DCFluX in: The Man with the Soldering Gun

Presented By:
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Las Vegas, NV
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The following presentation has been edited to run in the time allotted.



Thank you, Sir!


FLUX
RESEARCH

Hidden Agenda

1. Safety
2. Solder
3. FluX on: Flux
4. Soldering & Desoldering Tools
5. Soldering & Desoldering Demonstration
6. Editorial

1. Safety



Recommended Safety Procedures

- Safety Glasses or Face Shield
- Non-Synthetic Clothes
- Long Sleeves or Sleeve Extensions
- Fume Extractor
- Wash Hands After Touching Solder
- Use Flexible Drinking Straws

1. Safety

Don’t do what DCFluX does



- Low quality solder
- Solder in mouth
- Small soldering iron
- Burnt pinky finger
- Breathing fumes
- Synthetic blend pants
- Soldering over ‘The Package’

Photo By: Martin Rudolph

2. Solder

What is Solder?

1: a metal or metallic alloy used when melted to join metallic surfaces ; *especially* : an alloy of lead and tin so used

http://www.merriam-webster.com/dictionary/solder

2. Solder

Soldering / Brazing / Welding

- > 840°F = Soldering
- 840° - 1200°F = Brazing
- 1200 - 6000°F = Welding

2. Solder

RoHS:
Reduction of Hazardous Substances

- Lead
- Mercury
- Cadmium
- Hexavalent Chromium
- Polybrominated Biphenyls
- Polybrominated Diphenyl Ether

http://www.oehha.ca.gov/prop65/prop65_list/files/P65single061909.pdf

Regular vs. Unleaded

Lead is a soft metal that easily rubs off. Lead is poisonous and constant exposure is known to cause brain damage.

Regular vs. Unleaded

- Substances known to cause cancer in the state of California
  - Lead
  - Cadmium
  - Beryllium Oxide
  - Ethyl Alcohol (alcoholic beverages)
  - Marijuana Smoke

http://www.oehha.ca.gov/prop65/prop65_list/files/P65single061909.pdf

2. Solder

Regular vs. **Unleaded**

- Tin Plague (Tin Pest)



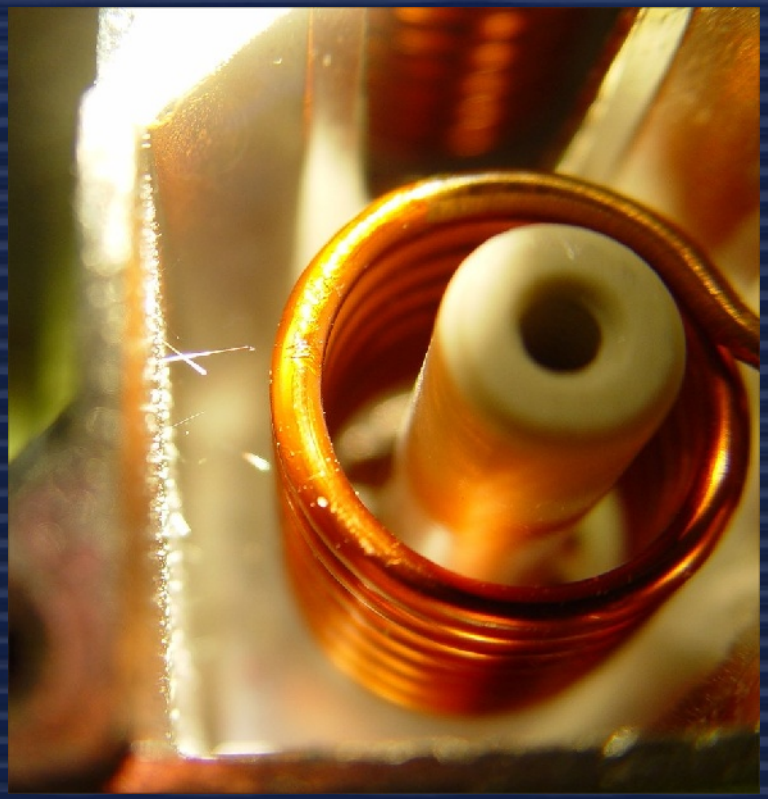
Photo By: DCFluX

2. Solder

Regular vs. **Unleaded**

- Tin Whiskers





Photos By: NASA and Tracey Hooker

2. Solder

Regular vs. **Unleaded**

- Tin Whisker Failures





Photos By: Boeing and Claremont Corporation

2. Solder

Regular vs. **Unleaded**

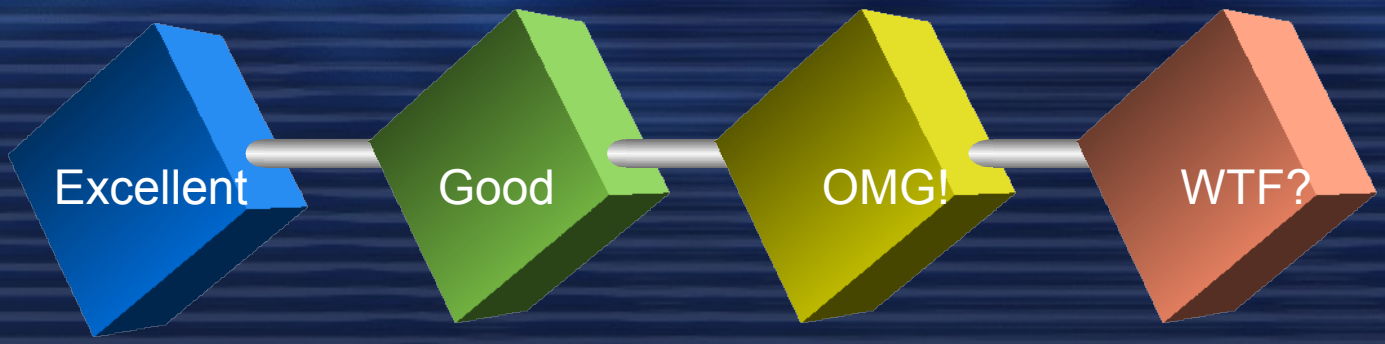
- Tin Solder Failures



Photo By: Microsoft Corporation

2. Solder

Solderability of Metals



Excellent	Good	OMG!	WTF?
Platinum	Bronze	Zinc	Aluminum
Gold	Brass		Chromium
Silver	Lead	Caron Steels	Titanium
Tin	Nickel		Tantalum
Copper	Nickel-Silver	Galvanized Steel	Magnesium
	Cadmium		Cast Iron
Beryllium-Copper	Palladium		
	Rhodium	Low-Alloy Steels	Stainless Steel

Who makes Solder?

- Kester
- Multicore
- American Iron and Metal (AIM)
- MG Chemicals
- Indium Corporation of America
- American Tin and Solder

Available forms of Solder

- Wire – 0.015” – 0.200”
- Bar – 1.66 lbs.
- Paste – 2 oz. – 1 lb.
- Spheres
- Preforms

Available forms of Solder

- Through hole components & wire
  - Wire, 0.025” – 0.04”; Solder bath; Preforms
- Surface mount technology (Visible)
  - Wire, 0.015”; Paste
- Surface mount technology (Invisible)
  - Spheres
- Copper pipe & plates
  - Wire, 0.125”

Metals used in Solder & Electronics

	Melting °C	Melting °F	Resistivity	Expansion
Tin - Sn_{100}	232°	450°	115 nΩ	22.0 µm
Lead - Pb_{100}	327°	621°	208 nΩ	28.9 µm
Antimony - Sb_{100}	604°	1167°	417 nΩ	11.0 µm
Gold - Au_{100}	1064°	1948°	22.14 nΩ	14.2 µm
Silver - Ag_{100}	962°	1763°	15.87 nΩ	18.9 µm
Copper - Cu_{100}	1085°	1984°	17.24 nΩ	16.5 µm
Zinc - Zn_{100}	420°	787°	59.0 nΩ	30.2 µm
Bismuth - Bi_{100}	271°	521°	1290 nΩ	13.4 µm
Indium - In_{100}	157°	314°	71.8 nΩ	32.1 µm
Cadmium - Cd_{100}	321°	610°	72.7 nΩ	30.8 µm

Regular Solder Alloys

	Melting °C	Melting °F	Resistivity	Tip °F
$Sn_{63}Pb_{37}$	183°	361°	205 nΩ	600° - 700°
$Sn_{60}Pb_{40}$	183° - 190°	361° - 374°	149 nΩ	600° - 700°
$Sn_{50}Pb_{50}$	183° - 214°	361° - 420°	158 nΩ	600° - 700°
$Sn_{10}Pb_{90}$	268° - 302°	514° - 576°	194 nΩ	700° - 900°
$Sn_{5}Pb_{95}$	301° - 314°	574° - 597°	196 nΩ	800° - 900°
$Sn_{62}Pb_{36}Ag_{2}$	179° - 189°	354° - 372°	114 nΩ	600° - 700°
$Sn_{10}Pb_{88}Ag_{2}$	268° - 299°	565° - 574°	203 nΩ	800° - 900°

Sn = Tin
Pb = Lead
Sb = Antimony

Ag = Silver
Cu = Copper
Zn = Zinc

Bi = Bismuth
In = Indium
Cd = Cadmium

Unleaded Solder Alloys

	Melting °C	Melting °F	Resistivity	Tip °F
Sn_{100}	232°	450°	115 nΩ	700° - 800°
$Sn_{95}Sb_{5}$	232° - 240°	450° - 464°	145 nΩ	700° - 900°
$Sn_{96}Ag_{4}$	221° - 229°	430° - 444°	123 nΩ	700° - 800°
$Sn_{96.5}Ag_{3.5}$	221°	430°	107 nΩ	700° - 800°
$Sn_{96.5}Ag_{3.0}Cu_{0.5}$	217° - 220°	422° - 428°	133 nΩ	700° - 800°
$Sn_{95.5}Ag_{3.8}Cu_{0.7}$	217° - 221°	422° - 430°	130 nΩ	700° - 800°
$Sn_{99.3}Cu_{0.7}$	227°	440°	132 nΩ	700° - 800°

Sn = Tin
Pb = Lead
Sb = Antimony

Ag = Silver
Cu = Copper
Zn = Zinc

Bi = Bismuth
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Zinc Solder Alloys

	Melting °C	Melting °F	Resistivity	Tip °F
$Sn_{91}Zn_9$	199°	390°	115 nΩ	600° - 700°
$Sn_{89}Zn_8Bi_3$	191° - 198°	376° - 388°		600° - 700°
$Sn_{45}Pb_{53}Zn_2$	170° - 215°	338° - 419°		600° - 800°
$Sn_{40}Pb_{58}Zn_2$	175° - 220°	347° - 428°		600° - 800°

Sn = Tin
Pb = Lead
Sb = Antimony

Ag = Silver
Cu = Copper
Zn = Zinc

Bi = Bismuth
In = Indium
Cd = Cadmium

Low Heat Solder Alloys

	Melting °C	Melting °F	Resistivity	Tip °F
$Sn_{67.8}Cd_{32.2}$	176°	349°		500° - 600°
$Sn_{60}Bi_{40}$	138° - 170°	280° - 338°	345 nΩ	500° - 600°
$Sn_{48}In_{52}$	118°	244°	147 nΩ	500°
$Sn_{42}Bi_{58}$	138°	281°	359 nΩ	500° - 600°
$Sn_{42}Bi_{57}Ag_{1.0}$	137° - 139°	279° - 282°		500° - 600°
In_{100}	157°	314°	71.8 nΩ	500°
$In_{97}Ag_{3}$	143°	290°	74.9 nΩ	500° - 600°

Sn = Tin
Pb = Lead
Sb = Antimony

Ag = Silver
Cu = Copper
Zn = Zinc

Bi = Bismuth
In = Indium
Cd = Cadmium

Removal Alloys

	Melting °C	Melting °F	Resistivity	Tip °F
$Sn_{12}Pb_{18}In_{21}Bi_{49}$	58°	136°	710 nΩ	500°
Chip Quik ® $Sn_{18}Pb_{28}Cd_{11}Bi_{43}$	58°	136°		500°
(No Pb) Chip Quik ® $Sn_{30}Bi_{56}In_{14}$	58°	136°		500°

Sn = Tin
Pb = Lead
Sb = Antimony

Ag = Silver
Cu = Copper
Zn = Zinc

Bi = Bismuth
In = Indium
Cd = Cadmium

Solder Alloys You Will Actually Use

	Melting °C	Melting °F	Resistivity	Tip °F
$Sn_{63}Pb_{37}$	183°	361°	149 nΩ	600° - 700°
$Sn_{60}Pb_{40}$	183° - 190°	361° - 374°	205 nΩ	600° - 700°
$Sn_{62}Pb_{36}Ag_{2}$	179° - 189°	354° - 372°	114 nΩ	600° - 700°
$Sn_{50}Pb_{50}$	183° - 214°	361° - 420°	158 nΩ	600° - 700°
$Sn_{95}Sb_{5}$	232° - 240°	450° - 464°	145 nΩ	700° - 900°
$Sn_{96.5}Ag_{3.0}Cu_{0.5}$	217° - 220°	422° - 428°	133 nΩ	700° - 800°
$Sn_{99.3}Cu_{0.7}$	227°	440°	132 nΩ	700° - 800°

Sn = Tin
Pb = Lead
Sb = Antimony

Ag = Silver
Cu = Copper
Zn = Zinc

Bi = Bismuth
In = Indium
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3. FluX on: Flux

What is Flux?

5: a substance used to promote fusion (as of metals or minerals) ; *especially* : one (as rosin) applied to surfaces to be joined by soldering, brazing, or welding to clean and free them from oxide and promote their union.

http://www.merriam-webster.com/dictionary/flux

3. FluX on: Flux

What does Flux do?

- Cleans the surfaces to be joined
- Increases the flow of solder
  - Conducts heat to a degree
- Prevents oxidation during soldering

3. FluX on: Flux

Available forms of Flux

- Liquid
  - Rosin, No clean rosin
  - Water soluble (Inorganic)
- Paste
  - Rosin
  - Acid
- Cored Solder
  - Rosin, No clean rosin
  - Water soluble (Organic & Inorganic)
  - Acid

3. FluX on: Flux

What is Rosin?

1: a translucent amber-colored to almost black brittle friable resin that is obtained from the oleoresin or deadwood of pine trees or from tall oil and used especially in making varnish

http://www.merriam-webster.com/dictionary/rosin

Readily Available Flux

	Type	Activation	Cleaning
‘44’ (ROM1)	Rosin	Full	Solvent
’48’ (ROM1)	Rosin	Full	Optional, Solvent
‘245’ (ROL0)	NC Rosin	Mild	No Clean
‘275’ (ROL0)	NC Rosin	Mild	No Clean
‘285’ (ROL0)	Rosin	Mild	Optional, Solvent
‘331’ (ORH1)	Organic	-	120°- 150°F Water
‘3350’ (INH1)	Acid	-	Neutralizer, Hot Water

3. FluX on: Flux

Rosin Flux Solvents

- Flux remover
- Heavy duty Flux remover
- Denatured alcohol
- 50/50 Denatured alcohol and acetone
- Rubbing alcohol
- 50/50 Rubbing alcohol and unscented nail polish remover

Flux Removal Tools

- Tooth brush
- Cotton swab (Q-Tip)
- Chamois cloth
- Dental pick

4. Soldering & Desoldering Tools

Standard Issue POS



Soldering Iron



Photo By: Weller

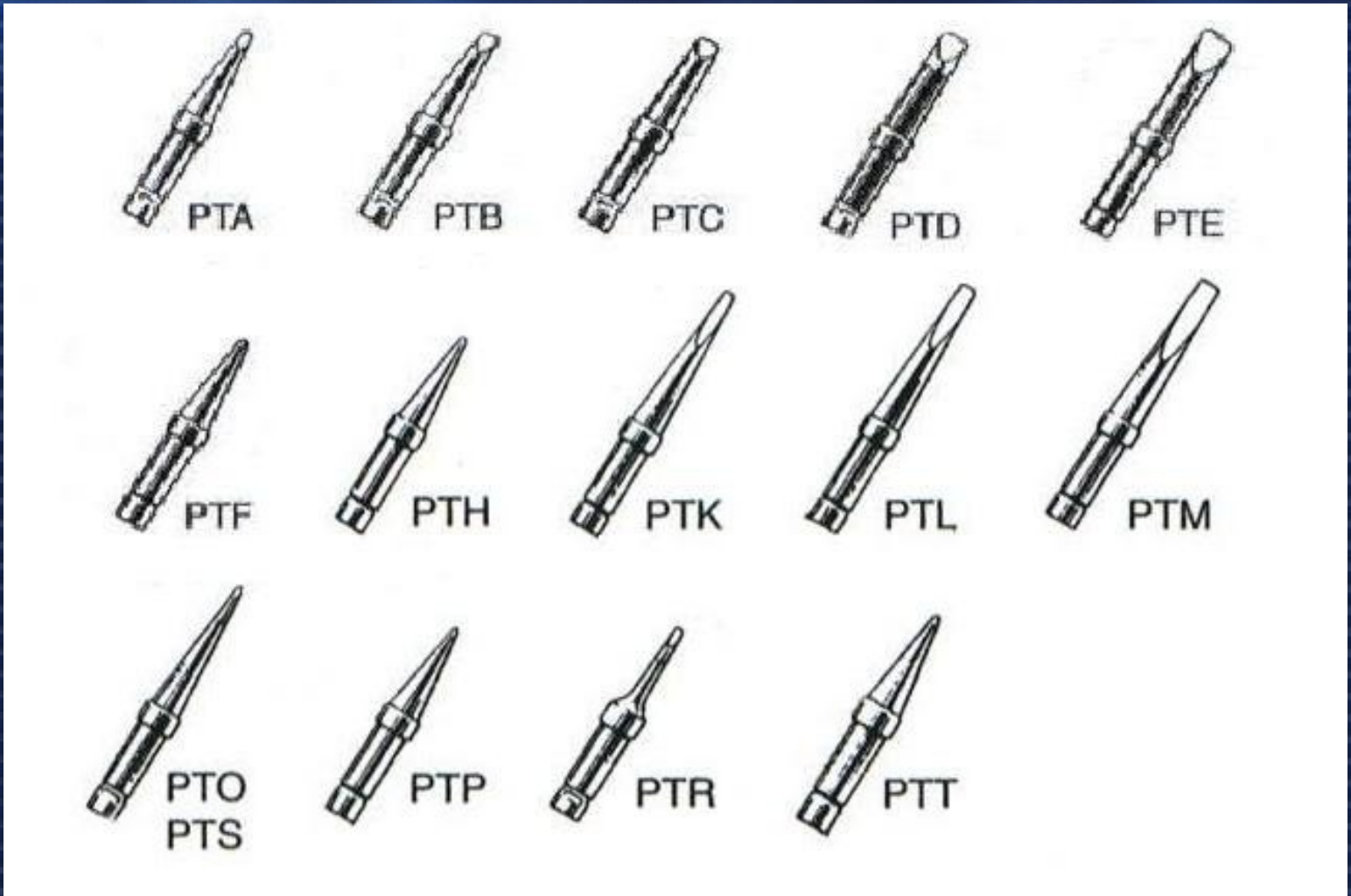
4. Soldering & Desoldering Tools

Soldering Stations



Photos By: Weller

Soldering Station Tips



4. Soldering & Desoldering Tools

Portable Soldering Irons







Photos By: Weller

Don’t do what DCFluX does

- Using a torch near ‘The Package’

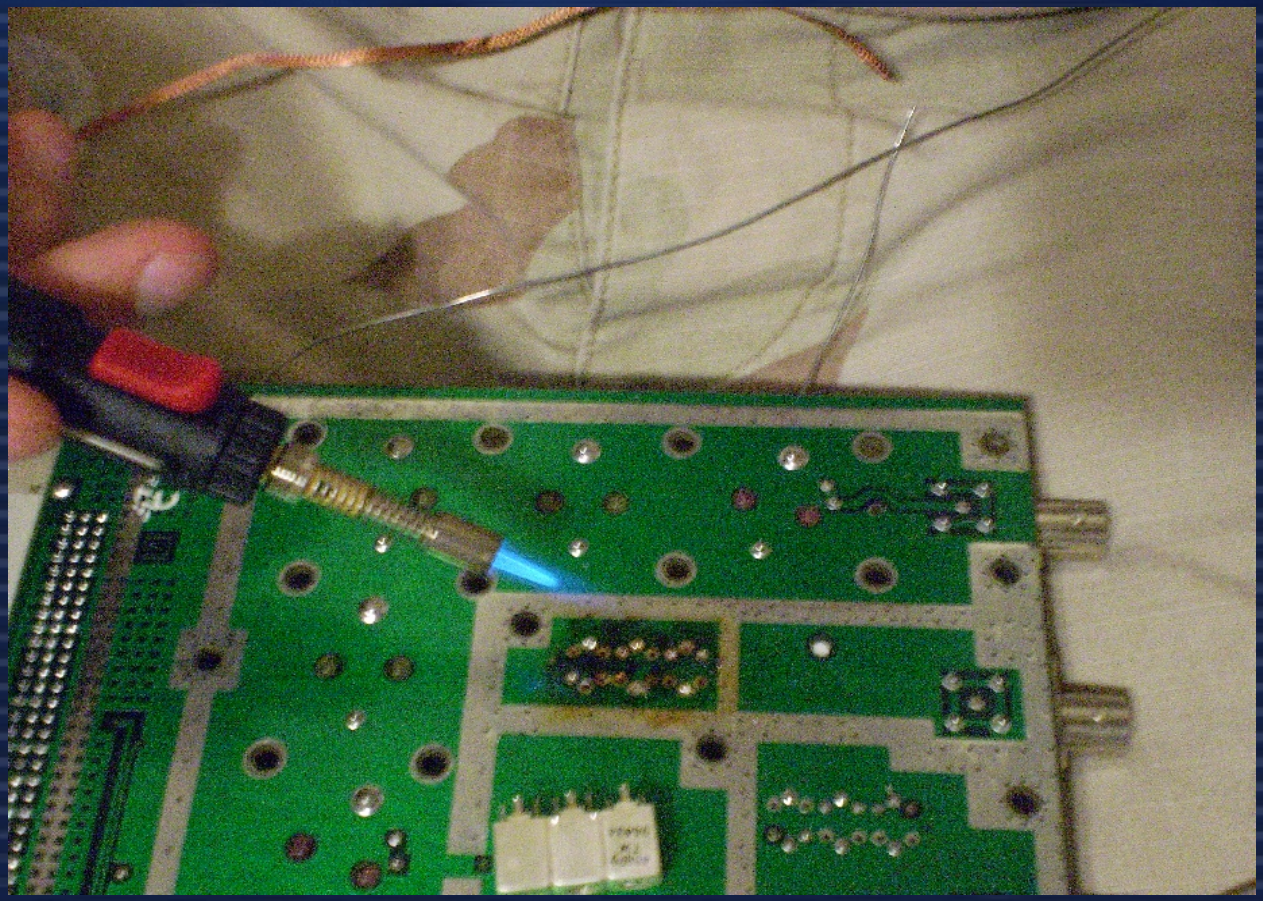


Photo By: DCFluX

4. Soldering & Desoldering Tools

Soldering Guns









Photos By: Weller

4. Soldering & Desoldering Tools

Hot Air Rework Stations









Photos By: Weller

4. Soldering & Desoldering Tools

Heat Guns





Photos By: Weller

Professional BGA Reflow Station

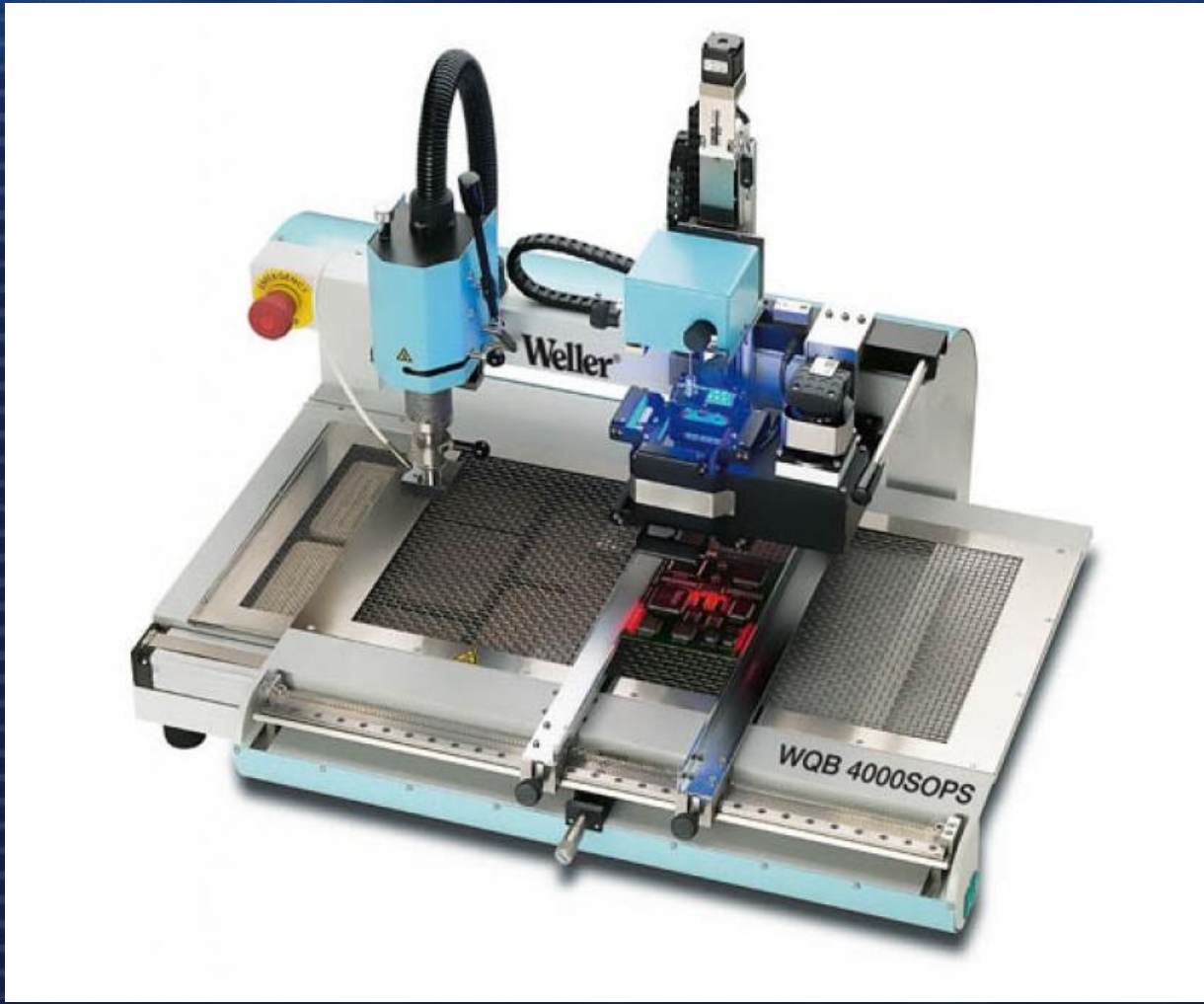


Photo By: Weller

Kitchen Top Reflow Station





Left Photo By: Spark Fun Electronics

4. Soldering & Desoldering Tools

What DCFluX uses











4. Soldering & Desoldering Tools

Solder Suckers







Photos By: Edsyn

Solder Wick



- Copper Braid
  - 0.025” – 1.5”
  - 5’ – 1000’ Rolls
  - Rosin, No clean rosin and Unfluxed

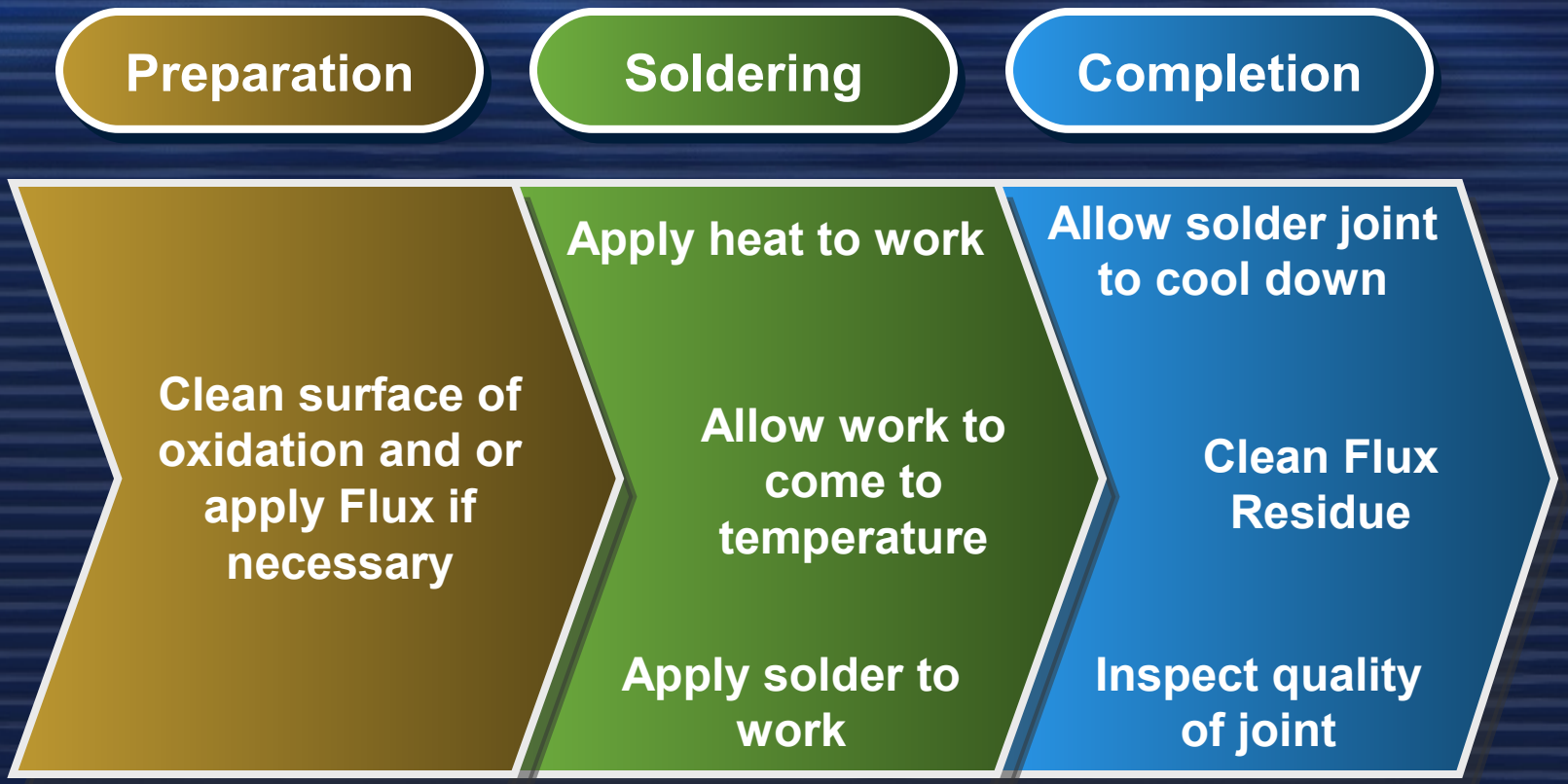
Photo By: Edsyn

Recommended Tools

- Relieved head diagonal cutting pliers
  - Flush cut
- Stainless steel tweezers & bulldogs
- Hemostats
- Metal IC remover
- Sponge
- 300-600 grit sand paper
- Pencil with eraser

5. Soldering & Desoldering Demonstration

Soldering Process Diagram



6. Editorial

Cyanoacrylate Does Not Conduct





Photos By: Super Glue Corp. and Krazy Glue

6. Editorial

Aluminum solder doesn't work for me





Photos By: BernzOMatic and Solder-It Co.

6. Editorial

Aluminum + Electricity = Evil



Photo By: DCFluX

6. Editorial

CADWELD® is awesome



Photo By: DCFluX

6. Editorial

This thing sucks

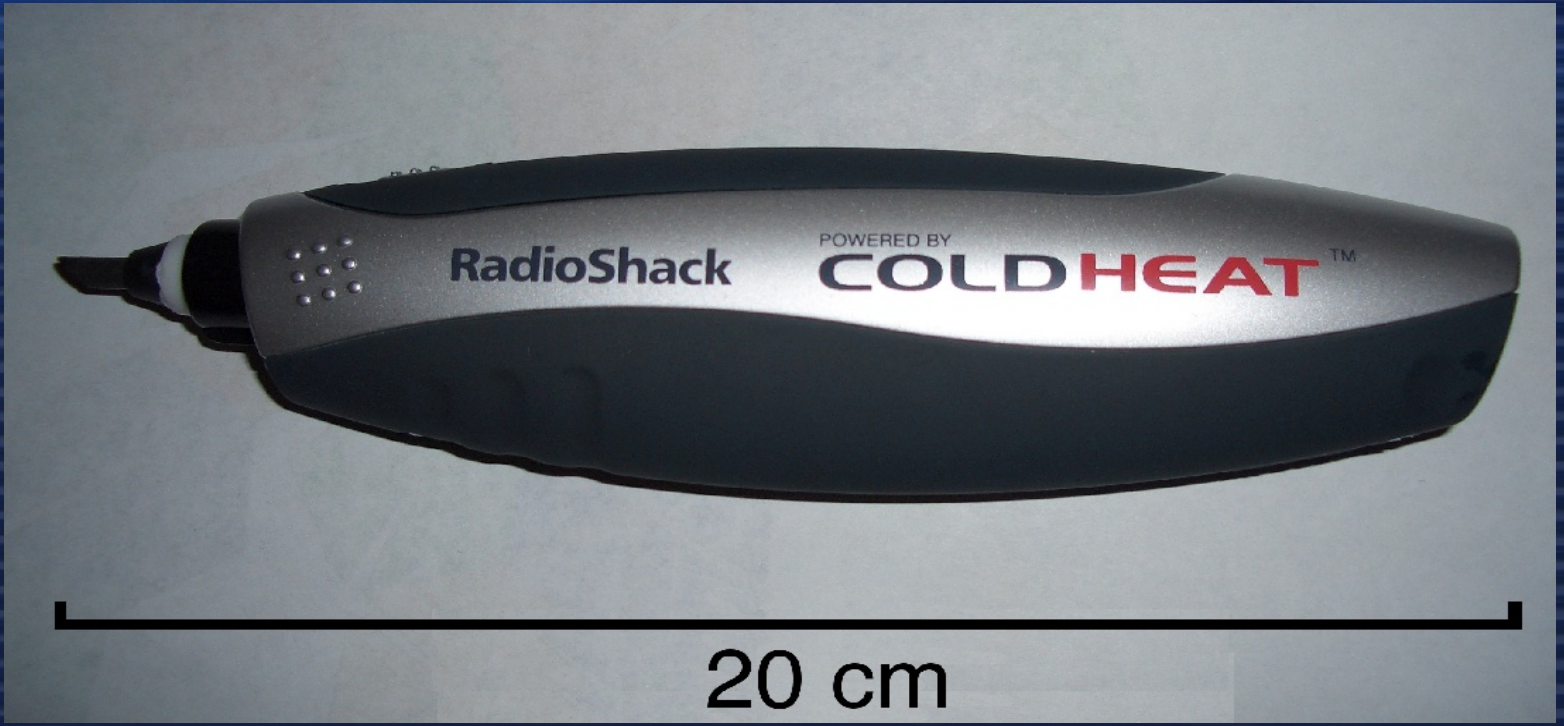


Photo By: Ilikefood

6. Editorial

This thing too



Photo By: Weller

6. Editorial

A good way to blow up your USB ports



Photo By: GetLoFi.com

6. Editorial

Cheap and effective



Photo By: Radio Shack

6. Editorial

Amateur Dentist™ Hobby Kit



Photo By: Radio Shack

6. Editorial

This is still a POS



DCFluX in:
The Man with the Soldering Gun

Questions?

Track 2 Q&A Room

matt@kgmn.net

FLUX RESEARCH

DCFluX will return in:
Moonbouncer





Photos By: CSIRO and NASA