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Electrolytic Rust Removal aka Magic



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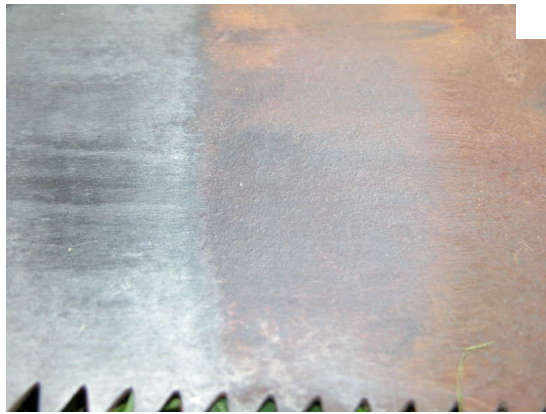
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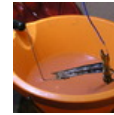
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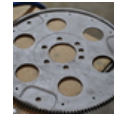
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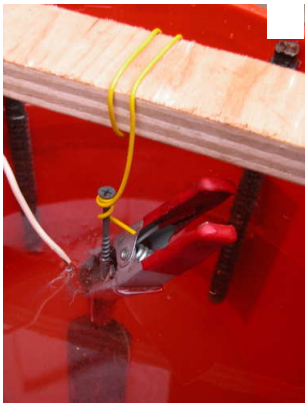
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This is a relatively simple, safe and cheap way to remove light or heavy rust from any ferrous object. I used this process to restore an old wood plane that I bought for \$1 (it looked totally un-usable because of the rust). As opposed to grinding, heavy wire brushing and acid bath processes, this method removes none of the original steel and is not noisy or caustic.

How this works:

Several other sites do a better job of explaining the chemistry of this - but basically you set up a conductive solution and insert some sacrificial anodes. You hang your rusted tool in the solution and attach it to the negative end of the power supply. You attach the positive end to the anode and turn on the power. The current travels through the solution and in the process flakes off the rust - the flaking/softening occurs because of the reaction at the surface of the good steel that pushes the rust off.

See [this site](#)

for more info on the chemistry of it all. (now linked to a waybackmachine archive of the site - modern suggestions for this background are welcome).

Step 1 Gather supplies



You will need:

This project cost me about \$40 because I did not have access to a small battery charger. If you have a charger, then most folks with a decent shop full of crap can do it for almost nothing.

- Clean 5 gallon spackle bucket or other plastic container to meet your size needs
- 5 sections of 18" long 1/2" steel rebar (\$5 at Home Depot – buy in longer sections as needed) (DO NOT USE STAINLESS STEEL)
- 5 feet 12 awg (or so) insulated copper wire in two colors
- 5 yellow wire nuts
- several red wire nuts
- 5 feet pliable tie wire (non insulated) SEE UPDATE on Step 2 - the tie wire rusts out after about a year - you may want to use something more substantial or resistant to rusting.
- Box of **washing soda** NOT baking soda
- Anti-oxidant goo (IE **Noalox** – This is not necessary but helps I think.
- Small battery charger or home made power supply (\$20-\$50 at AutoZone etc) - Its best if the charger

has a 6v option and an internal "trouble" switch that stops charging if something shorts out.

- Variety pack of alligator clips from RadioShack (unless charger comes with decent ones...)
- Outside outlet or extension cord
- GFCI protected outlet (this is a must in my opinion - working around power and water is stupid unless you have **GFCI protection**)
- 5 gal water
- misc clamps/small boards
- drill with 1/4 bit
- wire cutting and twisting pliers (**linemans tools** are best)
- wire brush (better if on a grinder or dremel tool)
- anti rust spray or light oil

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338 comments **Add Comment**

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PitStoP says:

Can this process be used to remove rust from chrome plated metal? I want to restore a drum set and most of the chrome has rust. Any info and advice on doing this will be appreciated. Thanks

1

Oct 1, 2012. 4:14 PM

flag **Reply**



morren says:

Great job! That stamp is interesting... it looks like it says "nsted, CONN, USA". I live in Winsted, CONN, USA... humm....

Jul 31, 2006. 10:05 AM

flag **Reply**



PRO ToolNut (author) says:

Thanks! I also wondered about that stamp. Tthe plane was made in New Haven.... Ive been buying these tools in CT so im guessing many of the old timers bought local stuff...

5

Jul 31, 2006. 12:35 PM

flag **Reply**



zacker says:

is it an old Sargent plane from Sargents in new Haven? lol Im from Hamden Ct. and Sargents (in the 1980s) was a good customer of ours, t that time they just made locks.

Sep 17, 2012. 1:00 PM

flag **Reply**



tbird2340 says:

Great article.. So what is the consensus for the metal to use if not the rebar?

Also, I don't have any of that tire wire and not sure HD or Lowes even sells that.. Can you just use electrical wire for that?

Anyone know what store(s) have washing soda readily available?

I have this charger here: http://www.amazon.com/Battery-Tender-021-0128-Plus-Charger/dp/B00068XCQU/ref=sr_1_1?s=automotive&ie=UTF8&qid=1336404217&sr=1-1 (12V 1.25A).. Will it work OK?

I plan on dunking my rotor(s) and hopefully my calipers as well..

May 7, 2012. 8:30 AM

flag **Reply**



jak442 says:

I found Washing Soda at Fred Meyer and assume it can be had at other Kroger stores like QFC, but sodium carbonate is also sold as a PH up product for pools and spas and as a water softener. I found some at Home Depot, but had to ask where their very well hidden pool chemicals were.

This is my first post here and I don't wish to offend, but this isn't an instructable for the perfect electrolysis tank, just ToolNut's design of "an" electrolysis tank. That's not meant to criticize, but to point out that every single thing can be replaced with something else(except water and electricity) that you probably already have and that might actually work better. Don't get hung up on the details.

Ideally you'd want the surface area of your anode to be equal to or greater than that of the cathode(the part you're trying to clean).

The battery tender should work just fine, but might switch to "float" as the part gets cleaner.

Jun 3, 2012. 6:52 PM

flag **Reply**



allniterunner says:

tbird2340

It's been a while but SCUBA shops used to have all plastic wire ties, to prevent various attached items from disappearing due to corrosion.

Good Luck

jim

May 11, 2012. 5:46 PM

flag [Reply](#)



allniterunner says:

May 11, 2012. 5:41 PM

ToolNut and everybody else on this site.
I'm new to the site and retirement. This tutorial is just what I need to salvage stuff I've accumulated over the years. I know I'm anal and maybe my concern has been addressed in an earlier post, and if it has I hope the administrator will delete this comment. But if anybody's concerned about safety, NEVER NEVER use the wrong colored clips for connections. RED is always positive and an uninformed person with the best intentions could mix things up and trash a good charger. I'm sorry, what I was referring to were the pictures in Steps 2,5&6. Please correct me if I'm wrong and I appologize if I am.. But isn't there a red clip connected to the blade? and shouldn't it be a negative connection (black) I hope I didn't offend anyone.

Be Safe
jim

flag [Reply](#)



PRO ToolNut (author) says:

May 15, 2012. 6:29 AM

It is a red clamp, but not related to polarity. I had to use a spring clamp to hold the wire onto the tool, and the clamp I happened to have was red. I can see how that would be confusing. If I ever re-do the pictures, I'll buy black clamps for the tool. the wiring is negative to the rusty tool, positive to the rebar/anodes. Step 4 outlines this.

No offense - and good clarification! I will make a note on the picture.

flag [Reply](#)



allniterunner says:

May 25, 2012. 7:25 AM

ToolNut

My most humble apologies. Considering all the great contributions you've made to Instructables I had no right to question your method and should have understood better what you meant by initial set-up. The operation worked better than I could've asked for and did a great job on my parts. I'm sorry that my initial post had to be one as a snob. You did great portraying the concept of how it should be set-up, and I failed to be more comprehensive in my reading. As I sit at your bench of wisdom I hope to absorb many more ideas and tricks of the trade that I missed the first time around.

Thank you for not torching me
jim

flag [Reply](#)



PRO jexter says:
allniterunner,

May 25, 2012. 10:30 AM

I don't think you need to apologize, and he can correct me if I'm wrong, but I think ToolNut didn't expect an apology either. The fact that you might not have commented if you had been "more comprehensive" in your reading actually highlights one of the risks of Instructables: a picture is worth a thousand words. That red-handled spring clamp DOES look an awful lot like the positive clamp of a battery charger, and you may have saved someone from using their favorite old tool as a sacrificial anode to brighten up some cheap rebar!

Instructables has no shortage of "concern trolls" (NEVER do ANYTHING with electricity EVER!!!!1!), but the good authors seem to welcome comments that point to photos or text that might be misinterpreted by reasonably intelligent people.

Cheers,

jexter

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PRO ToolNut (author) says:

May 15, 2012. 6:43 AM

Also, note that I state on the photo that uses this clamp that its a hokey set up as my first run, and the alligator clips were a good upgrade.

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wb8nbs says:

May 24, 2012. 7:44 AM

I've used electrolysis a lot for old tools I get for next to nothing at garage sales. My main tank is a five gallon bucket with 6 inch wide steel plates on either side. I have plastic grids cut from a milk crate attached to the the plates to lessen the danger of short circuits. I have made odd shaped tanks from wood, for example a long shallow one for de-rusting hand saw blades. Salvaged a couple of vintage Disstons with that. Just lined the crude wooden trough with a thick garbage bag.

I set up the tank with the work piece inserted and fill with water from the garden hose. The carbonate does not dissolve easily in cold water. I get a half gallon of hot water and dissolve a handful in that. Then add slowly to the main tank until the charger current comes up to what I want. I have an old 6 amp 6/12 volt charger. I don't know the chemistry either, but believe the lower voltage works better, and it is really amps per square inch of tool surface that controls the process.

I pull the tools out about every half hour and give them a light scrub with a brass bristle brush. The brass won't scratch cast iron. You can find good brass brushes at stores selling barbeque grills. Watch that they are not just brass plated steel though. If you scrub the piece while it is wet with carbonate, some of the brass will plate over onto the iron, giving it a slight yellow cast. I think it looks

antiquely. If you don't like that idea, rinse the piece well before brushing.

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pet1415 says:
I need the name for my science fair please. Great article

May 13, 2012. 1:11 PM

flag [Reply](#)



metalart72 says:
Awesome instructable! So much detail! I have been electrolytically been removing rust since 2007. I use it for bigger pieces of steel that I weld together for my metal art. You know reversing the polarity would be a good way to get a rust patina if that is your desired outcome.

Feb 17, 2012. 6:07 AM

I wrote an article featuring this instructable, check it out here at <http://www.squidoo.com/electrolytic-rust-removal>. I will be adding more content as I go along so stay tuned!

flag [Reply](#)



pro5200 says:
Can I use caustic soda (NaOH) ?

Feb 7, 2012. 9:57 PM

flag [Reply](#)



LynxSys says:
A great and thorough Instructable!

Jan 26, 2012. 2:30 PM

A suggestion for those of you who might be using this method to remove rust from an older steel-frame bicycle. Electrolysis is the only method that I know of which can completely de-rust the **inside** of a bicycle's frame. It can be accomplished by putting a metal anode in the tubes, surrounded by a perforated insulator to prevent direct contact with the cathode (bike frame).

For the seat-post tube you can use something like a piece of rebar inside a piece of PVC pipe with a lot of holes drilled in the pipe. For tubes that are harder to get something into (e.g. the top tube & down tube), you'll need something more flexible. An old chunk of steel cable or the jacketing from metal coated electrical cable can work, provided you can find something that's not stainless or galvanized. Then you just need to put your flexible anode inside some old hose with a whole lot of holes cut in it and feed it into the hard-to-reach spots.

I'd also suggest not de-rusting the inside of a frame at the same time as the outside. With the anodes inside the tubes, they're very close to the cathode, and so will slow down the rust-removal from parts that are farther away from their corresponding anodes, like the outside of the frame.

I hope that this helps someone to keep a classic bike back on the road!

flag [Reply](#)



augur45 says:
Continuing experimentation with electrolytic rust removal...

Jan 22, 2012. 8:50 AM

1

Turns out all that is needed is something to make the water conductive. The action of electrons leaving the (negative)workpiece on their way to the (positive)anode knocks the non-conductive rust off the workpiece. So don't fret over TSP/baking/washing-soda issue. Use any of them. In fact, plain old salt works fine: table salt, rock salt, ice-melter salt, water-softener salt. I used a cup of salt per gallon of water.

Using salt, I know for sure that hydrogen and oxygen are produced during operation. So long you don't trap these gases somehow, they will dissipate far to rapidly to be an explosion hazard, but I wouldn't tempt fate by making a spark over or in the bucket during operation. Unplug your DC power supply first, THEN disconnect your electrodes.

flag [Reply](#)



PRO maverickcanakay says:
This is to help a lot of you understand how to make this work better. Please don't get offended by what I say I'm not going into my back ground of what I do but I do know what I'm talking about.

Jan 7, 2012. 8:25 PM

1. stainless steel does not conduct amps well don't use it.
2. Copper for your anode is better used and a copper pipe flattening ¾ of it with a hammer
3. the further your anode is away from your work piece is bad it takes more amps and time to work on cleaning.
4. Power 1 to 12 volts they don't matter at all amps is what matters 10 amps works the best no closer than 4 inches from what you are cleaning the farther your anode is from what you are cleaning the more amps it takes to do the job.
5. Cleaning soap phosphates use TSP you will find it in a store that sales paint it is a mild soap use for cleaning walls in the house to paint. It will not harm you. Plus add two cups of white vinegar to 4 gallons of water in your 5 gallon buck of water mix with soap it will help to conduct the amps better. O and what I mean that TSP won't harm you I mean your hands please people don't drink it is a small joke:)

and one more thing please people stop telling people that stainless steel is toxic if they use it because its not it just wont carrier the amps. The only way to make it toxic is to weld with it over a long time or by passing volts throw it at high amps in a acid bath and I mean amps 150 amps and up.

Thank you for your time hope this helps

flag [Reply](#)



PRO ToolNut (author) says:

Jan 12, 2012. 8:53 PM

one more thing re copper - and I don't know squat about this statement, but am curious about this guy's take on it:

5

http://www.rickswoodshopcreations.com/Miscellaneous/Rust_Removal.htm

"It is important that any copper connected to the anode does not touch the solution. If it does, copper will oxidize to cupric ion, Cu^{++} . The connector will be destroyed. Most of the copper ions formed should precipitate as copper carbonate or copper hydroxide, but if any of this dissolved copper reaches the cathode it will be reduced to copper metal on the iron object. Its presence will promote rapid re-rusting."

flag [Reply](#)



PRO ToolNut (author) says:

Jan 12, 2012. 8:52 PM

maverickcanakay - good stuff! I appreciate the input, and I may figure out how to incorporate some of this advice into the actual instructable with some updates. I'm curious about your background in this, but fine if you'd rather not share.

5

Re the stainless steel advice - there is simply too much other advice out there warning of the potential hazards of this, so I am going to maintain my statement that stainless should not be used. For example, here is one of the original electrolytic rust removal sites that was inspiration for this instructable:

<http://antique-engines.com/stainless-steel-electrodes.htm>

So anyway, I'm going to stick to err on the side of caution on this one and continue to caution against stainless, but am interested if there is something definitive on this. Lastly, I don't see a real benefit to stainless, it's more expensive, and we are talking about a disposable anode by definition, no matter what kind of conductive material it is...

flag [Reply](#)



SvenPetersen says:

Jan 14, 2012. 12:25 AM

I have done a ton of this rust removal process. I mean well over a ton. I completely restored a 14x40 Davis metal lathe and a Index vertical end mill. Both were completely rusted solid. They are now ~100% operational. I used almost exactly the process listed above with only minor differences.

1. I only used washing soda in a 1tbsp /gal ratio. My largest tank was 7ft W X 3ft L X 3ft D. This was for the lathe bed and the Mill body.
 2. My anodes are always steel plate. Plain old 1/8" mild steel. Pieces about 10inx 12 in. In the large tank I had 8 of them. In a 35gal plastic garbage can where I did most everything I used 2. I drilled a hole and bolted bailing wire (now called tie wire) to them and hung them in the bath.
 3. I clean my pieces using a plastic bristle brush and some orange gojo degreasing hand cleaning stuff. Just get the grease off your part so it will conduct. This process has removed everything from unseen grease and dirt & paint, but especially rust!
 4. Leave overnight.
 5. remove the anodes and simply wire brush the crud off and set them aside to be used again. The anodes will corrode completely away eventually. I think it kinda looks cool the pitting and corrosion that occurs on the anode. the way I see it, the more surface area of the anode the more electrons can flow onto it and the more rust it removes.
- Sorry I don't have pics of the tank (I may somewhere) but I do have before and after pics of the machines, however in the after they are completely repainted. I've done parts hanging half in the bath then rotated over after the first part is done. Screws bolts and nuts are easy when you simply cut a long piece of wire then tie them all together with a couple wraps around them and space them about 1" apart. the results are nothing short of amazing. There is no damage to the original part.
- Warning!! Get the polarity right! If not you will corrode whatever you are cleaning into something unusable really quickly.





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PRO ToolNut (author) says:

Nice man - that is some serious restoration dedication. You are inspiring me to scale up my ideas here. What did you use for a power source? Batt charger? If you find pics of the tanks, I would love to see.

5

Jan 16, 2012. 7:13 PM

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dwhite0 says:

Leave the top of the rebar up out of the water for the electrical connections to eliminate corrosion. Or, bend top over 90 degrees and poke thru bucket above water line to make electrical connections.

Jan 10, 2012. 4:43 PM

flag [Reply](#)



PRO ToolNut (author) says:

more good ideas for v2.0...Thanks!

5

Jan 12, 2012. 8:39 PM

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Ian.Harrold says:

So why did you not connect the first to the last rebar? Electrically it is already connected, but I would think you would want provide even electron flow by tying them together.

May 9, 2011. 12:26 PM

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PRO ToolNut (author) says:

Hey Ian -Sorry for the massive delay in responding (kids!) - I dont think it was a super well thought out aspect of the design. I don't I agree with corey11 (see my response below) that it would be catastrophic - but any system you design you need to be comfortable with the safety etc etc. I didnt worry about even electron flow because I dont think its enough current to run into resistance issues by having to go further around the bucket, and honestly it was one less connection I had to wire together! Though it does mean that if you have a bad connection at the rebar (or eventual rusting out of wire) then the whole line goes out rather than just half.

5

Jan 12, 2012. 8:37 PM

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bongodrummer says:

I am intrigued and wondering the same thing?? Why not ToolNut?

May 20, 2011. 4:07 AM

flag [Reply](#)



corey11 says:

because it could short circuit the (anode? or cathode?) the negative terminal by completing the circuit therefore welding everything to itself. Bad idea.

3

Oct 25, 2011. 8:20 PM

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PRO ToolNut (author) says:

Really?? I cant figure that one out - it would basically be a loop on the end of a negative circuit - its not touching back to the positive - just the negatives all connecting together... Basically a big version of the little loop on the negative terminal of your car battery as far as I can tell... Or am I missing something?

5

Jan 12, 2012. 8:33 PM

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PRO The Insomniac says:

Would this work for removing oxidation from brass, assuming you replaced the anodes with brass ones?

Nov 14, 2011. 8:01 PM

5

flag [Reply](#)



PRO ToolNut (author) says:

I'm not sure if this would work on brass -one thing I worry about is a similar situation to doing stainless - that the process to end up causing something to come 'unglued' so to speak with the alloy and cause problems. Some brass has lead in it, lots of different configurations. This method excels at removing chunky thick rust - but leaves some oxidation you still have to get off with steel wool etc - so I doubt it would be worth it. Just my 2c...

Jan 12, 2012. 8:31 PM

5

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rlm98253 says:

"UPDATE: the tie wire eventually rusts out - mine in less than a year. Consider using something more resistant to rust - suggestions welcome."

May 15, 2011. 11:08 AM

Bare 12 gauge copper wire is excellent to secure the rebar for this project.

flag [Reply](#)



PRO ToolNut (author) says:

I'm going to build v2.0 this winter and try that... Thanks.

Jan 12, 2012. 8:25 PM

5

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vandenEynj says:

I have very successfully derusted a whole 1916 FWD truck and a 1915 model T using this method, After the derusting cycle all parts were wire brushed and came out as new with no pitting other than that caused by deep rust. Do not use any other metal but steel and cast iron. Do not use stainless steel as catodes, by product is cancer causing, The used up solution after derusting can be spread on your lawn, the gras loves the extra food. This method also will strip off paint, body filler etc but no grease.

Apr 23, 2011. 6:10 PM

flag [Reply](#)



PRO ToolNut (author) says:

awesome!

Jan 12, 2012. 8:24 PM

5

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peich1 says:

I have set this up using the same car charger and one piece of rebar. After about 30 minutes black stuff is falling off the rebar but nothing has happened to the piece of metal that I am trying to derust. Red to the rebar and black to the rusted metal..any ideas.

Sep 27, 2011. 2:05 PM

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PRO ToolNut (author) says:

Did you ever get this going? My set up usually ran much longer than 30 minutes - overnight or for a day depending on how much rust. pcooper2 is probably right that rebar isnt a great conductor, but it worked fine for me and others, and is cheaper to set up than other things. I dont know how other electrodes like copper, etc would work out. The other thing to remember is that the process needs line of sight (more or less) between the electrode and the rusty object. If you only have one rebar, its not going to work well on the opposite side of the rusty steel you are trying to clean up. Good luck!

Jan 12, 2012. 8:23 PM

5

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pcooper2 says:

Rebar isn't good choice of electrode. It is typically covered with a thick coating of mill scale (the "black stuff"), which is non-conductive. You'd probably have to try to get some of the mill scale off with a chipping hammer to expose the bare steel.

Jan 7, 2012. 1:41 PM

1

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mrlunna13 says:

Hello,

Please forgive my ignoramusity, I have never done rust removing with this method. My dilemma started when I acquired a very vintage/old, super crusty, rusty, from the fifties gas tank. It is crusty with rust inside and out.

My question is: Will this method work on my new to me tank? Or, Should I do the inside fist, and then do the outside?

Any and all help will be tremendously appreciated.

Thanks,

Jesse

(MrLunna13)

Jul 29, 2011. 10:05 PM



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