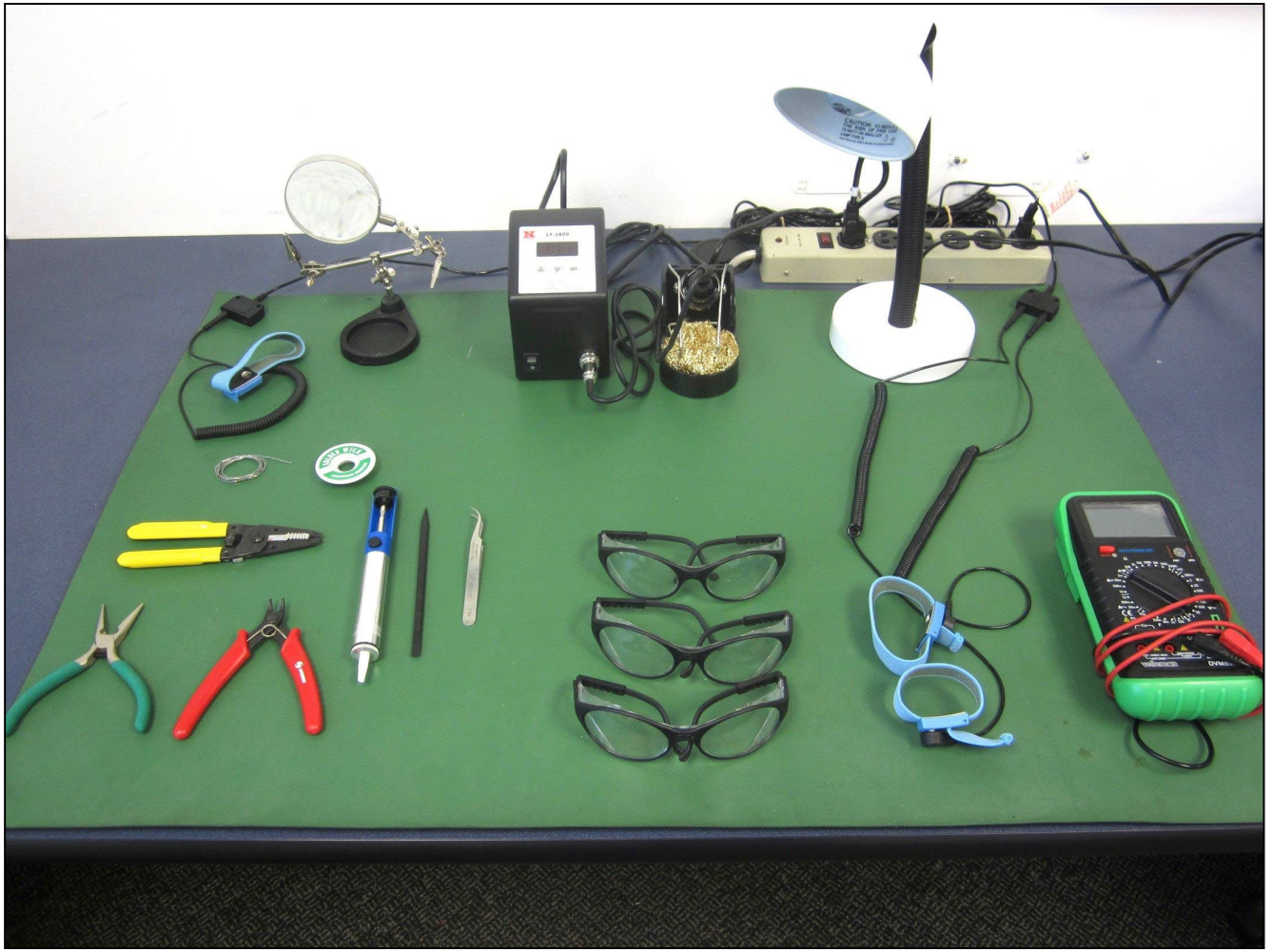
Soldering Techniques

Recommended Tools

- Soldering Iron
- Solder
- Safety Glasses
- Multimeter
- Light Source
- Needle-nose pliers
- Tweezers/Forceps
- ESD Mat and strap
- Solder wick
- Solder Pump
- Diagonal Cutters
- Wire Strippers
- Magnifier

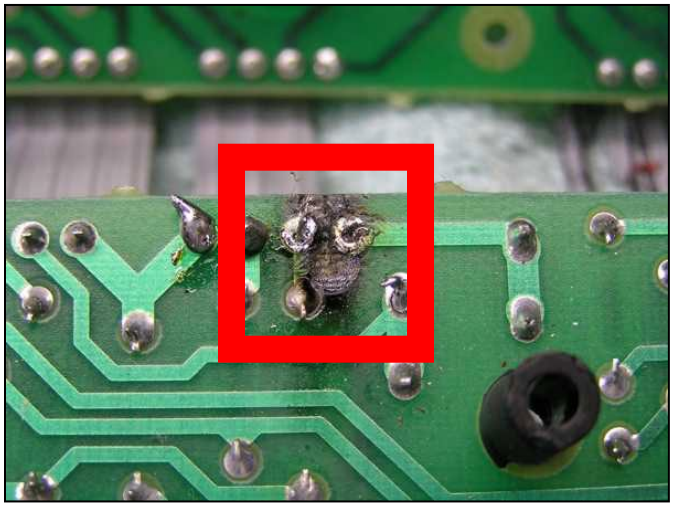


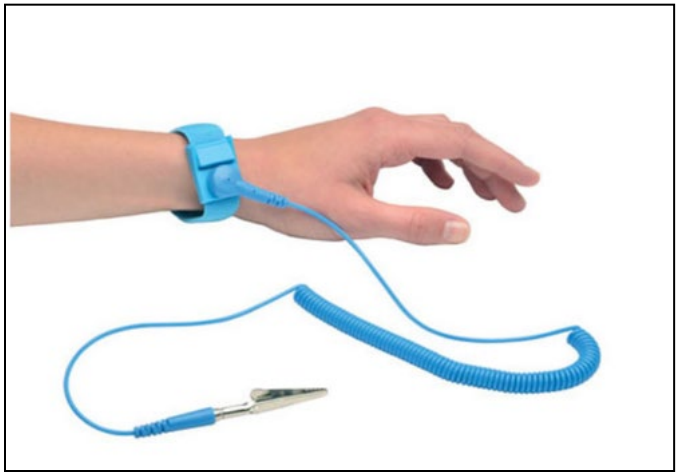
Safety Precautions

- Prior to assembly or any work, a clean and organized workstation is vital for safety and proper assembly
- Soldering Irons are extremely hot; do not touch the tip, and place the iron in a stand when not in use
- Always wear Safety Glasses while soldering
- Be mindful of where the solder might drip and where your body is relative to the iron
  - Tie back long hair
  - Wear long pants
- Wash your hands after handling leaded solder

Safety (for the components)

- Excessive heat can damage components and boards
  - Set your iron to an appropriate temperature for the solder you are using
- Electrostatic discharge (ESD) can destroy or damage sensitive components.
  - Leave components in static shielding bags until ready for use
  - Use ESD wrist straps to ground yourself while working





Tips for Success

- Use bright enough lighting to see the board and component marking
- Install smaller components first
- Install integrated circuits (IC's) into sockets, not directly on the board
- Choose a solder thickness and tip size appropriate to the component you are working with
- It's easier to add solder or re-melt than remove excess solder

Types of Solder

- Leaded solders
  - Primarily Lead and Tin
  - Starts melting ~350F
- Lead Free Solder
  - Lead-free but higher melting temperature (~420F)
  - Can be more difficult to work
- Solder Paste
  - Paste in syringe
  - Use for surface mounting compon soldering with hot air or ovens
- Solder flux
  - Rosin flux helps the solder flow and stick onto the PCB pads
  - Many solders have flux inside the solder, will be labelled “Rosin Core:

Soldering Irons

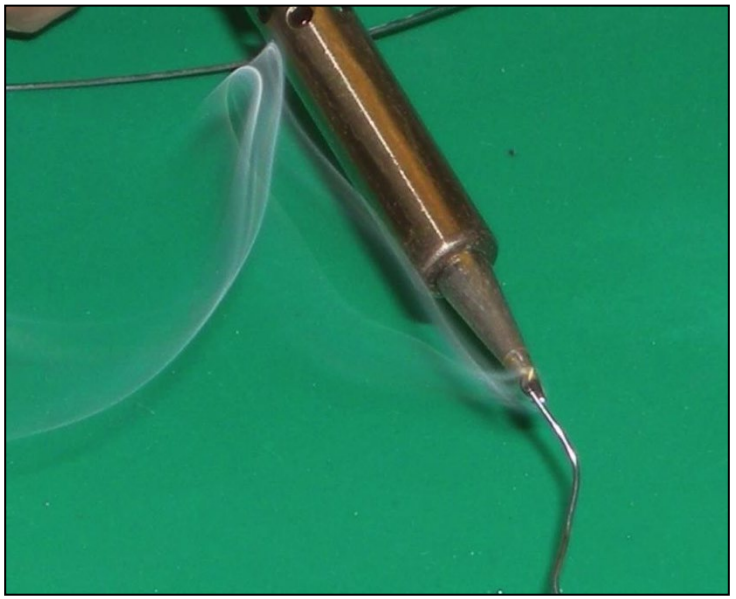
- Constant Power Soldering Irons
  - Iron continuously heats and eventually reaches equilibrium temperature
- Constant temperature
  - Tip heats to maintain a preset temperature
- Temperature Controlled Solder Station
  - Adjustable Temperature Setting
  - Often includes a temperature display

30-watt Constant Power Iron

Temperature Controlled Solder Station

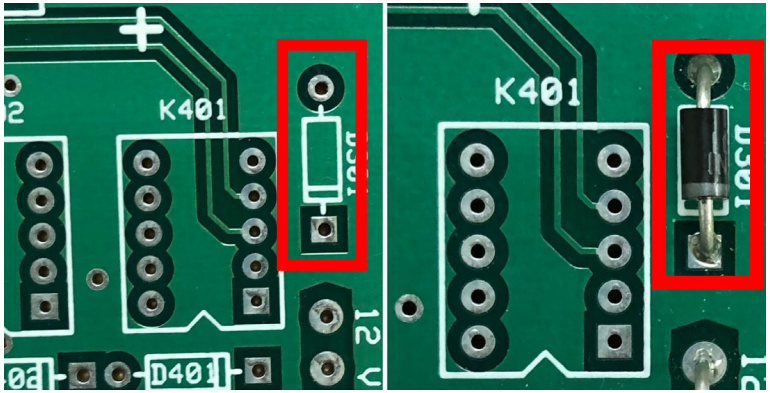
Soldering Tutorial
Through-Hole Component

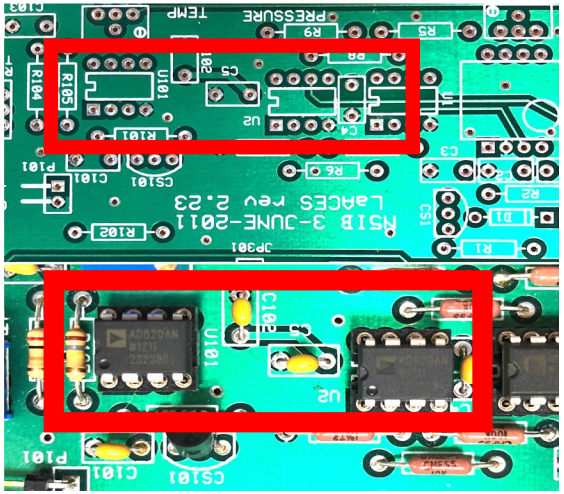
- Due to its high temperature, the iron tip will rapidly form an oxidation layer that slows heat transfer
- It will take a darker, dull appearance
- Frequently during usage, “Tin” the tip
- Melt a small amount of solder on the tip and then clean the tip on the sponge or metal scour
- The tip should look shiny



Identify component pads and orientation

- Locate the pads for the component by finding the identifier on the silkscreen of the board
  - This is often a few letters and a number, for example, D301 for diode 301 to the right
  - Check the schematic if markings are unclear
- Look for orientation or pin numbering marks
  - In the best case, the markings will be obvious, like lining the diode strip with the line on the board to the right
  - But sometimes markings may be ambiguous or have changed since the board was designed
  - Incorrectly installed components will not function properly and may damage other components in the circuit

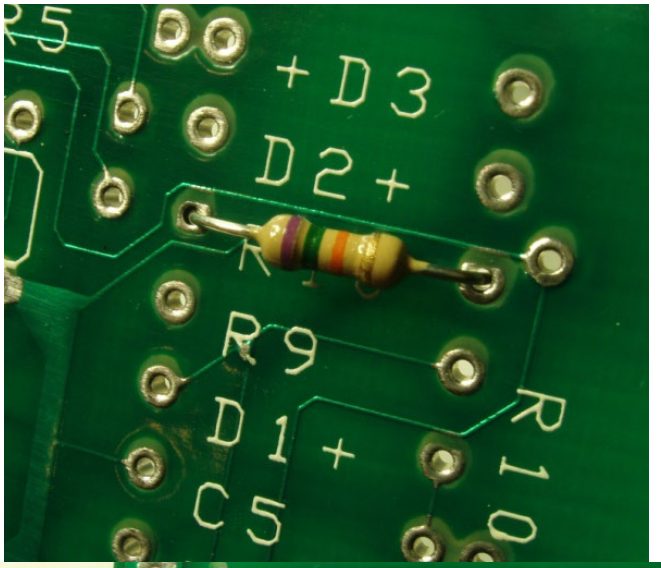


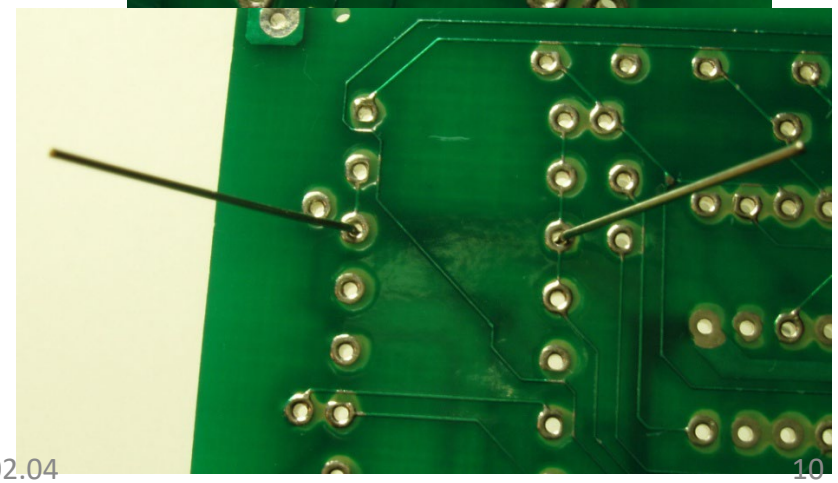


Proper installed diode and integrated circuit

Install the Component

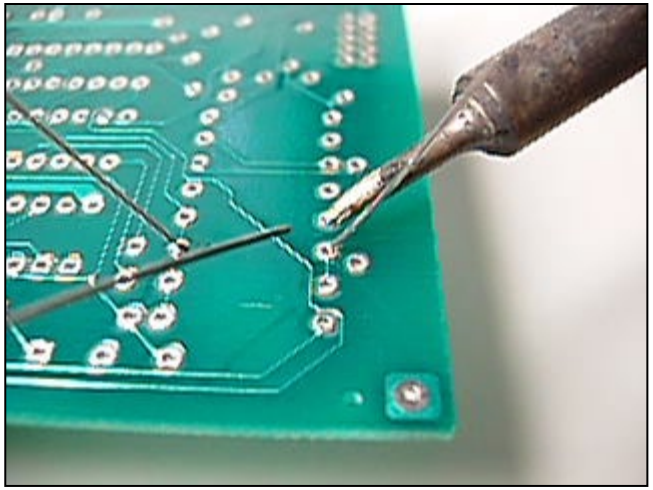
- Insert the component's leads through the holes in the circuit board
  - Most components should lie flush against the surface of the board
  - Do not force the component down as you may break a lead
- Fix the component in place and flip the board over
  - Bending the component leads outward can help hold the component in place
  - Tape can also be used to hold components down, just be careful not to tape the metal leads, which will get hot during soldering





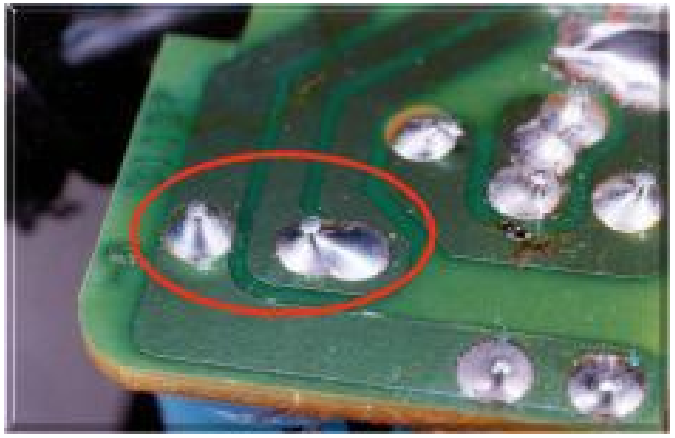
Heat Pads and Apply Solder

- Apply the iron in contact with both the circuit board pad and the component lead
  - The iron should be in contact with both so both heated
- Apply solder to the joint, <u>not to the iron</u>, and allow the heated joint to melt the solder
  - The solder should follow onto both the pad and the lead
- You want a “Hershey kiss” of solder when you are done

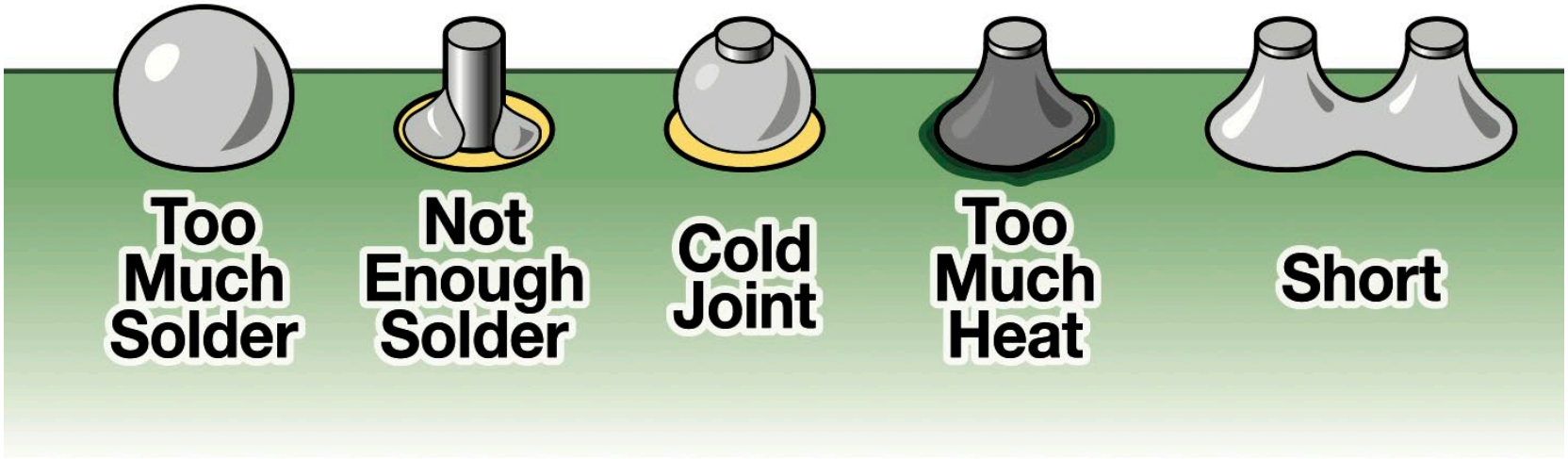


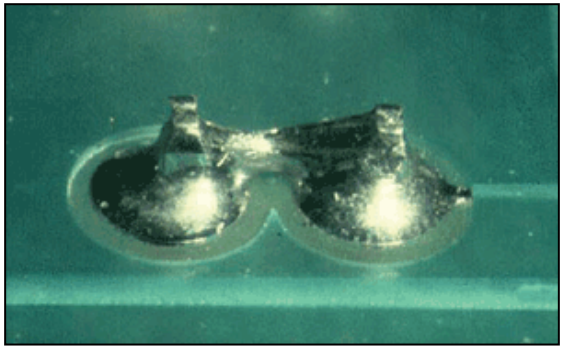
Inspect the solder

Inspect the solder joints. It should be uniform and shiny, with no cracks, gaps, or graininess. The images below are examples of good soldering.



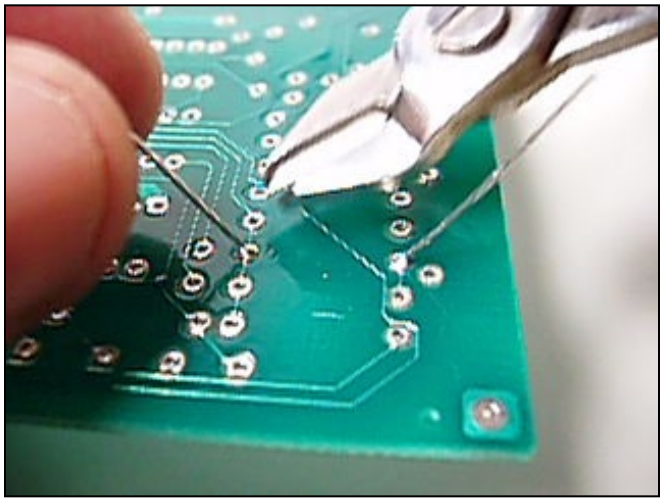
Bad Solder Joints

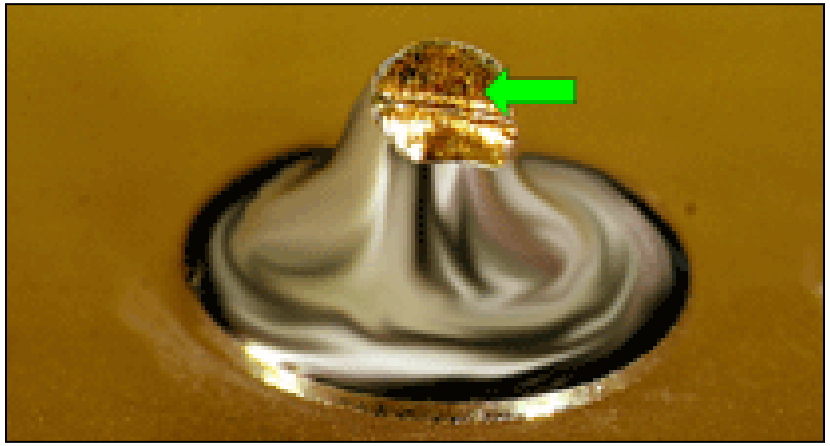




Trimming Leads

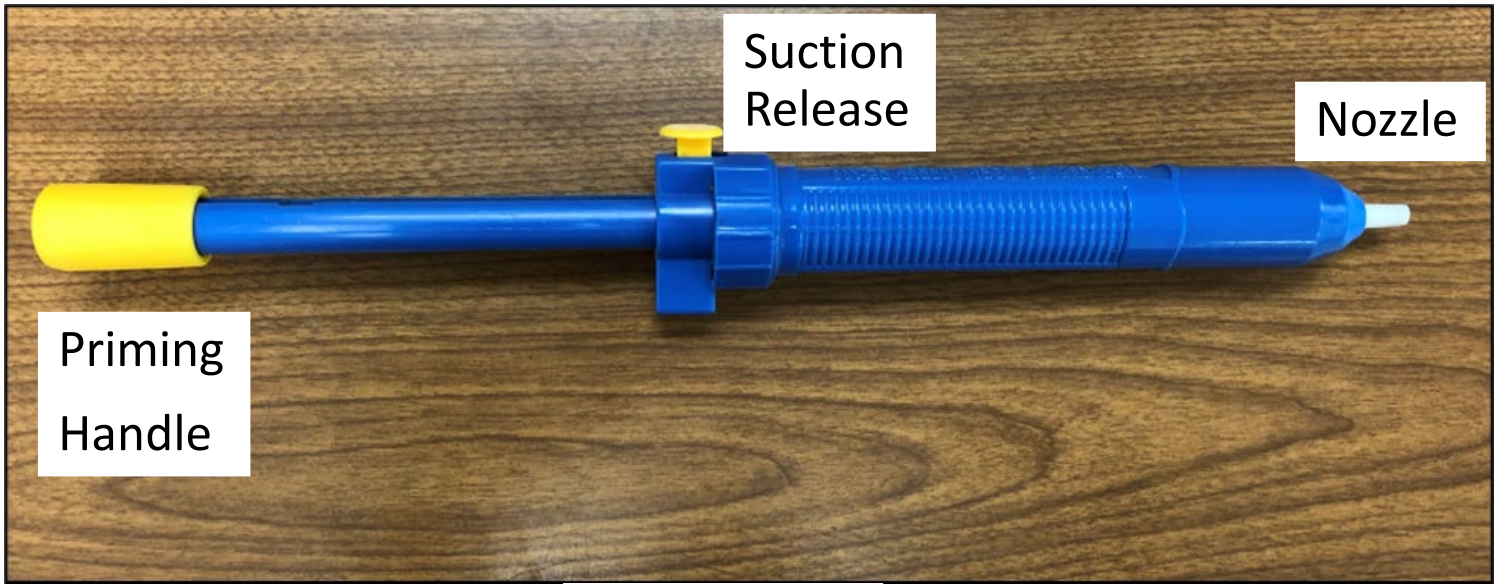
- If solder is good trim the excess leads using a pair of diagonal cutters
- When cutting hold the lead so it does not go flying when snipped
- Avoid cutting into the solder joint itself; the mechanical force could peel the pad off the board
  - The goal it prevent leads from being able to create shorts, not trim a flat surface





Solder Pump

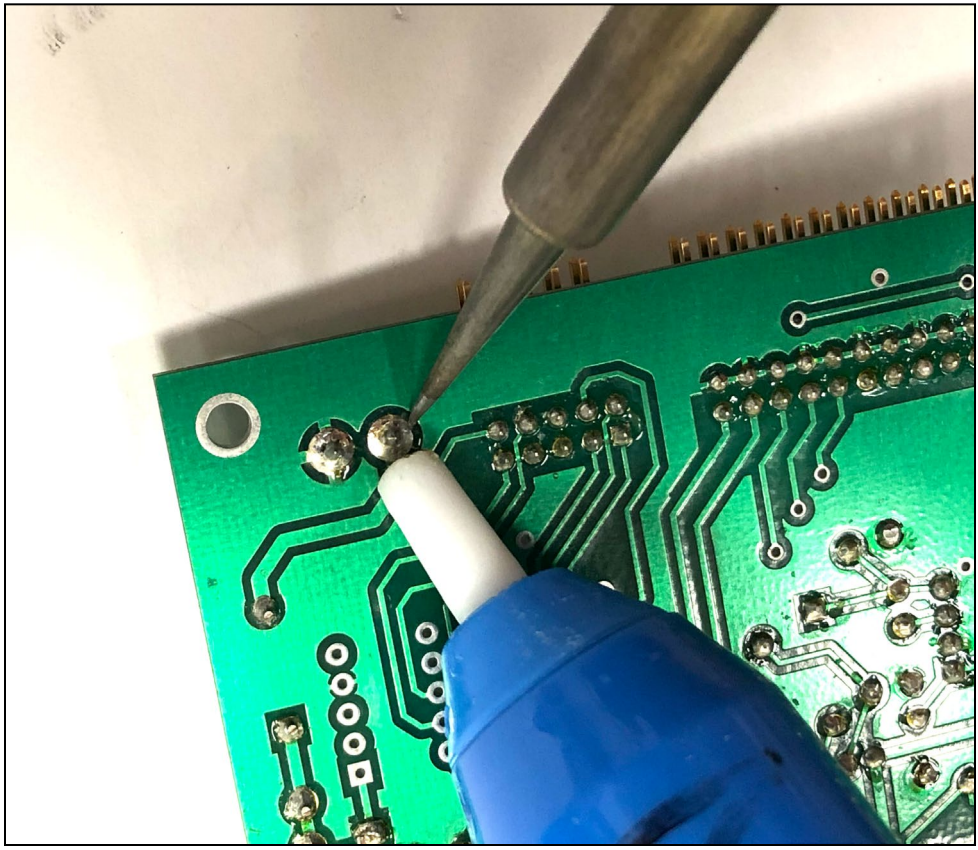
- If you need to remove excessive solder or remove a soldered component, one technique is a solder pump
- A solder pump, or “solder sucker,” removes liquid solder from the board with a small spring-operated vacuum



Solder Pump

Using a solder pump

- Compress the spring by pushing the priming handle down until you hear a click
- Heat the excess solder until it becomes molten
- Place the tip of the solder pump near or on the joint and press the suction release
- The spring will push the plunger up and suck some of the solder into the pump
- Eject the solder out of the pump by pressing down the priming handle
- You may need to repeat to remove the desired amount of solder



Removing excess solder by sucking it up with a solder pump.

Solder Wick

- Solder wick is copper braid that usually comes in spools
- When the wick is heated, excess solder will naturally flow up the wick
- To use:
  - Place the wick on top of the joint to be desoldered
  - Heat the wick by pressing it into the solder with the iron
  - The will flow onto the wick
  - Remove the iron and with wick from the joint simultaneously
    - If you allow the solder to cool, the wick will stick to the joint and potentially pull the pad away from the board as you pull the wick
  - A length of wick will now have solder on it, cut this off the spool and dispoe

Spool of Solder Wick

Removing Components

- For multipin components, it is very difficult to remove enough solder to completely remove it at once
- It is usually better to sacrifice the component by cutting its leads
- Then the remaining pins can be removed one at a time
- This will avoid damaging the traces on the circuit board, which are very difficult to repair