

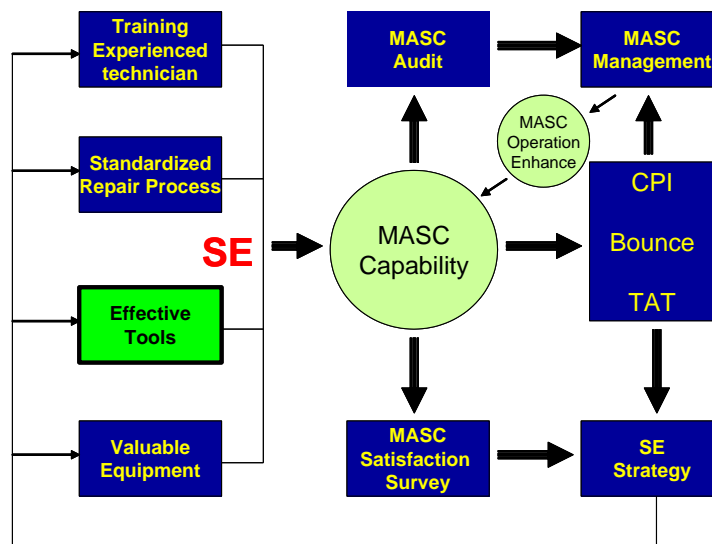
Lead-Free

Underfill/Underfirm

POP (Part on Part)

Repair Procedures

Revision 1.0
14 June 2007



AP SERVICE ENGINEERING

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Revision History

<i>Issue</i>	<i>Description of Release Change(s)</i>	<i>Originator</i>	<i>Date</i>
1.0	Initial Release	Patrick Goh	14 June 2007

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1.0 Introduction

1.1 Scope

This document describes procedures to PCB repair Lead-free (ROHS), Underfill/Underfilm production process, Removable Shield required for underfill/underfilm parts and special IC replacement for POP products

1.2 Terms And Acronyms

Acronyms / Terms	Definition / Description
ROHS	Restriction of Hazardous Substances
POP	Part on Part
BGA	Ball Grid Array
PCAP	Power Management IC
POG	DSP IC
NEPTUNE	DSP IC
BULVERDE	DSP IC
ATLAS	Power Management IC
IPA	Isoprophyl Alcohol
SMD	Surface Mount Device
UNDERFILL	Encapsulant material typically deposited between a flip chip device and substrate to reduce a mismatch in thermal expansion coefficients
UNDERFIRM	A polyurethane film that is machine placed in all four corners of the BGA package before the BGA is placed on the PCB. The reflow process adheres the film to the PCB and to the bottom of the component and provides a mechanism to reduce the strain on the solder bump
LEADFREE	"Lead-free / Pb-free" means that Pb has been removed which is required by the ROHS legislation and regulation

1.3 Safety and ESD Precautions

When performing any soldering tasks, following guidelines must be adhered upon :

- Wear ground strap prior to the start of any reball operation.
- Personnel with long hair must tie up neatly
- Wear finger cots.
- Do not touch the hot air nozzle.
- Do not direct any hot air / gases unto any part of the body.
- Do not place any flammable material in the vicinity of the hot air / gas nozzle.

1.4 Housekeeping

- Make sure to keep the rework area cleanliness and tidiness at all times

2.0 Lead Free

2.1 Equipment/Tools Set-up

Manufacturer:	Description	Type	Remark
Weller	Solderstation	WSD81	Or Similar for lead free use.
Metcal	Solderstation	PS800	Or Similar for lead free use.

- [Hakko](#) standard Preheater 853 with a universal universal PCB-fixtue from [[AMS](#) Part-# 1950090]



- [Steinel](#) HG 2310 LCD Hotgun with nozzle 070717



- [Indalloy](#) Lead-Free Rework Liquid Flux NC-771
- [Indalloy](#) 241 with core 230 Lead-Free Solder Wire
- [Indalloy](#) IND 241 Lead-Free Solder Paste
- Contact Cleaner (i.e. [KONTAKT WL](#)) or Isoprophyl Alcohol (IPA)
- Solder Wick
- Brush
- Tweezers
- Smoke Absorber ([Hakko H494](#)) / Fume Extraxion System ([Metcal BVX-201](#))

2.2 Procedures



For all lead-free/underfilled products, one has to perform proper heat shielding to components that are sensitive to heat like PCAP/NEPTUNE/POG/BULVERDE. Kindly adhere to procedures as stipulated in Appendix B – Heat Shielding Methods

2.2.1 Removal of SMD Components

- Apply a little flux on the SMT component to be reworked
- Turn the temperature setting nob to 300 to 325° C
- Switch “ON” the Heat Gun to blow HOT air.
- Hold the Heat Gun to blow directly onto the SMT component to be reworked.
- Height of Heat Gun to component must be 3.0cm to 4.0cm as shown in Figure 1
- Heat the SMT component until the solder at the side starts to melt than perform rework on the component with the use of a tweezer.
- Switch the Heat Gun to blow COLD air to cool down the reworked area.
- Switch “OFF” the Heat Gun and put back onto the table.
- Use IPA to wash away the flux on the reworked area

2.2.2 Removal of BGA Components

- The temperature of heat gun should be set to 300 to 325° C
- Apply a little flux under the BGA component to be reworked.
- Switch “ON” the Heat Gun to blow HOT air.
- Hold the Heat Gun to blow directly onto the BGA component to be reworked.
- Height of Heat Gun to component must be 3.0cm to 4.0cm as shown in Figure 1
- Heat the BGA component until the solder balls under the BGA melts by using a tweezer to slightly push one corner of the BGA.
- If the BGA component moves and bounce back, this shows that the solder balls under the BGA are already melted and the BGA can be removed by using a tweezer.

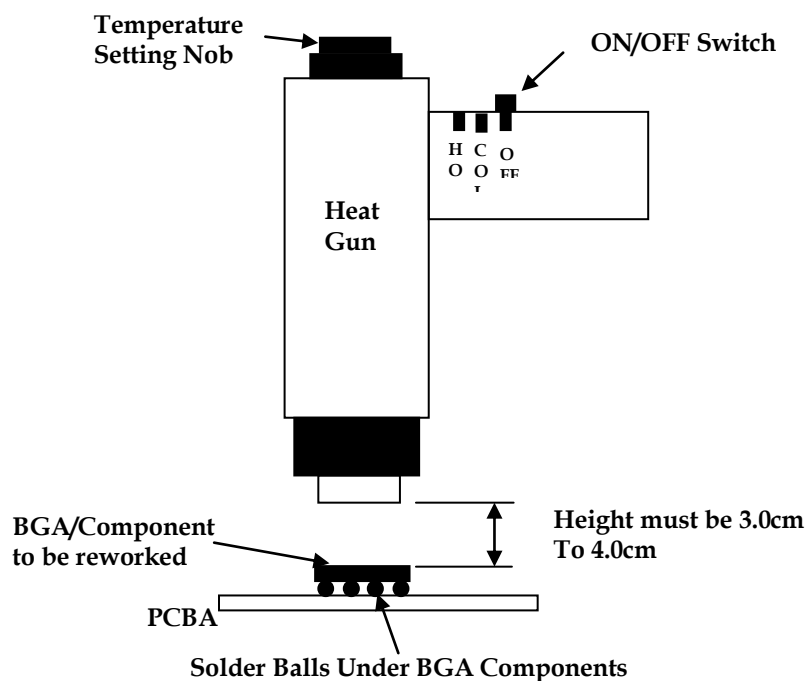


Figure 1

2.2.3 Placement of BGA Components

- After BGA component is removed, use solder iron to touch up the solder pads on the PCBA of the BGA component until the solders on solder pads are even
- Use IPA to wash away the flux for removing the BGA component from the PCBA and apply new flux on the solder pads.
- Align BGA component onto the solder pads on the PCBA by using the crop mark printed on the PCBA or by the runners as guidelines.
- Hold the Heat Gun to blow directly onto the BGA component to be reworked
- Height of Heat Gun to component must be 3.0cm to 4.0cm.
- Heat the BGA component until the solder balls under the BGA melts by using a tweezer to slightly push one corner of the BGA
- If the BGA component moves and bounce back, this shows that the solder balls under the BGA are already melted
- Switch the Heat Gun to blow COLD air to cool down the reworked area
- Switch "OFF" the Heat Gun and put back onto the table.
- Use IPA to wash away the flux on the reworked area.

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2.3 Inspection Criteria

- After the rework is done, need to inspect the solder joint of the reworked component. Refer to for Appendix C – Soldering Visual Inspection
- Visual inspect solder joint for any process Issues, e.g solder short, insufficient solder, dry joint, excessive solder or unsolder.
- For excessive solder, use solder wick and solder iron to remove the excess solder.

Lead-free soldering video is vailable in

[MD- Service Portal](#) (South Asia)

<http://esupport.motorola.com> (PRC)

<https://serviceone2.motorola.com/tw/> (TW)

<https://serviceone1.motorola.com/index.htm> (Japan)

<https://serviceone.motorola.com> (Korea)

3.0 Underfill/Underfirm Rework Procedures

3.1 Equipment/Tools Set-up

Manufacturer:	Description	Type	Remark
Weller	Solderstation	WSD81	Or Similar for lead free use.
Metcal	Solderstation	PS800	Or Similar for lead free use.

- [Hakko](#) standard Preheater 853 with a universal universal PCB-fixture from [[AMS](#) Part-# 1950090]



- [Steinel](#) HG 2310 LCD Hotgun with nozzle 070717

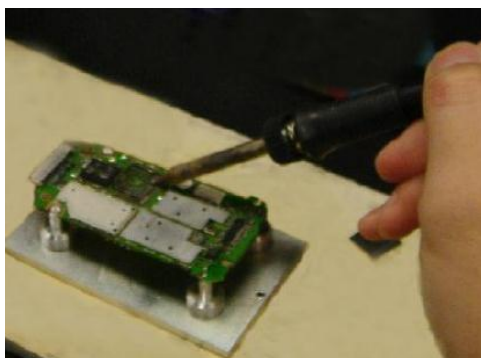


- [Indalloy](#) Lead-Free Rework Liquid Flux NC-771
- [Indalloy](#) 241 with core 230 Lead-Free Solder Wire
- [Indalloy](#) IND 241 Lead-Free Solder Paste
- Contact Cleaner (i.e. [KONTAKT WL](#)) or Isopropyl Alcohol (IPA)
- Solder Wick
- Brush
- Tweezers
- Smoke Absorber ([Hakko H494](#)) / Fume Extraction System ([Metcal BVX-201](#))
- [Flux pen/Cleaning](#) CW9100/CW9200 pen
- [CN-1703](#) Zymet underfill and injector

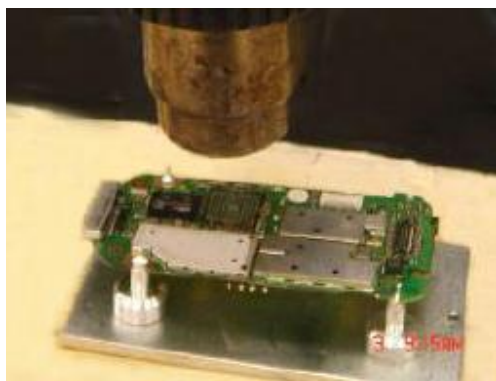
For all lead-free/underfilled products, one has to perform proper heat shielding to components that are sensitive to heat like PCAP/NEPTUNE/POG/BULVERDE. Kindly adhere to procedures as stipulated in Appendix B – Heat Shielding Methods

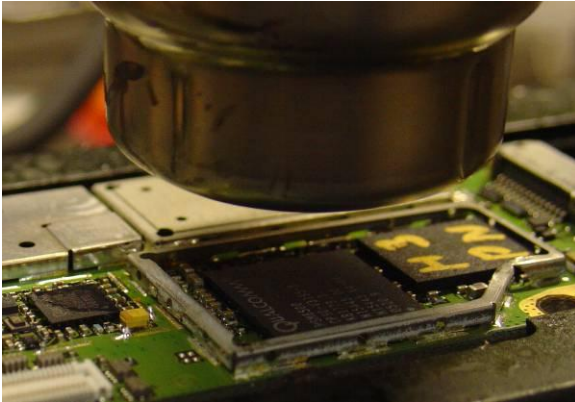
3.2 Underfill Rework Process

- Open/peel off the shield cover, put the board on the repair fixture, use hot gun to heat the BGA, remove BGA when the solder melted.
- Apply flux to the pads of the board, and clean the BGA area with electric iron

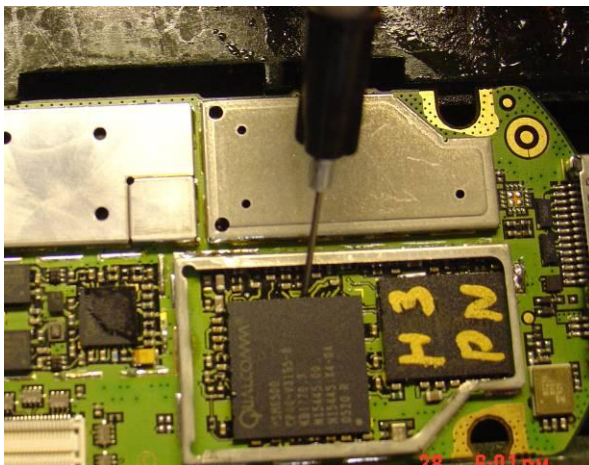


- Use the hot gun to heat the board until the corner film/underfill residual becoming soft, then wipe BGA area with a cleaning pen, inspect the board with a microscope to ensure the BGA area is smooth and clean.





- Wipe the PCB solder pad around the BGA with flux pen, then place the BGA on board accurately aligned with the corner mark, use hot gun to heat the BGA at 350°C for about 120s.
- After the rework is done, need to inspect the solder joint of the reworked component.
- Refer to for Appendix C – Soldering Visual Inspection Visual inspect solder joint for any process Issues, e.g solder short, insufficient solder, dry joint, excessive solder or unsolder. For excessive solder, use solder wick and solder iron to remove the excess solder.
- Conduct RF and Functional testing
- Only if it has passed the testing, put the board to repair fixture again, dispense the encapsulant along two adjacent edges of the BGA parts until it flows to the other side.



- Adjust hot gun temperature to 180°C and heat the board for about 70s, stop heating, wait the board cooling to room temperature.
- Place/solder a new shield cover on the shield frame.

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3.3 Underfilm Rework Process

The IC replacement process is similar to ones in Underfill. The instructions indicated here specifies the techniques used for putting underfilm once the replacement IC has been put back onto the PCBA and passed GP Gate testing.

- By using the Flux injector, apply flux on the Tact Pad area as shown in Figure 6.
- Place the Underfilm with the Tact Pad as guide as shown in Figure 7.
- By using the Solder Iron Tip, strike out the two corners of the underfilm as shown in Figure 8.
(Ensure that the underfilm does not touch the BGA solder pad and underfilm will stick on the PCB as shown in Figure 9.)
- Apply Flux on BGA and place IC with reference to the PCB crop mark as shown in Figure 10.
- Turn on the Pre-heater and Heat Gun as shown in Figure 11.

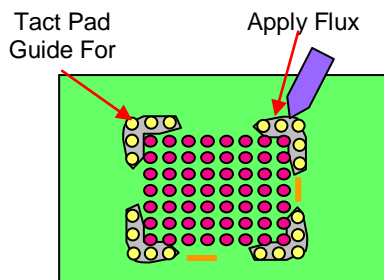


Figure 6

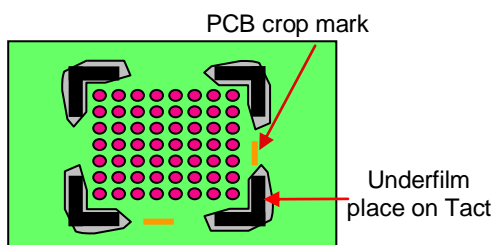


Figure 7

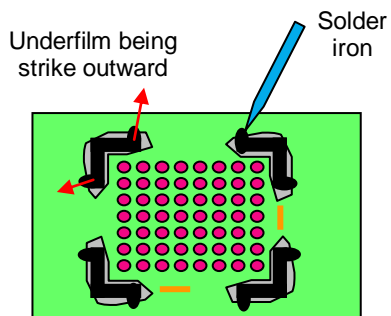


Figure 8

All the corners are stick on to PCBA

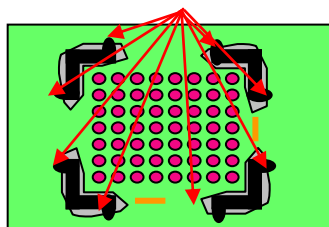


Figure 9

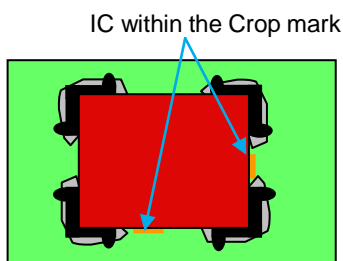


Figure 10

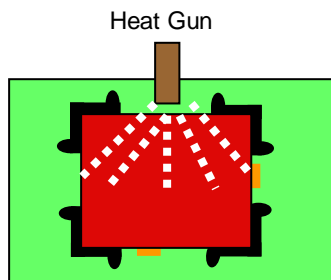


Figure 11

[MD- Service Portal](http://esupport.motorola.com) (South Asia)<http://esupport.motorola.com> (PRC)<https://serviceone2.motorola.com/tw/> (TW)<https://serviceone1.motorola.com/index.htm> (Japan)<https://serviceone.motorola.com> (Korea)

4.0 POP Parts Replacment

4.1 Equipment/Tools Set-up

- [Hakko](#) standard Preheater 853 with a universal universal PCB-fixture from [AMS](#) Part-# 1950090]



- [Steinel](#) HG 2310 LCD Hotgun with nozzle 070717

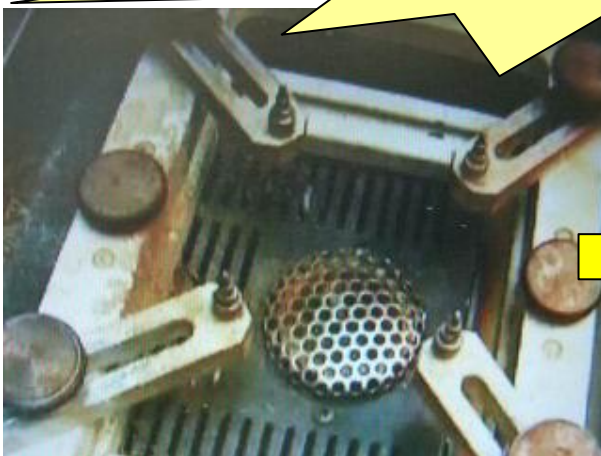


- [Indalloy](#) Lead-Free Rework Liquid Flux NC-771
- [Indalloy](#) 241 with core 230 Lead-Free Solder Wire
- [Indalloy](#) IND 241 Lead-Free Solder Paste
- Self Made Air-Cooling Fixture (See Appendix A)
- Contact Cleaner (i.e. [KONTAKT WL](#))
- 5 V DC Power Supply with current level indication
- Solder wick
- Brush
- Tweezers
- Smoke Absorber ([Hakko H494](#)) / Fume Extraxtion System ([Metcal BVX-201](#))

4.2 Procedures

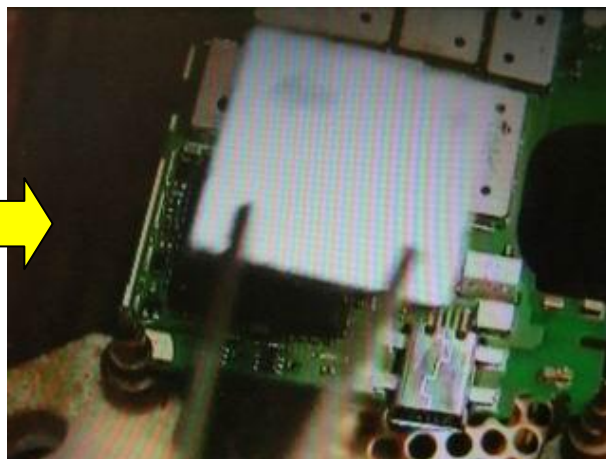
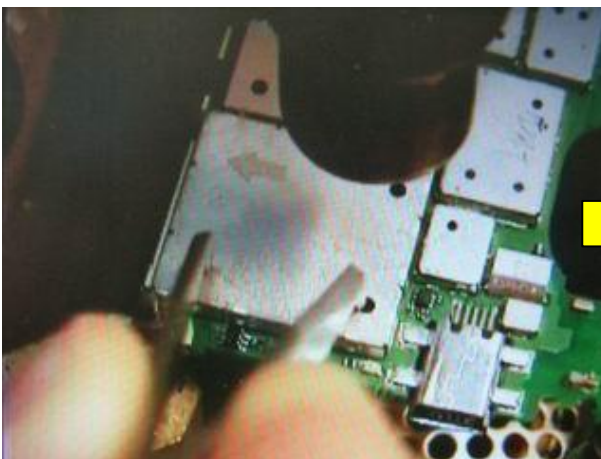
4.2.1 Set-up for POP IC Removal

**Strongly recommend Steinel HG 2310 LCD
Hotgun**



- Set Steinel heat gun to 330° Celsius, HAKKO Preheater to 220° Celsius.
- Attach Air Cooling fixture onto the ATLAS shield on the bottom side of PCBA with the other end being connected to the air pump.
- Turn on the Airpump

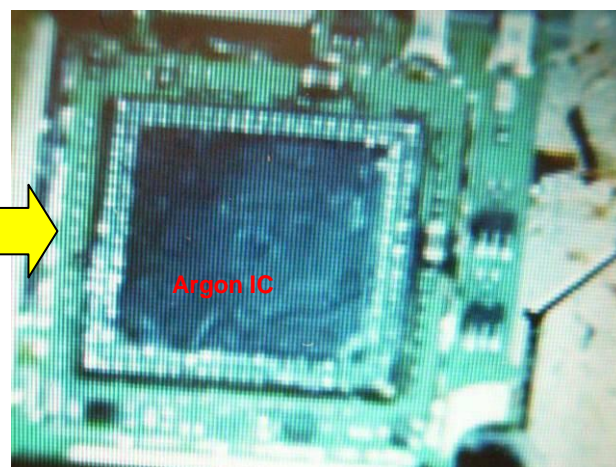
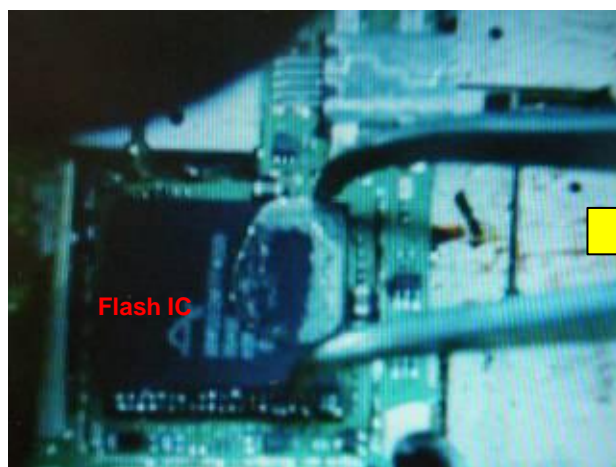
4.2.2 POP IC Removal



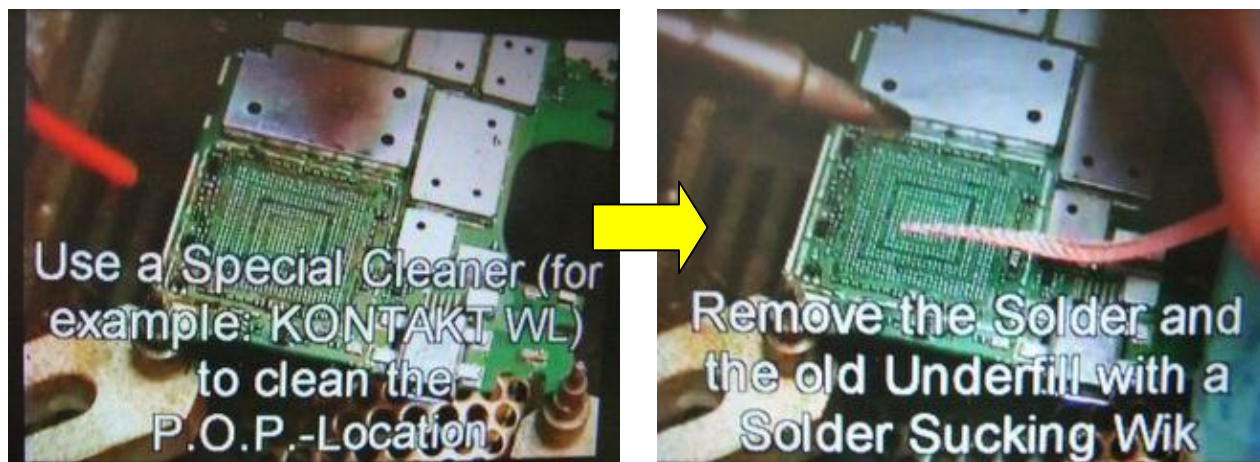
- With the shield in place, use tweezer to remove the shield.



- Heat underfill with hot air gun and with preheater on
- Remove the underfill POP IC from the edges carefully



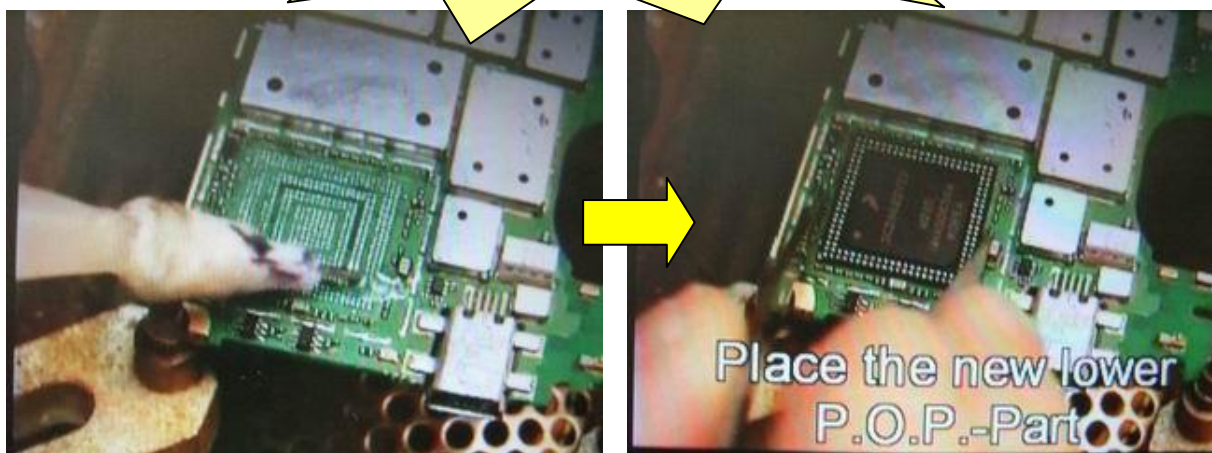
- Remove Flash IC only by tweezers with the Argon IC still intact
- Remove the Argon IC
- Off the Air Cooling



- Use contact cleaner to clean the BGA pads
- Remove solder residue and underfill using solder wick

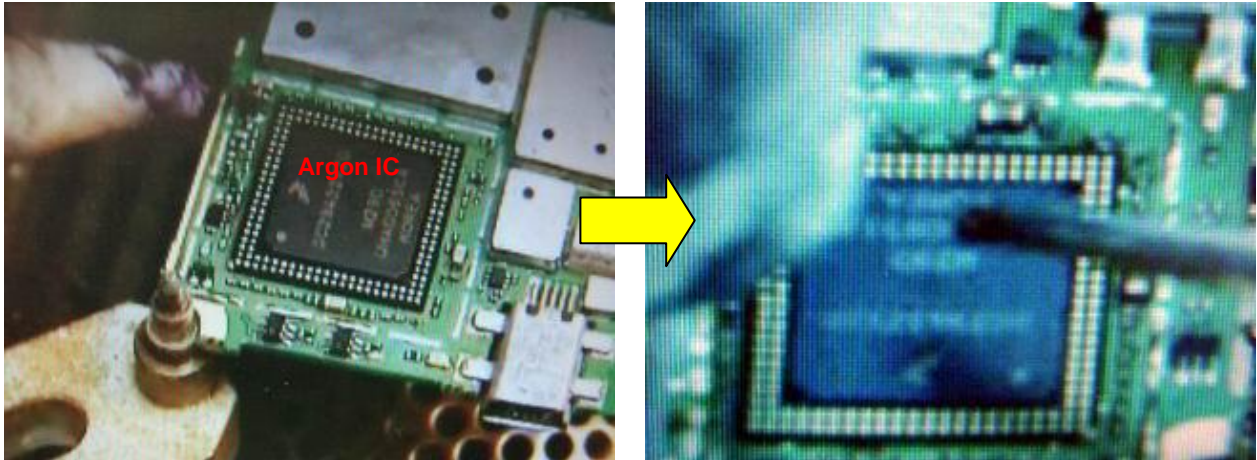
4.2.3 POP - Argon IC Placement

**Strongly recommend Indium NC-771
Liquid Flux**



- Add liquid flux to the BGA pads
- Place and align the Argon IC carefully

The distance between heatgun and POP-parts has to be 3 to 4 cm @ 330° C and airflow should be minimum.



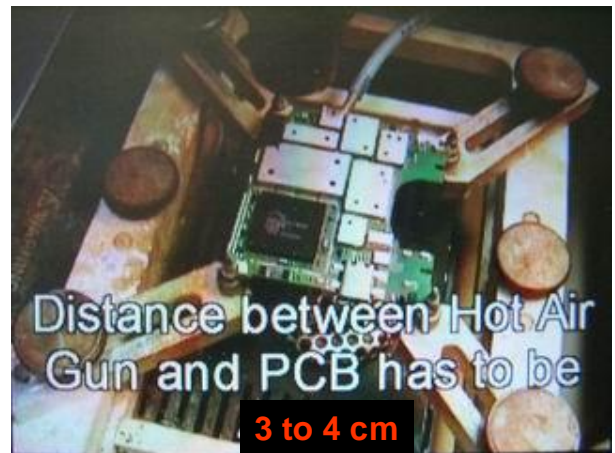
- Add liquid flux to the pads above Argon IC and turn on the air colling again
- Using the heat gun, heat the Argon IC for about 2 minutes.
- The distance between the heatgun and Argon IC has to be 3 to 4 cm apart
- Temperature of heatgun is set to 330° C with airflow switch to minimum
- Turn off pre-heater and let PCB cool down

4.2.4 Argon IC Current Check

- Connect the PCB (Only Argon IC is soldered) to Power supply with 4V output, the current drawn should be about 121 – 128mA.
- If current drawn >130mA, Argon IC may be short
- If current drawn < 50mA, Argon IC may be cold soldered

4.2.5 POP – Flash IC Placement

The distance between heatgun and POP-parts has to be 3 to 4 cm @ 330° C and airflow should be minimum.



- Add Liquid flux on Argon IC
- Place the flash IC on top of the Argon IC
- Align the flash IC carefully
- Add liquid flux to both ICs
- Turn on the preheater and use heat gun to heat the flash IC for about 2 minutes
- The distance between the heatgun and Argon IC has to be 3 to 4 cm apart
- Temperature of heatgun is set to 330° C with airflow switch to minimum
- Afterwhich, turn off pre-heater, aircooling and let PCB cool down

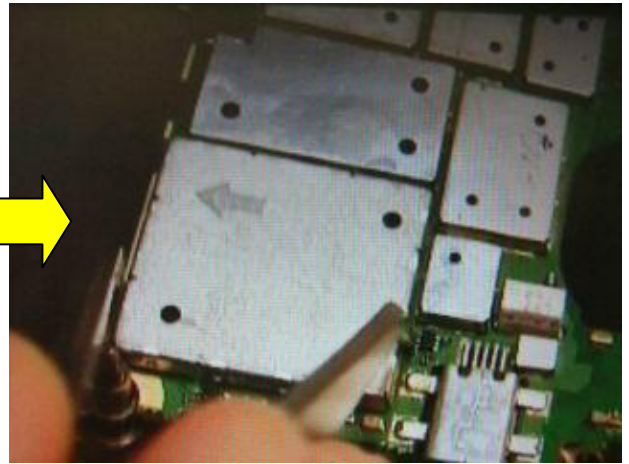
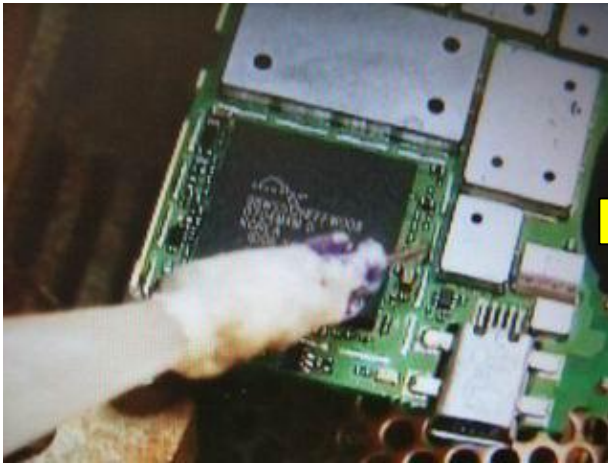
4.2.6 Argon and Flash IC Current Check

- Connect the PCB (Only Argon IC is soldered) to Power supply with 4V output, the current drawn should be about 124 – 130 mA.
- If current drawn >130mA, Flash IC may be short
- If current drawn < 50mA, Atlas IC may be faulty
- If current reading is OK, connect PCB to PC RSD_Lite program for flashing
- If uploading bootloader file is failed, Flash IC short
- If uploading Image/Monster file is failed, Flash IC short.
- If everything is OK, then PCB can upload all necessary file.

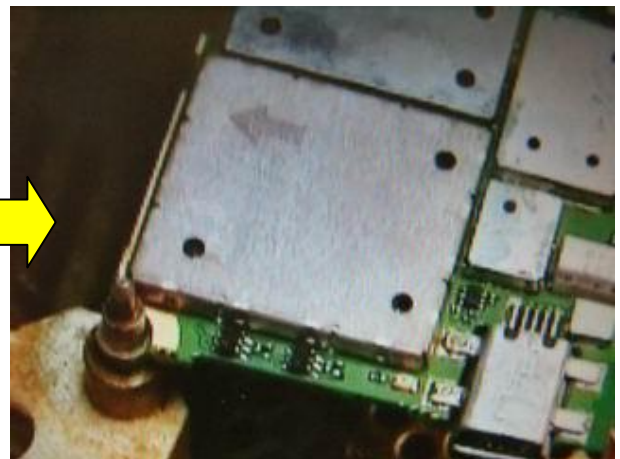
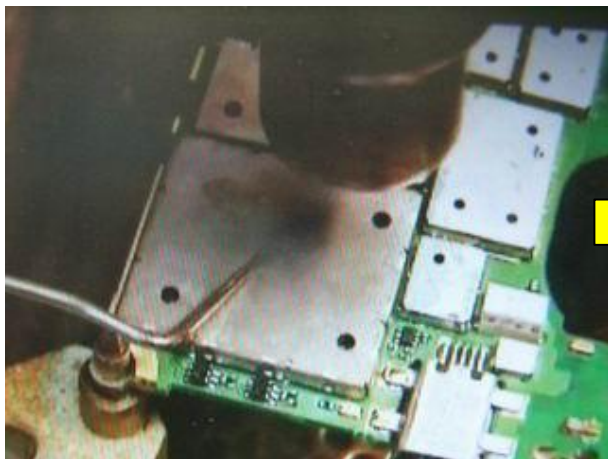
4.2.7 Software Upgrading Procedures

- I. Connect phone to EMU-cable (i.e. No display but RSD_Lite can still detect it)
- II. Flash Bootloader ROM file
- III. For V3xx, BL_0302_umts_izarglobal_rom.sbf
(http://compass.mot.com/doc/219131941/BL_0302_umts_izarglobal_rom.sbf)
Also available in [MD- Service Portal](#)
For V6, BL_0302_umts_volans_rom.sbf
(http://compass.mot.com/doc/218244666/BL_0302_umts_volans_rom.sbf)
Also available in [MD- Service Portal](#)
- IV. Phone will be restarted but enter into flash mode
- V. Flash image/monster and flexing file
For V3xx, the monster & flexing file is:
Monster file:
http://compass.mot.com/doc/219137076/IzarG_R26111_U_96.48.320P_LP0003_DRM0001_UIIZRGBLFACTR2611101B_p33a_128.5Mhz_RDL_302_MonsterLite_Signed_flash.sbf.gz
Also available in [MD- Service Portal](#)
Flexing file:
BP FLEX:
<http://compass.mot.com/doc/206585997/UIIZRGBLFACTR2611101B.hs.gz>
For V6, the current monster file is: (no Flexing file is requested)
http://compass.mot.com/doc/218300063/R26111VL_U_96.48.321P_LP0003_DRM1001_JP_UIVOLANSFACTR26111015_p42a_hwcfg_block_128.5MHz_monster_flash.sbf.gz
Also available in [MD- Service Portal](#)
- VI. Upgrade to the latest approved customer software as 1FF file
- VII. Write IMEI by using RadioCom
- VIII. Write Primary/Secondary Passcodes (if required)
- IX. Write and save Bluetooth-address by using RadioComm
- X. After restart:
- XI. Do Master Clear
- XII. Do a complete phasing/call processing by using GP Gate.

4.2.8 POP IC Shield Placement



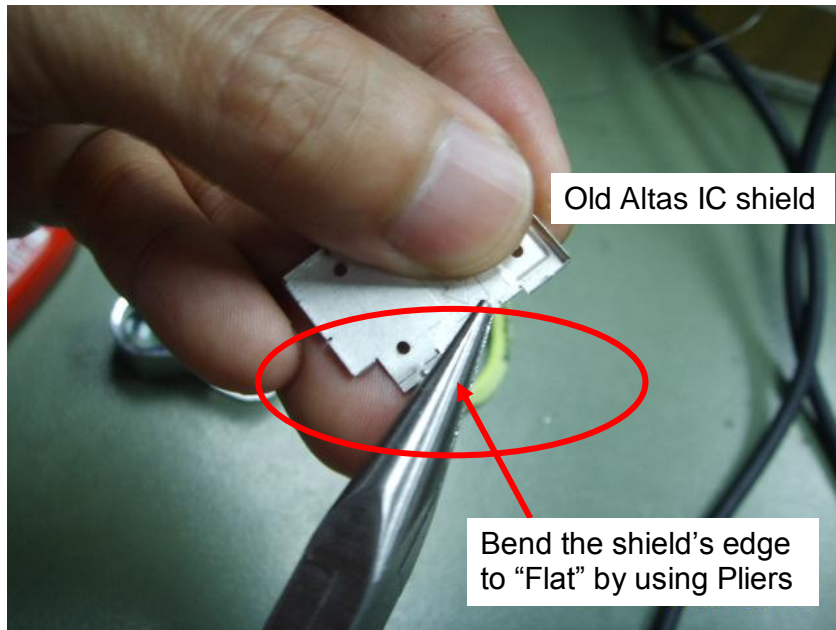
- Add liquid flux to the shield outline
- Place shield onto PCB



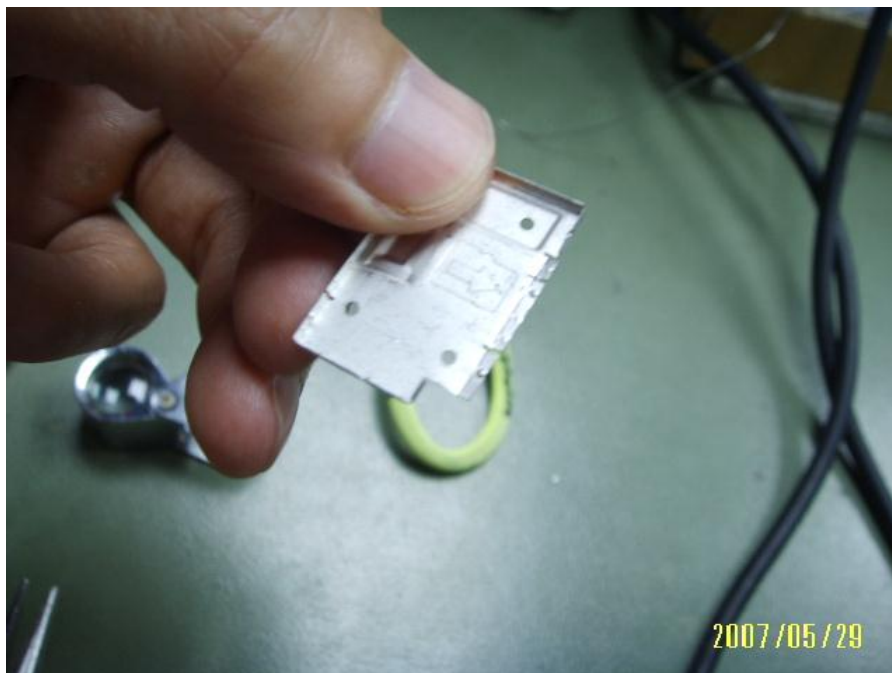
- Turn on Aircooling
- Heat the shield using heat gun

Process Complete

5.0 Appendix A - DIY Air Cooling System



- Recycle ATLAS shielded from faulty boards
- Bend the edge as shown in above picture by using pliers





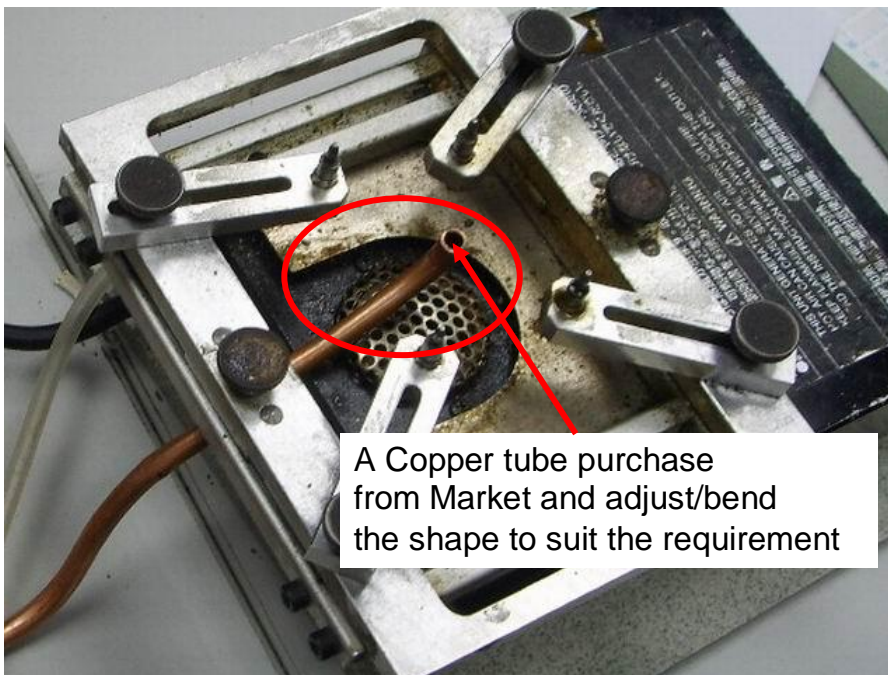
- Use a hole puncher to punch a hole on the shield



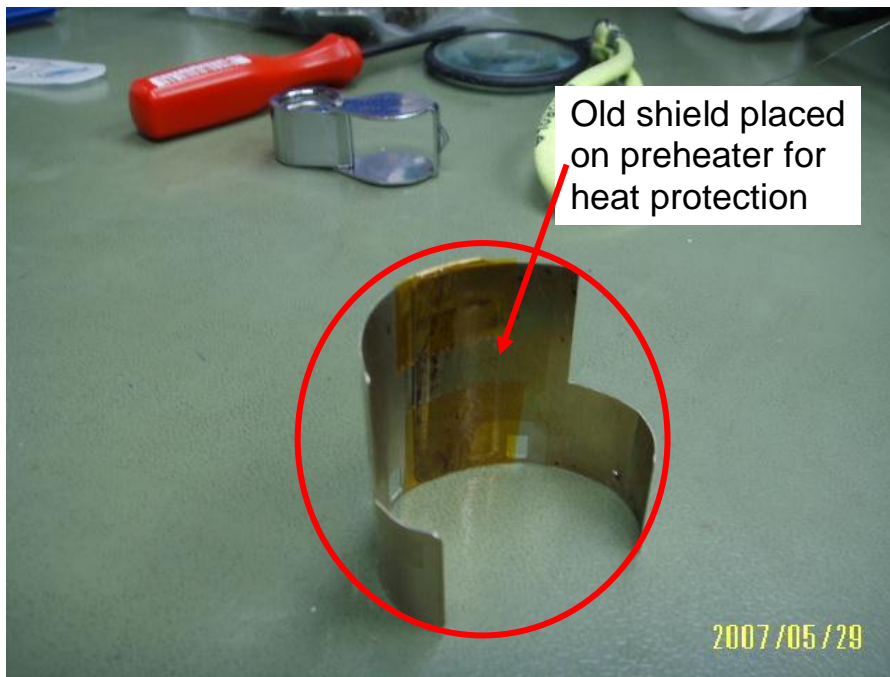
- Enlarge hole size using pliers so that it will be able to fit to the available copper pipe in your region



- Outlook of shield when completed



- Picture above show copper tube that is purchased from local market. We will use hole punch to gauge the diameter of the tube
- It is being bend to suit the requirement



- Metal plate that has been bent to be placed on preheater for heat protection



Power Fish Air Pump



A Completed DIY Air Cooling system

POP-replacement videos are available in

[MD- Service Portal](#) (South Asia)

<http://esupport.motorola.com> (PRC)

<https://serviceone2.motorola.com/tw/> (TW)

<https://serviceone1.motorola.com/index.htm> (Japan)

<https://serviceone.motorola.com> (Korea)

6.0 Appendix B – Heat Shielding Methods

6.1 Using Kapton Tape on recycled shields

The vendor contact information is:

[3M™ Polyimide Film Tape \(Kapton tape\)](#)

then key in: “Polyimide Film Tape 5419” to
browse the information.



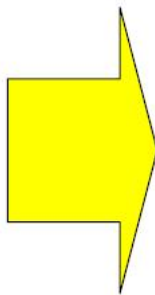
Using W220 as Case Study to remove U201 Calypso Lite)



Prepare Tailor-make shield
(by using Kapton tape + old shield)



W220 PCB



Place Tailor-make shield on PCB to prevent
damaging Other ICs.

6.2 Using Enhanced Heat Shielding Tape on recycled shields



The vendor contact information is:

Prevent heat tape
(NITTO DENKO 日東電工有限公司 NO.973UL-S)
深圳市南山區捷達電子五金商行
+86 0755 28149995
廖娜

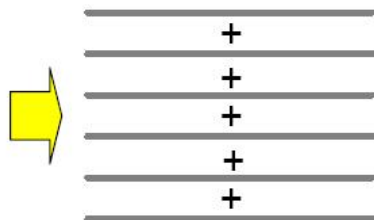
Price : US\$100/21 tapes



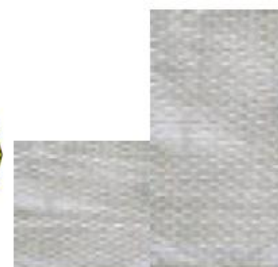
Make a 6-layers prevent heat tape to increase the heat protection effectively



Prevent heat tape

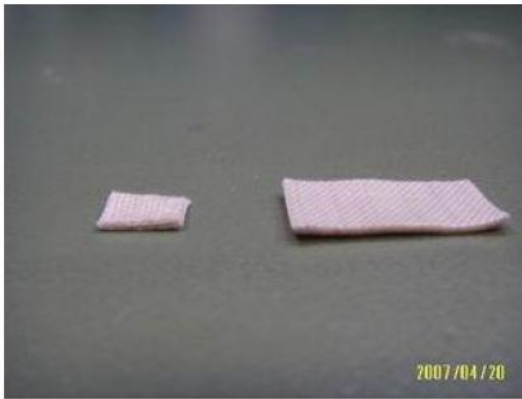


Stick six tapes cohere together into one



Reform/cut them into different shape

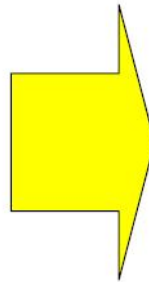
- Case Study to remove ABB processor (U202 “IOTA”)



Prepare the 6-layers prevent heat tape



W220 PCB



Stick the 6-layers prevent heat tape on PCB to prevent damaging Other ICs.

Advantage of “Prevent heat tape”over “Kapton tape + shield”:

- Tailor-make different shape prevent heat tape by requirement.
- Cheaper price than Kapton tape

Disadvantage of “Prevent heat tape”over “Kapton tape + shield”

- Can only re-use 7- 8 times only as the adhesiveness is degrading every time it is being recycled

5.3 Using Aluminium Blocks to cool ICs



The vendor contact information is:

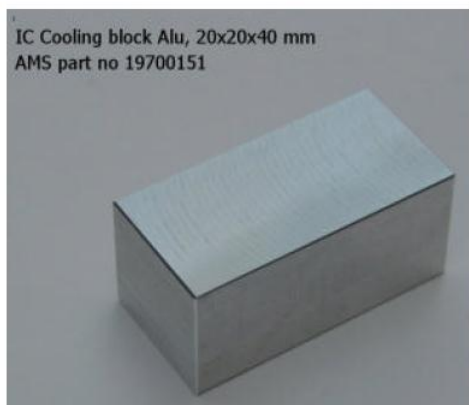
AMS on-line shop

- Part number: 19700150 (set of 2 pcs)

1 pc 19x20x80 mm

1 pc 19x20x100 mm

Price: US\$ 11.08



- Part number: 19700151(1 pcs)

1 pc 20x20x40 mm

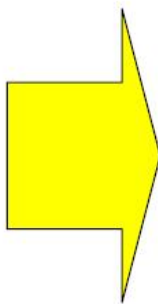
Price: US\$ 3.84

- Part number: 19700156 (set of 2 pcs)

1 pc 5x20x80 mm

1 pc 5x20x100 mm

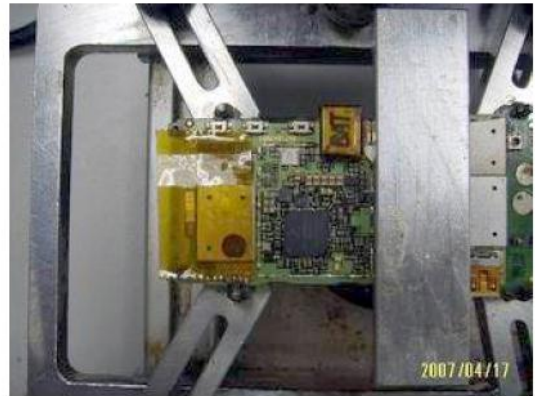
Price: US\$ 11.52



- Case Study on K1 – To Removal ATLAS IC



Place Aluminum blocks on another PCB shield that near Atlas IC.



By using aluminum block to spread out the heat, remove the Atlas IC shield on PCB

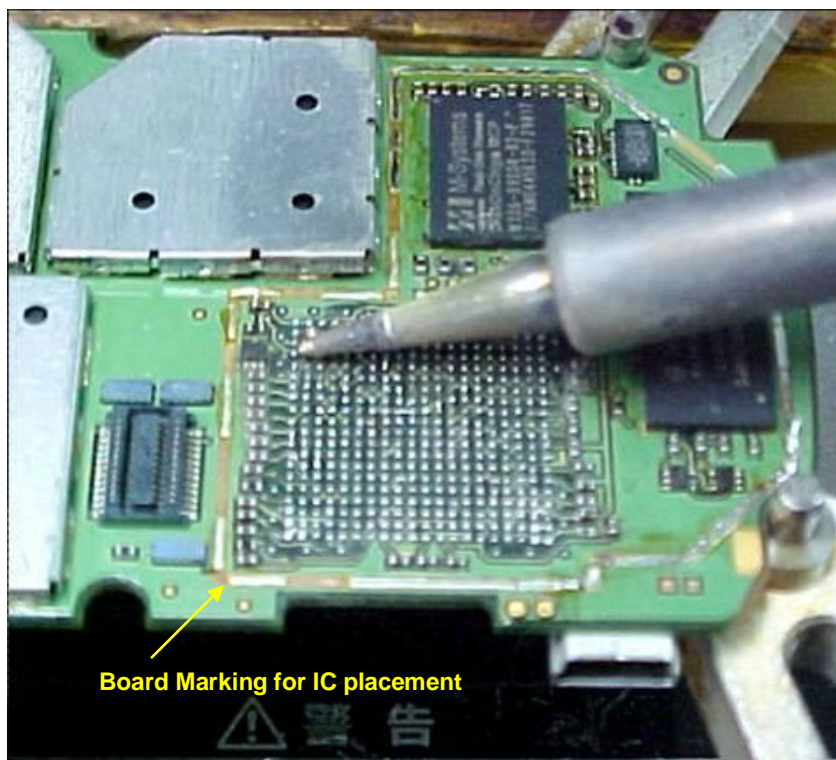
7.0 Appendix C – Soldering Visual Inspection

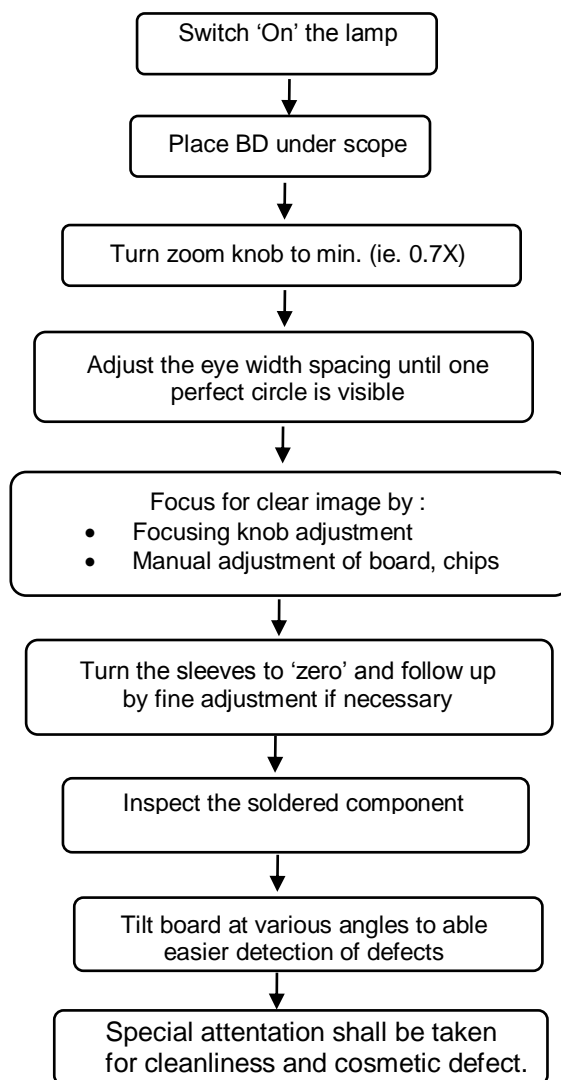
7.1 Purpose

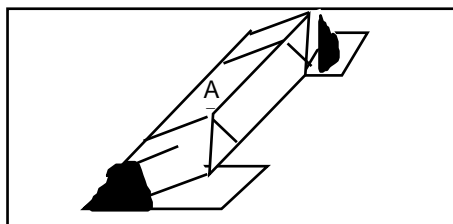
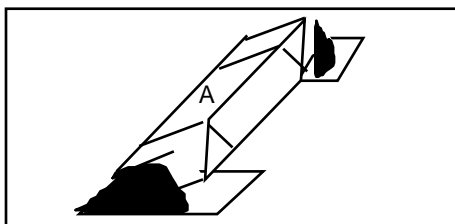
This document serves as an outline of the visual & mechanical inspection criteria for phone repairs via microscope

7.2 Inspection Criteria

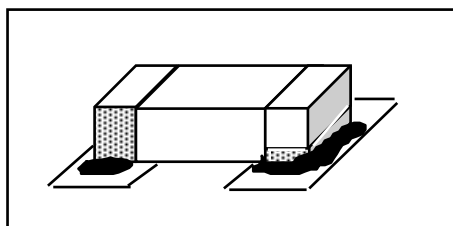
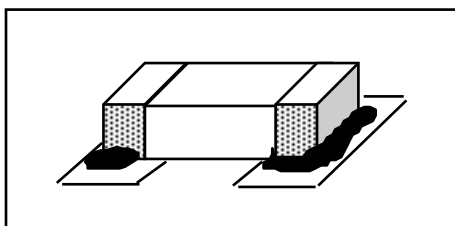
- After the rework is done, need to inspect the solder joint of the reworked component.
- For SMT component rework, visual inspect for solder joint solder short, insufficient solder, dry joint, excessive solder or unsolder.
- For BGA component rework, inspect for excessive solder from the side of IC and alignment of IC to the marking on PCB



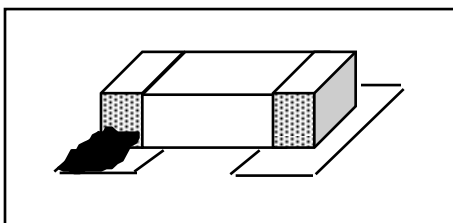
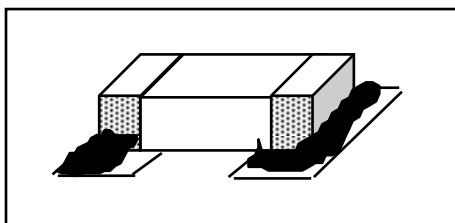
MICROSCOPE OPERATION SET-UP

Component Placement Criteria after rework**ACCEPT****REJECT**

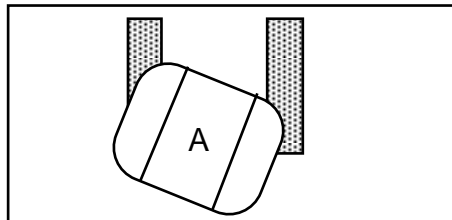
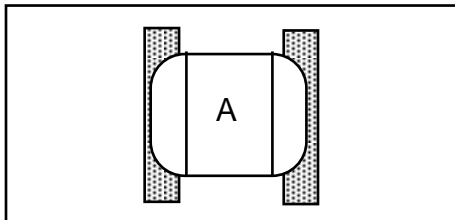
Any unflush chip component will be rejected if it has less than 50% solder joint



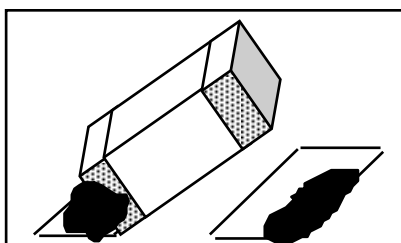
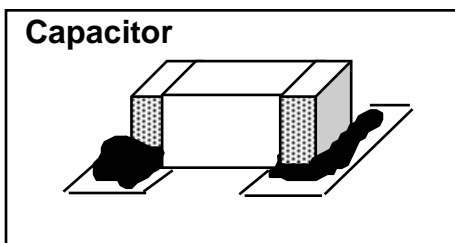
Any missing metallization found at chip capacitor or chip resistor reject if more than 50%



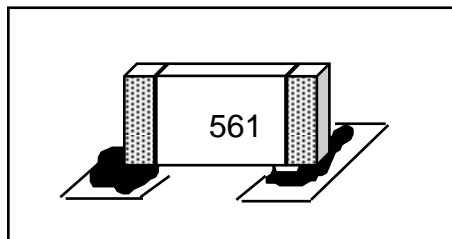
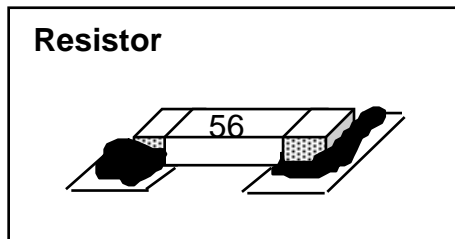
Any missing solder paste on component is a reject

ACCEPT**REJECT**

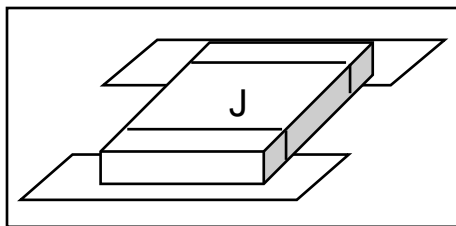
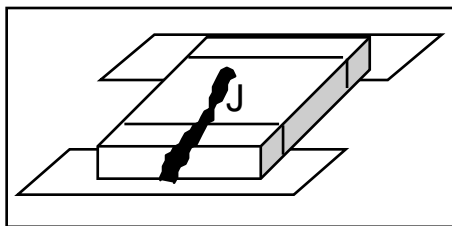
Any misalignment chip component is acceptable based on 50% metallization on the pad

Capacitor

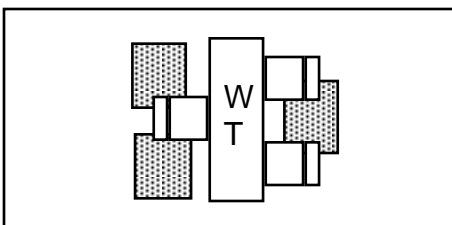
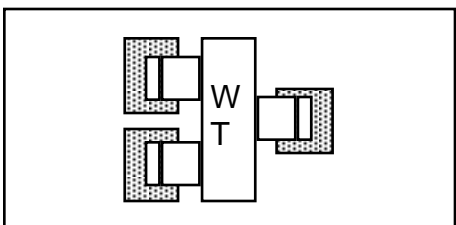
Any tombstone found is a reject

Resistor

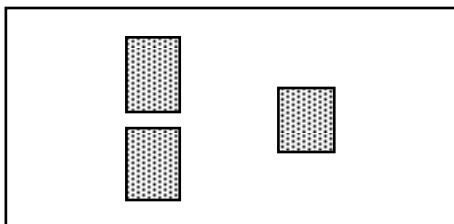
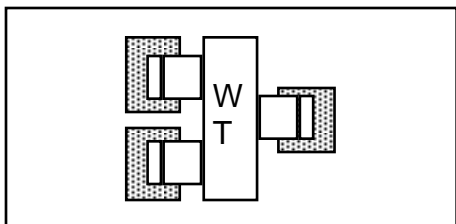
Any marking overturn is not acceptable for resistor (can cause obstruction) but acceptable for capacitor

ACCEPT**REJECT**

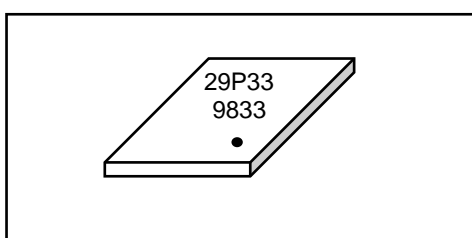
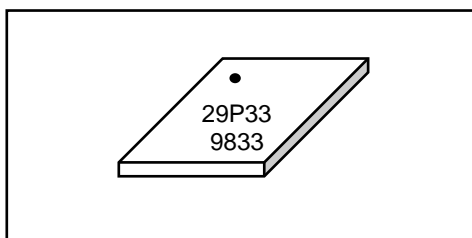
Any crack component is a reject



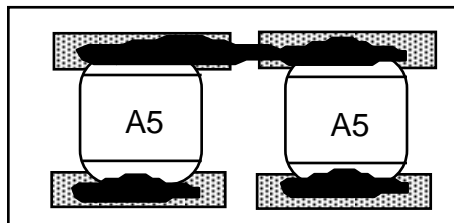
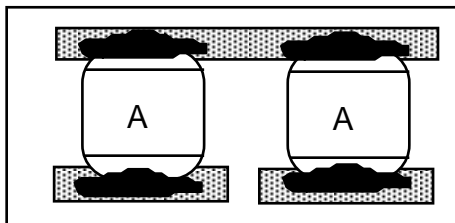
Any wrong orientation of SOT and tantalum cap is a reject



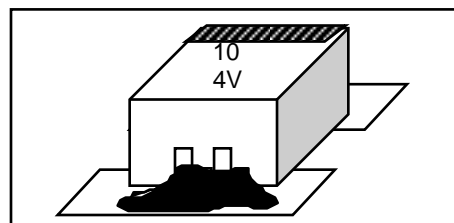
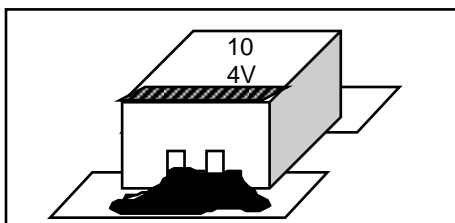
Any missing component is a reject



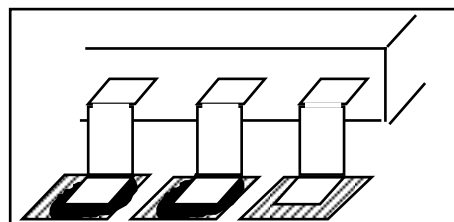
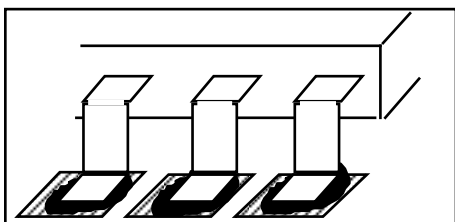
Any wrong orientation of chip carrier after reflow is a reject

ACCEPTREJECT

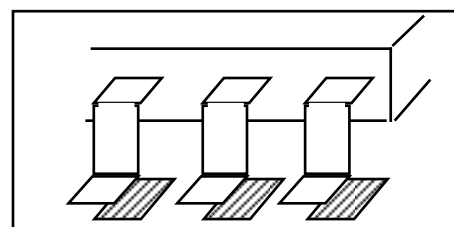
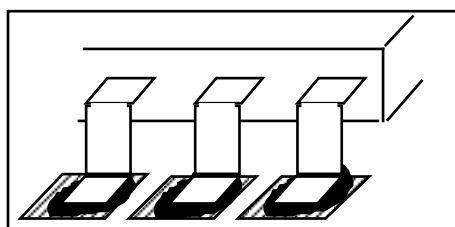
Solder short found at a different runner is a reject



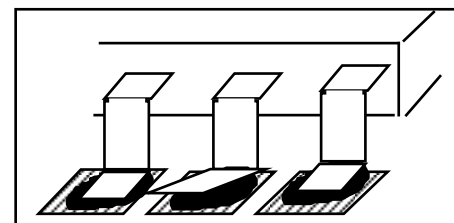
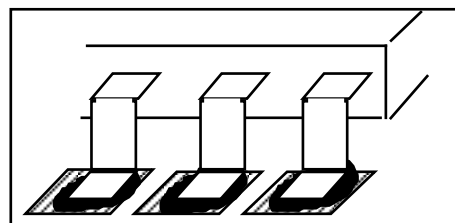
Any wrong orientation of SOT and tantalum capacitor is a reject



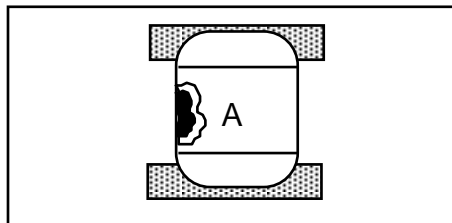
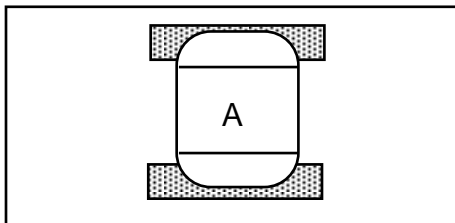
Any unsolder lead found at QFP is a reject



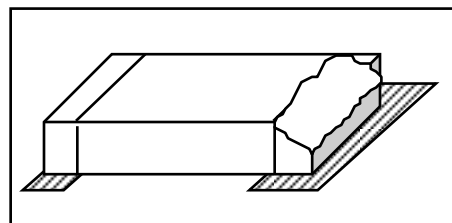
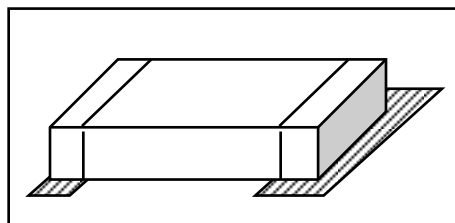
Any misalignment QFP is based on 25% of the pad



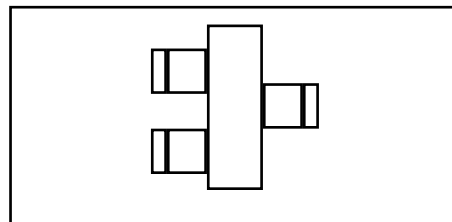
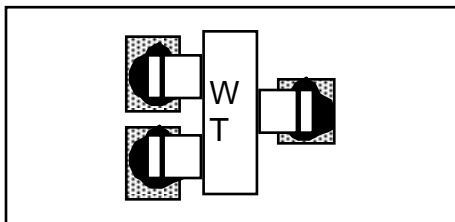
Any bend lead on QFP is a reject

ACCEPT**REJECT**

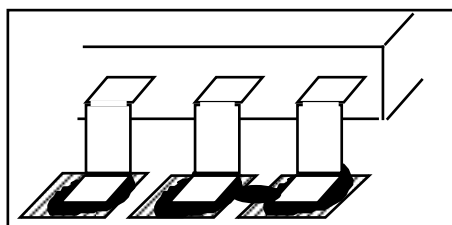
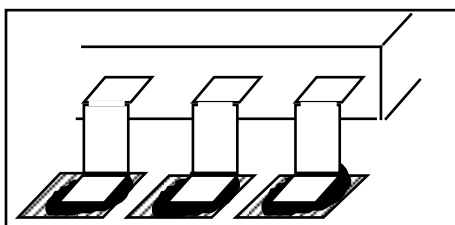
Insufficient solder found at chip transistor, reject if it less than 50% of lead soldered



Chipped off found at chip components. Reject if the terminal has less than 50% of its metallization



Insufficient solder found at chip transistor, reject if it less than 50% of lead soldered



Reject solder short between the leads