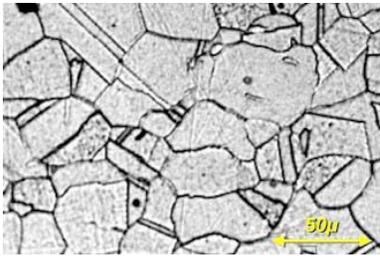


**1** Rust is what happens when you expose iron and steel to air and water. The ions in the water cause the iron atoms in your tools to combine with the oxygen atoms and create  $\text{Fe}_2\text{O}_3$ , or **orange rust**. This is bad rust, the kind that eats away at the metal and will eventually ruin your tools. There is such a thing as “good” rust,  $\text{Fe}_3\text{O}_4$ , also called **black oxide**. When stabilized, this actually protects your tools from bad rust. What makes orange rust so much worse than black oxide or other forms of rust, is that it converts the dense crystalline structure of the metal to a loose, lattice-like structure that flakes away easily. If left unchecked, the rust first weakens the metal, then eats it away completely.

*A clean steel surface magnified, below left. A steel surface allowed to rust for several weeks, below right.*



**2** Rust only forms when conditions are right – when there is enough water and air. Iron will rust when the relative humidity in the air climbs above 50%, and steel rusts when the relative humidity reaches 80%. If your shop is unheated, iron and steel tools will also rust when the nights are cooler than the days. At dawn, the temperature of the air rises faster than dense solids and moisture condenses on the cool metal surfaces. One way to prevent rust is to change the shop environment – either heat the shop to keep the tools surfaces warm or install a dehumidifier to remove the humidity from the air.

**3** If neither of these are an option for you, there are other things you can do to **prevent** your tools from rusting.

- One of the best is to **wax and buff** the metal surfaces. This not only creates a barrier to the moisture, it also lubricates the surfaces helping the wood to slide across them.
- Machinists like to wipe their tools with **oily rags**. This not only creates a barrier to moisture; it removes moisture and acids that are transferred from your hands to the tool surfaces.
- You can wipe the tools down with a mixture of anhydrous **lanolin and mineral spirits**. This offers the same protection as oil.

4

There are good rust preventatives that you can buy.

- The easiest to use, perhaps, are **spray-on chemicals** – Starrett *M-1*, Boshield *T-9*, *Top Coat*, *Way Lube*, and the old stand-by, *WD-40*. The "WD," by the way, stand for "water displacement." It was originally formulated for rust prevention.
- There are **wipe-on rust preventatives** on the market such as *Tool Wipes*.
- You can either save the special paper that many tools come wrapped in or buy it new. This called "**VPI**" **paper**; it's impregnated with chemicals that condense on your tools to form a moisture barrier; and it's an effective way to prevent rust especially for tools that you have in storage or those that you only use once in a while.
- If you store small tools in drawers or tool boxes, **camphor tablets** and **Vapor Tabs** both release oils that condense on the metal surface to form a moisture barrier.
- Keep a **desiccant** – a hygroscopic chemical such as silica gel – in your tool drawers to absorb moisture before it condenses on the tool surfaces.

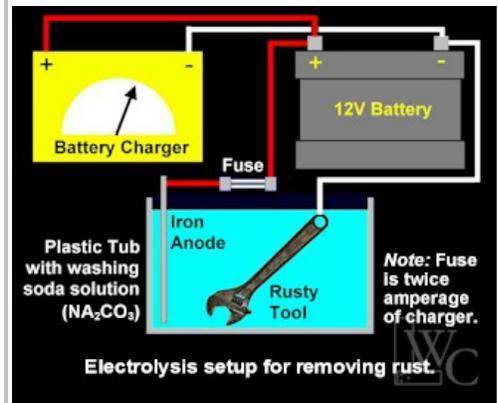
5

If the corrosion has gotten out of hand and you need to **remove rust** from your tools, there are several chemicals that will help do this.

- Use a **chelator** such as *Naval Jelly*. Or, you can also make your own chelator by mixing black strap molasses and water. Chelators are chemicals that bond with the orange rust, hold it in solution, and let you wipe it away.
- Use a **mild acid** such as phosphoric acid to etch the rust and remove it. DuPont *Qwik Prep* has both phosphoric acid to remove the rust and alcohol to dissolve the grease. This is an excellent product for cleaning a lightly rusted metal surface and preparing it to be painted.
- **Electrolysis** reverses the little electron dance that causes the rust to form in the first place. Immerse the tool in an electrolytic solution made from washing soda and water, hook the negative (-) pole of a car battery to the tool, and the positive (+) pole to a scrap of steel. Place the scrap in the solution, but don't let it touch the tool. The rust will seem to "jump" off the tool and deposit itself on the scrap.



The steel tube in the background was once as rusty as the one in the foreground. We removed the rust with a chemical chelator.



6

And there's good old-fashioned elbow-grease and **abrasives** for removing rust. These include:

- **Sandpaper sheets**, flutter sheets, and flex or flap sanders for drills and rotary tools.
- **Rubber-bonded abrasives** such as *Rust Erasers*. These also come as solid wheels and wheels of bristles for rotary tools.
- **Surface conditioners** – nylon and fiberglass materials impregnated with abrasives, such as 3M's *Scotch Brite*. These come in pads, discs for drills and rotary tools, even sanding belts for strip sanders.



A "Rust Eraser," a rubber-bonder abrasive.

7

Every now and then you come up against a *rust-lock*. The metal parts are actually welded together by rust. To break this lock, you need a **penetrant** such as *PB Blaster*. Or, use beeswax. Heat up the rust-locked parts, touch a stick of beeswax to the heated metal, and the melted wax will wick its way between the parts helping to break the lock.

8

If you're interested in protecting your tools with black oxide, purchase **gun bluing** and apply it to the metal following the instructions that come with the chemical.

9

Finally, there's nothing that protects your tools from rust as well as a **wooden tool box**. Wood is a natural desiccant that absorbs moisture and keeps it from the tools.