# DIVING EQUIPMENT GUIDELINES

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AIMS

The following guidelines are aimed at ALL levels of divers, from those just beginning to those people who have dived for many years. If you doubt this, spend some time reading the section discussing the long hose and those references made to the use of a small wing with harness and single tank adapter. The cost of much of the equipment that I am recommending is the same as much of the “normal” gear. Bear in mind also that it won’t become obsolete/inadequate if, at a later date, your needs change as you venture into more advanced diving. I have learnt this lesson the hard way! Even if you never intend to get into such diving, you are diving a more thoroughly thought out and safer system in the meantime.

The aim is to encourage the reader to think seriously about what they use and why. It is hoped that the person just starting out will gain some insight as what to buy (avoid pitfalls & regretted purchases). It is also hoped that by reading the following pages, an experienced diver will be encouraged to look again at what they use and why. Frequently a diver ardently defends what they use purely on the grounds of “this is what I have got and I’m not changing now”. Many divers often recommend equipment to other divers purely on the grounds of “this is what I use” without being able to give the detailed underlying reasons. If they were to admit what they use is actually not ideal, no longer appropriate or outdated, they wrongly feel that this is a poor reflection on themselves or their diving prowess. If they were totally honest and armed with their current knowledge and experience, would they buy it again?

THE DIVING EQUIPMENT INDUSTRY

Being a large training organisation, the BSAC is unable to condone specific types/brands of equipment. Nor can they criticise unsuitable equipment for fear of legal action.

At any given time, most equipment manufacturers seem to have two concurrent top lines: a novelty line and a value line. The novelty line is aimed at the diver who is susceptible to advertising and just has to have the latest and greatest, and the value line at the diver who knows gear, buys for the long term, and isn’t easily seduced by glitz. The novelty line has all the bells and whistles, which are promoted at any given moment as offering significant advances in technology, and clear cut superiority to anything else on the market, including the manufacturer’s own “value line”. The funny thing is, that while the bread and butter lines don’t change much, the novelty lines do, and what is being promoted as the latest and greatest thing one year is often forgotten the next. This makes the novelty line a dubious buy. The diving industry is continuing to “try and reinvent the wheel” in an attempt to sell more gear. Much of the best equipment has been around largely unchanged for a long time.

Back plates and wings, although relatively new in the UK, have been used in the States since the early 1980’s. The Jetfin (see later) has been around for
at least 30 years. The Scubapro balanced piston 1st stage regulator has slowly evolved over time, but in essence it has been around since the 1960’s.

Any magazine that is attempting to do impartial testing while at the same time deriving most of its income from advertising (as most do) must cultivate a certain delicacy when it comes to describing a product’s shortcomings. It’s up to you to read between the lines and to speak to people you think know what they are talking about.

Ask yourself WHO is giving you advice. What is the breadth and depth (excuse the pun) of their knowledge and experience? What qualifications do they hold? Have they gained experience from agencies other than BSAC/PADI that may be valuable EVEN when applied to NON-technical diving? The use of the long hose (see later) is a good example. This technique is safer for ALL types of diving.

Ask yourself whether the benefits of certain types of equipment discussed later apply to your gear. Conversely, ask yourself whether the disadvantages discussed apply to your gear. Having read all the arguments and spoken to different people, you are in a better position to make an informed decision.

Just because the majority of the sports diving community uses something, this IN ITSELF is not a good reason for using/buying it. You should think about the pros and cons of everything you take into the water with you and be able to outline the thought process and logic that led to your decision to buy/use something.

Merely following suit and “doing everything the same as everybody else” is not an adequate reason in itself. If a piece of equipment has been thoroughly thought out and tested out, both in concept and practice, AND it happens to be “what everybody else” has, then fair enough. But don’t assume for one minute that this is the case. A lot of dive gear (most!) is badly designed, overcomplicated or simply not needed. It is better to stick to things that are simple, well designed and made of quality materials. Just because a particular piece of equipment has never failed on you, doesn’t mean that this IN ITSELF makes it a suitable choice. I have flown across the Atlantic on several occasions without incident. Common sense tells me that it is safer to fly on a plane with two jet engines than one.

Most recreational divers, regardless of skill level, are poorly informed on which gear will be ideal for them as they progress in ability. The goal is to educate yourself to actually speed your learning curve over typical first choices, and understand from the start which gear will NOT become obsolete as you jump to much higher levels of skill and dive site choice. Gear purchases can actually be modular. If you start with the single tank adapter, back plate, harness and wings, any advancement in your skill and
diving location choice will be a natural progression, allowing you to use the same type of gear configuration.

The diver who starts with the "back plate and wings" type system, in a basic single tank configuration with a long hose primary, will be very comfortable moving into the wreck penetration arena, to deeper diving, or the cave diving arena should they wish to in the future. Once you are familiar with a harness set-up, with a streamlined profile and proficient use of a minimum number of D-rings to standardise gauge and gear placement, the move from a single tank to doubles becomes a non-issue.

**USING A CONSISTENT SYSTEM**

There is a lot to be said for diving with the same system as other people PROVIDED this system has been painstakingly thought out and extensively tested. I will give four good reasons for this, I am sure that there are many more:

1) The ability to interchange/swap between your own equipment. An example would be having the same size and type of direct feed on all your gear (see later).

2) The ability to interchange/swap between yours and someone else's equipment. An example would be using your direct feed on their stab/wing for a CBL or if you wish to borrow a part of their gear for the dive if yours is unavailable/broken and they aren’t diving.

3) In an emergency situation, you will know their gear as well as your own. “Buddy checks” will never make you as familiar with their set-up as you are with yours.

4) If many experienced divers, diving as a team for many years on thousands of demanding dives (under different conditions and in different environments) have put their heads together and adapted/chosen their gear based on their experiences and collective thought, what makes you think you know better?

This last point annoys some people as they think it eradicates personal choice. It does to some extent, but choosing a piece of diving equipment is not the same as choosing what clothes to wear. Choosing clothes does not require the technical know-how that diving does. Nor does it have a bearing on your safety (I hope!).

Having the right equipment won’t make you a great diver unless you also have the right skills and experience in the water. Having good skills but the wrong equipment will, at best, mean that you are not reaching your full potential and, at worst, mean you are taking unnecessary risks. Having the wrong equipment and poor skills means that you are an accident waiting to happen.
LONG HOSE VS STANDARD OCTOPUS

Is the “standard” way of using a 2nd stage regulator on a normal length hose plus an “octopus” regulator on a slightly longer hose the best way to arrange things? Have you just taken this for granted and not given it any serious thought? Using this system the diver breathes from his primary regulator (on a normal length hose) and stows the “octopus” about his person somewhere.

There is an alternative system that has many benefits over the standard system described above. This involves having your primary regulator on a 7ft long hose and your back-up regulator on a standard length hose.

The 7ft hose is routed so that it points down from the regulator 1st stage, runs down along the tank, across the chest, around the neck and then into the mouth. For obvious reasons do not try and wrap this hose around your neck multiple times. The photo below will help you visualise.

Note that the long hose is tucked under a waist pocket in the above picture. For wreck and cave diving, a light canister would be situated where the pocket is in the above picture. The long hose would be tucked under this canister.

The backup regulator, on the normal length hose comes over your right shoulder and sits under your chin attached to a length of bungee cord. The situation of the backup regulator has many advantages. Firstly, it is right where you need it, close to your mouth. It only takes a slight movement with your hand and the backup is in your mouth. With practise you can even get the backup regulator into your mouth without using your hands! Secondly, the backup is not dragging in any dirt/mud and will therefore be less likely to have problems. Thirdly, the position of the backup means that it doesn’t present a snagging point. Fourthly, if the backup was to free-flow or gently stream bubbles, you will notice it immediately because the bubbles will be in front of you. The standard position of the “octopus” has none of these benefits.
In addition to these advantages, the biggest advantage of using the 7ft long hose is when it comes to “emergencies”. The system is set up so that in the event that your buddy (someone else) is out of air/gas, you donate the long hose and switch to your backup below your chin. This system is ideal in that it allows nearly five feet of hose to instantly be available and the remaining two to be deployed with a quick flick of the hand. In addition, the diver can easily return the long hose to its original position without needing assistance.

Other techniques whereby the 7ft hose is stuffed against the side of a cylinder (e.g. held by surgical tubing) or behind the diver’s head near the manifold do not allow the hose to be repositioned without assistance and pose entanglement problems or restrict access to the manifold isolation valve. When you tuck a long hose into some surgical tubing you feel that it is forgotten and indeed for some, it is, but what happens when it pulls free or is not set just right? If you rely on your buddy to arrange this hose for you, what guarantee do you have that it is to your liking or even correctly placed? In a sport that preaches self-sufficiency, does it seem logical to configure your equipment in a way that forces dependence on your dive buddy?

By donating the long hose regulator from the mouth in an out of air situation, one guarantees that the person most in need of a clean, fully functioning regulator is going to get it. If you pass any other regulator to an out of air diver it is possible that the regulator received may contain contaminants that will be impossible for the stressed diver to manage. In essence, what you will have done is to place the last straw on the camel’s back, creating the last problem your dive buddy can manage. The advantage of donating your long hose primary is that you are always ready for this very real possibility. You are, in essence, always prepared for the out of air situation.

In an out of air (OOA) scenario, the diver who is out of air may typically be in great panic, unable to breathe for much longer than they can stay calm. As tunnel vision closes in on them, you do not want to leave their fate to chance by handing them a secondary that may not be working, or that is not purged, or that may take you an extra 4 seconds to deploy. This type of delay will have them reaching for the regulator in your mouth anyway. Consider also that the mass of bubbles present in a regulator free-flow situation might make the conventionally placed “octopus” difficult to locate.

The long hose will place a regulator in their mouth immediately, and they have room to become comfortable. By breathing the long hose, the OOA diver does not feel like the hose may rip the regulator out of their mouth at any moment, such as by a sudden body motion that one might expect in an emergency situation.

They will feel comfortably supported by a functional breathing system. They will be far more likely to calm down, and assist in the swim to the surface.
The 7 feet long hose provides you with a good safety margin for reaching the other diver if they are in a small confined space, and once in the open, your control and swimming are not hampered by constantly bumping in to the other diver who is pulled too close by a short hose (e.g. in a current or during decompression).

Although the 7ft hose was originally developed for cave diving, what is the difference between having to swim along a passageway of a wreck and along a tunnel of a cave? Even if diving in open-water, the longer hose makes swimming easier and less stressful. In an out of air/gas situation, the person receiving the long hose swims in front where the other diver can keep a close eye on the diver and monitor their progress. He/she will be in a much better position to respond to any further problems.

If you read any of the incident reports you will note that people have died even after the initial donating of air. This is because the panicked diver either had further problems or the situation simply became too stressful and the divers didn’t rectify the situation in a swift and controlled manner. With proper training and practice, the OOA situation becomes little more than an inconvenience (having to abort dive) when using the 7ft hose.

Despite its growing popularity, many divers remain opposed to donating the regulator from their mouth. The following discussion reviews the most common resistance to donating the long hose from the mouth.

*The last thing I want to do in an out of air situation is give up my primary regulator.*

This concern does not really seem to be a rational fear. It is likely that a diver incapable of removing the regulator from his or her mouth for five to ten seconds is not skilled or practised enough to be in open-water anyway. One may question this divers ability handle an out of air situation in which the out of air diver chooses the regulator in their mouth despite their best intentions. A diver with this degree of concern over the regulator in their mouth may find it quite a challenge to even deal with the very real possibility of an accidentally dislodged regulator.

*I don't want to breathe my long hose, I want to have the best performance regulator in my mouth and the long hose decreases this performance.*

With literally thousands of deep exploration dives accomplished by divers breathing the long hose, the performance argument seems rather a moot point. Yet, if one were to insist that the reduction of performance is true, it seems like a poor solution to leave the stressed, out of air diver gasping for air on this lower performance regulator so you can have a more relaxed dive. Your best performance regulator must be on your long hose and if its performance is unacceptable in a relaxed situation then it is certainly inappropriate to suggest that the your stressed dive buddy is better prepared for this increased resistance. I use a Scubapro G250 2nd stage on my long hose and a Scubapro R380 as my backup regulator.
Both 1st stages are Scubapro Mark 20’s (see regulator section for the reasons for this choice). I have noticed no difference in performance when using the long hose.

*I just don't want to deal with that hose on the second stage in my mouth.*

Any skill worth learning usually takes refinement. The long hose may at times seem unusual to some people at first, but with a little practice it is surprising how you can adapt. Regularly repeating out of air drills should be done whether you are an experienced diver or still undergoing training. By doing such drills you will get proficient at deploying and stowing the long hose. When/if it comes to do it for real, only those tasks that have become automatic responses can be relied upon.
**BACKPLATE & WING VS STAB JACKET**

The vast majority of recreational divers use stability jackets ("stabs"/BCD) and “wing” type buoyancy aids are relatively rare. Ten or so years ago stabs were relatively rare and most UK divers used the ABLJ (Adjustable Buoyancy Life Jacket). The stab gradually replaced the ABLJ as divers realised that the stab was more comfortable and cleared the chest area of the annoying “horse-collar”. The same is now true of the comparison between a wing and a stab.

This issue relates directly to a marketplace driven by yearly overhauls of product lines and the push to sell "tech-like" equipment. Manufacturers have created the "image" of the present BC as a large jacket with big roomy pockets to put "stuff" into, and which surrounds the diver with the "protection" of buoyancy on virtually all sides. The problem with this concept is that by spreading out the buoyancy as they do, jacket style BCs create a very large surface area for drag, and the addition of large gear pockets makes this drag even worse. To manufacturers and dive stores, the more complicated and large they can make the BC, the more they can charge for it. As the buoyancy device becomes more complicated, manufacturers can create a seemingly unending variation of colour schemes and add-ons, and make it look like a spectacular fashion accessory.

A look at the picture below will immediately show that the wing used with the correct type of harness keeps the chest and front of the diver completely clear.

![Left: 55 lb wing with harness, twin-set and backup lights. Right: 27 lb wing with harness, ideal for single tank.](image-url)
Note the stainless steel back plate, the position and number of D-rings, the short corrugated hose and the position of the back-up lights. I will refer to this picture again when we come to discuss the harness in more detail.

This set-up provides many advantages over the stab and other types of wings:

1) Chest and front of diver is clear. This means that the diver is more streamlined and that there is easy access to the dry-suit inflate button, the corrugated hose and the backup regulator. The long hose is routed so that it is close to the chest and is thus not going to get snagged.

2) The buoyancy is behind the diver and does not restrict the diver’s breathing even when fully inflated.

3) Manoeuvrability. Because the buoyancy is right next to the cylinders, the centre of buoyancy is very close to the centre of gravity. This means that you are more manoeuvrable underwater. With a stab jacket, most of the buoyancy is around the lower abdomen area and the majority of the weight at the back where the cylinder(s) are. This means that the centre of buoyancy and gravity are much further apart. This results in less manoeuvrability and a tendency to exaggerate a roll if you roll slightly.

4) Modular. By buying a separate harness and wing, you can use different size wings depending on the type of diving you are doing and what size/number of cylinders you are using. Furthermore, if, as a relatively inexperienced diver, you start by using a single tank configuration (e.g. 27 lb wing with harness), you can very easily switch to a twin-set by simply buying a bigger wing (e.g. 55 lb wing). You will still use the same harness. This is great because it means that you won’t have to fork out for a completely new stab jacket/wing and you will already be familiar with the harness. It makes for a very easy transition.

The myth that all wings don’t float you face-up at the surface is no more correct than was the myth that stabs did when ABLJ’s were the norm. It is important to match the size of the wing to the tanks being used. If you were to use the large 65 lb wing with a small aluminium tank, there would be a slight (and I mean slight) tendency not to float you face-up. However if you used the 27 lb wing you would be fine. The 65 lb wing is better suited to large twin-sets where the extra weight of the tanks means that you float face up.

**Why not to use integrated-type wings**

Many wings on the market (e.g. Zeagle et al) are all one piece (i.e. you cannot separate the harness from the wing). They also have fixed D-rings (or limited to a very small adjustment). This is a very important point because no two people are exactly the same size & shape. By having one-piece webbing with D-rings fitted with sliding retainers, you can adjust the
position of all the D-rings and all the lengths of the straps infinitely. Even the same diver needs to do this if switching from cold UK diving (with dry-suit and undergarments) to warm tropical diving (wetsuit/"shortie"). In this way you can ensure that the tanks are always firmly and snugly held onto you.

Many manufacturers have brought out a “Tech” stab (e.g. Poseidon “Tech Lift”) or “Tech” wing (e.g. DiveRite Transpac, Scubapro X-Pac, Custom Divers or Zeagle) in order to jump on the gravy train of the growing number of people wanting to either get into technical diving or look like they are. These solutions invariably result in an overly complicated and cumbersome design. In an effort to look “technical” and to get around the problem of not having fully adjustable D-ring positions, these designs usually have an inordinate number of D-rings. The result is that the chest area is now cluttered and you are left fumbling around with cold, gloved hands wondering which D-ring you clipped a particular item to.

Be aware that what feels comfortable in a shop whilst wearing a T-shirt is not necessarily good in the water. The back plate and harness won’t feel as comfortable as a "soft back" type wing (e.g. Zeagle) in the shop, but once you have a wetsuit or dry-suit on and you are in the water, there is no comparison.

If you ever wish to get into using side-mounted stage/decompression cylinders you will find that the position of the shoulder D-ring on the Zeagle-type jackets is too low and not up against your collar bone (as it should be).

The harness should be constructed from a continuous piece of webbing, avoiding two-piece designs and quick-release buckles (Zeagle-type jackets have plastic quick release buckles). Interrupting the single-weave design creates unnecessary points of weakness that may cause very dangerous failures. There have also been cases where a rescuing diver has accidentally squeezed the shoulder buckle and caused it to become undone. The failure of a two-piece design or the accidental release of a buckle system could easily result in a diver's tanks falling from his body.

Without the weight of his tanks, the diver would likely rapidly ascend to the surface, resulting in serious injury or death. Individuals are occasionally confused into believing that convenience at the surface is a more important concern than safety during the dive. It is never a reasonable trade-off to accept a potentially fatal risk in favour of a minor convenience. Another unrealistic concern that occasionally leads divers into the use of quick-release buckles involves the belief that a diver should be able to quickly remove his equipment at the surface. Again the diver should not place himself at a higher risk during a dive due to an irrational fear over an unlikely and easily managed surface episode. There is a very simple technique to be learned in order to get out of the harness easily. This is best shown by demonstration.

The use of integrated units with padding and built in pockets is really not appropriate for more advanced diving techniques. A conventional back plate
has less drag, is more secure and more versatile than integrated units such as those distributed by DiveRite, Scubapro, Zeagle and OMS. You won’t “outgrow” the back plate should you wish to get into using larger twin-sets with multiple stage cylinders.

Additional Considerations:

1) One-piece webbing designs are usually less expensive (the actual webbing costs US$20 and lack the failure points inherent in other systems (see photo later).

2) A chest strap is unnecessary and may impede a diver’s ventilation. The way in which the webbing is twisted when putting together the harness means that a chest strap is not needed. Again, a clear uncluttered chest area.

3) Stainless steel waist buckles are much stronger than plastic designs and create a more reliable hold.

4) The stainless steel back plate at 6 lbs. is heavier than a “soft back plate” but a certain amount of weight is needed to compensate for the insulation of either a dry-suit or a wetsuit. This is weight that you can take off your weight belt. A diver can also add weight behind the back plate in the form of a “V-weight”. Taking some of the weight off of your weight belt is actually more comfortable underwater and it will take the strain off of your lower back. A lot of weight around the hips in the horizontal position means that your upper body is being pulled upwards by the buoyancy of the stab and your hips are being pulled down by the weight of the weight belt. This often causes backache after long dives.

5) While plastic back plates are very strong, aluminium or stainless steel is generally preferable. Aluminium can be used if weight allowance on aircraft is critical.

With a twin-set the cylinders are held by stainless steel cam bands, which have protruding bolts. The back plate is bolted to the cylinders using “wing nuts” onto these bolts. This is a much stronger and tidier arrangement than using fabric cam bands which have the potential to slip.

Furthermore, once the stainless steel cam bands are at the right height on the cylinders, you can guarantee that the height of the harness on the cylinders will always be the same on every dive. This is very important, as you must be able to reach the valves behind you (once underwater) in the event of a having to shut down one of the valves.

For single tank diving, one uses an adapter that bolts onto the back plate. This adapter has 2 cam bands made out of webbing rather like most stab jackets but 2 instead of the 1 found on some stab jackets.
Left: Single tank adapter. Right: Stainless Steel back plate.

Below: Single Tank set-up (boot to stand upright for picture only).

Be aware that some manufacturers use a steeper or shallower angle on the centre section of the back plate, requiring shorter or longer bolts, which may create compatibility problems between various back plates and sets of doubles.

**WHY NOT TO BUY WINGS WITH ELASTICATED CORDS.**

Many brands of wing often have "bungee wings". These are elasticsed cords that are used to constrict the wing when it is not inflated. These are a very bad idea for the following reasons:

1) In the event the wing was holed, they would force the air out of the wing resulting in loss of buoyancy (prior to the hole: the pressure inside wing = ambient pressure)

2) If you had to orally inflate the wing, the exertion would be much harder because you are fighting against the elasticity.
3) All wings come with overpressure release valve (as stabs do). The elastic cords may cause this valve to open BEFORE the wings are fully inflated. You cannot therefore achieve full inflation and buoyancy.

4) The rippled surface of the bungeed wing actually creates more drag, as it hasn’t got a smooth surface like the wings shown below have.

5) The elastic cords present snag points & things can hook onto them.

I would recommend the 27lb wing to anybody using a single tank (including trainees). If you were using a twin-set I would go for the 55 lb wing. If you were intending to use large twin-sets (>twin 15L) with multiple stages I would go for the 65lb wing. All of these use the same harness.

Left: 27lb wing. Suitable for single tank diving.
Right: 55lb Explorer wing. Suitable for twin-set diving.

Wings come in different sizes; you need to decide which will suit you best. The 27lb wing for singles and the 55lb for twin-sets would suit most people. The total cost therefore for a harness, back plate and 55 lb wing (twin-set set up) is similar to the price of a new Buddy Commando. So is the single tank set up.

DRY-SUITS

In simple terms, there are 2 types of dry-suit: the membrane dry-suit and the neoprene dry-suit. There are a few variants such as the DUI crushed neoprene, which behaves like a membrane suit, but for simplicity I shall only refer these 2 types.

The disadvantage of a neoprene dry-suit is that the spongy neoprene behaves in the same way as it does with wetsuits: buoyancy and warmth are lost at depth as the neoprene is compressed. Although more undergarments can be worn to counter this, this means that you are bulkier and more buoyant at the surface. This in turn means that you have to use more lead weight in order to get down. However, as stated above, much of this
buoyancy is lost at depth so one has to put more air into your wing/stab and/or drysuit. This increases drag and makes buoyancy control more difficult.

Wearing an excessive amount of underclothing will also restrict shoulder movement: an important consideration if you have to turn the pillar valves off behind you.

Because the trilaminate material of membrane suits is non-compressible, loss of buoyancy and insulation is not an issue. That said, a baggy membrane dry-suit will also create too much drag and will “balloon up” in places where there is excess material.

In my opinion the best solution is to use a well-fitted membrane type suit with an automatic shoulder dump valve. The cuff dumps appear to take longer to dump air from and mean that you have to keep raising your arm (annoying if using reel). They also appear to leak more frequently.

Most suits in the UK come with Apeks inflate and dump valves. Although Apeks do make a lower profile dump valve, SI-Tech make a better one that has a lower profile (won’t catch when taking set off) and flows more freely. Like the Apeks it can be adjusted by turning the valve. If you are concerned about having to dump air faster, then perhaps you should consider the SI-Tech. Prices are comparable.

Putting/having pockets on the thighs of a drysuit are also a good idea. Objects such as dive-slate, decompression tables, wet-book, strobe, line cutter etc. can all be stowed here. They are very accessible (take a look where your hand rests when you stand up) and are out of the way of the important chest area. Stab jacket pockets are generally harder to access and when full restrict the inflation of the bladder of the stab jacket, which then restricts breathing. Avoid zipped pockets as they are harder to operate with gloves than a straightforward Velcro flap.

Advice on DIN fittings and A-Clamps.

Before I outline 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, 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 1990’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, 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 (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 I doubt that you will believe this.

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?

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 are 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: 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.
REGULATORS

After your brain and body, your regulator is the most important part of your equipment. It should be regarded as a piece of life-support equipment and as such you should choose and maintain one with care. 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. Club equipment is often at the lower end of the market in terms of performance and durability due to cost constraints within the club. Other club members and instructors 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.

What to look for in a regulator

Your choice in regulator is one of the most important decisions you will make in buying diving equipment. You should first of all look for something that is tried and tested. New products may look good and the advertising may highlight many unique features, but this gives no indication of how it holds up to time and use. Next, you need to 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.

The final considerations are the ease with which it can be stripped down (even underwater) and the design of the first stage for efficient hose routing. A regulator may fail underwater for many reasons, but a majority of cases are the result of debris or other foreign objects getting into the second stage, partially opening the diaphragm or blocking it. In these circumstances, the second stage can be opened up, the offending object removed, re-assembled and returned to normal use. If the second stage does not allow you to do this, you should look at other options.

First Stages

First stages broadly break down into 2 groupings - piston and diaphragm. The piston design is slightly superior and far simpler in terms of operation with fewer moving parts. This allows easier work of breathing (WOB) and
will also take more abuse than a diaphragm. However, this is not to
denigrate the diaphragm, as there are some wonderful diaphragm first
stages on the market. The best piston design available is the Mk 20 by
Scubapro. The best diaphragms are the TX50 and US4 by Apeks.

The placement of ports on the first stage is also an important consideration. Poorly routed hoses will result in loops that will catch on wrecks / rocks etc.
and sometimes result in compromises elsewhere in your kit. Ideally, all
hoses should point down thus minimising the risk of loops that will cause entanglements. You also need a minimum of 4 low pressure and 1 high
pressure port. If we look at the Mk20, it 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 hose routing. The TX50 first stage has 4 LP
ports, but one of them is a non-standard size, so an adaptor is
recommended if you need all 4 ports.

For diving in colder waters - such as we experience over the winter, it is
important that the first stage is not overly prone to problems such as free-
flowing. A free-flow can be initiated at either the first or second stage of a
regulator, so some thermal protection is preferred. It is less easy to
insulate piston first stages, but the Scubapro Mk 20 is insulated with their
TIS (Thermal Insulation System). Diaphragm regulators are easier to insulate
and this is done by putting alcohol (or similar) into the open area facing the
diaphragm and sealing that.

Various manufacturers have introduced ultra-light first stages that should be
avoided at all costs. These are made from Aluminium and are prone to
breaking and corroding over time.

**Second Stages**

Second stages are driven by a diaphragm that opens a valve when you
inhale. Most regulators can be classed into 2 groups - side breathing such as
the Poseidon Jetstream and Oceanic Omega and front breathing such as the
Scubapro G250 and Apeks TX50. There are also 2 other groupings - upstream
and downstream regulators. The difference is primarily their behaviour in
the event of failure - an upstream fails closed (no gas) and a downstream
fails open. In the UK, Poseidon are the only upstream regulators. You need
to consider how important you regard the method of failure.

Most regulators have the hose feed in from the right but some newer models
can feed from either side. This is a simple procedure that most shops can
do for you. As I said above, you should be able to strip down a regulator
easily (and even underwater). Many regulators on the market do not allow
this and should therefore be avoided.

When choosing a backup regulator, you should opt for an unbalanced design. This design is far less prone to free-flow - a very important consideration for
cold water and diving in currents (they're also cheaper ;-)
General

Some regulators show reduced performance with time after servicing. It is important to choose a regulator that maintains good performance over time without the constant need for re-tuning - such as Poseidons (quickly lose their performance after servicing). The more complicated the design the more to go wrong and the higher the price of the “service kits”.

The picture below shows how to correctly route your regulator.

For a more detailed explanation and discussion about the different types of regulator, their characteristics and the way they work, there is a good book that explains this clearly (see reference section).

HIGH PRESSURE HOSE, CONTENTS GAUGE & CONSOLE

The standard High Pressure (HP) hose that you would get if you walked into most dive shops is 36 inches long. With a console attached to the end this increases to 42 inches. Even when using a single cylinder this is far too long as the console (even when the HP hose is run through a plastic hose guide, Velcro retainer or pocket) hangs below the diver when in the horizontal position. With a twin-set the problem is worse as the 1st stage of the regulator is now to one side.
Having the console dangling in the water increases drag, increases the chance that it will get wedged on a piece of wreckage and will mean that it will get battered around a lot (not something you want to be doing with a HP gauge!). For wreck penetration dives and cave dives this is an absolute “No, No”; and for open water dives it still does not make sense increasing your chances of a problem.

A better solution is to have a shorter 22-inch HP hose with a simple HP contents gauge on the end. The picture below will aid explanation:

![Image](image.png)

Note that the HP hose comes down the left side and that the HP is clipped onto the left D-ring of the waist strap using a stainless steel piston clip. You will also notice that there is no large and cumbersome console. The compass is kept in a dry-suit pocket (one of these pockets is situated on each thigh). Dry-suit pockets are a great place to stow things out of the way and they are easier to get in and out of than pockets that are part of the stab jacket. If using a wetsuit, you would use a pocket on the waist strap as shown on page 4. You rarely need to use the compass for the entire dive. When it comes to use the compass you get it out and hold it in the palm of the hand or strap it to your wrist using bungee cord. Navigation is actually easier and more accurate this way too because you are free to hold the compass where you like (up to eye and straight in front of you).

Traditional consoles often have a depth gauge as well as the pressure gauge. For most recreational dives, given the reliability of dive computers and digital depth timers, there is no need for a console mounted depth gauge. When diving as part of an experienced team, there is an argument for only using just the one.
In the above picture the piston clip is attached to the HP hose using cave line. I use an old medium sized O-ring. Both could be easily removed if needed by either cutting the line or in my case, pulling the contents gauge hard so that the O-ring that attaches to the piston clip breaks. Stainless steel piston clip shown below.

Stainless steel clips are harder to find in shops than brass ones but the sliding mechanism on steel ones is much smoother and they don’t cut your fingers (soft from in-water exposure) like brass ones do. When you want to read your contents gauge you always know exactly where it will be and you simply unclip it, look at it and then replace it. In this position the gauge is in the slipstream, it is not going to get hooked up on anything, nor is it going to bang around.

Additional considerations:

1) A rubber console covers the connection point where the HP hose attaches to the contents gauge. To make the console swivel you need a small swivel pin with 2 tiny O-rings at each end. These O-rings can gradually wear if grit and sand gets into the connection and is left there for some time. Each turn of the swivel can gradually wear them thin. I don’t know how, but even with a rubber console covering this area, grit still gets in there. When you come to clean your regulator the rubber console prevents you washing this grit away, despite a “good soak”. How often do you check under the console? Not very often. Without a console the connection area gets a thorough clean and the grit is washed away. I used to use a console and over a 7 year period had several leaks from this swivel connector. I have seen many others. Since getting rid of the console (about 2 years ago), I haven’t had a problem and, on inspection, the 2 tiny O-rings are in much better condition.

2) If you were to experience a leak from this swivel connection, you would notice it sooner without a rubber console. The rubber console obscures the joint. You would therefore be at an earlier stage of the dive with more gas and your tissue saturation levels would be lower (emergency ascent less risky). With a twin-set you would simply shut down the left pillar regulator that fed the HP hose.

3) Most of the times I have seen the swivel joint “blow” it has been whilst initially pressurising the regulator (pressure and pressure change greatest) on the boat/shore. Without a console it is much quicker to repair the swivel joint (by replacing swivel pin or carrying 2 of the tiny O-rings) as you don’t have to remove the rubber console.
Isn’t the contents gauge vulnerable without the protective rubber?

No because of where you clip it. A contents gauge protected by a rubber console bashing into things is far more vulnerable.

The case against the AP Valves AutoAir, Air II (or similar).

1) Everyone should be diving with 2 second stages anyway (be it a primary regulator plus octopus on a single tank or a twin-set with 2 first stages and 2 second stages), you must then ask the question, what does the AutoAir add? It provides no more redundancy.

The negligible benefits (3rd unreliable regulator on a stupidly short hose) as outlined in 1) are more than outweighed by the costs, namely:

2) Introduction of more failure points

3) Their tendency to free-flow when not regularly serviced or gritty (you tend to take your regulators off you set when transporting/filling etc, you don’t take the AutoAir off the jacket so it is more abused/exposed to grit etc).

4) Overly large & cumbersome object in the all important chest area = clutter

5) The connection from the Low Pressure Hose to the AutoAir is not compatible with any other Low Pressure connectors.

You cannot therefore swap over very easily if you use different length hoses for different types of diving (e.g. single tank to twin-set). And more importantly, the low pressure direct feed hoses to your wing/stab and dry-suit should be interchangeable. If either fails you can swap it underwater. This happened to me on one dive where I had to shut down the 1st stage that fed my dry-suit as part of a training exercise. I was getting bad suit-squeeze, as I couldn’t put air into my dry-suit. I simply disconnected the direct feed to my wing and plugged it into my dry-suit to squirt some air in and get rid of the squeeze. I then put it back onto my wing. Clearly this would not be possible if I had had an AutoAir, as the connectors are incompatible.

The solution is simple; ALL low-pressure connectors should be the same, period.

And finally and perhaps most importantly,

6) The positions of the purge, inflate & deflate buttons are non-standard. I have personally seen trainees (on more than 1 occasion) try and dump from the stab jacket whilst doing a CBL and not succeed = uncontrolled ascent. What they were actually doing was pressing the purge button of the Auto Air regulator (where the deflate button normally is situated) thinking that they
were letting air out of the stab. In fact they were just purging the AutoAir reg. Air comes out nonetheless but from the cylinder and not from the stab!

I am not aware of any other inflate/deflate in the world that has the same position of buttons. Pointing out the irregular position of the buttons to your buddy during the buddy check is one thing. Your buddy reacting correctly and QUICKLY in the stressful situation of an emergency is another.

**CYLINDER NETS/MESH**

These are those plastic mesh things you slide over your precious cylinder in the hope that they will be safe from the ravages of the sea.

Most dive shops are all too keen to sell you these, often with the advice that “they will protect your brand new cylinder from being scratched and chipped” thus extending the life of the cylinder, better still “they grip the tank better”.

Let us look at the facts shall we:

1) When did you last see a cylinder rust from the outside anyway? The odd chip may expose some of the steel underneath, but as long as the chip or scratch is free to dry, rust doesn’t set in. The steel is about an inch thick anyway.

If rust was to start, it would take so long that the cylinder would fail for other reasons long before (e.g. internal corrosion).

The only time external corrosion may occur is when salt water is left trapped under the cylinder boot for a long period of time (one of the reasons for not using cylinder boots - see later) and not allowed to dry. The mesh wouldn’t prevent corrosion under the boot anyway. Ask any of the cylinder testing (IDEST) centres when they last failed a cylinder for external corrosion. Cylinders fail either due to internal corrosion or wear, tear, corrosion and physical stress of the threads of the neck of the tank (pillar valve). Tank nets help none of these. None of my cylinders are showing any signs of corrosion even after being used without boots or nets for the last 3 years.

2) They don’t actually protect the cylinder anyway. If you look closely at some of these nets after they have been used a while, you will notice that the mesh is holed or torn and that contact with rocks and wreckage just cuts through the mesh and touches the cylinder anyway.

3) The plastic of the mesh DOES NOT hold onto the cylinder as well as the rubber of the cam band of the jacket/harness. If you don’t believe this, try taking a piece of soft rubber and whilst pushing down hard, try and slide it across a smooth surface (wet or dry). Now try it again with the cylinder mesh rather than the rubber. If your cam bands haven’t got rubber on them use the rubber bit that A.P.Valves use for their jackets. I have lost count
the number of times I’ve seen tanks slip on cylinders with meshes on. A poorly tightened cam band may slip on a tank without a mesh, but not as easily as with a mesh.

4) The mesh increases drag and may pose a snagging problem on a wreck. Although the increased drag is small, if lots of bits of equipment all add more unnecessary drag, the combined effect is significant.

Cylinder nets/meshes therefore add no value and cause the problems outlined above. You have to ask therefore, “Why bother”? You are better off without them and can save yourself the £5 or whatever they cost. If you don’t need it in the water, don’t take it!

**CYLINDER BOOTS**

In simple terms, boots should not be fitted to cylinders because they are not required. As mentioned above, boots can cause and hide corrosion and are only usually removed at test. When did you last check under your cylinder boot(s)?

1) Not having boots will mean that some of the paint on the bottom of the cylinder will wear off, but as stated earlier this does not cause problems in any way, shape or form. Having no boots means that the bottom of the cylinder gets to dry properly.

2) Cylinder boots may allow the tank to be stood upright. But, in our first scuba lesson, we are told never to leave a tank upright (for it may topple over and damage gear or injure people). So go and figure this out.

3) A double cylinder boot is sometimes used to hold the lower end of a twin-set together. The problem with this is that you still have all the problems of boots (corrosion, drag etc) and the double boot doesn’t hold the cylinders together as well as stainless steel cam bands. If the double boot was to slide off by accident, the cylinders would only be held together by the manifold.

Most people who use double boots also use manifolds that rely on “facing” O-rings to form the seal (see later notes on manifolds). Any twisting or outwards movement of the cylinders would result in serious loss of air/gas. Using a pair of stainless steel cam bands is more expensive than using a double boot (maybe an extra £40), but if you are going to cut costs, don’t do it with anything involving your air/gas supply (i.e. tanks, manifold & regulators).

4) Cylinder boots also increase drag in the water. Although the increased drag is small, if lots of bits of equipment all add more unnecessary drag, the combined effect is significant. This was also the case with the cylinder meshes. You can now start to appreciate that if the streamlining of every single piece of kit is considered, the overall effect is to reduce drag and snag points significantly. This not only makes diving safer, it also means we
enjoy it more as we can swim with less effort, use less gas and get tangled up less often.

**FINS**

Although dive manufacturers release more new fin designs every year than just about any other piece of equipment, no fin is better suited for wreck, cave or technical diving than the Scubapro Jet Fin.

Based on a design that is at least 30 years old, the Jet Fin is a perfect example of a low-tech solution to better gear design. Jet Fins are manufactured out of negatively buoyant black rubber. You can therefore get rid of (or save money by not buying) ankle weights.

They are stiffer than most other fins and therefore better for modified flutter and frog kicks. These fining techniques are used to avoid kicking up silt. The standard flutter kick creates large amounts of downdraught, which quickly reduces visibility.

The extra stiffness is also better suited to UK diving due to the currents we experience and the amount of gear our cold water necessitates.

The strap connections are moulded into the fin. Unlike the “quick release” plastic connectors most commonly used, there is no leading edge groove to potentially catch line (fishing line or off of a reel).

The Jetfin is now available in the UK for about £65 (comparable with the other fins in terms of price e.g. Mares).

The rubber straps are much quicker to get on & off with gloves or cold hands.

The straps should be arranged in such a way so that the ends are on the INSIDE of the rest of the strap. This presents a perfectly smooth surface on the outside of the strap and clip area so entanglement is virtually impossible. The most common place to get snagged (rarely life threatening, but annoying nonetheless) is around the ankles and around a
dive knife that is strapped to the lower leg in the traditional (but stupid) James Bond way.

COMPUTERS/DEPTH TIMER/TABLES

If you asked most people why they use a particular computer the answer will often be along the lines of “I use the xyz computer, I like it and I haven’t had any problems with it”. Fair enough you might say, but the decision of which computer to use/buy isn’t quite the same as other kit.

The computer is a piece of equipment that many people rely on to tell them how long they can spend at a given depth; and how long and at what depth to do their decompression stops. Therefore, HOW the computer calculates this has a DIRECT bearing on the profile of their dive and therefore the probability of them getting Decompression Illness. It is therefore somewhat alarming that the vast majority of divers don’t understand how their computers calculate their No Stop Time, their stop depths and their stop times and the off gassing during surface intervals.

The vast majority of people don’t know what assumptions have been made in the model and the model’s limitations. And yet these same divers are advising others on what computer to use. I find that both strange and worrying.

With few exceptions, modern dive computers are reliable bits of kit and most now have reasonably well laid out displays. Most of them also perform the same functions, be it just for air, or for Nitrox and/or Trimix as well. The primary consideration then when deciding which to use should be “it uses the xyz a model, I understand that model and I am happy with how it calculates my decompression and with the assumptions made in the model”. Alas, this is rarely the case.

Since the functionality of most modern dive computers is by and large the same, the issue with regard to dive computers is therefore which decompression model they use and whether they factor in deep stops. This is a huge topic in itself and is probably best discussed and taught by way of a lecture/discussion session.

That said, I will mention at this point that the only dive computer (at the moment) that I am aware of, that utilises the latest theories on bubble mechanics (Varying Permeability Model) is the Suunto Vyper. The Aladin and most other computers use a Buhlmann algorithm (either ZHL16c or ZHL8) BUT allow tissue saturation’s to reach close to the M-Values.

Computers that allow for gas switches are a bad idea since they may allow for a change in the dive plan or bottom time “on the fly”, but have you planned for this in your gas requirements? An extra couple of minutes of bottom time on deep dives may cost you 10 to 15 minutes more decompression. Such computers also invariably lead to less planning of the
dive and all the attendant risks that involves. For technical dives you are better off using a simple UWATEC depth timer. These simply show max depth, current depth and dive time. They cost £70 and the battery lasts about 5 years. It has no seals to the battery compartment and thus has to be disposed of when the battery runs out. No failure points therefore.

**DIVE LIGHTS**

The light below is designed as a back-up light and is made from a single, milled piece of a very tough plastic called Delrin. Note that there is no switch as this is a common failure point. The light is switched on by turning the bezel.

The light is neatly clipped to the shoulder D-ring and lies in line with the webbing. For open water dives not involving wreck penetration I wouldn’t bother getting two of these, just the one will do. For cave diving and wreck penetration I would use two of them as the consequences of a light failure are much more serious. This back-up light costs US$79 (£50). Although this is not cheap for a small light you are paying for quality of materials. The assembly inside and bulb are standard UK (Underwater Kinetics) parts that cost US$10 (£7).

If your main light failed and you had to go to your back up, turn on the back-up light BEFORE you unclip it. This is in case you drop it. If you drop a light that is switched on you can see it easily. If you drop a light that is switched off you can’t see it easily and inside a wreck or cave you don’t want to be digging around looking for your back-up when your main light has failed. Common sense, but you will be amazed how this isn’t many people’s instinctive reaction.
The back-up light can suffice as your main light but if you want a brighter light you are better to go for a canister-type light with umbilical cord and light head. There are hundreds of lights on the market but most of them involve holding the light with the palm of your hand. This effectively means that you either lose the use of one hand or you have to let go of the light in order to do something with that hand. Most people therefore attach their light to either a lanyard or a stretchy cord attached to their stab jacket.

The light head shown below uses a “Goodman handle”. You can immediately see that even whilst holding the light you have full use of your hand.

![Goodman handle](image)

Depending upon your level of diving you might not be that worried about this, but if you either intend to, or are currently involved in, more technical dives you will greatly appreciate this advantage as the number of tasks during the dive increases (reel work, gas switches etc). Even if you don’t intend to get into this sort of diving, there is something to be said for being able to inflate your wing/stab AND dry-suit with one hand and STILL have the other hand free to do other things (assist buddy, tie in shot, pull yourself down shot line etc).

The advantage of using a canister for the battery is that you can get better burn times for any given wattage of bulb (you can therefore use brighter bulbs for any given burn time) and you do not have to hold a large light (with battery) in your hand. The canister is attached to the waist strap on the right hip. Here it is out of the way and because it is in the slipstream of the right arm and shoulder, it doesn’t increase drag or present any entanglement points. The in-water weight of the canister can be taken off your weight belt.

Mounting a canister on your cylinder has several disadvantages:

1) You can’t remove it by yourself if you had to.

2) It creates a very bad entanglement point in a place that you cannot reach (bear in mind 1) above).
3) It is situated in a place where is directly increases your profile thus increasing drag significantly.

4) If you mount it on the side of the cylinders it will affect your trim as the weight is further from the central axis of the body (tendency to roll). If you mount it between the cylinders you have increased the headroom you need.

**CYLINDERS/TANKS**

If you are going to buy or use cylinders that are going to be mounted on your back they should be made of steel. Aluminium tanks, because of their lower density displace more water and are therefore more buoyant. If you were to use aluminium tanks on your back and use either a dry-suit or thick wetsuit, you would need a very large amount of weight to keep you neutrally buoyant at the end of the dive when cylinder pressures are low. Most tanks (Faber, Roth etc) sold in the UK are steel so that’s fine.

On holiday in a tropical location (Caribbean, Red Sea, Far East etc) you will probably find that you are using an “aluminium 80”. This is an 80 cu ft (1 cu ft = 28.3 litres of gas) cylinder made of aluminium, probably by a company called Luxfer. This normally doesn’t present problems because you are probably only wearing a thin wetsuit, shortie or no wetsuit. You can therefore get away with the buoyant tank by using a little lead. I find that by the end of the dive the bottom of the tank starts to lift off of my back. I find this uncomfortable so I thread 2 two lb weights onto the lower cam band of the single tank adapter. This seems to solve the problem.

Conversely, any tank that you intend to sidemount as a decompression bottle or stage cylinder should be made of aluminium. This is because anything negatively buoyant (i.e. steel cylinder) mounted on the side will tend to make you roll over to that side. Furthermore, if you intend to “drop” (collect & use on way out) a bottle when cave diving, you do not want to become positively buoyant after you have dropped the tank because you were relying on the negative buoyancy of the steel tank at the start of the dive. For wreck diving you always want to carry your decompression gas with you.

For single tank diving in the UK, a 15L or 12L tank is probably all right if you don’t stray below about 25 to 30m too often and you are not incurring significant decompression stops. That said, a twin-set is obviously safer. Unless you are short, I would advise against a “dumpy” tank because they have a bigger profile, move the centre of buoyancy back too far and don’t enable you to take the weight off your back very easily when sitting and kitting up. If you are short and find that a correctly positioned normal length tank means that you keep clunking your head on the pillar valve/regulator, then you may have no option but using a “dumpy”.


“PONIES”: HOW TO MOUNT THEM PROPERLY & WHERE.

Many people in the UK start off with a 15L or 12L cylinder and then, as they venture deeper/longer, they realise the need for either more gas or a back-up gas supply. Most therefore opt for a “pony”. A “pony” is a small (usually 3L) cylinder that one fits a second regulator and contents gauge to. I have nothing against “ponies” per se but I do have some comments on how they are set-up and where they are put.

Firstly, my comments above regarding steel verses aluminium cylinders apply. Most “ponies” that are sold are made of steel. Aluminium “ponies” are slightly heavier (3.7KG verses 3.3KG) than steel ones because the wall thickness has to be thicker for aluminium tanks because of the lower tensile strength of aluminium. But the aluminium cylinder is less dense and therefore less negatively buoyant. Steel “pony” is about 2-3KG negative once fitted with regulator.

This will roll you if you mount it on your cylinder (as is the norm - but see later comments). An aluminium “pony” is only slightly negatively buoyant when full and neutrally buoyant once you have breathed it down a bit. It therefore doesn’t have a tendency to roll you. The same principles apply with larger cylinders (e.g. 7L) except that the problem of steel is exaggerated and the benefits of aluminium even greater (refer to website http://www.subaqua.co.uk/cgi-bin/cylinder-buoyancy.cgi).

Secondly, most UK divers mount their “pony” by strapping it to the side of their tank. This has many pitfalls:

1) Because the “pony” is strapped to their tank it is out of reach. You must therefore dive with the valve open and the regulator pressurised. This means that if the regulator free-flows you can’t turn it off yourself. Your buddy may be able to help but by then a significant amount of your valuable reserve/deco gas has gone. It also means that you are RELYING on your buddy.

2) Because the “pony” cylinder has to be turned on throughout the dive, it means that your buddy (anybody else) could breathe it by mistake if they had an emergency. This is a serious problem if your “pony” deco bottle has an enriched Nitrox mix and you happen to be deeper than the safe Maximum Operating Depth (MOD) of that gas. A buddy check before the dive may be one thing but in a panic situation things may get desperate and it may not even be your buddy (won’t have been briefed therefore).

3) Whilst strapped to the outside of you main tank it poses a significant entanglement threat and the worst place to get entangled is behind you where you can’t reach.

4) It creates more drag and increases your profile.

5) They usually “slop” around.
The way to get around these serious drawbacks is to mount the “pony” on your left hand side by attaching it to a D-ring at the collarbone and another at your hip. Because the pillar valve of the “pony” is about where your left nipple is, you can turn it on and off easily. You dive with the regulator pressurised but the pillar valve OFF. This means that points 1) and 2) above no longer apply. Because the tank is off you cannot get more than a single breath of the gas. This is not enough to cause an O2 hit. When it comes to use the “pony” you simply turn the “pony “pillar valve on.

In this position, the “pony” sits under your left armpit and thus introduces very little drag. It is also unlikely to get entangled but if it did, you would easily be able to deal with it, as it is visible and accessible in front of you. The best way to for someone unfamiliar with this arrangement to understand is by demonstration.

Below is a picture of a deco bottle correctly set up. Note the use of stainless steel piston clips (not snap hooks) and the use of only 1 jubilee clip which is under a piece of bicycle inner tube at the bottom. This cylinder is 10L but the same set-up is used for a 3L Pony. The rope, piston clips and jubilee clip together costs about £15. You can get the length of garden hose (shown in red) and the bicycle inner tube for free.

At the beginning of this section I described how many people move on from using just a single tank to using a single tank and a “pony”. Consider that a 15L steel cylinder plus a “pony” weighs (16.6KG +3.3KG = 19.9KG) MORE than Faber 232 Bar twin 7L’s (8KG + 8KG plus say 1KG for manifold). The advantage of a twin-set over a pony set-up is that the set is more balanced and the weight closer in to your back. You also have access to more air/gas if you have to shut down one side than if you switched to a 3L pony.
Unfortunately a lot of recreational divers regard a twin-set as “Tekkie” and suited only to macho-types and those people doing deep dives. Yes, there are lots of macho-types who use twin-sets and all sorts of other ridiculous gear (a trip to Stoney Cove on a winter weekend will confirm that), but just because you use a twin-set doesn’t necessarily mean that you are in this camp. It may simply mean that you have given the subject some thought (see section on manifolds).

For all of my UK diving I use a twin-set because of the added safety and the comfort factor. If I intend to use enriched Nitrox mixes or pure O2 for deco I will carry that side-mounted as described above.

Some divers use D-rings mounted on the bottom of the cylinders for hanging torches and reels etc. These are, in reality, mounted in a terrible place. The D-rings are an entrapment point for any line or monofilament that the diver brushes against.

Any torches hanging from these D-rings are free to swing about and bang / clang around - this stresses and shakes the bulb filaments. These torches are your backup and emergency lights, you don’t want to go to find one and then find out that it broke on the walk down from the car park or when jumping into the water.

**CYLINDER MASSES**

Different batches of the same size and brand of tank weigh slightly different amounts. The weights below are typical and are when empty on land for 232 Bar tanks:

- Faber 3L steel: 3.3KG
- Faber 7L steel: 7.5KG to 8.1KG
- Faber 15L steel: 16.6KG
- Faber 12.2L steel: 13.3KG
- Luxfer 3L aluminium: 3.7KG
- Luxfer 7L aluminium: 8.8KG

**MANIFOLDS: WHY USE THEM & WHICH ONE TO USE**

The following discussion is only relevant to diving with a twin-set.

Having two first stages means that you have a back up should one of the 1st stages fail. To repeat an earlier point I made: I have flown across the Atlantic on several occasions without incident. Common sense tells me that it is safer to fly on a plane with two jet engines than one. If one regulator fails you can simply “shut down” that side by turning off the pillar valve of the relevant side and switch to breathing off the other regulator. By having
your dry-suit inflator coming off one side and your wing inflator off the other you also achieve redundancy (i.e. back-up) of buoyancy control.

Having a single regulator 1st stage off of a twin-set does not achieve this redundancy and in fact introduces more failure points due to the O-rings (at least 4) in the manifold. It is akin to taking the worst aspects of a single tank set-up (no back-up air supply or buoyancy) and combining it with the worst aspects of a manifold (the introduction of at least 4 more O-rings).

Diving with completely independent cylinders does mean that you have protected part of your gas supply but it also means that you need 2 High Pressure (HP) hoses and 2 contents gauges. This causes more clutter and more failure points (HP ones at that). It also means that you cannot access the gas from the tank that you have shut down. One final disadvantage of using independent doubles is that you have to keep swapping regulators in order to ensure that you are breathing down a 1/3rd of each. If you don’t do this you could be left with insufficient gas if the regulator on the side with the most gas failed.

The advantage of a manifold is that you only need one HP hose and one contents gauge as the cylinders are connected. The pillar valves operate at the level of the regulator and not the manifold. You can also breathe the gas from both cylinders even if you have to shut one of the regulator 1st stages down.

Above: Isolation manifold (note rubber knobs and DIN fittings).

A manifold may be a simple bar connecting the 2 pillar valves or it may include an isolation valve in the middle like the picture above. The value of the isolation valve is that it protects against a cylinder neck O-ring failure. Should this happen with a simple bar-type manifold you would lose the gas from both sides. With the isolation manifold you protect ½ the gas supply.
When diving with an isolation manifold you should always dive with the valve in the fully OPEN position. The reason being that if/when it comes to turn it off, you are leaving nothing to chance by deciding which way to turn it (and thereby losing valuable time). It will only turn one way, and that is closed.

It is also a bad idea to dive with the isolation valve fully CLOSED for 3 reasons:

1) At the filling station a dive shop monkey may have not checked to see whether the isolation valve was open or not. When he does his partial pressure fill (for nitrox or trimix) he may put the O2 in one side and then when it comes to top it off with air or add helium, he may fill the other side. This can have two consequences, either you start your dive breathing almost pure O2 and get an O2 hit near the surface (probably at about 15-20m), or worse still, if you ever had to switch to your back-up you would be breathing a very rich O2 mix at depth and suffer an O2 hit at depth.

This sounds far-fetched but it has happened and may be less obvious than you think. Firstly, if the cylinders weren’t empty when you took them to get filled, there may be enough O2 in the top-off side still to maintain consciousness. Secondly, your pressure gauge may still be showing adequate pressure.

2) When shut you will be breathing down one side only. You will therefore either be shocked at how fast you are breathing, or worse still, think that you have loads of gas left when in fact you have much less. With experience you will get to know whether the gauge has been static for too long or going down too fast. The best solution therefore is to dive with it fully open.

3) Having it fully CLOSED effectively means that you are diving independents and you therefore suffer most of the disadvantages outlined above.

There are a few different brands of manifold on the market (MDE, OMS, Scubapro, the IANTD/”Italian” manifold etc). The MDE and OMS manifolds have what we call “facing” O-rings. The Scubapro (232 Bar), Sea Elite (300 Bar) and the IANTD/”Italian”(232 Bar) manifold have “Barrel” O-rings (below left = barrel; below right = facing, apologies for granularity)
The major drawback of the “facing” O-ring is that if the isolator is knocked or the manifold twists in any way, the seal is broken as the O-rings face each other. I have seen this on 2 separate occasions, both using the MDE manifold. Luckily one was on the boat (he lost £50 worth of trimix), the other relatively shallow. Had this happened by striking wreckage at depth the consequences would have been serious.

The advantage of barrel O-rings is that the O-ring is on the outside of a barrel (rather like putting an O-ring halfway along a pipe, and then sliding a larger pipe over the smaller pipe). The great advantage of this is that if the manifold is knocked, or the cylinders move relative to each other, gas does not escape. This is a good example of how a little more thought in the development process has led to a far safer design.

To reiterate an earlier point I made when discussing double cylinder boots: you can now see that a less secure method of twinning up your cylinders (double boot rather than 2 pairs of steel cam bands) IN CONJUNCTION with a manifold that uses facing O-rings is far more hazardous. You have compounded the problem. My guess is that 9 out of 10 dive shop assistants don’t know about these sorts of minor, but no less important, details: details that have a bearing on your safety.

Finally, rubber knobs fitted to your pillar valves are easier to turn and are better at withstanding any knocks. If one of your hard plastic knobs cracked you would no longer be able to shut down that valve. Sherwood makes rubber knobs for £3.95 each.

Above: twin-set with stainless steel cam bands and isolation manifold.
FINALLY...
Two final tips:

1) Always know EXACTLY what you want BEFORE you go into a dive shop to buy something (this means doing the necessary research BEFOREHAND).

2) Educate yourself enough to at least know when somebody knows what he or she is talking about.

REFERENCES AND FURTHER READING

EQUIPMENT

http://www.gue.com/equipment/index.shtml
http://www.extreme-exposure.com/
http://www.halcyon.net/
http://www.gasdiving.co.uk/pages/misc/kit.htm
http://www.conknet.com/~g_packard/AIRSPEED.HTML
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DECOMPRESSION THEORY

http://home.adelphia.net/~robworld/Bubble_Decompression_Strategies.htm

Understanding M-Values by Erik C Baker

Clearing Up The Confusion About “Deep Stops” by Erik C Baker