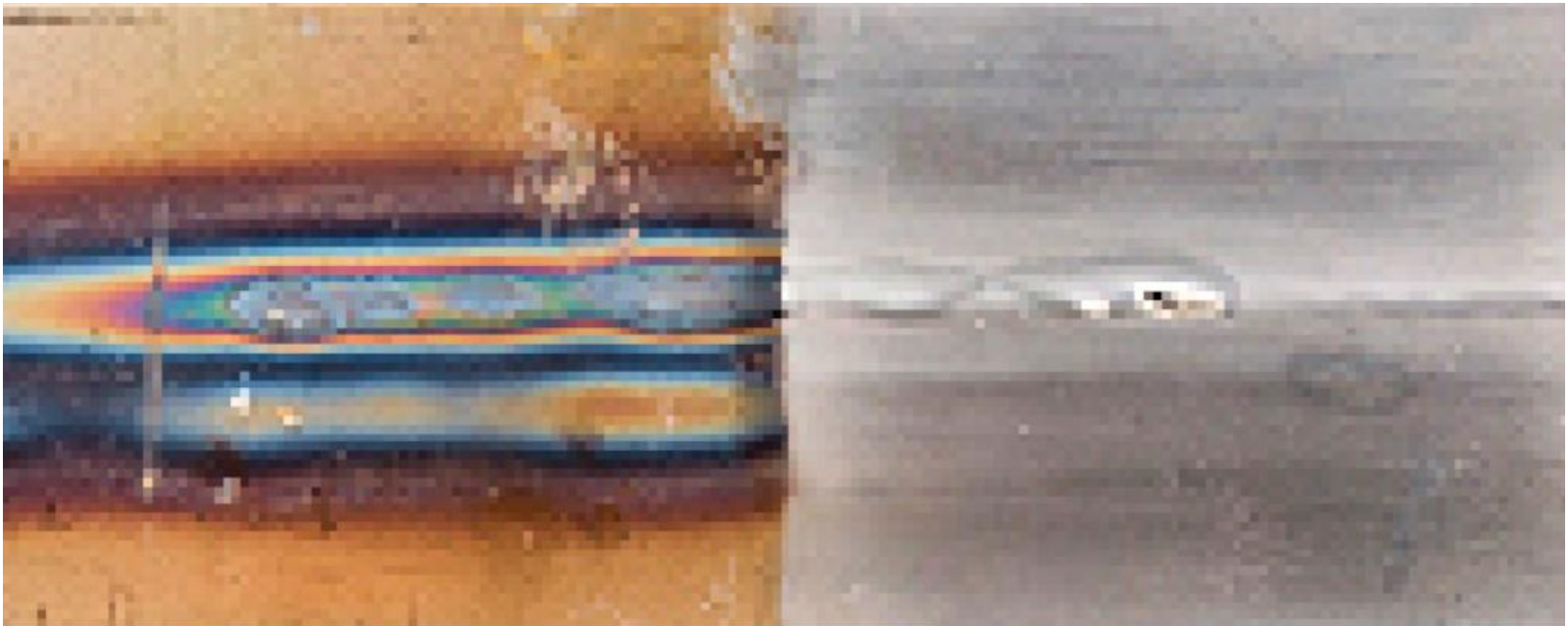


# Cleaning Stainless Steel After Welding



**Before**

**After**

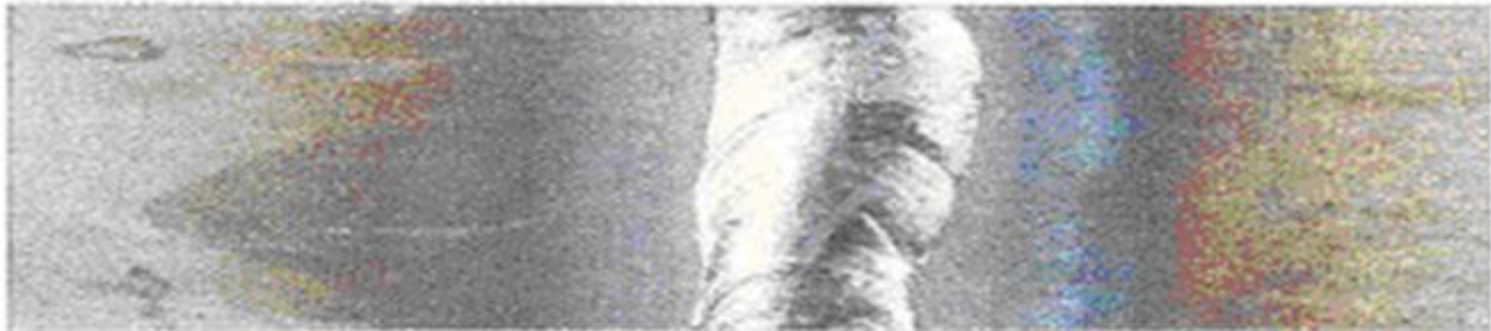
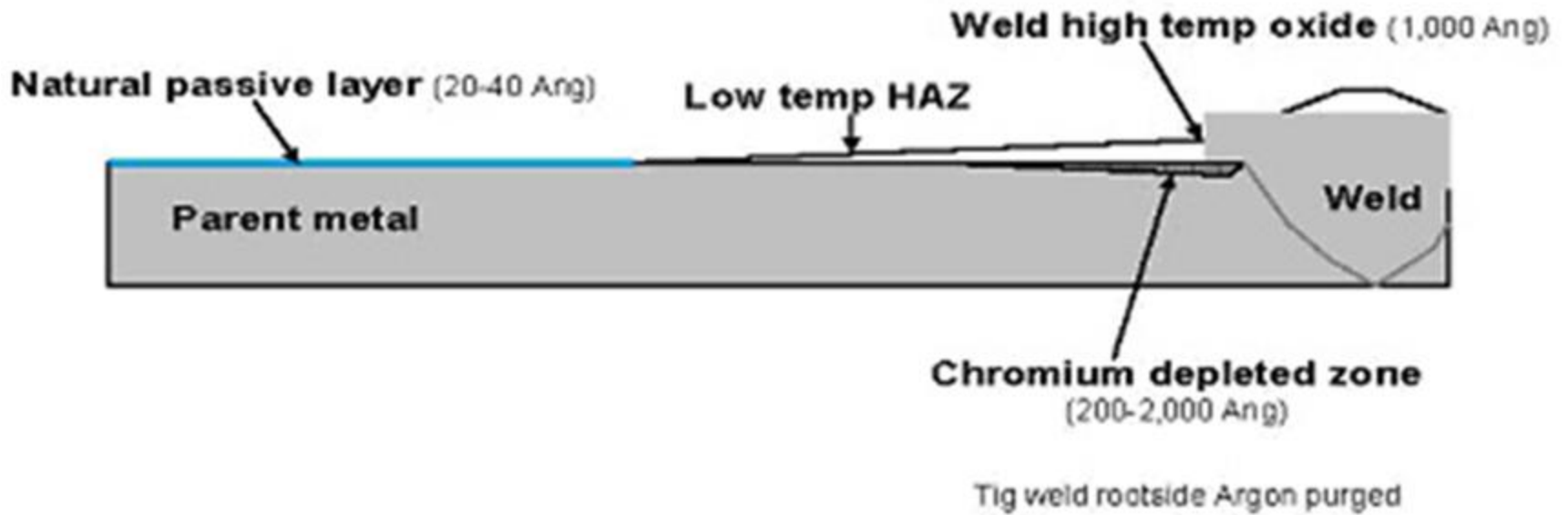
*By Dick Kostelnicek*  
Home Metal Shop Club – August 2013

# Stainless Steel

Corrosion Resistant Iron

- Contains Chromium
- Passive surface film of chromium oxide
- Chromium oxide turns brown when heated
- Iron oxide (rust) appears when Cr-to-Fe ratio is reduced
- Nickel provides malleability and renders iron non-magnetic (300 series)
- Molybdenum prevents pitting and inhibits marine corrosion (300 series)

# Weld Oxidation



<http://www.electropolish.com.au/download/071002%20Electrocleaning%20Technical%20Brief.pdf>

Note: HAZ is **H**eat **A**ffected **Z**one

# Pickling vs Passivation

**Pickling** is remedial. It removes oxides, scale and other impurities from surfaces.

**Passivation** is preventative. It provides a protective surface to resist corrosion.

# Pickling Methods

**Pickling Gel**

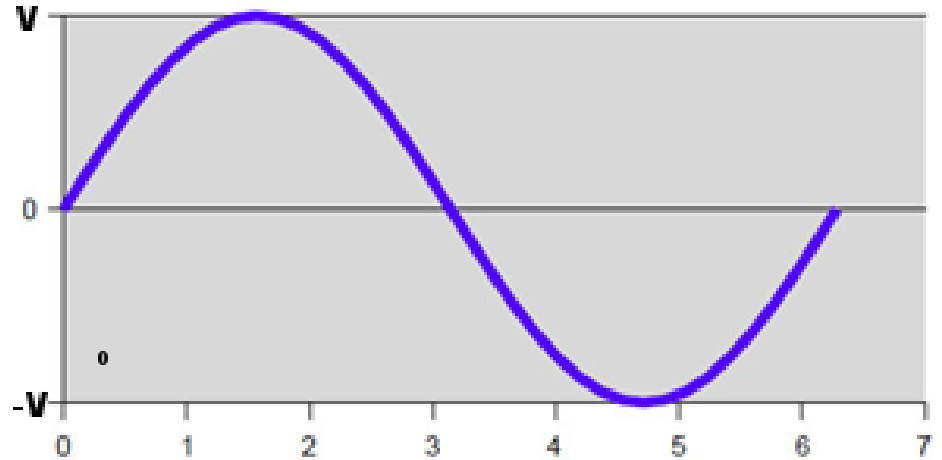


**Electro Cleaning**

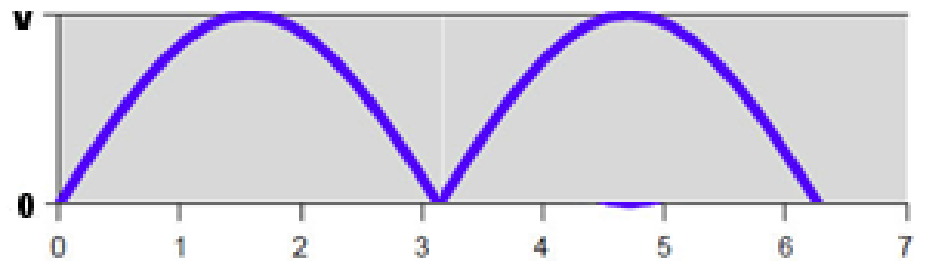


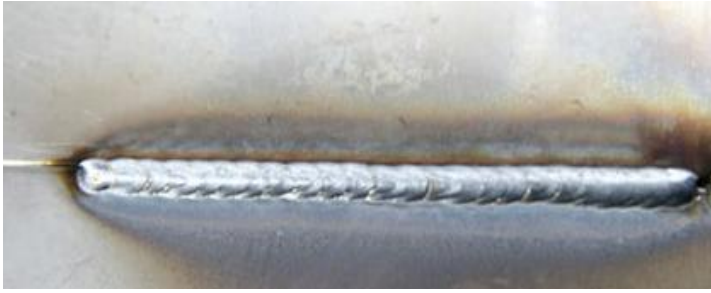
# Electro Cleaning and Polishing

AC => Cleaning



DC => Polishing



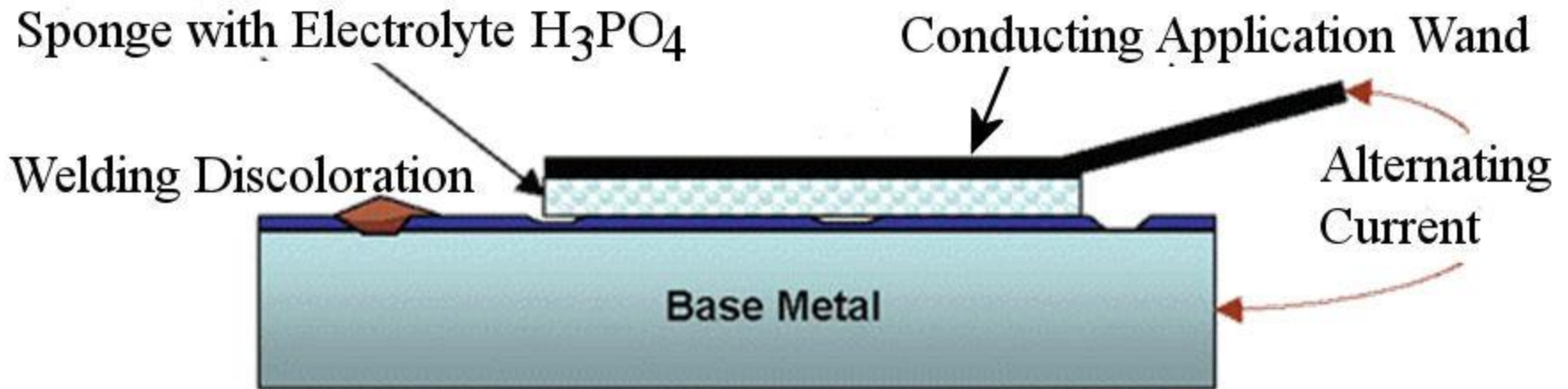


# Electro Cleaning

- Electric current in combination with a mild electrolyte
- Uses Alternating Current (clean not etch)
- Dissolve surface rust, iron contamination, and inclusions
- Reform original protective chromium oxide layer
- Performed in situ without immersion



# Electro Cleaning



<http://www.electropolish.com.au/download/071002%20Electrocleaning%20Technical%20Brief.pdf>

Note: 20% phosphoric acid  $H_3PO_4$  solution in water used as an electrolyte

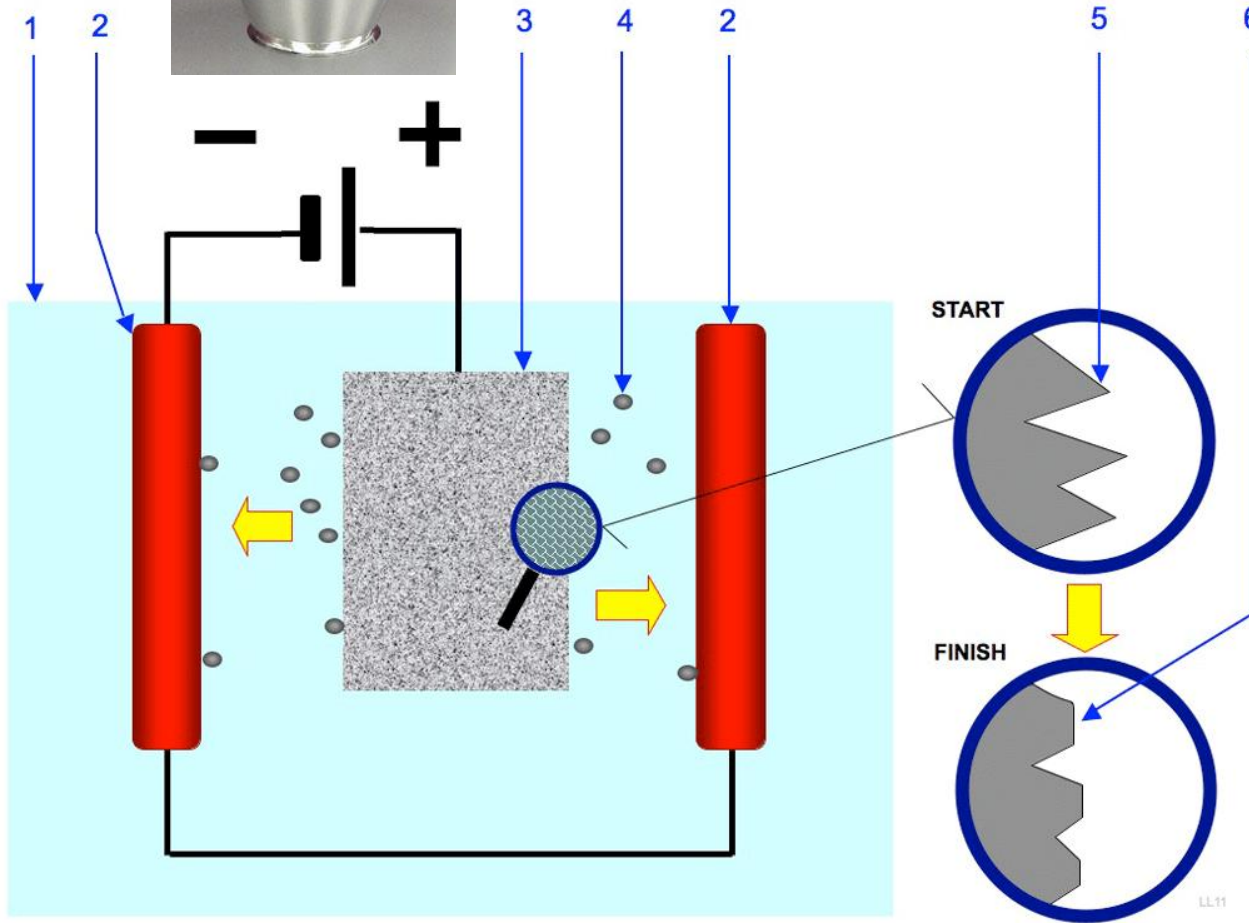




# Electro Polishing

- *Remove oxides and iron from the surface*
- *Use DC current with work as (+) anode*
- Requires immersion and lengthy time period
- Dissolves surface iron to improve Cr-Fe ratio
- Levels surface by selectively *de-plating* high points
- No messy abrasives

# Electro Polishing



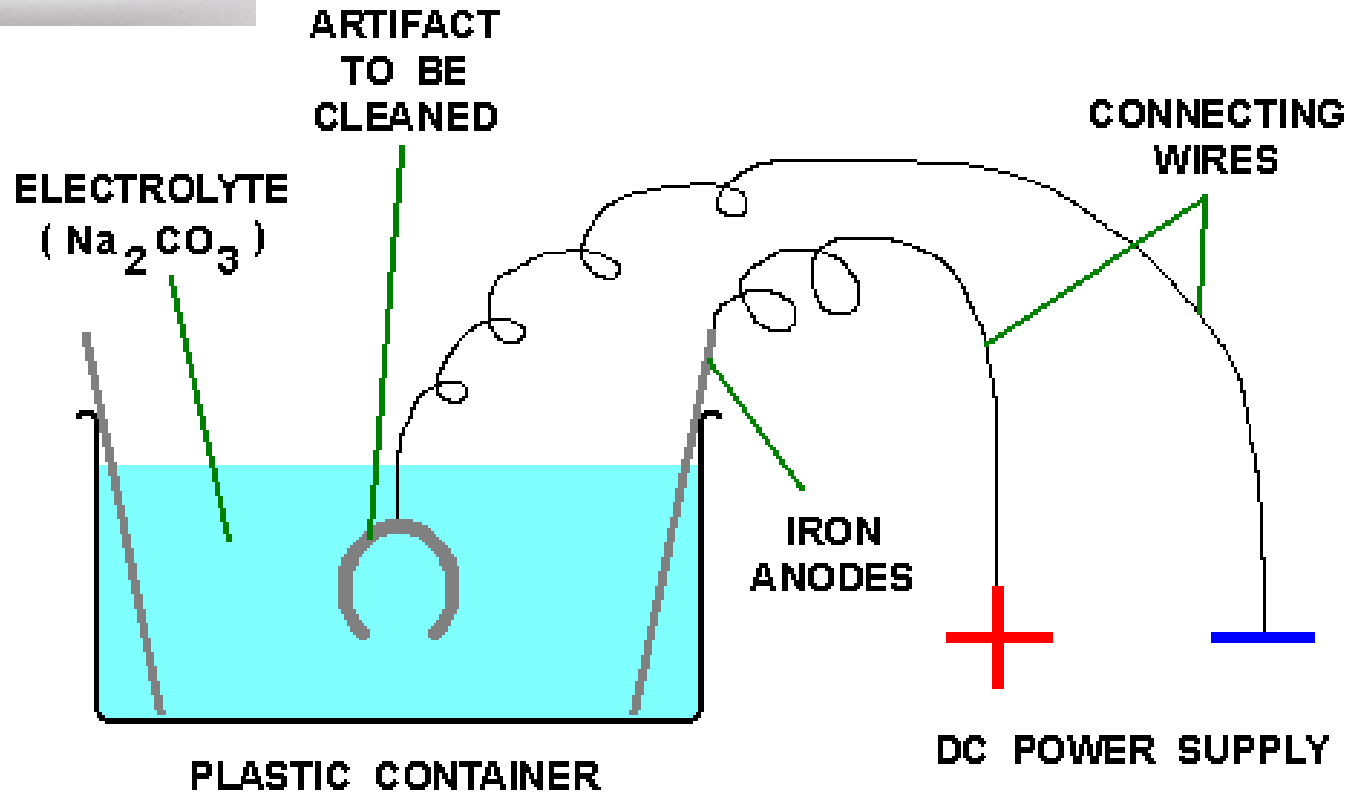
1. Electrolyte
2. Cathode (-)
3. Workpiece to polish, Anode (+)
4. Ion moving from the workpiece to the cathode
5. Surface before polishing
6. Surface after polishing

[http://commons.wikimedia.org/wiki/File:Electropolishing\\_principle.png](http://commons.wikimedia.org/wiki/File:Electropolishing_principle.png)

Note: Electrolyte is a combination of nitric and hydrofluoric acids

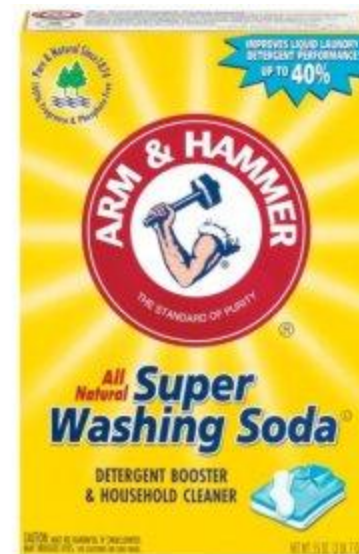


# Electrolysis of Rust



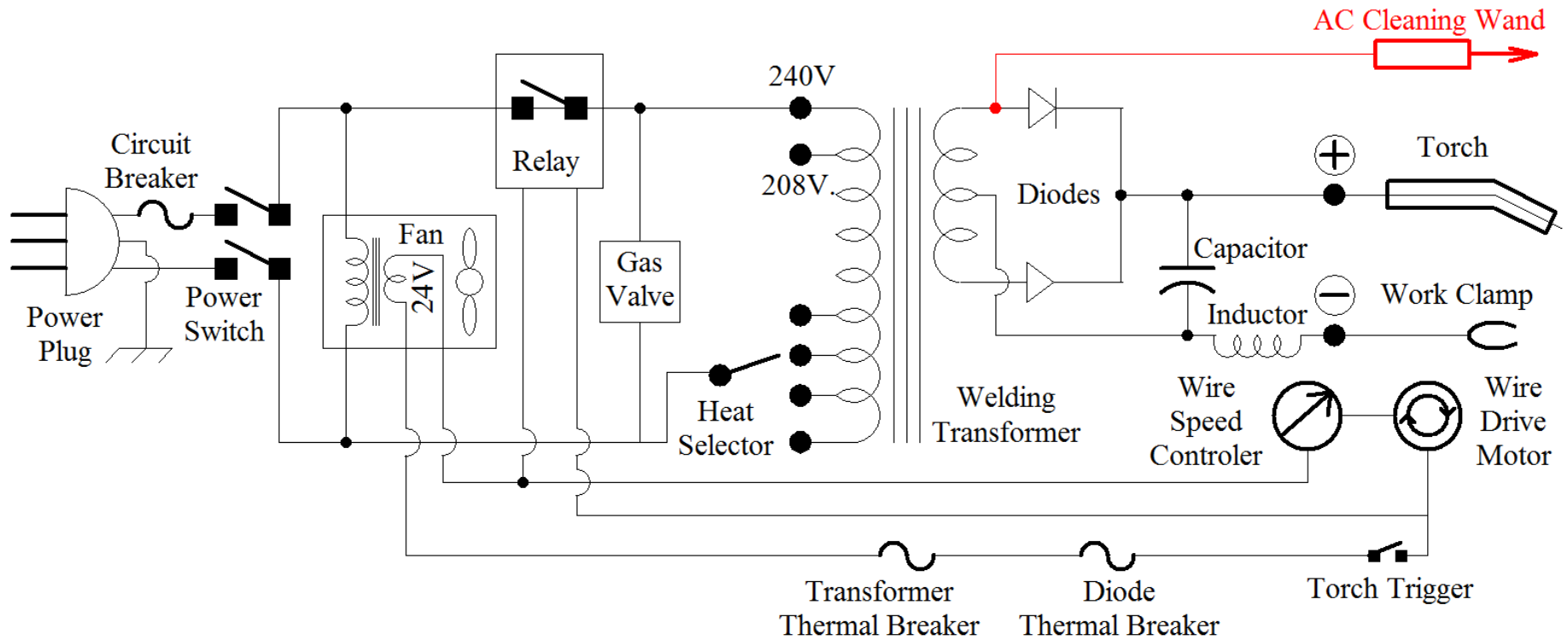
# Washing Soda - $\text{Na}_2\text{CO}_3$ Sodium Carbonate - Electrolyte

- Salt-based good conductor of electricity
- No chlorine gas produced
- Not corrosive to anodes (ph - slightly basic)
- Solid, air stable, and easy to weigh accurately
- Available at grocery store as *Washing Soda*



Note: Not to be confused with Baking Soda =  $\text{NaHCO}_3$  – Sodium Bicarbonate

# Use a Welder as an Electro Cleaning 25 Volt AC Electrical Source



# Electrical Source Summary

Process	Polarity of Work
Electro Cleaning	Alternating Current
Electro Polishing	DC (+) Positive
Electrolysis of Rust	DC (-) Negative



# Safety



- Old clothing - may develop holes after washing
- Protective eyewear
- Protective gloves
- Standby bucket of water and large box of baking soda
- Old leather shoes, preferably rubber boots
- Beware of shocks from electricity and wet floor



# Cleaning Stainless Steel After Welding

*Fin*

*Dick Kostelnicek ~ 08-10-2013*

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