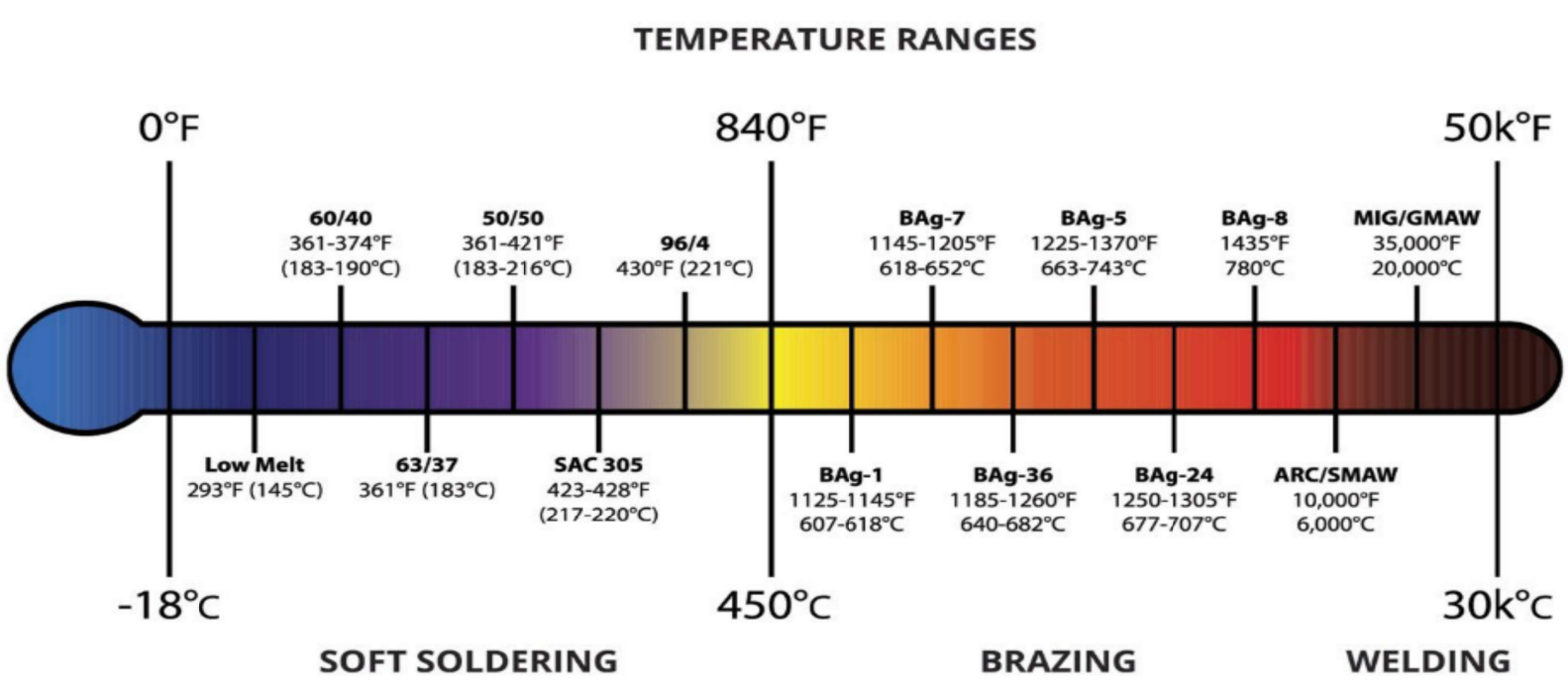
Soldering

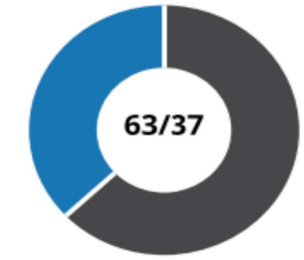
Temperature Range

Solder alloys with melting temperatures below 840°F (450°C) are considered to be “soft” while any soldering above that point is referred to as “hard soldering” or brazing; also called silver soldering when an alloy containing silver is used. Brazing is used in industrial applications such as plumbing, jewelry, and dentistry. Whereas all electronics work is considered soft soldering.



Solder Types

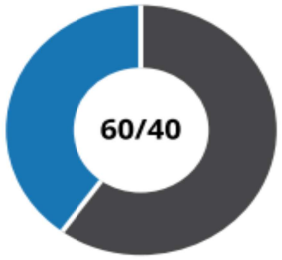
POPULAR LEADED SOLDER ALLOYS



361°F (183°C)

Solidus Eutectic Liquidus

63%	TIN (Sn)
37%	LEAD (Pb)



361 - 374°F (183 - 190°C)

Solidus Plastic Range Liquidus

60%	TIN (Sn)
40%	LEAD (Pb)

361 - 421°F (183 - 216°C)

Solidus Plastic Range Liquidus

50%	TIN (Sn)
50%	LEAD (Pb)

293°F (145°C)

Solidus Eutectic Liquidus

52%	TIN (Sn)
32%	LEAD (Pb)
18%	CADMIUM (Cd)

POPULAR LEAD-FREE SOLDER ALLOYS

423 - 428°F (217 - 220°C)

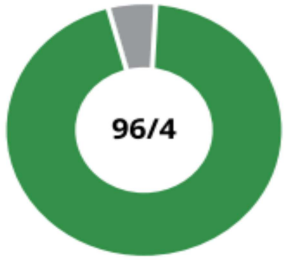
Solidus Plastic Range Liquidus

96.5%	TIN (Sn)
3%	SILVER (Ag)
0.5%	COPPER (Cu)

419 - 428°F (215 - 220°C)

Solidus Plastic Range Liquidus

96.5%	TIN (Sn)
3.45%	COPPER (Cu)
0.05%	SILVER (Ag)



430°F (221°C)

Solidus Eutectic Liquidus

96.5%	TIN (Sn)
3.5%	SILVER (Ag)

441°F (227°C)

Solidus Eutectic Liquidus

99.7%	TIN (Sn)
0.3%	COPPER (Cu)

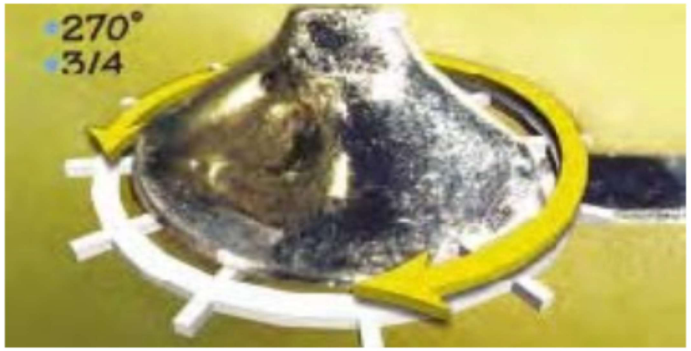
Soldering Irons

- Generally speaking, a basic AC voltage iron of around 40-60W is ideal for electronics. Anything higher wattage on a non-digitally controlled iron will get too hot to solder accurately. When the temperature is regulated by a microprocessor with a closed feedback loop, higher wattage ratings become an asset. This is because it will maintain your set temperature no matter how big the surface area is. Where higher wattage simply means more heating power in reserve to use if needed. This opens up the possibility of using anything from 40 to even 100 Watts for electronics

Basic 60 Watt Iron

Digitally-Controllled 60W Iron

Solder Joints



WHATS A GOOD SOLDER JOINT?

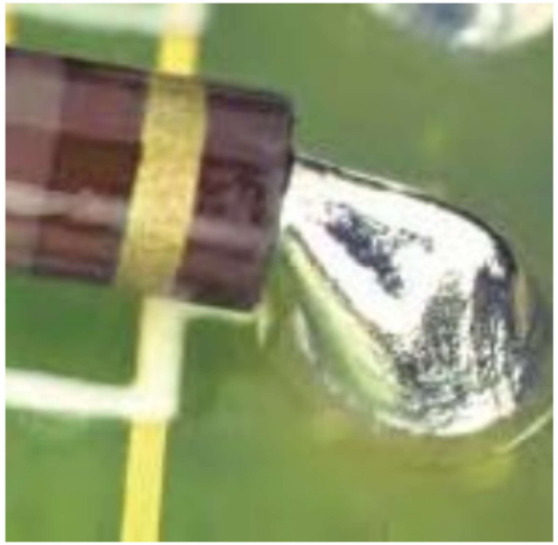
Bad solder joints can fail when you least want them to! Here are some things that make a "good" solder joint.

1. For through-hole and SMD components, the solder "wetting angle" (pictured) should never be more than 90°.

2. For through-hole pins, the solder needs to cover at least 270° of the circular pad. In other words, 3/4 of the pin should have solder connecting it to the circuit board pad.

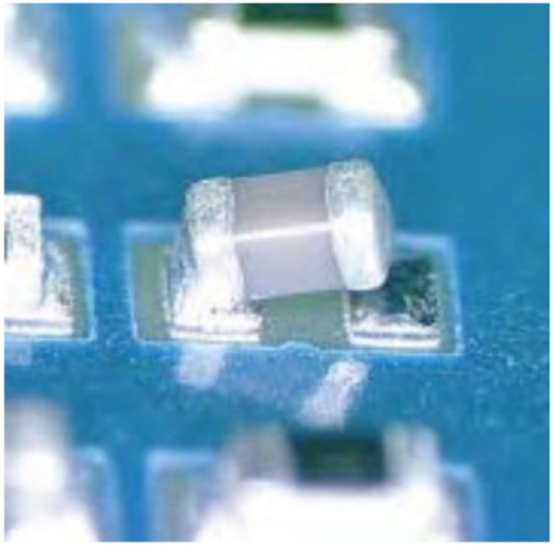
GOOD

Proper amount of solder, good wetting



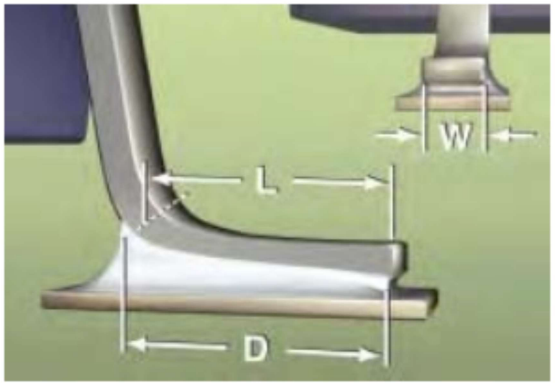
BAD

Too much solder. Contacting the body of the component



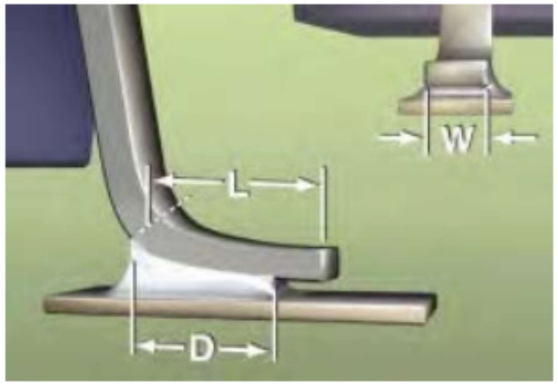
BAD

Surface tension can lift small resistors/capacitors



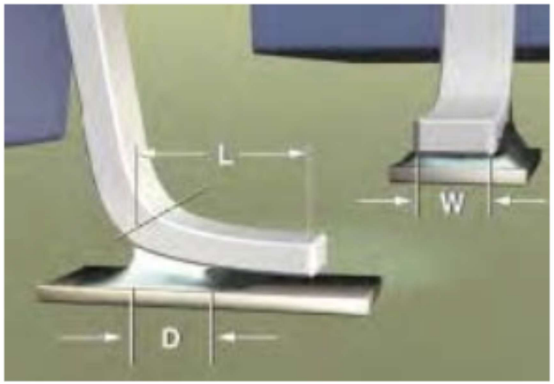
GOOD

Solder length (D) is the length of (L)



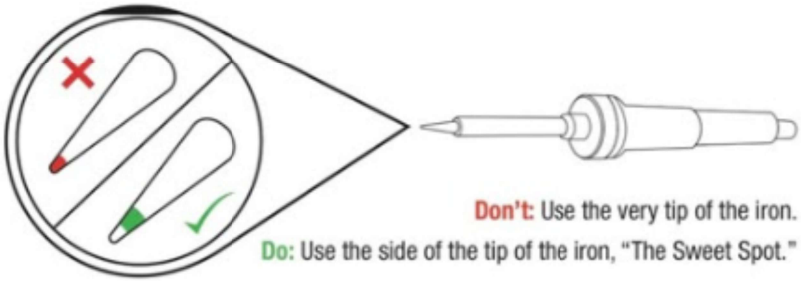
OKAY

Solder length (D) greater than pin width (W), but less than (L)



BAD

Solder length (D) less than pin width (W)



Don't: Use the very tip of the iron.

Do: Use the side of the tip of the iron, "The Sweet Spot."

Do: Touch the iron to the component leg and metal ring at the same time.

Do: While continuing to hold the iron in contact with the leg and metal ring, feed solder into the joint.

Don't: Glob the solder straight onto the iron and try to apply the solder with the iron.

Do: Use a sponge to clean your iron whenever black oxidization builds up on the tip.

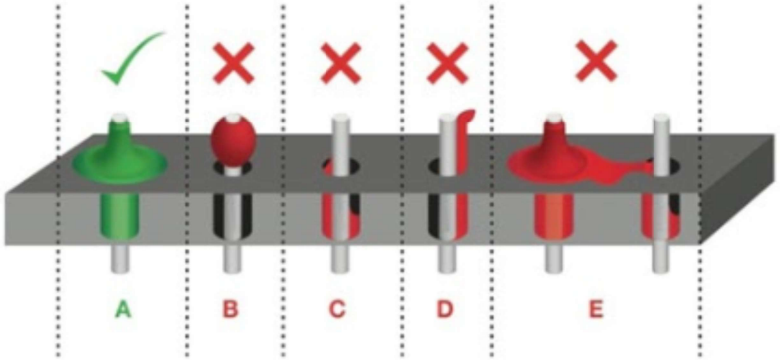
A Solder flows around the leg and fills the hole - forming a volcano-shaped mound of solder.

B Error: Solder balls up on the leg, not connecting the leg to the metal ring.
Solution: Add flux, then touch up with iron.

C Error: Bad Connection (i.e. it doesn't look like a volcano)
Solution: Flux then add solder.

D Error: Bad Connection...and ugly...oh so ugly.
Solution: Flux then add solder.

E Error: Too much solder connecting adjacent legs (aka a solder jumper).
Solution: Wick off excess solder.



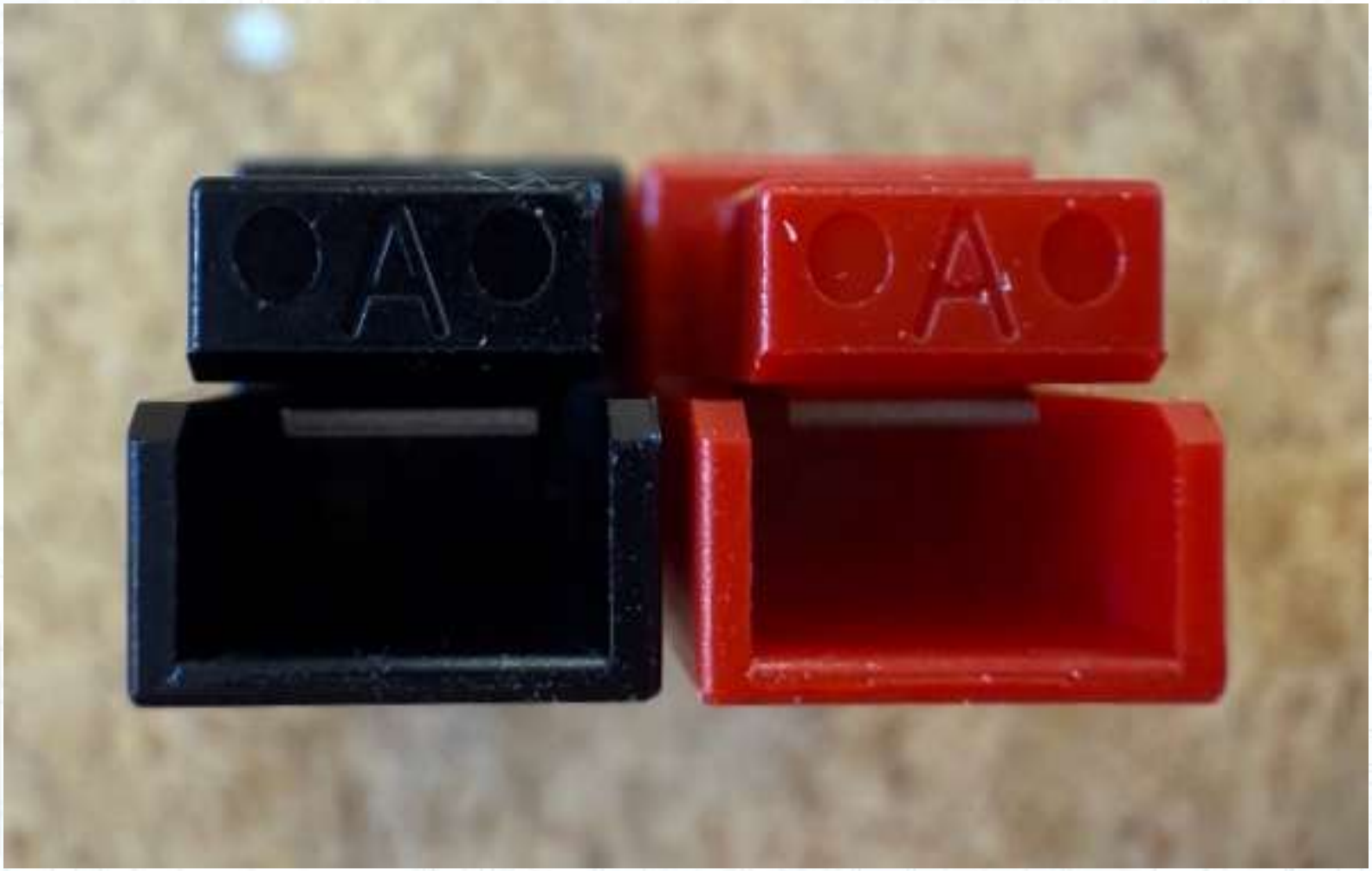
Powerpole Cutaway

Cutaway view of a Powerpole connecor.

Note that the contact must fit through the gap between the housing and the spring and that the contact is snapped over the end of the spring.

Orientation

- ARES /RACES Standard Orientation



Credits

Google - Introduction to Soldering

https://sites.google.com/stanford.edu/soldering-internal/learning

Autodesk Instructibles - Intro to Soldering

https://www.instructables.com/Intro-to-Soldering/

SRA Soldering Products - How to Solder Electronics

https://fpg.phys.virginia.edu/fpgweb/memos/soldering_instructions.pdf

ARRL - Powerpole Installation Tips

https://www.arrl.org/files/file/Public%20Service/TrainingModules/Technical/Anderson%20powerpole.pdf

KOTFU - Getting started with Anderson Powerpoles

https://www.k0tfu.org/deep-dives/getting-started-with-anderson-powerpoles

Ham Radio Tube - Powerpole distribution box video

https://youtu.be/um1m8h9-lB4?si=uWfJZNDBZFnwzSjP