

Tank cleaning and flash rust.

It is one of the most common questions that we used to read periodically on the board. If you have cleaned your tanks by yourself, especially steel tanks, you must know how much PITA it is. You must know that the dive shop can't make any money from a tank cleaning. It is a dirty and monkey job.

If you have all equipments at hand, such as a tank rack, tumbler, [whip](#), nitrogen, etc....., it would be great though. If you have it all, you aren't in a normal diver category anymore and this is almost dive shop set up. My research starts from how to clean the tanks as less hassles as possible AT HOME. An acid bath method caught my eyes to realize my goal, however I don't feel comfortable to use an acid on my breathing air supplying tanks. So, my journey begins from this point.

In-organic acid detergent:

I am not sure what the difference between a parkerizing and an acid bath is. Common acid bath method is using a phosphoric acid that is also main ingredient on most RUST INHIBITORS in the market. Blue Gold Industrial Cleaner also contain a mild acid. GMC is using **Compound O** (a diethanolamine (aminoethanol/ethanol 2,2'-iminobis), but I haven't checked it out yet. Please let me know if you have any info on this product.

In the health perspective, phosphoric acid is an acid and can develop a chemical pneumonitis by inhaling. There is a huge difference between drinking and inhaling because our lung is much more vulnerable than a stomach. A chemical pneumonitis can be developed very slowly and trigger an asthma symptom in the long run. If you don't mention about your hobby, scuba, your pulmonologist has no clue on your symptom. Maybe, this is the reason why a rust inhibitor has been an issue for the long time in a diving industry.

Of course, I have used a phosphoric acid on my steel tanks. I know its Pros and Cons more than enough. I picked up two products from Lowes, [Aqua mix](#) and [Phosphoric Prep & Etch](#). ([David, a.k.a dmdalton, has used this one as I recall](#)).

This acid did a great job to get rid of all levels of rust without a single question. As you may know, a phosphoric acid bath remains a phosphate coating inside tanks, so the coating acts as a rust inhibitor. Technically speaking, when phosphoric acid is used to remove rust, it converts the red rust to a black oxide coating. Phosphoric acid on steel leaves a light phosphate compound on the surface. It may or may not be iron phosphate.

This black oxide coating residual is also associated with the carbon levels in steel tanks. That is, high carbon steel tank produces more of black residual. I believe that PST has more carbon than Worthington based on my application. This black residual isn't removed easily with a simple fresh water rinse (hot or cold). If you don't remove it immediately, it takes a long to remove and eventually, you have to use a cleaner (detergent) to completely remove it. Yes, your tank remains in black whenever you open up next time. "Black and Black, Not shiny!" I have often seen this black inside the tanks cleaned by the local dive shops in mid-west. They don't know exactly what it is and assume that it is an iron phosphate by just saying "it is good for your tanks." LOL~~~~

The iron phosphate coating is a very THIN layer, so it is washed out with a hot water rinse (<160 degree), so a low percentage of phosphoric acid washing is guided as a final application without a rinse. However, the problem is what if your tank has a chance to get moisture in hot day?

If you are going to eBay to get an activate carbon, one guy is regularly selling a Lignite activated carbon. Based on his description, his carbon has been washed with hydrochloric acid in order to remove ash and phosphate. This carbon is only mainly used for the water application though. How about on an air purification system? Are you willing to breathe a phosphate layer?

Here is my experiment over the weekend. Most common frustration of a phosphoric acid bath is a re-occurring flash rust after completing a hot rinse and blowing out with filtered air. Technically, a hot rinse will neutralize the acid and stop any rusting attributed to the acidic or low pH condition in the cylinder. Low pH, especially after an acid cleaner will promote a flash rusting mechanism, especially on clean bare metal. As a matter of fact, you can avoid a flash rust after doing a phosphoric acid bath. How? The trick is to use a mild water rinse, not hot water rinse. HOT cleans up a phosphate layer, NOT water. So, you can keep a phosphate layer with mild water and mild air dry (virtually any air). Two PST steel shinny inside the tanks are in my living room and I brought these tanks to the local dive shop to get the second opinion after cleaning. I was told that they actually want to hire me. (I am not cheap... LOL~).

Yes, it remains an iron phosphate coating inside my tanks without any final coating without a rinse. That is, this coating is very sensitive to the heat. But, again, who want to breathe this in hot day?

For the reference, [Coca Cola contains a phosphoric acid as the active ingredient.](#) Its PH is 2.8. So, go figure what you are drinking. Actually, that is my favorite soda. (I told you there is the difference between drinking and inhaling.)

Organic acid:

I looked at the organic acid instead because most organic acids are non-hazardous and non-toxic and don't leave a phosphate layer. The organic acids are also doing the job to remove rust, but it leaves a rough surface inside the tank. So, you should scrub the surface to do it right. It means that you need an extra tumbling

or whipping step. It is better than a phosphoric acid in health wise, but it requires another step to complete.

Alternative: Rust remove solution:

If you are googling, there are a couple of companies to sell a rust remove solution that used to be advertized as non-toxic, non-harzarous, and non-acid. I have looked up two companies, [EVAPO-RUST](#) and [D-Rust-it Remove](#). Their chemicals are based on **chelant** technology for the rust removal mechanism that will not "etch" the metal like an acid. It just removes all the rust, leaving a rust free surface.

Another problem of an acid bath is to wipe off all surfaces no matter what there is rust or not. So, a steel tank is more likely to have a flash rust because it has more bare steel surface. However, the manufactures contend that this solution only converts a rusted area. I have tried this chemical from D-Rust-it on the heavily rusted steel tanks and some AL tanks over weekend. It cleaned out all rust completely on the steel tanks and some AL oxides on AL tanks. It definitely works better on the steel tanks. Please keep in mind that an acid bath method is NEVER NEVER used on AL tanks. GMC also clearly mentioned about this matter.

The solution is a little yellowish color (brighter than your pee). You can use it over and over again until the solution turns in black. Once the solution turns black, it's pretty much done. Typically, the solution lasts quite a while. If heavy rust is encountered, then it uses up the chemistry quickly. This solution may or may not leave a black residue, this depends on the amount of rust and carbon content in the steel. It is NOT an iron phosphate. I have also used their [Metal Kleener](#) that is a detergent like a simple green. It completely removes a black residue both after a phosphoric acid bath and solution method. The company contends that their

Metal Kleener is more effective on various substrates and contaminants than Simple Green. Both Metal Kleener and Simple Green contain a hazardous chemical (Diethylene Glycol Monobutyl Ether and butyl cellosolve), but it is COMPLETELY soluble with a slightly caustic rinse. Otherwise, you will taste like chlorine.

I rinsed out the tanks with a hot water and blow out with filtered air. The tanks are clean and shiny without any flash rust. (I also brought these tanks to the shop to get the second opinion two days later) It doesn't have a bare metal due to an acid bath, so it isn't a surprising fact.

As I mentioned, this solution isn't acid base so that you can be free from any unnecessary caution when you deal with an acid. In fact, I spilled a dilute acid on the outside the tanks. The exposed areas remain a little whitish stain. With this solution, you don't need to worry about an air dry hose due to a corrosive residue from the tanks. I am pretty much sold on this solution.

As usual, there are cons of this solution. First, it takes longer than a phosphoric acid bath (There is no wonder). But, you don't need to worry about leaving the tanks with a solution because there is no etch. Second, it will be a little pricey compared to a phosphoric acid depending on how much rust you have. I have used 25% dilution quart and could clean about 6 tanks. Third, no matter what method you choose, a heavily rusted tank needs a tumbling and whipping step, even with this solution.

Rule of thumb:

"If there is no rust inside tank, leave it alone. O2 cleaning is more than enough."

This solution meets this rule above...

Attachment:

1. MSDS-D-Rust-It
2. MSDS-Metal Kleener
3. MSDS-Simple Green

Note:

1. I am Not a medical doctor, chemist, or toxicologist. My research is based on my own experiment and legal public records.
2. I am NOT affiliated with any companies mentioned above and I don't have any stock share from those companies.
3. It is your own risk which method you prefer.

Thanks for your reading,

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