

# Rust Removal Using Electrolysis



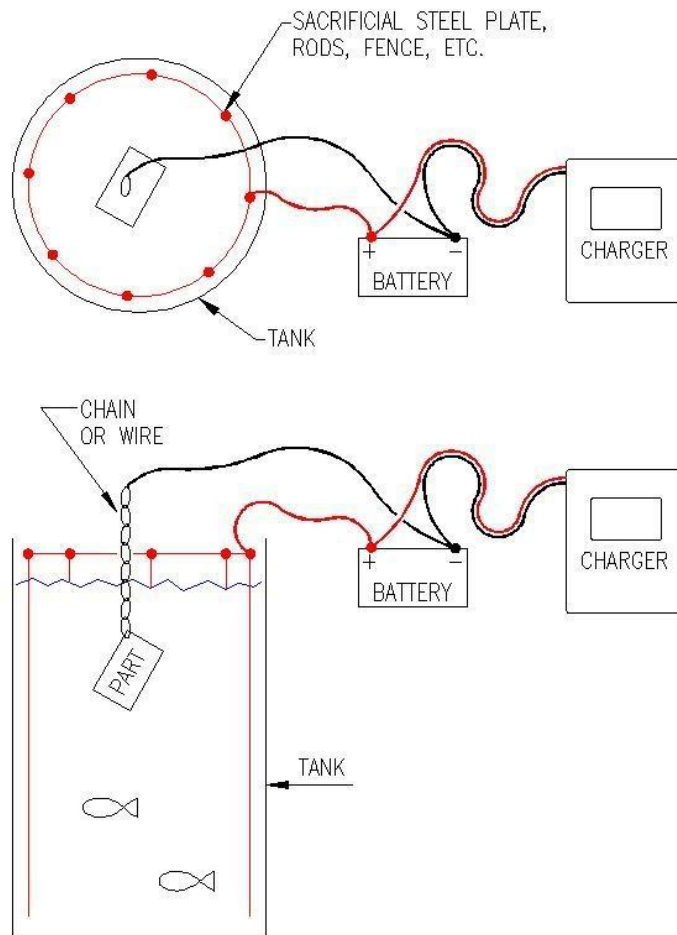
Some people have provided physical protection to prevent the sacrificial metal from touching parts. One of the best ideas I have seen was to cut a piece of 3/4" PVC pipe for each piece of rebar. Drill a series of large holes in the pipe about 1" apart and put the piece of rebar inside. The rebar can still "see" your parts through the holes, but the PVC helps keep them from actually touching.

**ELECTROLYTE:** Electrolyte is the washing soda and water solution in your tank. You only need about 1/4 cup of washing soda for each 5-gallons of water. That is enough to get the current flowing. Adding more washing soda will make the solution more conductive and increase the amount of current flow, but does not appear to speed up the process and may burn out your charger. This is a case where more is not better, it simply wastes energy. Start with about 1/4 cup per 5 gallons and adjust to your conditions. You can fine-tune the mixture by watching your ammeter and stirring in a little more washing soda. If you see bubbles forming on the parts, the process is working.

The electrolyte will last indefinitely, it just gets more and more old rust and paint deposited as sediment at the bottom. If you don't stir it up, it can just lay there. You should have a lid for your tank to keep trash out. A lid also greatly slows evaporation loss. You don't need to add more washing soda when you replace water lost by evaporation. Only the water evaporates, the original washing soda stays in the tank.

The solution strength indicated with just washing soda is a bit caustic. It can be irritating if you have sensitive skin or if you leave it on your skin long enough to get a reaction. Don't splash it in

your eyes! I wear [safety glasses](#) as a rule in the work shop. It is a good habit to get into. Some people add lye or other ingredients. I don't believe the health risk is worth any benefit these products may have. You might as well just use chemical paint strippers and rust removers.



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## STAINLESS STEEL:

There are some warnings on the web that using STAINLESS STEEL for the sacrificial anode may create hazardous waste. Stainless steel will certainly last much longer than plain steel. The warnings claim that, as the stainless steel breaks down, it releases chromium and other toxic substances into the electrolyte, turning it into toxic waste. I seriously doubt if these warnings are completely true (probably 1% truth, 99% exaggeration). In my ignorance, I am going to stick with plain steel for my sacrificial anode. Mostly because I have an abundant supply of used welded wire fence fabric. You shouldn't use galvanized metal, for the sacrificial steel. But the galvanizing has almost completely weathered away on the old fence material I am using. The fence fabric has a much larger surface area than using a few pieces of rebar. That creates many more "sight" lines to the rusty parts and works great for me.

Other substances like copper, zinc, oil, grease, paint chemicals and alloy metals may eventually contaminate your electrolyte. If you notice strange colors being deposited on your parts, it may be time to drain and clean your tank. I don't bother. The tiny bit of electroplated foreign material seems to have no effect on any of my parts (so far).

## **MONITORING:**

Electrolysis with washing soda requires very little monitoring. Iron and steel parts can be left to cook indefinitely with no damage. They may get a little warm, but the process only removes rust and loosens most paint. Once all the rust is removed, the parts just hang in the vat with a little current going through them. I have often left parts cooking overnight. Be very careful with parts made with aluminum, brass, and other metals. Plated finishes could easily be ruined. I have not had any problems using my tank to remove paint from the few non-steel parts I have tried, but you could ruin some non-steel parts if you left them cooking unattended.

## **LINE-OF-SIGHT:**

Electrolysis is largely a line-of-sight process. The sacrificial metal needs to be able to SEE the rust. The larger your tank and the more distance you put between the part and your sacrificial metal, the better your tank will be at cleaning odd-shaped parts. Loose paint and dirt can block the process from working on the rust. Most paint is conductive enough to allow the process to work through it and loosen the paint. I have found that it helps to occasionally pull the parts out for a moment and brush most of the loosened stuff off by hand. It can be a bit tricky to get all the rust out of cracks and crevices. I usually still need to do a little wire brushing and scraping before the parts are clean enough to powder-coat them.

It is possible to clean inside something (like a gas tank), you have to set up an inside-out version with the sacrificial metal inside the part you want to clean. I have done this by attaching an insulated wire to a piece of sacrificial metal (big rusty bolt) then wrapping the sacrificial metal with a porous insulating material (PVC pipe drilled full of holes works good). Put the insulated sacrificial metal inside the part you want to clean. Attach the negative lead to the part, and the positive lead to the insulated wire coming from your sacrificial metal, then fill the tank with electrolyte, or sink the whole works into your tank if the part won't actually hold water.

**STRENGTH:** If you do find Sodium Carbonate in a swimming pool supply store, it may be PURE Sodium Carbonate. The Arm-N-Hammer Washing Soda may look like a dry powder, but it actually contains about 15% water. Start with much less of the ph-UP product or you may peg your ammeter and burn up your charger.

If you cannot find washing soda and want to try this on a small scale to test it, Arm-N-Hammer Baking Soda will work. It is less effective and there are other disadvantages, but I did it, and was pleased enough with the results to move up to a bigger tank with washing soda.

## **NEGATIVE LEAD:**

Hook the wires up backwards and your vintage part will become sacrificial! Please make sure your sacrificial metal is always connected to the positive terminal (RED) and good parts are connected to the negative terminal (BLACK)! Any class in basic electricity will explain that current is the flow of positive or negative charges, and because the positive charges are stationary in the various types of metals used as conductors, the negative electrons are actually moving from negative to positive (the direction opposite of conventional current flow). This is a case where too much knowledge only serves to confuse. Just remember any items connected to the RED lead will become sacrificial, and will RUST!

## **FINISHING:**

The rust attached to good metal is converted to an iron oxide and magnetite. This looks like a black powder on the parts. This residue should wipe off easily as soon as you pull the part out. The clean metal will immediately start rusting if you don't use something to prevent it. Let it dry on there and it will help keep the parts from rusting if you aren't going to finish them immediately. You can later put the part back in the tank for a while to loosen the black stuff, or just prime and paint over it. Most of my parts still need some wire brushing and/or light sanding before I feel like they are ready to be finished.

Heavily rusted parts do not come out smooth. The rust is loosened from the good metal, most will fall off. After cleaning, the part will have pits and valleys where the rust was. Electrolysis will not fill those pits and valleys with new steel. For a smooth finish you may need to apply a skim coat of filler.

## **EXPLOSIVE GAS:**

**YES!** This process does generate hydrogen and oxygen gas. These gasses will burn VERY enthusiastically if allowed to accumulate. Remember the Hindenburg? The local 6:PM news anchor may use the word "explosion" to describe the event as they show pictures of the fire truck spraying water on what is left of your shop. Even outside, the area immediately above your tank is a bad place to generate a spark. Turn the power off before fiddling with the electrical connections. If you have a cigarette in your mouth, don't lean over to inspect the process. **DO NOT** leave your tank running while completely covered. You need good ventilation.

## **FREEZING**

My tank sits outside all winter and usually does not freeze. The washing soda lowers the freezing point slightly below the average low temperature for VA. If the temperature will be significantly below freezing for several days, my tank will start to freeze, unless it is in-use.