orifice) has to be weak or assisted.

Balancing in the 2nd stage is whereby the pressure of air coming from the 1st stage (around 9.0 to 9.4 Bar) is used to assist in opening the 2nd stage valve. Air BOTH sides of the actual LP seat (where the seal is formed) is at this intermediate pressure and so the spring only has to be strong enough to reliable close the valve (because the gas on the downstream side of the LP seat is assisting with closing the valve). The spring can be therefore be weak. Because the spring is weak the inhalation effort is small, thus high performance. The diagram below of a TX50 2ns stage will aid explanation; Apeks call it “pneumatically balanced”.



With an unbalanced 2nd stage, the spring has to be stronger as it does not have the assistance of the 9 Bar of air behind it. The spring has to be strong enough to close the valve against the interstage/intermediate pressure without the assistance of this gas pressure behind it. This stronger spring means that performance is poorer.

Balanced is therefore desirable for your primary regulator (the one in your mouth) as it is higher performance due to the sensitivity of a weaker spring. This is the case with the G250 or TX50. The TX40 is also balanced but you cannot adjust the spring pressure as you can with the TX50 or G250.

The balanced type will more likely stay in free-flow should one occur. This is because the spring will be stronger on an unbalanced 2nd stage (unless you swap out the normal spring on a balanced 2nd stage for a stronger one) than a balanced 2nd stage.

Advice on DIN fittings and A-Clamps.

Before outlining all the benefits of DIN fittings, I would like to dispel some myths:

Myth number 1: ***"If you buy DIN fitting regulators you won't be able to use them abroad".***

I have dived using DIN fitted regulators since 1989 in the following Countries without EVER being unable to use my regulators (UK, Bahamas, Barbados, Australia, Egypt, Jordan, Maldives, Spain and the USA). People I know have had no problems in many others.

The reason is that the vast majority of cylinders manufactured since the mid 1980's have an insert in the pillar valve that can easily be unscrewed using a hexagonal alum key so that the DIN fitting can be screwed in. This takes about 5 seconds. In the couple of instances where this has not been possible (e.g. Maldives), I have simply used a yoke adapter (A-Clamp) that simply screws onto my DIN fitting. Also a 5-second job. The point is that, DIN is very quickly adapted to an A-Clamp but an A-Clamp not so easily adapted to a DIN (but can be done for about £30 – 40 by a dive shop).

In the UK (where I do most of my diving) I have my cylinders set up permanently for DIN.

Myth number 2: ***"DIN fittings are hard to undo"***.

This was the case with some Poseidon regulators (until you learnt the knack) but is not the case with other brands of regulator (Scubapro, Spiro, Apeks, Oceanic, Sherwood, Mares etc).

Myth number 3: ***"DIN fittings are more expensive".***

This is simply not the case. The price of a DIN and A-Clamp regulator are the same bought from new.

Myth number 4: ***"DIN fittings are only for "tekkies" and they offer no advantages to the recreational sports diver".***

After reading the various benefits that follow ask yourself this again:

1) The first advantage that a DIN fitting has over an A-Clamp is that it is a more secure and positive connection. If the first stage or pillar valve is knocked (against wreck/cave/on boat) the connection is much less likely to fail. If an A-Clamp is knocked with reasonable force the seal can be broken between the regulator 1st stage and the cylinder pillar valve.

Most experienced divers would have seen at least one occasion where, on pressurising the regulator, a hiss was heard as gas escaped out of the tank between the O-ring and regulator 1st stage when using an A-Clamp.

This is usually put right on the boat/shore, but how much confidence does this give you about the strength/integrity of the seal? About the A-Clamp - "It might simply take a few goes to get it to seal right". What sort of confidence does this give you!!

2) The O-ring on a DIN fitting is trapped and cannot burst out. Similar comments as 1) above apply. Again, many an experienced diver has seen the O-ring burst out the side of an A-Clamp.

3) For the above reasons DIN fittings can be rated to 300 Bar, A-Clamps can only rated to 232 Bar. What does this tell you?

4) The O-ring on a DIN fitting is part of the regulator not part of the tank. It therefore gets looked after better and is kept out of the sun and salt water. Sun & salt water cause O-rings to harden, crack and thus form a less good seal. Whilst on your Red Sea live-aboard, you may check the O-ring on the tank each time you select a new tank, but what is the betting that you will still use an O-ring that "looks OK" but is actually past its best. Is your buddy as thorough? This is a major failure point and not fun with a single tank!

5) The DIN fitting is more compact and does not have a knob at the back. The knob at the back of an A-Clamp is a great place for line to entangle. The worst place to be entangled is behind you. With a single tank configuration the pillar valve is hard to reach, never mind untangle line from.

When you consider the above points together you have to ask the question: "What are the benefits of an A-Clamp?" because there are certainly some very serious disadvantages. So much so that some training agencies ban A-Clamps on back mounted cylinders whilst in any overhead environment (i.e. wreck, cavern or cave). Frankly, I can't think of any advantages to using an A-Clamp and would be interested in hearing any from other people.

Almost all modern regulators can be converted from A-Clamp to DIN. I wouldn't expect the cost to be more than £30-40. This, I trust that you will agree, is a small price to pay for the added safety of using DIN fittings.

SOURCES

1) "Scuba Regulator Maintenance & Repair" by Vance Harlow. Airspeed Press (http://www.conknet.com/~g_packard/regbook.HTML)

2) Membership of organisations (GUE, WKPP and DIR-UK) and email Groups (DIR-UK & Quest) over the last 3 years has resulted in a vast pool of detailed knowledge based on literally tens of thousands of dives. By the pooling of the knowledge of hundreds of technical divers & regulator technicians from all over the world one is able to impart advice based on a much wider depth of experience than if just recommending things based on personal experiences or based on a relatively small group of divers. Many of the members of these groups are at the cutting edge of diving and it is fortunate to be able to communicate directly with them on diving matters, one such example being the subject of regulators.

3) My personal experiences and observations over 12 years of diving & those of all the people I have dived and chatted with.

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