

People often ask about weighting, how things work, so I thought I'd jot down some notes:

### *Neutral at Surface Plus 5 Pounds*

The neutral-at-the-surface-then-add-5-pounds approach is based on solid physics when someone is diving an AL80, if the desired end state is neutral at 500psi and you're starting with a full 3000 psi. The reason is simply the mass of air that is depleted -- an AL80 holds 77 ft<sup>3</sup> of air, which is just about 6 lbs (air weighs about 0.078 lb per cubic ft, and  $77 \times 0.078 = 6$ ). If your desired end state is neutral-at-500, this means that you've used up 5/6 of that air:

$(3000 \text{ psi starting pressure} - 500 \text{ psi ending pressure}) / (3000 \text{ psi starting pressure}) = 2500 / 3000 = 5/6$  5/6 x 6 lbs (total weight of the air in the tank) = 5 lbs (air expended)

The only "gotcha" is that you really need to be thoroughly wet, no air pockets, no air in your BCD. It's really easy to have a bit of trapped air, whether in your wetsuit, in your BCD, or trapped between your body and the BCD. No big deal, just make sure that you're thoroughly wet, fully dumped, else you'll be carrying extra lead.

Personally, I prefer to be neutral all the way down to an empty tank -- if something has gone really wrong, blown o-ring for instance, I really don't want to cork up. On a normal dive, surfaced at 500 psi, it means I'll be carrying an "extra" 1 lb of lead. While there are some who really stress minimizing their weight, a 1 lb "excess" is trivial. This means that for me, I would use neutral-at-the-surface-plus-6-pounds, if I have a full AL80.

In other words, neutral-plus-5-pounds is an entirely valid method to determine your base weighting for a given exposure suit and AL80

### *Neutral for An Arbitrary Starting PSI -- New Exposure Suit Dial-In*

I know my weighting with a 5 mm full suit, just got a new 3mm -- what to do? Go to the shop, get some pool time. Whoops -- a pool tank will often be a lower fill, not 3000 psi, since it's being used in extremely shallow conditions.

No problem -- on an AL80, each 500 psi is 1 lb. If you get neutral, see your tank has 2500 psi, that means you would add 4 lbs to be neutral at 500 psi, or 5 pounds to be neutral all the way down to an empty tank.

### *Changing Between Fresh and Salt Water*

OK, I'm dialed in, good for the Great Lakes. Time to go on vacation to the Caribbean -- what do I do?

There's a buoyancy change between salt and fresh water. Ocean salt water weighs about 2.5% more than fresh water, so there's about a 2.5% buoyancy swing. Going from fresh to salt you add weight, going from salt to fresh you subtract it, for a given exposure suit and other gear.

The amount of weight you need to add (or subtract) is based on the total dry weight of you and your gear, 2.5% of it. Step on a scale wearing your exposure suit and BCD (no weights or tank needed). Write that number down. Add the weight of lead you wear for that particular suit.

For the weight delta, take 1/40 (2.5%) of that, then add 1 for tank.

|   |        |
|---|--------|
| Me in a 5 mm and BC on the scale:           | 190    |
| Weight I wear with that, fresh water, AL80: | 10 lb  |
| Total:                                      | 200 lb |
| 1/40th:                                     | 5 lb   |
| Tank:                                       | 1 lb   |

Weight Delta:

$$6 \text{ lb } ( 5 + 1 )$$

If I am going to dive in salt water, I would then need to add 6 lb, switch to 16 lb of lead, when wearing that 5 mm and diving an AL80. In the other direction, if I needed 10 lb in salt water, wanted to know what I need in fresh, I would subtract 6 lb, so I would now need 4 lb of lead (10 - 6 lb of weight delta).

Why 1 lb for the tank delta? That's because the dry weight, empty, of tanks in the 60 - 140 ft<sup>3</sup> range are between 27 and 50 lbs -- if you think of them as 40 lbs, which means a 1 lb change (that 1/40), you'll be "close enough" -- within about 5 ounces of lead. If you're diving a Heiser water tank, the 190, that beast is 87 lb empty, you need to use a 2 lb tank delta.

This 2.5% is for typical ocean water – certain dive locales, seas, have higher salt concentrations. The same principal applies, but you may need a different % correction.

### *Changing to a New Tank*

Periodically folks wonder about buoyancy change when they pick up a new tank. They're dialed-in with something, say the AL80, then suddenly pick up a different tank, not quite sure what to do.

You don't have to redo the pool buoyancy checks, with each exposure suit. Rely on the underlying physics, the difference in buoyancy between the old tank and the new.

The table on the next page goes through weight changes related to changing between tank types.

As an example, say my old tank was a Catalina S80, and I'm changing to a PST E7-120 (I'm no air sipper, this gives me a lot of extra gas). The E7-120 shows 0 pounds buoyancy, while the S80 shows +4. I adjust the weight I carry by:

$$0 - 4 = -4 \text{ lb}$$

Meaning that I would remove 4 lb when diving the E7-120 compared to what I would use diving the S80.

### *Putting it All Together*

These concepts can be combined. Here's an example:

I've got a new vacation coming up, Caribbean, very warm water, just picked up a new dive skin. I hear the Utila Op will be using E7-100s.

I ask the shop to let me do a weight check in their pool, find out that I need no weight at all, am neutrally buoyant right after jumping in with a shop AL80. I've fully dumped my BC, no air pockets. Checking my SPG I see that it's at 2000 psi.

Step 1: Establish a baseline weight for using that diveskin in the AL80. The tank shows 2000 psi, which means that it has  $2000/3000 \times 6 = 4$  lbs of air.

My weight baseline is 4 lbs for that diveskin, diving an AL80, fresh water.

Step 2: Calculate the weight delta for going from fresh to salt. I jump on the scale, wearing my BCD and the skin, see that it's 185 pounds. Add 4 lb lead, that's 189. 1/40 of that is pretty close to 1/40 of 200, so I'll need +5, and the +1 for tank shifting to fresh means a total of +6. My salt water weighting therefore would be  $4 + 6 = 10$  lb.

Step 3: Calculate the weight delta because of the tank change. PST E7-100 is 0 lb, while the S80 is +4 lb buoyancy.  $0 - 4 = -4$  lb. I'll need 4 lb less lead diving that E7-100.

My final weight then, in Utila, will be  $10 - 4 = 6$  lb. Let's dive!

| Manufacturer & Nominal Capacity | Service pressure, psi | Actual air capacity, ft3 | Buoyancy Empty, lbs (w/valve) |  | Manufacturer & Nominal Capacity | Service pressure, psi | Actual air capacity, cu. Ft. (at +10%) | Buoyancy Empty, lbs (w/valve) |
|---------------------------------|-----------------------|--------------------------|-------------------------------|--|---------------------------------|-----------------------|--|-------------------------------|
| Catallina S6                    | 3000                  | 6                        | -1.1                          |  | OMS 13                          | 2400 +10%             | 13                                     | -2.25                         |
| Luxfer 6                        | 3000                  | 6                        | -1.03                         |  | OMS 20                          | 2400 +10%             | 20                                     | -1.5                          |
| Catalina S13                    | 3000                  | 13                       | -0.8                          |  | Heiser 45                       | 2400 +10%             | 45                                     | 0.8                           |
| Luxfer 13                       | 3000                  | 13.2                     | -0.72                         |  | PST LP 45                       | 2400 +10%             | 45                                     | -0.5                          |
| Luxfer 14                       | 2015                  | 13.7                     | 1.7                           |  | OMS 45                          | 2400 +10%             | 46                                     | 0                             |
| Catalina S19                    | 3000                  | 19                       | 0                             |  | OMS 50                          | 2400 +10%             | 50                                     | -1.5                          |
| Luxfer 19                       | 3000                  | 19.9                     | 0.12                          |  | OMS 66                          | 2400 +10%             | 66                                     | -1.67                         |
| Luxfer 27                       | 3000                  | 27.9                     | 0.6                           |  | PST 65                          | 3500                  | 67                                     | -1.5                          |
| Catalina S30                    | 3000                  | 30                       | -0.2                          |  | PST MP 72                       | 3300                  | 72                                     | -6                            |
| Luxfer 30                       | 3000                  | 30                       | 1.2                           |  | Faber 72                        | 3000+10%              | 72                                     | -3.7                          |
| Catalina S40                    | 3000                  | 40                       | 1.7                           |  | Faber 80                        | 2400 +10%             | 78                                     | -1.7                          |
| Luxfer 40                       | 3000                  | 39.9                     | 2.2                           |  | Faber 80                        | 3180 +10%             | 80                                     | -7.22                         |
| Catalina S45                    | 3000                  | 45                       | 1.3                           |  | PST E7-80                       | 3442 PSI              | 80                                     | -2.5                          |
| Luxfer 50                       | 3000                  | 48.4                     | 1.3                           |  | PST LP-80                       | 2400 +10%             | 80.6                                   | -1                            |
| Catalina S53                    | 3000                  | 53                       | -0.2                          |  | PST 80                          | 3500                  | 82                                     | -3.3                          |
| Catalina C60                    | 3300                  | 60                       | -0.4                          |  | OMS 85                          | 2400 +10%             | 85                                     | 0                             |
| Catalina S63                    | 3000                  | 63                       | 2                             |  | Faber 95                        | 2400 +10%             | 95                                     | -1.2                          |
| Luxfer 63                       | 3000                  | 63                       | 2.6                           |  | PST 95                          | 2400 +10%             | 96.6                                   | -3.3                          |
| Luxfer 72                       | 3000                  | 69.6                     | 3.6                           |  | OMS 98                          | 2400 +10%             | 98                                     | 0                             |
| Luxfer 80                       | 3000                  | 77.4                     | 4.4                           |  | Faber 100                       | 3180 +10%             | 100                                    | -7.26                         |
| Luxfer S80                      | 3000                  | 78.2                     | 2.26                          |  | PST E7-100                      | 3442 PSI              | 100                                    | -1                            |
| Catalina S80                    | 3000                  | 77.4                     | 4                             |  | PST 100                         | 3500                  | 102                                    | -1.3                          |
| Catalina C80                    | 3300                  | 77.4                     | -0.2                          |  | Heiser 104                      | 2400 +10%             | 104                                    | -7.46                         |
| Luxfer 92                       | 3200                  | 90.3                     | 3.1                           |  | PST 104                         | 2400 +10%             | 106.2                                  | -3.3                          |
| Luxfer 100                      | 3300                  | 99.3                     | 3.11                          |  | OMS 108 (112)                   | 2400 +10%             | 112                                    | -1                            |
| Catalina C100                   | 3300                  | 100                      | -0.4                          |  | PST E8-119                      | 3442 PSI              | 119                                    | -2                            |
|                                 |                       |                          |                               |  | Heiser 120                      | 3190                  | 120                                    | -17.82                        |
|                                 |                       |                          |                               |  | Faber 120                       | 3180 +10%             | 120                                    | -7.22                         |
|                                 |                       |                          |                               |  | PST E7-120                      | 3442 PSI              | 120                                    | 0                             |
|                                 |                       |                          |                               |  | PST 120                         | 3500                  | 122.5                                  | -1.3                          |
|                                 |                       |                          |                               |  | PST 120                         | 2400 +10%             | 122.5                                  | -1.7                          |
|                                 |                       |                          |                               |  | OMS 121 (125)                   | 2400 +10%             | 125                                    | 0                             |
|                                 |                       |                          |                               |  | PST E8-130                      | 3442 PSI              | 130                                    | -1                            |
|                                 |                       |                          |                               |  | OMS 135 (131)                   | 2400 +10%             | 131                                    | 0.75                          |
|                                 |                       |                          |                               |  | Heiser 140                      | 3190                  | 140                                    | -18.04                        |
|                                 |                       |                          |                               |  | E8-149                          | 3442 PSI              | 149                                    | -1.7                          |
|                                 |                       |                          |                               |  | Heiser 190                      | 4400                  | 190                                    | -46.86                        |

  

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| <b>Weighting change when changing tanks:</b>  |  |  |  |
| If your weighting is known on one type tank, to change use:   |  |  |  |
| NewTankBuoyancyEmpty - OldTankBuoyancyEmpty   |  |  |  |
| Change from Catalina S80 (old) to PST E7-100 (new):   |  |  |  |
| -1 - 4 = -5 Remove 5 lbs of lead  |  |  |  |
| Change from Faber 72 (old) to Catalina S63 (new):   |  |  |  |
| 2 - (-3.7) = 2 + 3.7 = 5.7 Add 6 lbs of lead  |  |  |  |
| Ref:  |  |  |  |
| <a href="http://www.huronscuba.com/equipment/scubaCylinderSpecification.html">http://www.huronscuba.com/equipment/scubaCylinderSpecification.html</a> |  |  |  |