

The answer to buoyancy issues is simply to be neutral in the water at all times. In other words you want to displace as much mass of water as you mass. Regrettably this is much simpler to say than to do.

Your buoyancy has several components. Some of the buoyancy components change as the dive progresses and you descend and ascend in the water column. The BC has to offset only these CHANGES in the buoyancy of you and your gear from the start of the dive at the surface throughout the dive and back to the surface. The best way to get a feel for what these are is to list them by type.

The first thing to do is determine your "residual" buoyancy. Fat along with lung and sinus cavities float, muscle and bone sink. The mix of those components in YOUR body will determine your residual buoyancy. Almost all women and a large percentage of men float to some extent. Women who don't have at least some fat on them simply don't look like women, and the ladies tend to have smaller bone and muscle structure. As a result most ladies will float to some extent. Men are all over the spectrum. Take you and swimming suit to a pool and determine how much lead or air it takes to make you neutral with lungs inflated to the middle to middle top range of your normal tidal volume. This is your "base load" that everything else you take into the water either adds to or detracts from. Also please be aware that this base load changes slowly over time. As an example, 30+ years ago when I was in engineering school I was diving one or more tanks every day to catch lunch, measured 6' tall, weighed 135# soaking wet, with a base load of about 5 pounds negative in seawater. Now 30+ years and about 100 pounds later I'm still 6' tall, but the base load has changed to about 7 pounds positive in seawater. I lost much of the big "jet fin" leg muscles, and added fat everywhere, so my base load reflects that change

The next biggest non-reversing item in your buoyancy calculation increases in buoyancy throughout the dive. This is your decreasing "gas load", or the mass of the air or other breathing mix in your tank(s) that is consumed at a relatively constant rate throughout the dive, with due consideration to the increased use rate due to the compression of the gas volume inhaled as depth increases. If you are talking just "sport" diving with an 80 cubic foot tank this buoyancy change is in the range of 5 to 6 pounds, assuming you plan on coming up with around 500psi. Note that this change is *independent* of the tank construction. Tech and deep penetration cave divers with larger gas loads may have up to 50 pound of "expendable" gas in several back gas bottles and decompression stage bottles. You need to determine the maximum amount of gas you intend to use with a particular setup to determine this gas load swing buoyancy for your type of diving. Add that amount of positive buoyancy to your "base load". You'll need to add lead or other negative components to your rig to offset this buoyancy change to remain neutral at the deco end of your dive.

The next biggie effecting BC size for most folks is the changes to the displacement of your exposure suit. This is not a major item for those diving in t-shirts and shorts, or for most of those diving in dry suits. For the rest of us diving in wetsuits this can be pretty drastic. When planning for BC size you need to assume your suit loses ALL buoyancy to suit compression at depth. Closed cell neoprene will not normally go negative due to compression at normal open circuit SCUBA depths, so that side of the swing is not necessary to compute. To determine the *maximum* possible change in your exposure suit buoyancy you need to determine the near surface buoyancy of the suit. This can be done in a pool with a mesh bag and a weight belt with multiple small weights on it. Take the bag into the pool empty, and then add the suit to the bag underwater, being sure not to trap air in the suit as you put it into the bag. Tie the bag to the end of the belt, and see what amount of lead comes off the bottom with the suit and bag still fully submerged. This is the net positive buoyancy of the suit at the surface. You need to add this amount of negative buoyancy to your base load, since you'll be wearing lead or other negative gear to counteract this at the deco end of your dive.

Other things that can change your base load during the course of the dive. One is the escape of air trapped in your wetsuit suit when you first put it on. Another is the escape of, or development of, methane in the gut. Avoiding chili, bratwurst & kraut, bean soup and other methane producers before diving is the simple solution to that one. One common with "branded" BCs is the trapping of air in the BC outer bag between the BC bladder and the case. This air will work out of the case during the dive, yielding a more negative result at the end of the dive than would otherwise be expected.

Picking the rest of your gear wisely, taking into account your base load and buoyancy "live loads", can minimize the lift required for your BC. In any case you need enough lift to enable you, at the first of your dive with the maximum possible negative "live load", to swim up to the surface from the maximum dive depth **POSSIBLE** in your area. IOW If the bottom of the wall you dive is at 230' you had better be able to swim up from **there**, even if you never intend to get that deep! The world occasionally turns brown, so it's best to have the gear setup to handle it. The difference in cost is minimal, but the difference in result can be huge. There have been several instances where people have drowned from not being able to swim their rig to the surface.

All other things being equal choosing the rest of the gear you carry is an exercise in minimizing the amount of lead you need by judicious selection of the rest of your gear. If diving in warm water you may want to select a tank that counteracts your base load so all you need to deal with by BC flotation is your minimal exposure suit changes and changing gas load. This could be as small as a 10 pounds of flotation, or as high as 40 pounds.

I use my BC for other things besides buoyancy compensation quite often. This is NOT suggested by most instructors, but then again most instructors have never tried to turn an over 7' long speared AJ heading to the bottom in 800+' of water... They have their agenda; I have mine.

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