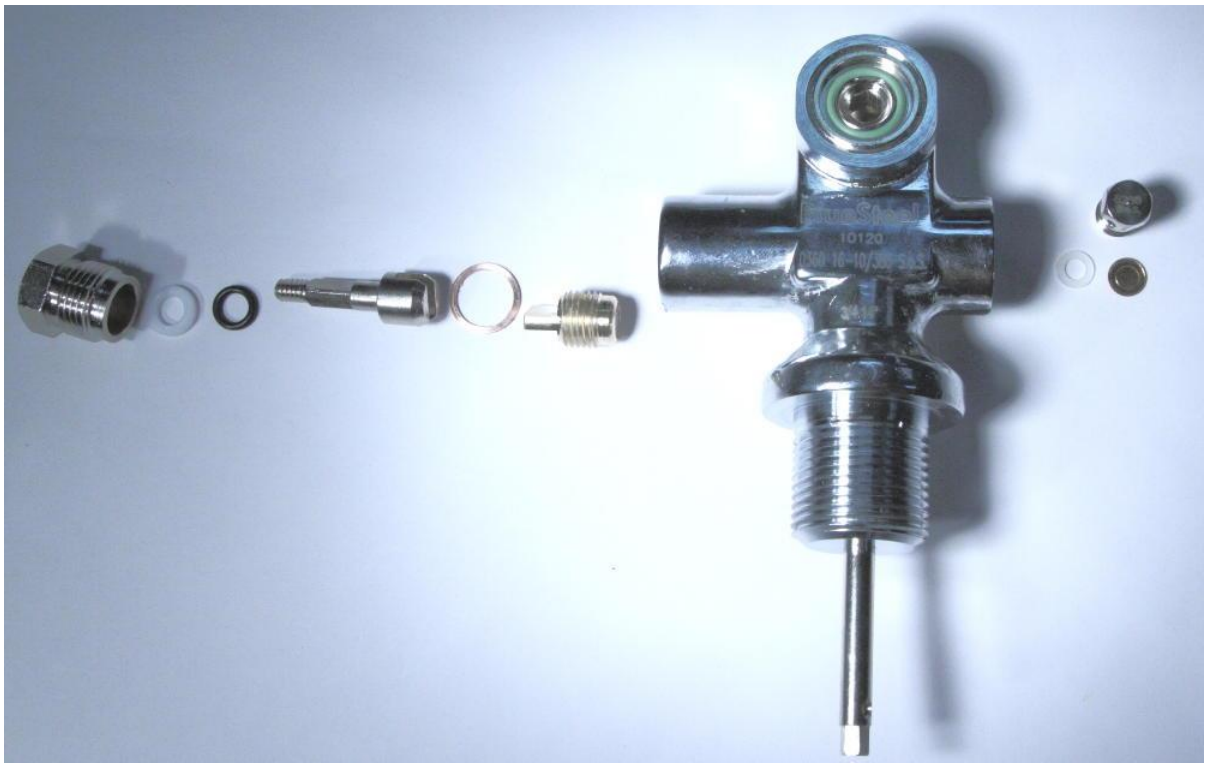
Tank Valve Maintenance 101



The lowly tank valve is a piece of equipment that we turn on, we turn off and never consider servicing unless it fails? We are taught that scuba regulators should be serviced annually, tanks are VIP annually, and hydro's are done every 5 years. While VIP's can be a nuisance, and honestly many ccr divers will ignore this step by avoiding dive shops that screen tanks, or they have their own garage fill stations, anything to avoid the nagging service, service, service = $ $ $. I have to admit that the last thing that I want to do is drain a cylinder of gas, or even trans pump it into another.... But hydros are one of those things that make people cringe if they fill a tank that has not been "tested" or approved for pressure?

So what is the real truth about tank valve maintenance or failures. Well from my 20 years of owning a dive center and 15 years working at other shops, it is at least 35 years of observations. And here is the real poop; tank valves are very robust and hardly ever fail. But they do wear seats, O-rings, and burst discs do age and stress over time especially if they get filled by me. Here are some common failures that I have seen:

- Valve nuts un-screw and tank knobs fall off (yes it was covered above but its most common)
- Valve Stem O-Rings #010 wear and leak. You will see "mouse farts" coming from underneath the tank knob as they leak out the stem packing. Its an easy thing to miss as they are small bubbles and most common blame is given to a bad DIN O-Ring #111 or #112.
- Tank Valve to Cylinder O-Ring #214 leaks or extrudes. This is more common with todays concern over oxygen and compatible materials. O-rings of yesteryears would last for decades, but not today's oxygen compatible elastomers. Color of O-rings is not an accurate factor, but I can pick on a certain company that supplied purple O-rings and I've seen entire #214 O-rings squirt out a crack that I could not get a fingernail underneath? So yes this is more a recent history failure, and controllable by careful selection.
- Valve HP Seal wears out. This is fairly frequent and occurs more often than divers realize. When you turn a valve off, it does not take much pressure to seal the seal on the seat. The seal is a nylon 6/6 common material which is not oxygen compatible. Sherwood Selpac make a seat that contains Kel-F polymer. While the right material choice for gas is important, both materials are soft compared with the "volcano" seat / orifice and that is point of a soft material sealing on a hard cutting edge surface. Eventually the seal is indented/cut/worn to the point where more and more pressure is required to close the valve. I notice this when I remove a solid metal DIN plug that pressure locks. At first you may think the valve got bumped and the DIN plug did its job, but if every time you try to remove the plug it is locked, it may be a creeping leak.
- Valve Stem Shearing - this is an accident, but common as stage bottles standing up on a boat may fall over and hit the valve knob, and the valve stem snaps.
- Burst disc failure. If you know the actual age or experience of the valve, meaning the history of fills and pressures then you can say that they will last ten to fifteen years on average. Hot fills, over pressure, storage in a hot location can all prematurely weakening a burst disc. Many divers are unaware that burst discs are a North American thing and they are not found on most valves in Europe.
- Valve Snorkel Tubes fall out. Valves have an extension tube called a snorkel that essentially keeps water in an inverted tank from running directly into the valve. A rattling noise is clear give away that the snorkel tube has unscrewed, fallen out, or broken off.

Ding! You have a DIN valve with regulator off and the Diluent (Oxy, drysuit gas, stage bottle) rolls off the dive bench and dings the top of the valve. Cry and get it out of your system as its junk and no way you can save the valve? Only thing to do is prevent this in future by always using Solid Metal DIN plugs that seal. This will prevent DIN dings as well as loss of gas.

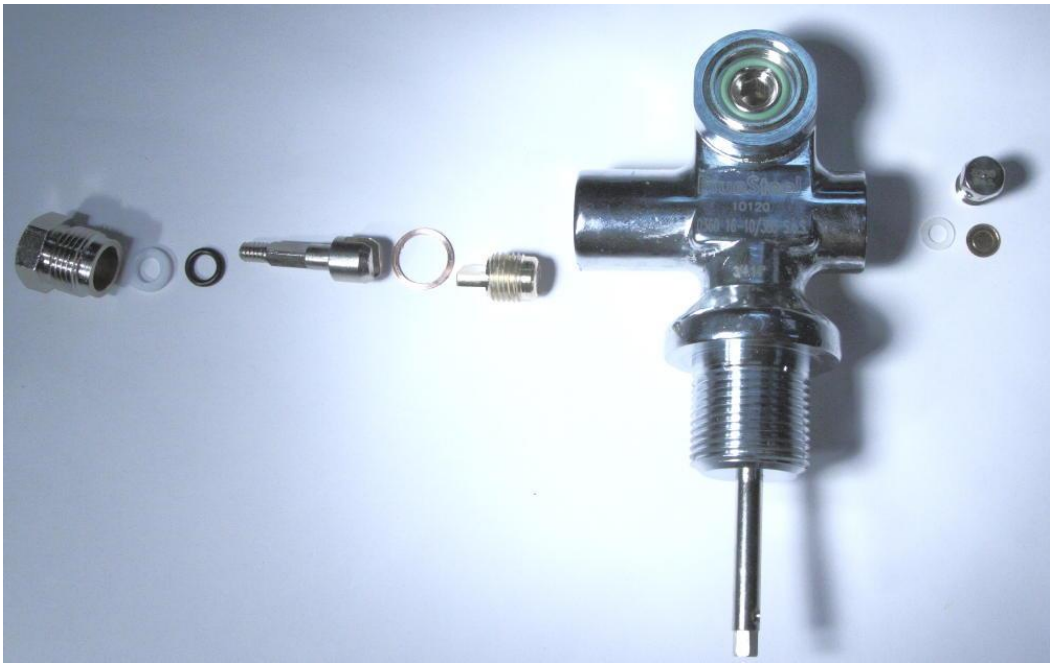
So my advice is if you buy good valves on good cylinders and you know the history, then assume that a new valve can easily go ten years without service. But here is smart idea, and good insurance by servicing the valve when you do the hydro. This gives you peace of mind that you are keeping ahead of potential failures. This is the time to put a new valve seal, stem o-ring, Teflon back up rings, and replace the burst disc.

And cheap insurance is to carry an "oops my valve fell off" kit with a knob, spring, nut as well as carry a complete valve service kit, main valve o-ring and burst disc. Now I have to admit that you cant change either a main valve o-ring or a burst disc unless you are Superman fast. Just kidding the gas would escape if you could overcome the pressure lock on the valve or burst assembly. However you can do simple things like replace a valve stem O-ring, and Teflon back up rings.

Oops My Valve Hand-Wheel Fell Off!

Generic Valve Rebuild Kit

Ok lets do a little simple maintenance. You have sent the tank to the hydro shop and by being smart you kept a few old junker valves to send the tank off to service with a dummy valve. Now you can take the time to strip the valve, clean, and install new kit.



valve bonnet-Teflon ring-#010 o-ring - valve stem - copper ring - HP valve seal (left to right)

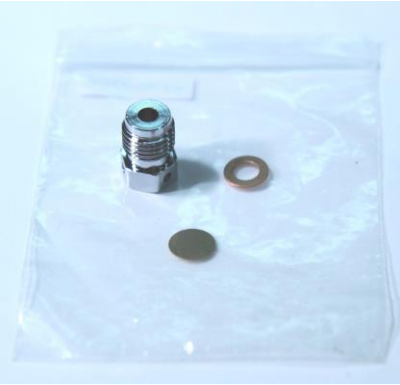
*Note this is a Blue Steel Valve. Most valves are very similar, but take apart carefully and take pictures to remind you have it came apart. After you have the valve apart, toss out the parts that you will replace, and wash the valve body.

Next is to get a Tupperware to fit the valve and make the cleaning solution. Use Dawn dish soap and household distilled white vinegar in 50%-50% and stir well. Find an old toothbrush with descent bristles for scrubbing. 

Most Excellent Solution for cleaning scuba bits, regulators, etc... But do not leave un-attended as vinegar is a weak acid, yet will still strip plating on metal parts! Rinse well with copious amounts of hot/warm water.

Purchase a Valve Service Kit and new Burst Disc kit and replace. There is no torque spec aside from an old service tech knows when the elbow clicks, you have it tight enough. Also this is time to tighten the snorkel tube so it doesn't fall out and drive you nuts rattling around bottom of the tank...

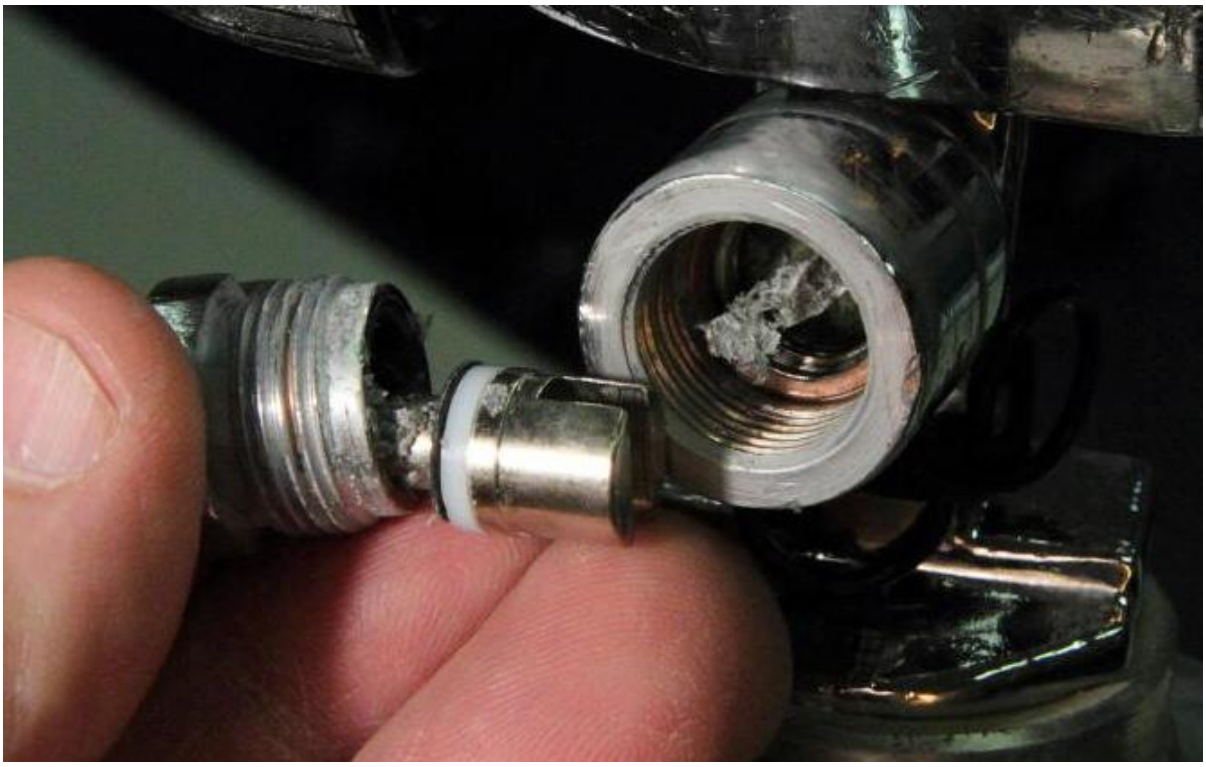
For burst disc, I have never double tank burst disc "**CRACK**"  Damnit God stop shooting lighting at me! Everyone knows I double disc, so its not like I'm really lying.... Ok, yes I do routinely double up on burst disc, but considering that they do not use burst disc in UK, then I'm going Limy and voting for Queen next election? So if you double disc, you need to find the individual parts and not the crimped burst disc kit as you cant double this kind.



Remember that you only lubricate the "dynamic" or moving O-rings like the stem O-ring and do NOT lubricate the main valve to tank O-ring. You will want to use a generous amount of Triolube or other Oxy compatible lube on the valve thread. This is to prevent galvanic seize of the two dissimilar metals.

Now here is where I am going to ask the stupid people to step outside for this next paragraph as I am going to describe how you can remove the valve bonnet while the tank is fully pressurized, to replace the valve stem O-ring.

To replace a leaky valve stem o-ring without depressurizing the tank requires common sense and understanding of how the valve works. You must close the valve completely - remove the valve hand wheel to expose the bonnet - with wrench turn left/loose to unscrew the valve bonnet - pull the valve stem and bonnet away - push valve stem out of bonnet. Replace the worn o-ring #010 with a high durometer 70-90 o-ring and lubricate. If you have the Teflon packing ring, replace this as well. Insert the stem into the bonnet and insert stem into valve, and tighten bonnet. Replace valve hand wheel.



This shows a very compressed o-ring (black line left of the white Teflon ring) and a fuzzy residue? This is ground up Teflon backing rings and valve seal surface. This valve needs rebuild!

Ok stupid people if you did not happen to step off 3rd story deck, then come back in and read the final remarks.

This is simple stuff that you should feel comfortable to do on a regular basis. If you have any questions, do not hesitate to ask your instructor to show you, or better yet watch you as you do the job for the first time. You can also email questions and I will try to answer them in timely fashion.

Ron