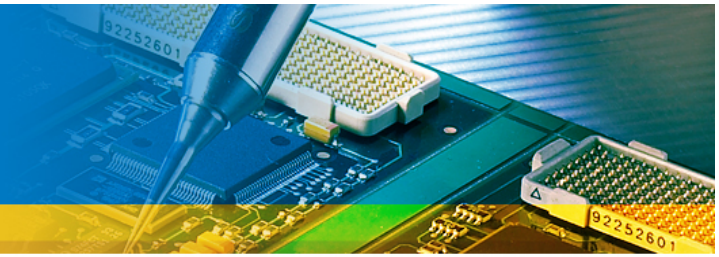
Tip Care Tutorial

How to extend the life of soldering tips and cartridges

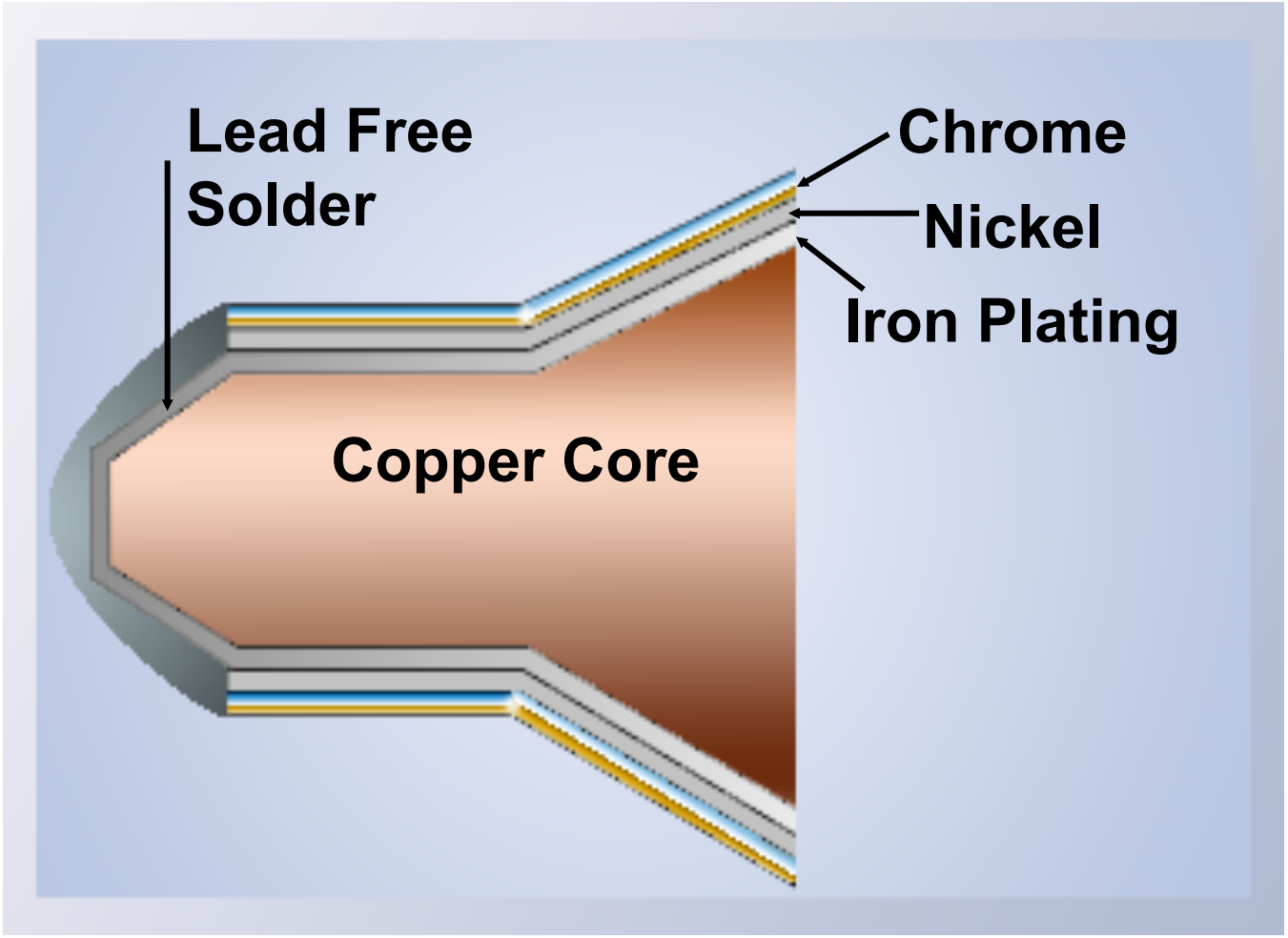
OKI okinternational METCAL

Overview



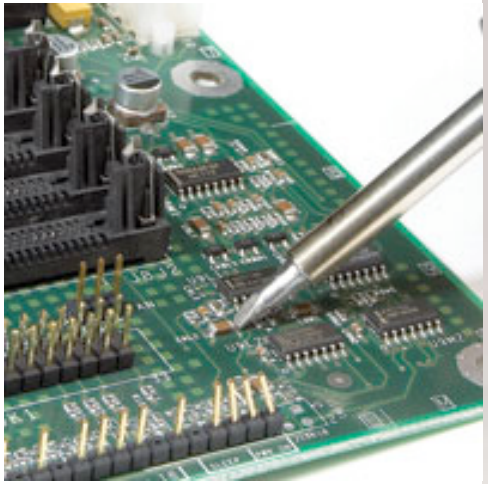
- Tip Construction, costs
- What effects tip life with lead free solder
- Plating failure explained
- Best practice, soldering techniques
- Tip maintenance

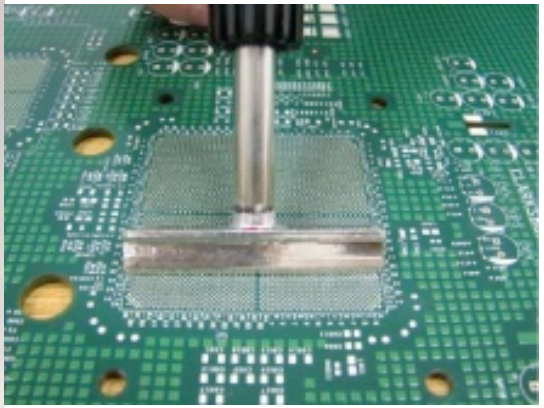
Tip construction



Tip costs

With the cost of tips and cartridges varying from $8 to over $60, the implications on cost of ownership are dramatically increased due to lead free soldering

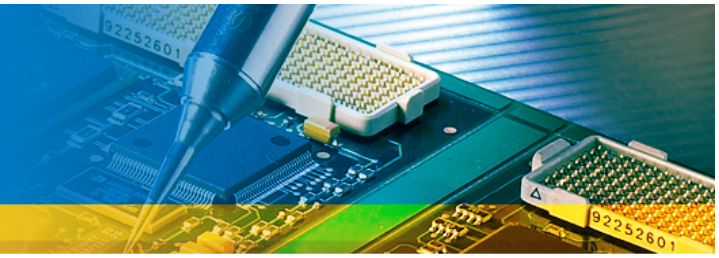




What Affects Tip Life With Lead Free?

- High tip idle temperatures are the major cause of Short Tip Life
- Flux is much more aggressive, especially with Pb-Free Alloys
- Surface contaminates (Oxidation & Flux Residues) build very quickly causing a reduction in thermal transfer to the working area
- Surface contaminates (Oxidation & Flux Residues) build very quickly causing operators to aggressively “force” the connection causing tip damage
- Tip surface Tin-Iron Intermetallics form faster with lead free solders

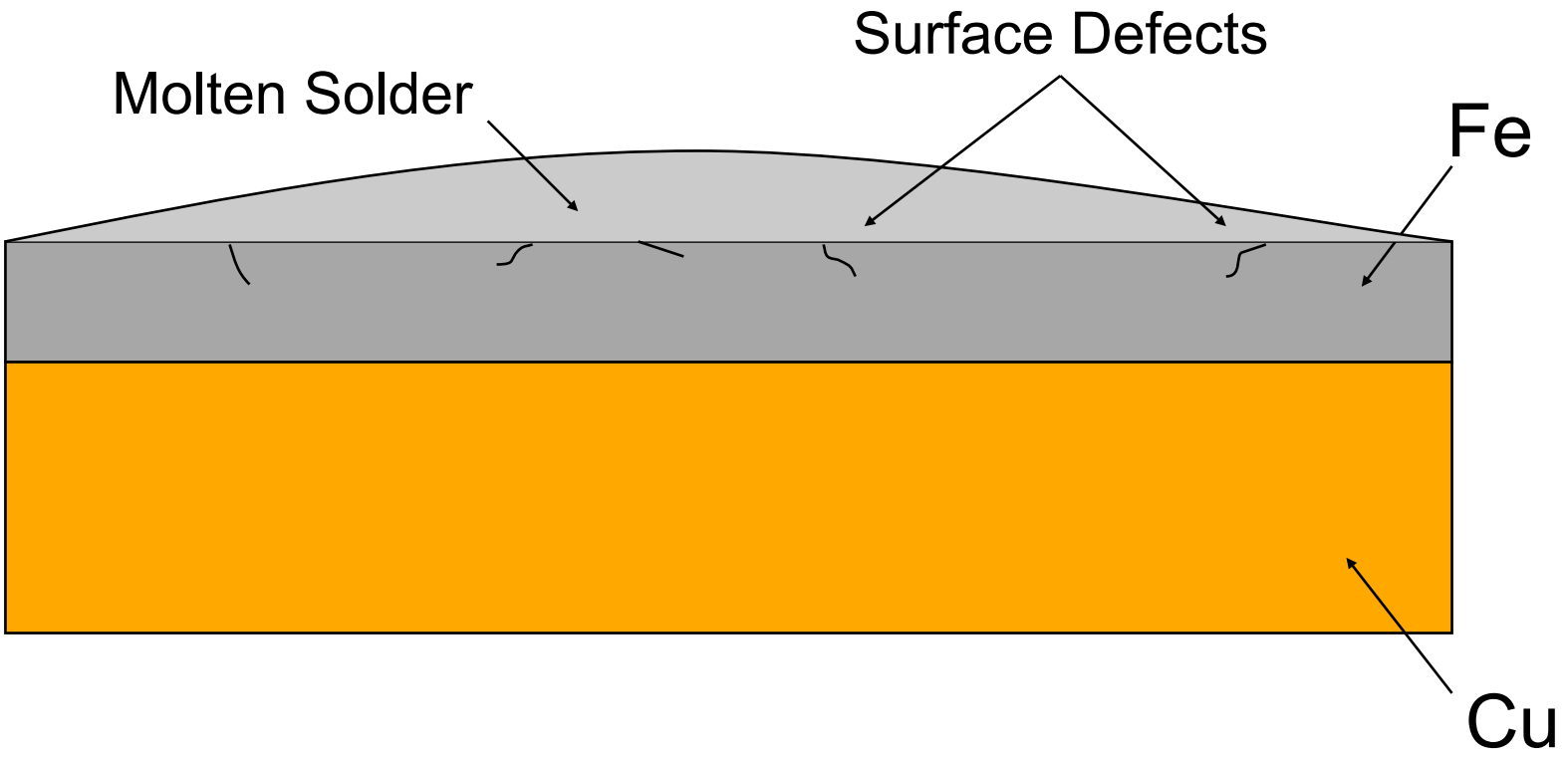
Lead free



Alloy	Tin	Lead	Antimony	Copper	Silver	Melting Point/Range	
Sn63, 63/37 & 63EN	63	37	-	-	-	183	standard electronics rework
Sn60, 60/40 & 60EN	60	40	-	-	-	183-188	standard electronics rework
50/50 & 50EN	50	50	-	-	-	183-212	electrical/industrial soldering
45/55 & 45EN	45	55	-	-	-	183-224	electrical/industrial soldering
40/60 & 40EN	40	60	-	-	-	183-234	electrical/industrial soldering
30/70 & 30EN	30	70	-	-	-	183-255	electrical/industrial soldering
20/80 & 31D	20	80	-	-	-	183-275	electrical/industrial soldering
15/85 & 4D	15	85	-	-	-	227-288	electrical/industrial soldering
45D	18	80	-	-	2	178-270	Aluminium soldering
95A	95	-	5	-	-	236-243	high temp. lead free alloy
96S & Sn96	96.3	-	-	-	3.7	221	possible lead free option
96SC (SAC387)	95.5	-	-	0.7	3.8	217	common lead free alloy
97SC (SAC305)	96.5	-	-	0.5	3	217	common lead free alloy
97Cu3	97	-	-	3	-	230-250	high temp. lead free alloy
99C	99.3	-	-	0.7	-	227	common lead free alloy
HMP	5	93.5	-	-	1.5	296-301	high temp. standard alloy
Savbit1	50	48.5	-	1.5	-	183-215	thin copper wire soldering
Savbit6	60	38	-	2	-	183-190	thin copper wire soldering
Sn62 or LMP	62	36	-	-	2	179	low melting point alloy

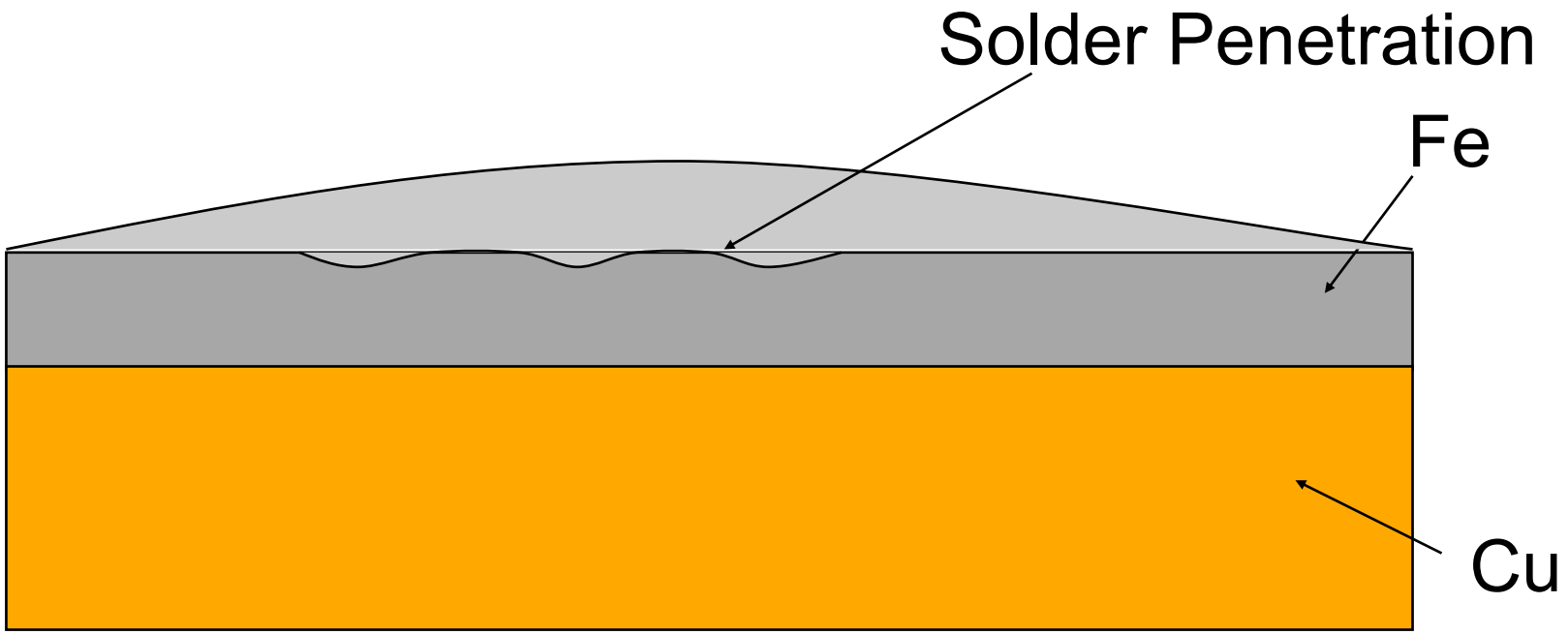
The table shows the tin content and melt point range for a range of solder wires from multicore

Failure Mechanism



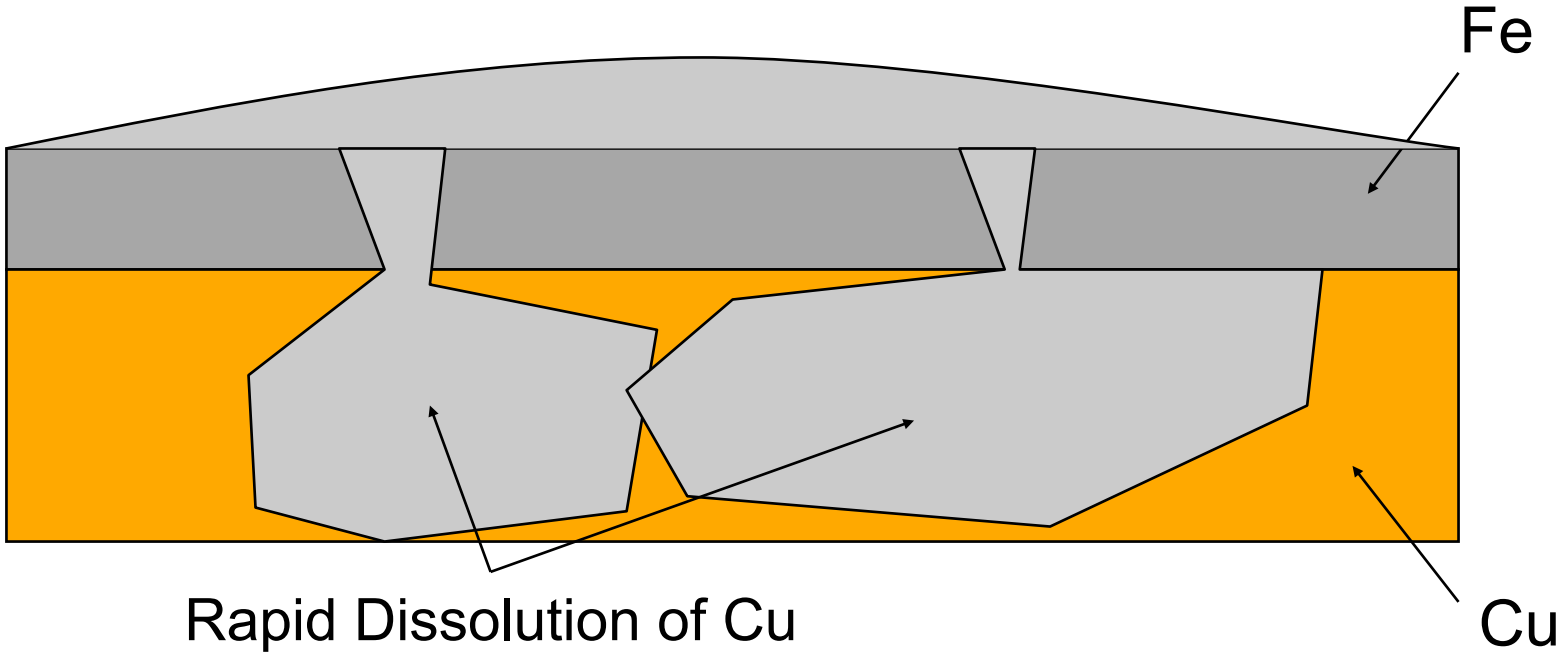
Defect Initiation

90% Time to Failure



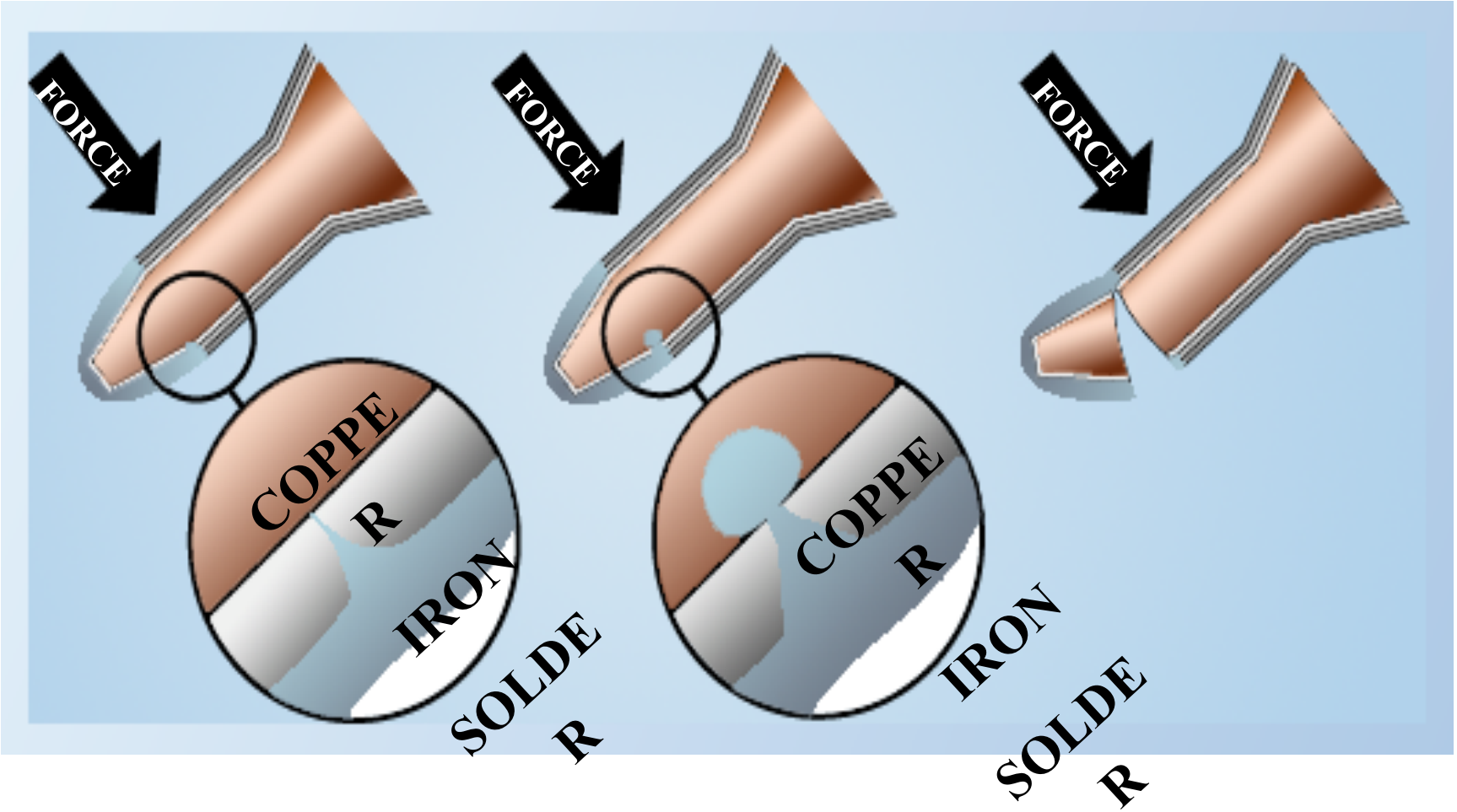
Defect Propagation

10% Time to Failure

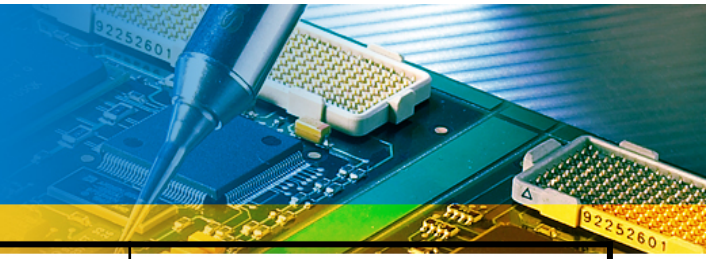


Accelerated Tip Erosion with Lead-Free

Stress/Cracking Failures



Tip Life Failure Matrix



Condition	Symptom	Cause	Prevention	Remedy
Organic Residue	De-wetted & Black Residue	Acidic Erosion	Keep Tip Well Tinned	Solvent clean + Mild Abrasion + Solder pot re-tin if needed
Oxidation	De-wetted (rust colour)	Tip to air exposure	Keep Tip Well Tinned	Activated flux & solder pot re-tin
Sn-Fe Oxide Intermetallc Formation	De-wetted & Black Residue	Excessive tin exposure	Power Back system during idle	Mild abrasive clean and solder pot re-tin
Fe-Cracking	Hole in Fe	Operator tip pressure	Keep Tip Well Tinned	Discard Tip
Fe-Dissolution (flux)	Hole in Fe	Acidic Erosion	Rotate tip to distribute solder	Discard Tip
Fe-Dissolution (tin)	Hole in Fe	Long term tin exposure	Power back system at idle	Discard Tip

Bulk Failures

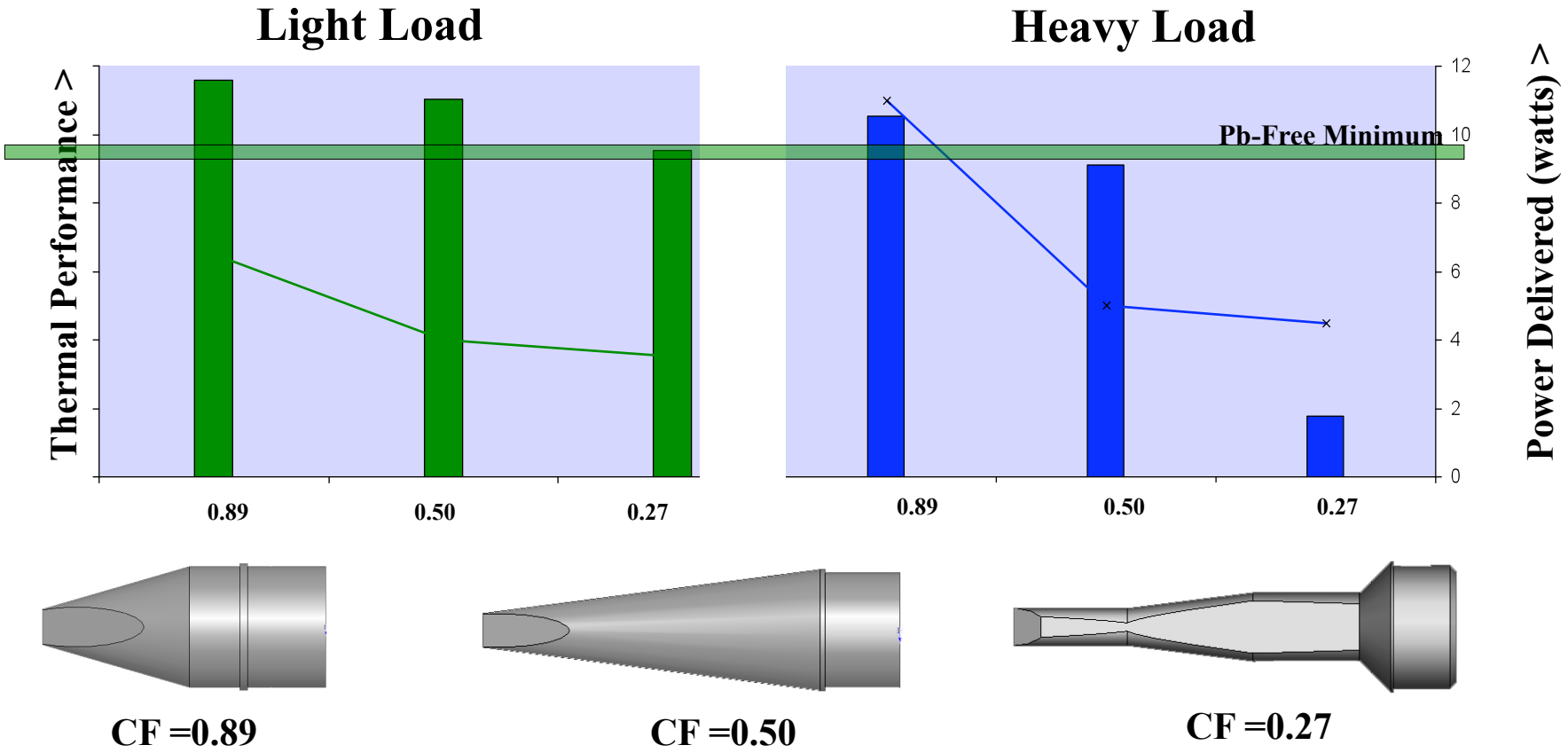
Surface Failures

How To Extend Tip Life

Higher Conductivity Factor Tips:

- Conductivity is the method thermal energy travels from the tip to the PCB. It is *conducted* from the heater through the tip to its target
- The larger the thermal highway the more efficient the delivery of thermal energy will be
- Selecting the optimal thermal highway will minimize the amount of thermal demand to a tip and improve tip life.

Conductivity Factor



Conductivity Factor = Energy Transfer Capability of the Tip Geometry
It is Directly Related to Tip Width and Length

How To Extend Tip Life

- Use higher thermal performance systems that operate at lower tip temperatures
- Power Control (SmartHeat®), *not* Temperature Control (Conventional)
- Tin tips well to prevent oxides and flux contamination
- Reduce tip idle temperature over long idle periods – use an “Auto Sleep Stand”

Auto Sleeper Stand

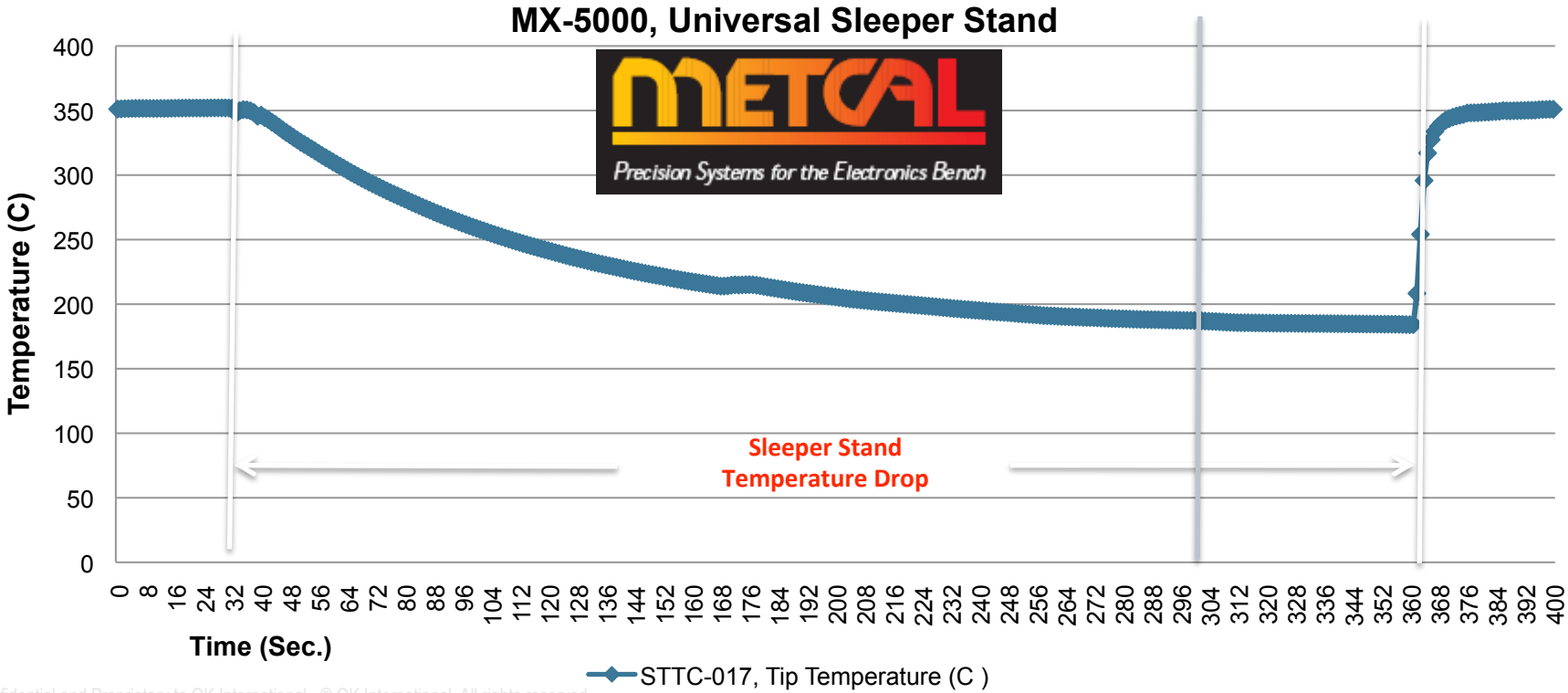
- The Auto Sleep Work stand only works with Metcal's SmartHeat® Technology
- These stands automatically reduce the power supplied to the hand piece, which leads to:
  - Reduced idle temperatures
  - Slower chemical reactions
  - Less inter-metallic formation
  - Less de-wetting
  - Longer tip life

Sleeper stand effects

Example:

STTC-017 assumed tip idle temperature approx of	350°c
Sleeper stand for 60 seconds temperature drops to approx	310°c
Sleeper stand for 200 seconds temperature drops to approx	205°c
Sleeper stand for 300 seconds temperature drops to approx	187°c

Temp Drop



Additional Sleeper benefits

With a sleeper stand the power consumption of a soldering iron is greatly reduced

Theoretical Example:

If you have 5 irons each in production using on average 40 watts per hour over an 8 hours day your consumption is:

5 irons X 40 watts = 200 watts X 8 hours (1 day) = **1600 watts** per day

Potentially a soldering iron can spend up to **50%** of its time in the stand between operations; if the stand is a sleeper stand the idle wattage is reduced to around 5 watts.

The equation now becomes;

5 irons X 40 watts = 200 watts X 4 hours (1 day) = **800 watts +**

5 irons X 5 watts = 25 watts X 4 hours (1day) = **200 watts** =

1000 watts per day

saving **600 watts a day!!!**

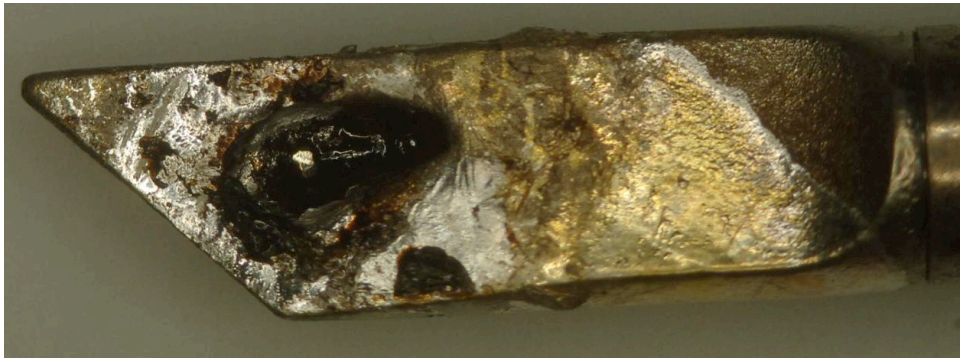
Soldering – Tip selection

It is important to select the correct geometry for the job. Selecting a geometry which is too small will lead to cold solder joints or increase the dwell time on the solder joint.

Selecting a tip which is too large could result in causing damage to the PCB.

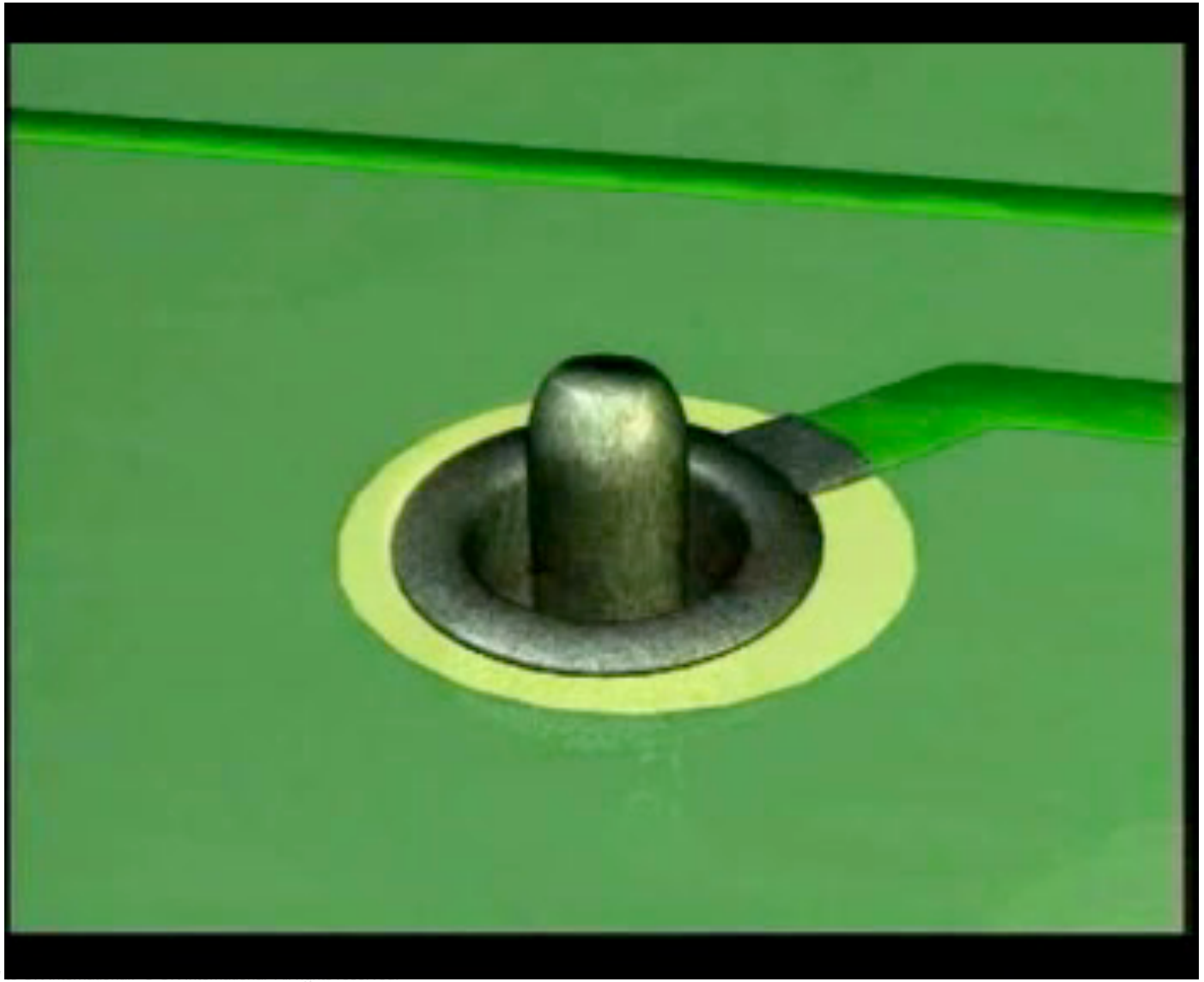
Soldering techniques -

Another common cause of tip failure is the method in which solder wire is applied. If the wire is continually fed onto the same point of a soldering tip, eventually, the plating will be removed and a hole will appear at this point.



To eliminate this risk, NEVER feed the solder wire into the soldering tip. The solder wire should be fed onto the component and/or terminal

Soldering techniques – Heat bridging



Tip Care: During Soldering Application - Summary

- Use correct amount of heat for the job
- Select correct tip geometry for the application
  Note: more than one tip may be required
- Feed solder wire onto the component lead
  <u>NOT</u> on the tip directly

- Always re-tin the tip when returning the hand-piece to the workstand.
- Do not apply pressure to tip to get more heat
- Do not “scrub” lead
- Only use clean, damp sulphar free sponges or the brass pads supplied to regularly clean the tip.

Tip Care: After Soldering

1 Do Not Use Tips as a Screwdriver or Prying Tool

2 Turn Station Off When Not in Use . . . . . .

3 Remove Components / Debris with Tweezers or Cleaning

Do Not Bang on Work Station Edge

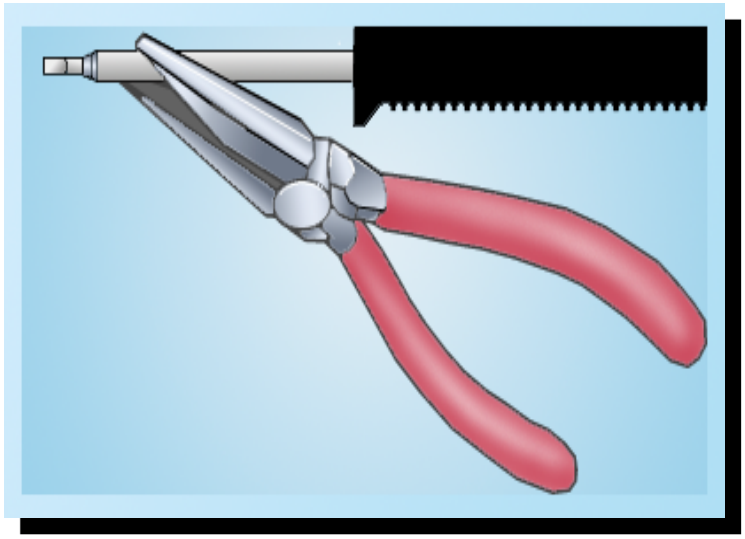
YES

NO

Correct Tip Changing Procedure

Do Not Use Pliers to Change Tip Cartridges.

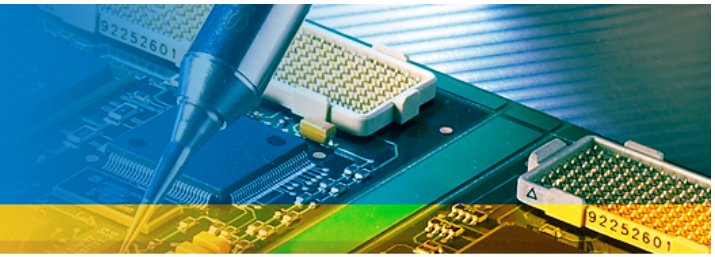
Use a Cartridge Removal Pad



NO !

YES !

Tip Care: Cleaning and Tinning



- Use a Clean, damp sponge to Clean the Tip
- Use De-Ionized or Distilled Water ONLY!
- Do Not Use a Sponge With Sulfurs or Detergents
- Tin Tips During Storage

Tip Care: Cleaning and Tinning

Abrasives

- **LEAD**: Do Not Use a Dry Sponge, Rag, or Any Abrasive

- **LEAD-FREE**: Use Abrasive Pad Recommended by the Manufacturer

With Lead-free, a brass cleaning pad may be required if you are experiencing contamination problems associated with higher volumes of flux, higher soldering temperatures and more active flux composition

BE CAREFUL !

Reconditioning Tips

- All methods currently stated are suggestions to prevent reduced tip life.
- If excessive levels of oxides are allowed to build up, the thermal performance and the tips ability to wet will deteriorate.
- In these circumstances, it is possible to re-condition an abused tip to a re-usable condition by the following methods.
- Tip Scrubbers. These are mild abrasive blocks which remove heavy oxides from the tip.
- Tip savers. These are a flux and solder paste compound which can be used to recondition the tip.
- Please be aware that the methods mentioned above should not be performed as part of regular cleaning operations but only as a last resort.