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Cleaning Your Tractor Parts with ELECTROLYSIS !!!

I have been accused of attempting tractor restoration on occasion, and because I sometimes run into one that is not all that, (ahem), pristine, I find that have need to remove all manner of grease, oil, layers of paint, and of course rust. After searching the Internet, I learned of a cleaning method that works for me and might work for you. That method is called “Electrolysis”, and I’ll get to that in a while.

First, some history.

I married a city girl who after over thirty years of marriage still can’t understand why I just have to have a tractor in the garage while her car sits outside. What can I say? I moved her to Florida from Ohio so she doesn’t have to scrape windows!

If you have ever attempted to resurrect an old machine, be it a lawn mower, tractor, or old car, you know cleanliness is indeed next to Godliness. I have seen many a valiant effort to perform a proper rebuild stopped dead because of a shaving in a bearing, or a speck of dirt in a newly rebuilt DLTX.

In cleaning parts, one usually performs the following steps, in some sort of order: pressure wash chassis, remove part, soak in suitable solvent, drip dry, apply paint remover (if needed), use oven cleaner (for heavily soiled/greasy items), wire brush scrub, wash, dry, prime, and finally paint. Sometimes, these activities take place in the residence around the laundry sink (not recommended), the dishwasher (HIGHLY not recommended), or the bath tub (now that you’re single, who’s gonna know?). Now if your part has a fair amount of rust on it, you should apply something like phosphoric acid to convert the red rust to black oxide, or your beautiful paint job may soon have all sorts of pits and pops before you ever get the first pop out of the tractor !

On heavily painted and/or rusted parts, sandblasting had been my cleaning method of choice, and I still use it. One of the problems with sandblasting is that you use, well, SAND!, and it gets into places of which you never dreamed. Here, again, phosphoric acid as a wash is helpful, as it will, for the most part, dissolve the remnants of silica stuck to the metal surface, and help to dislodge and dissolve any remaining grains of sand. The downside is that because it is an acid, it will also erode a small portion of the part surface, so that you could find yourself with a shaft journal that is bit smaller than when you started.

Electrolysis is a method used by many who restore old tools, hardware, musical instruments, or anything else that is made of cast iron, wrought iron, or steel. Electrolysis to the purist means the splitting of water into hydrogen and oxygen using electricity, but for our discussion, we will assume it to mean a solution that contains water and a suitable electrolyte, which can be either washing soda (Sodium Carbonate) or household lye (Sodium Hydroxide), and through which is run an electrical current. We will be making an electrolytic bath. In our bath, our part will have its red rust (Fe_2O_3) converted to the black rust (Fe_3O_4,or black oxide to you tool & die types). This black oxide is stable in that it doesn’t want to react with oxygen anymore. Once dry, it not swell or shrink, so you can safely paint it, though I like to scrub as much of it off as I can with some brown Scotch Brite since it removes fairly easily. This will normally reveal nice shiny iron metal beneath, among the patches of gray or whitish material. This coloration is normal.

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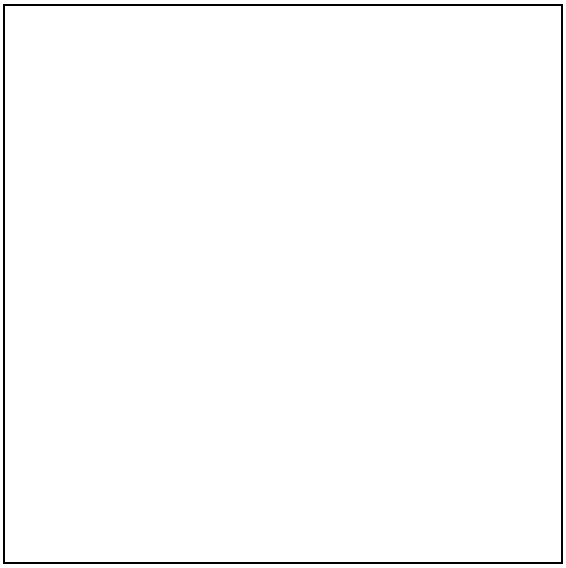
A word of caution: While the strength of the chemicals in the bath is pretty tame, you are still dealing with caustics that can cause discomfort to skin and eye membranes. Always use appropriate precautions when mixing, handling, and disposing of these compounds.

Here's what you'll need:

Washing Soda: This is Sodium Carbonate. Some folks use baking soda or trisodium phosphate and report satisfactory results, but I find that the reaction seems to yield much better results if I use washing soda. I found my washing soda in the laundry detergent aisle of the supermarket.



Lye: Also known as Sodium Hydroxide, it's often found under the Red Devil label. Again, it's available at the supermarket or hardware store. If lye is difficult to find, you can use crystal Drano (Drano is not my first choice as it has some magnesium crystals in it that can intermittently plate onto the iron but it's not really a problem). Lye is nasty stuff. Handle it carefully! If you rub a bit of lye and water solution between your fingertips, you'll notice it is very slick. My old chemistry professor reminded us that "That's your top layer of skin cells sliding around on one another as they come loose". USE RUBBER GLOVES AND EYE PROTECTION ! Some folks say it is getting more difficult to find lye in their local markets. However, if you keep you eyes open you will often find it under another product name in another area of the store. I recently found this product in the plumbing aisle of Home Depot: Roebic Crystal Drain Opener. A quick look at the label shows it is 100% Caustic Soda, which means it is perfect for our needs.

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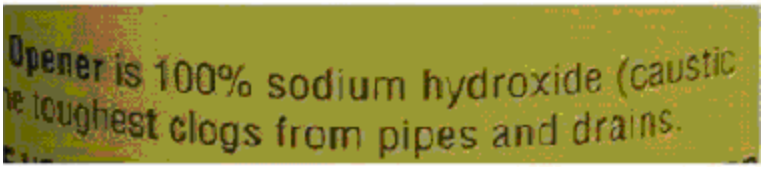

Plastic container(s): Size depends on the parts you intend to clean. I started with a five-gallon plastic bucket, then I moved on to one of those plastic storage containers you find at Wal-Mart, and now I am building a large tank from a black plastic, 150 gal stock tank. I ought to be able to fit most large parts in that. I have also used the 35 gallon tall plastic cans for long pieces like hoods. You can use virtually anything, but stick with plastic.

Battery charger: Now one time someone let the switch on on my tractor, so now I have a charger. If you've never run a battery down you all might have to go out and buy one. Big or small, 6 or 12 volt, around 10 amps is fine.

Scrap iron, steel, or stainless metal: This will function as the sacrificial electrode, so don't use anything you'll want to use again because it will eventually erode into rust (a great time to put that old cracked "G" cylinder head to use!). I have used 16 Ga. sheet steel, old steel fence posts cut and welded together, and old lawn mower blades. The main thing is you want it to have an

exposed metal surface so that it will be in contact with the bath. Once the electrode gets coated in red slimy rust, which will occur as the part is cleaned (the rust is traded from the part to the electrode) the reaction will slow or stop. At this time, you'll have to stop and scrub the red rust from the electrode so that the process can continue. If you use stainless steel, the cleaning will be greatly reduced or not required at all.

NOTE: A few people caution about the use of stainless steel for the sacrificial electrode, because they claim there is a risk of producing chromium tainted waste products. However, after much study, several calculations, and after 30 years of industrial experience with electrochemical machining of stainless alloys to the tune of 20,000 pounds per month, I have determined that I never come close to approaching the technical and legal quantities of chromium concerns in my little electrolysis tank. If you would like to read my reasoning for this position, please continue to my text on the subject. **See link to F-I-T opinion on using Stainless Steel for Electrode. Main thing**. **If you are concerned in the slightest, stick with common carbon or cast iron and you will have no question as to the safety of the process.**

Water. I'll let that up to you.

Let's cook a part !

Mix your solution at the rate of one tablespoon of washing soda or lye to one gallon of water. It's not critical, and it will vary from tank to tank, part size to electrode square area, etc., but add the chemicals to the water so it doesn't splash full-strength on you. Take a stick and stir it a bit.

Place your sacrificial electrode in the bath, say around the edges of the container. Place the part in the center so that it doesn't touch the electrode. I use old 12-14 Ga. iron wire to connect the part to the battery clamp above the bath surface. Since we're dealing with just a few amps, it doesn't take much of a connection. See Figure 1.

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Figure 1: Electrolytic Bath in Action (two electrodes). Charger reads approximately 6 amps.

Hook up the charger.

NOTE: Two important points here:

1: We're dealing with electricity (110 v at the charger) and water that is in a highly conductive state. Use an appropriately fused or GFI outlet.

2:Polarity is important ! If you hook it up backwards, the part will erode, and receive the red rust from the electrode.

Hook the **BLACK** cable of the charger to the part you want to clean, hook the **RED** cable to the electrode that will erode. Turn on the power and observe bubbles coming up from the part as well as the electrode. This is hydrogen and oxygen gas bubbles, and it means current is flowing just fine. If you have lot of current flowing, or the meter goes off the scale, you probably have the part touching the electrode. Shut off the power, reposition the part, and try it again.

Now that everything is working properly, go away for a few hours. Time is your ally. Since this process will only work on the red rust, you can leave the part in the bath for weeks, and as long as the electricity flows, the part will not rust in the solution. If the power stops, it will begin to rust in seconds.

After it appears that the part has had all of its rust converted to black oxide, take it under running water and scrub it with a wire brush or some Scotch-Brite® to remove the loose black oxide. Don't work too hard. If it still has paint or rust on it, cook it some more and work on something else. You'll note the pits will remain, as there is nothing we can do to replace the metal that is gone, but now the part is rust-free. If it needs more time, put it back into the bath. On a particularly rusty piece, you will find that if you remove the part and give it a good scrub, and then put it back in, it will speed up the process. Now dry it and prime it or oil it if it needs to remain natural. By the way, a pressure washer works very well here, too (See Figures 2 & 3).

Figure 2: View of #45 axle mounts prior to electrolytic cleaning.

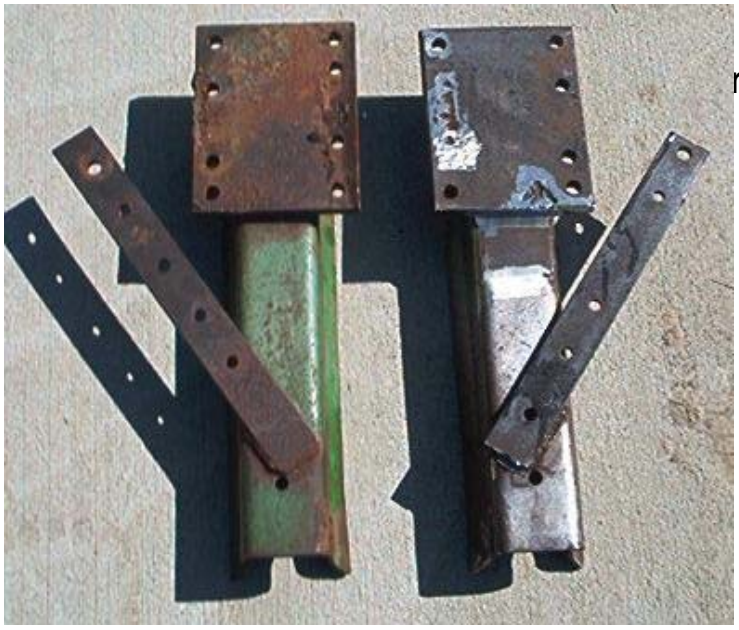

Figure 3: Comparison of original finish with one mount after 30 hours in bath. Light scrubbing with Scotch-Brite® pad under clear water rinse. Rusting will occur again without primer or oil !

This reaction is for the most part line of sight, so the placement of your electrode is important. Feel free to add as many electrodes as your charger can accommodate. I even link parts to be cleaned together with wire until I reach the load of my charger. You can also pass a rod down into a passage to clean something out, but you may have to play around with insulating parts of the electrode so that it doesn't short against the part. I have even placed a long rod from a hydraulic cylinder into a PVC pipe to soak, and it worked well. Almost any container can be fabricated. It just has to be able to support itself, and hold water.

Because almost any piece of iron or steel has some rust on its surface, even under the paint, soaking in an electrolytic bath can and probably will damage or remove paint. If you use lye as the electrolyte, this can almost be guaranteed. For me, that was a real plus to using this method. The lye electrolyte does the best job on grease, too. I call it my "Electrical Paint and Rust Remover". By the way, I figure if I run mine 365 days a year, I won't use over $60 in power, and that won't begin to buy the oven cleaner and chemical paint remover that I'd need to accomplish the same amount of cleaning.

I have cleaned exhaust manifolds, cylinder heads, engine parts, sheet metal, even bolts with rusted nuts on them, and have been very pleased with the results. I even soaked my belt pulley assembly (after removing the bearing) and it came out very nice. It even cleaned to flaky rust out of cotter pin eyes and the rust from the clutch bolt threads.

The solution can get pretty nasty looking, but it really doesn't ever need to be changed, though sometimes you may want to do so. You can strain it through some panty hose (but now that you're single, how you gonna get those?), or skim off the large pieces of debris and foam. It's mildly basic, so you can pour it out in the yard, and hose things down well. The grass will like it as it normally likes to be limed anyway. But please! Check with local ordinances first!

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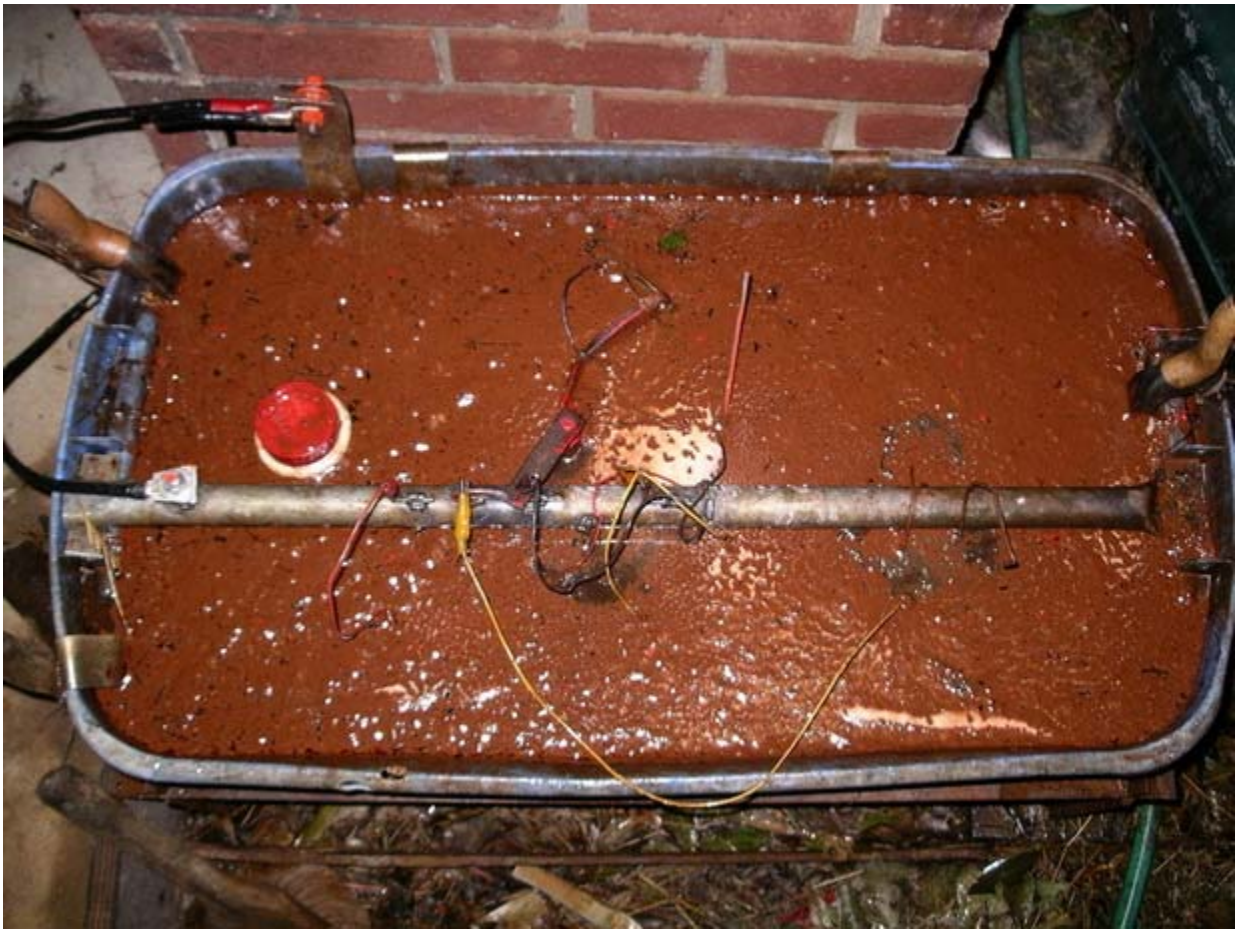

You can clean your sacrificial electrode with a wire brush from time to time, as this helps to maintain peak conductivity. If I really want to clean the electrode well, I'll put it in the bath hooked up as the part, and use another electrode. That really makes the rust fly off of the electrode. By morning, it's ready to go. Eventually, the electrode can rust no more, and must be replaced (see Figure 4). Remember, now is the time to weld together all sorts of bits of junk. My steel fence post electrode is very rugged and extremely durable.

If you are going to prime your part right away, it can be coated as soon as it is completely dry. If the part is for an internal engine or gear box use, I oil or grease it lightly prior to storage, just like you would if the it was a new part. If it will be a while before you can get to the priming, I like to treat the surface with a phosphoric acid product like Ospho brand, Ph-Ospho-Ric+, or Jasco Prime and Prep. There are many products out there that contain sufficient amounts of phosphoric acid, so read the labels. I have found these three products at my automotive paint supplier and in the paint prep aisles of Home Depot/Lowe's/Ace Hardware. Here is a typical product label:

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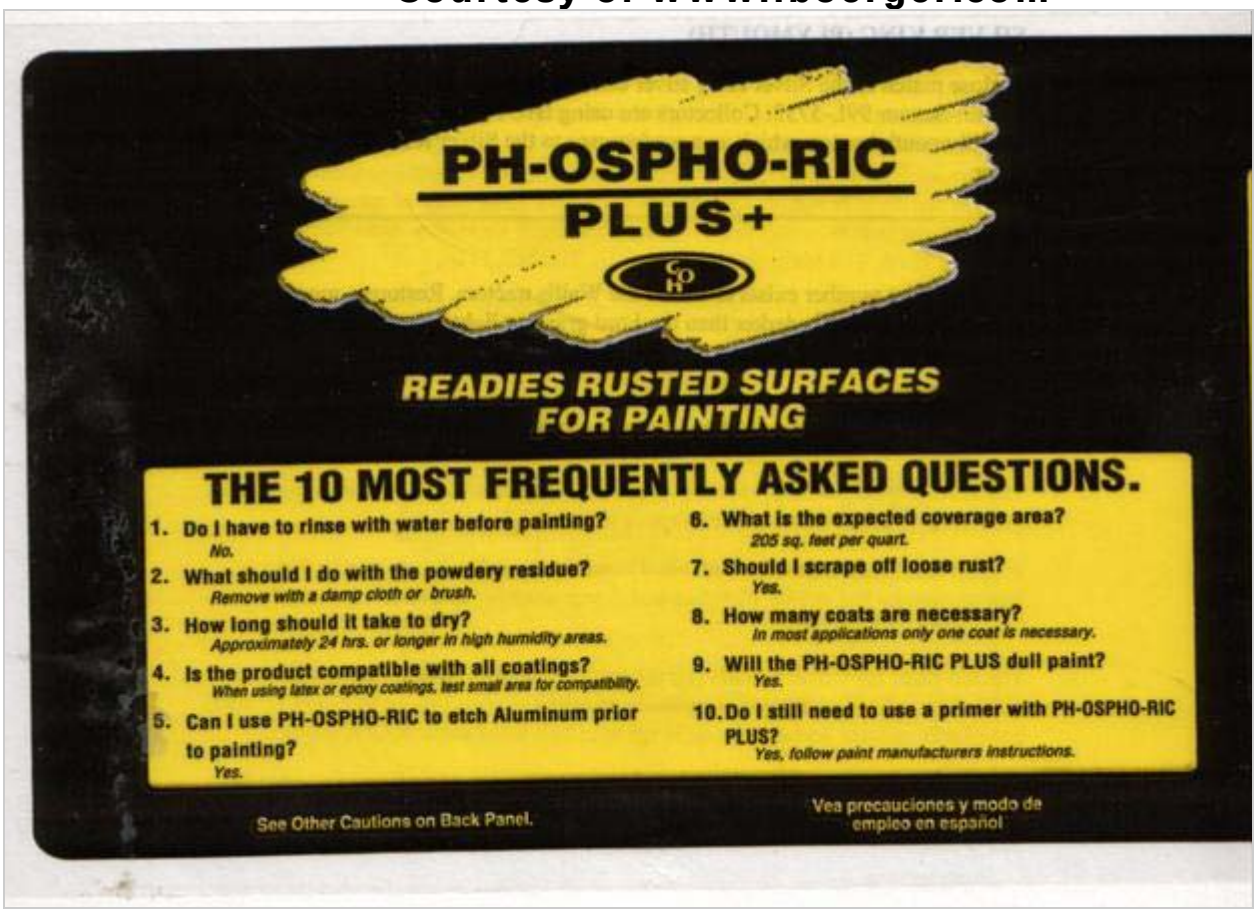

After the phosphoric acid has been applied and left to dry, the part can be stored inside for quite a while, if not for years. When I am ready to prime and paint, I scrub the dry surface once again with a fresh bit of brown Scotch Brite, wipe down with a tack cloth, and apply my coatings.

I've been very pleased with this process, and I hope you'll try using electrolysis on your next project. It's simple, cheap, and all you have to do is let the electricity do the work and sit back and wait for the results.

You can contact me at frank@fboerger.com if you have any questions.

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Figure 4: My original 16 Ga. sheet steel electrode is nearing retirement !