Diving a Backplate and Wing with Double Tanks
By Mike Ault, Copyright 2006

If you have been following my material on scuba diving you know I have been writing about diving, diving dry suits and diving back inflate BCDs (buoyancy compensation device) a natural follow-on is diving what are known as backplate with wing type BCDs and the configuration of tanks, regulators and hoses known as the DIR (Doing It Right) configuration. The main purpose of double tanks is to extend the amount of time one can remain underwater and to provide for redundancies in your air supply.

In normal configuration for an open water certified diver the diver has a single air tank, a primary and backup regulator (known as an “Octo” or “Octopus”) a gauge console, usually including a submersible pressure gauge (SPG), a air pressure gage, a compass and in advanced configurations, a dive computer. The dive computer may or may not be air-integrated, which means it is able to sense and record changes in your air tank volume. The normal configuration may also include one or more low pressure inflator hoses; one for your BCD and one for a dry suit. In a DIR configuration using double tanks, the tanks are connected through a three-valve manifold assembly with a right and left tank isolator valves (called the right and left posts) and a cross connect valve. This configuration utilizes two-primary regulator stages with the various hoses logically configured across the two primaries.

![Picture showing manifold and regulators on a dual tank](image)

Usually the right hand tank valve has the main primary regulator attached, the main primary has the primary-secondary stage (the one you breath through, normally called the primary) and the fill line for the wing. On the left tank valve (or “post” you attach the secondary-primary regulator you attach the backup secondary regulator (taking the place of the octopus) however now it is simply called the backup. On this left hand regulator
you also have (in a “pure” configuration) a single, small SPG (usually what is known as a brass and glass SPG) and the fill line for your dry suit, if needed, since actually in a “pure” setup you would have a small bottle of compressed argon with its own regulator that would fill your dry suit.

Let me explain about this backplate and wing I keep talking about. The backplate is just what its name implies, an aluminum or stainless steel (I guess there may some titanium ones out there, but I haven’t seen any) plate that is specially drilled and milled to hold a single continuous length of nylon webbing that forms the shoulder straps and waist belt. This continuous piece of nylon webbing makes for a simple, easy to maintain, method of wearing the backplate for a diver. Being a continuous piece of webbing this eliminates points of failure present in standard BCDs. In the picture below you will see a second strap, called the crotch strap, coming off of the bottom of the backplate. The crotch strap prevents the backplate from riding up and provides a point of attachment for a pull line from a scooter, relieving your arms from having to provide not only steering control but a grip on the scooter itself.
A wing is a flotation bladder with an inflation hose (called a “corrugated hose”) and usually a dump valve (on the back side of the one pictured below.) The buoyancy bladder is encased in a protective covering usually of a rugged nylon fabric. Some wings, like the Oxycheq Signature 50 pound, have a double layer of fabric for added protection of the inner bladder.

Example of a Wing

The metal backplate provides a rigid mounting point for either a single tank or a set of doubles. When a single tank is utilized it is more stable to use a special metal bracket called a single tank adapter or STA. STAs are usually made from the same metal as the backplate to reduce the possibility of galvanic corrosion, likewise the attachment posts or bolts should be of the same material, either aluminum or stainless steel.
As its name implies, a set of doubles consists of two air tanks connected through a manifold assembly and rigidly mounted to each other through a set of stainless steel tank bands. The tank bands have the attachment fasteners (bolts) that attach the tanks to the backplate and are usually mounted on the tanks with 11 inch centers to allow mounting to the standard backplate. Using an STA when using a single tank allows for rapid conversion between diving a single tank and diving a set of doubles as it only requires removing two wing or butterfly nuts and swapping out the doubles for a single tank mounted to an STA.
One major difference between a backplate and wing assembly and a BCD is that many modern BCDs have built-in or “integrated” weight pockets, some fixed, some removable, while, generally speaking, backplates with wings do not. This lack of weight pockets requires either mounting weight pouches on your tanks or your harness, wearing a weight belt, or, utilizing a weight harness. Most advanced divers seem to prefer the weight harness over the other options usually with placement of “trim” weights either on the tank or harness straps. Below is a picture of the DUI weight harness I use. The DUI harness has threaded weight packets (see the yellow handles?) you simply pull the yellow handles and it unthreads a heavy nylon cord that holds the pouch in place allowing dropping the weight pouches if needed. The use of the harness removes the weight pouches from the BP/W or tanks unless trim weights are needed.

![Weight Harness from DUI](image)

I purchased a stainless steel backplate from Kraken Forge (a custom backplate provider) and using the DIR guidelines from http://www.gue.com/Projects/WKPP/Equipment/index.html, configured my webbing, buckles and D-rings as specified. I then had my local dive shop (LDS), Sea Sports Scuba, http://www.seasports.com/, configure a set of dual 80 cubic foot air bottles with a DiveRite 300 bar manifold. A bar is a single unit of pressure equivalent to the pressure of the air at sea level (not exactly, but close enough) therefore a 300 bar manifold can withstand internal pressures of 300 times that of the air at sea level (4350 PSI, your car tire has about 35 PSI.) I also had them O2 clean and certify the tanks and manifolds so I can utilize Nitrox (air with increased levels of Oxygen.)

I also purchased an Oxycheq 50 pound lift wing and a DiveRite TrekWing 35 pound lift wing with an aluminum backplate. To provide single tank use capability I purchased both a aluminum and a stainless steel STA. Once I had all of the required components, I had the LDS assemble the stainless steel backplate, the Oxycheq wing and the set of doubles. I assembled the aluminum backplate with the DiveRite TrekWing wing and aluminum STA for use with single tanks.
Meanwhile I purchased two Oceanic Alpha 8 PX3 Piston Regulators, a seven foot hose for my primary and a set of inflator hoses and a Sherwood Compact Navigational 3 Gauge Console with Compass from http://www.leisurepro.com/. I realize that a three gauge console with a SPG, depth gauge and compass is not true DIR but I like it simple and having the three in one place makes it easier for me. I then configured the dual regulators as shown on the GUE website.

Two Regulators, one Primary, one Backup (Primary has long hose)

So, what does it feel like to dive this contraption? Now as you can imagine, dual tanks, a manifold, and a stainless steel backplate are all heavy, to the tune of around 100 pounds with the tanks fully loaded with air. Add to that the needed lead weights to ensure you are neutrally buoyant if you breathed the tanks down to 500 pounds of pressure (where they become positively buoyant) and to offset the possible positive buoyancy of the wet or dry suit you are using for thermal protection, in my case an additional 14 pounds of lead. So all told, about 114 pounds of equipment not counting the weight of the exposure suit, fins, mask, gloves, hood and other paraphernalia. All told, diving a dry suit with a backplate and wing using double aluminum 80 tanks, a diver probably weighs at least 120 pounds more than their normal weight when out of the water.
A Backplate and Wing with Doubles it is much easier to don when elevated

Lifting the backplate and wing with the doubles from the ground up to your back could result in a hernia, it is much simpler to don it from the back of a SUV or pickup truck tailgate. Once it is in place, and the straps of the webbing are properly adjusted, it actually is not difficult to walk around with, as long as you aren’t climbing stairs or navigating difficult terrain.

Once you get in the water, you must inject some air into your wing to provide flotation, usually you carry your fins and then lay back in waist deep water to put them on, if you don’t inject some air into your wing you could get pulled under by the heavy gear, this nearly happened to me when I lost my balance. Once you are in the water the weight of the equipment becomes negligible due to the buoyancy of the air tanks (a Catalina aluminum 80 is listed at 31.6 pounds with 4.1 pounds positive buoyancy empty. So its real weight is 35.7 pounds, however in water the apparent weight will be about 2 pounds for each tank when full.)

Once I got my buoyancy nearly sorted out (I started out nearly 12 pounds over-weighted at 26 pounds of lead additional weight) the actual diving with the backplate and wing was comfortable and easy. Of course viewing me underwater when I was over weighted you would have thought I was a rototiller. I also had some issues with hose creep with some of the hoses, but as I learn to position them better and clip some of them to the harness assembly that will be reduced. There have been comments about the 7 foot primary being difficult to deal with, I found no such issues when I rigged it as suggested (down the back, under the right arm, across the chest, around the back of the neck to the mouth). The secondary has a bungee necklace attached that is used to hang it directly below your
chin so it is available immediately for use. In this configuration you donate the 7 foot primary hose to a dive buddy who has an out-of-air (OOA) situation and then breath off the backup yourself.

The original idea behind the 7 foot hose on the primary is that in situations where there may be restrictions, such as in a cave or wreck dive, you would not be able to share air with an OOA buddy if you were tandem with a short hose. A long hose used in an OOA allows for two divers to swim in tandem formation (one in front of the other.) If the diver never does cave or wreck a 5 foot hose on the primary should be sufficient.

Another question asked usually goes something like “In my open water class we were taught to give the octopus (backup regulator) to an OOA diver, why do you give the primary?” The answer to this is simple, many times an OOA diver will be near panic, he or she will grab your primary as it is usually the most readily visible air source. It is also easy to just take the primary and pass it properly oriented and you know it works, so it just makes sense to pass the primary, dip and grab the backup that is bungeed around your neck and resolve the OOA divers problem, or assist him or her to exit the water.

Once the buoyancy weighting is determined and proper trim weights (if needed) are mounted, diving a backplate and wing is just as comfortable, if not more, than a vest or back inflate BCD. In fact I am finding it takes less weight to get me neutral with the backplate and wing with doubles (about 14 pounds) than it did diving a back inflate BCD with a single tank (18 pounds) while offering more freedom of movement and more secure tank mounting.

So the main downside to the BP/W with doubles is that it is more bulky and heavy on land. With proper planning you can overcome the cumbersome nature of the BP/W with doubles and once you are in the water will really enjoy this configuration.

It should be stressed that before you use a set of doubles with a manifold that you be properly trained in the manipulation of the three valves in emergencies such as a free flowing primary or backup, rupture disk rupture, or ruptured hose. These “valve drills” as they are called usually involve switching to the backup regulator (if the primary was the one that failed) then isolating the free flowing hose or tank by use of the tank valve and isolator valve (the one in the middle). Reaching the valves in a dry suit or thick wetsuit can be tough and you should practice stretching exercises to ensure you are limber enough to reach them.