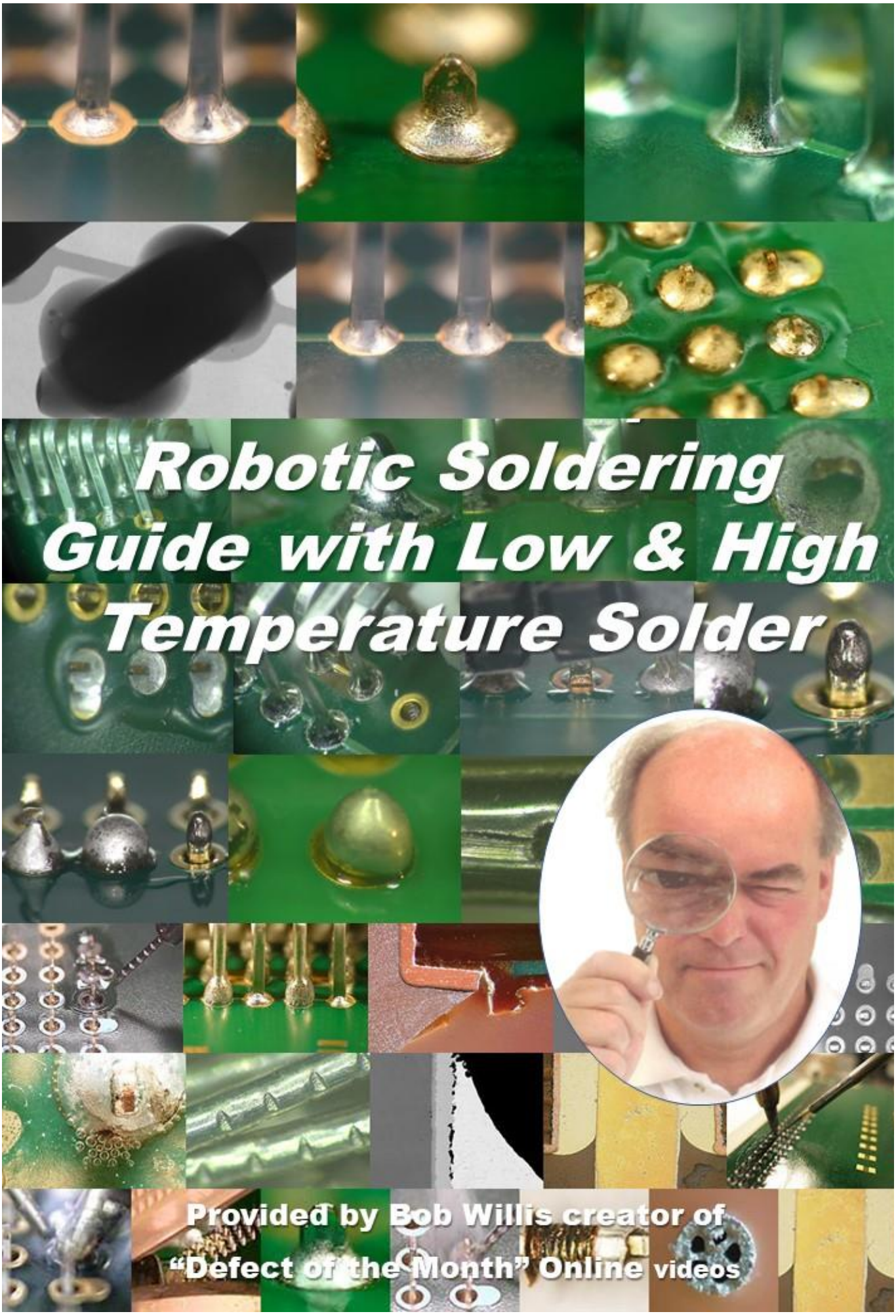
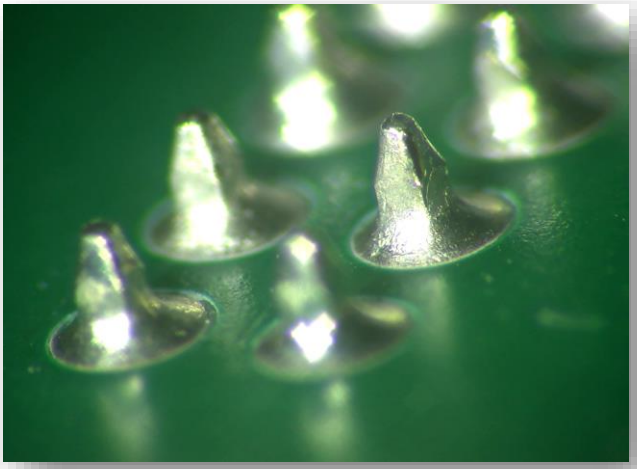


Produced by: Bob Willis © Tel: (44) 01245 351502 bob@bobwillis.co.uk www.bobwillis.co.uk

Low Temperature Solder Joint Inspection Criteria

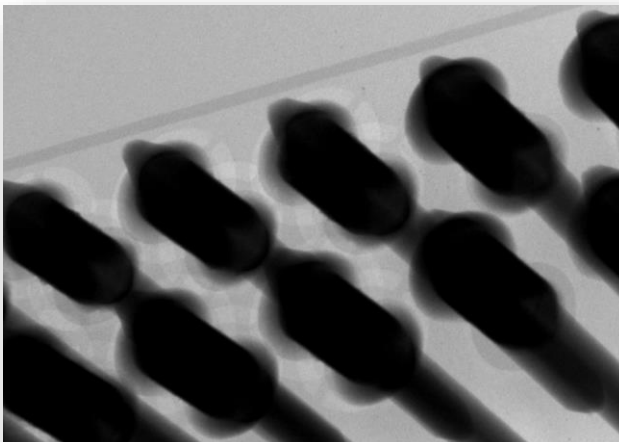
Satisfactory

Solder joints produced with Tin/Bismuth/Silver (SnBiAg) with a robotic soldering process at 240°C. Although the solder does not cover all of the pad surface, this is perfectly acceptable solder joints



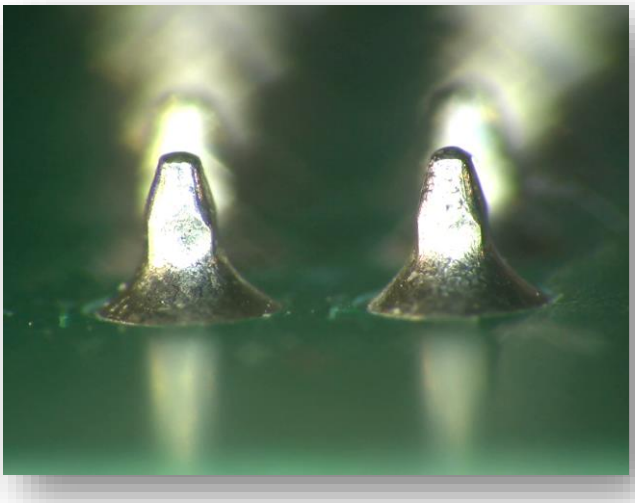
Satisfactory

Satisfactory joints formed with SnBiAg solder alloy during robotic soldering. X-ray inspection was used to show the degree of the through hole fill on a copper OSP finish printed board assembly



Satisfactory

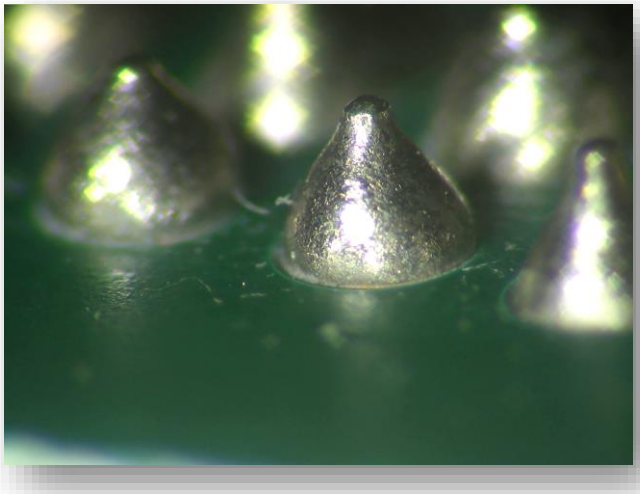
SnBiAg solder joint produced with a robotic iron soldering process at 240°C. The solder has formed a perfect solder joint with a concave fillet formation



Low Temperature Solder Joint Inspection Criteria

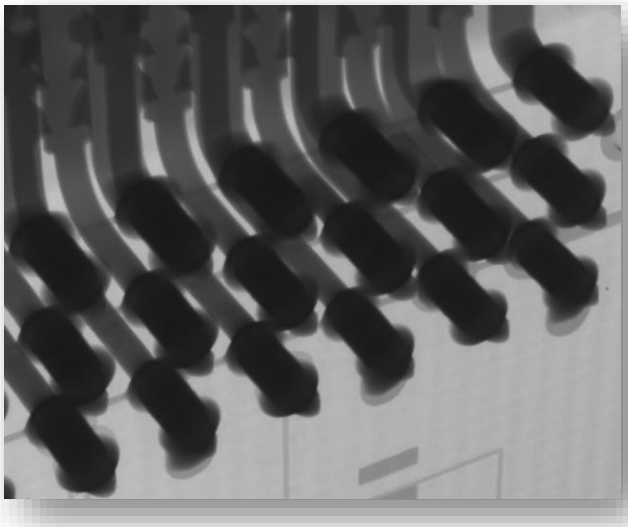
Satisfactory

Solder joints produced with Tin/Bismuth (SnBi) on a robotic soldering process at 240°C



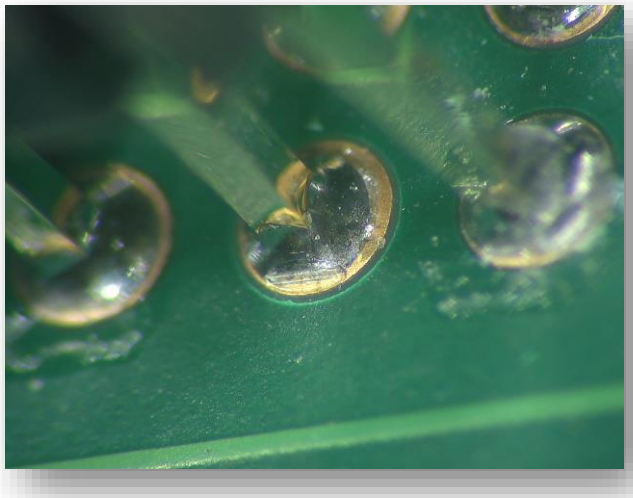
Satisfactory

Satisfactory joints formed with SnBi solder alloy during robotic soldering. X-ray inspection was used to show the degree of the through hole fill on a copper OSP finish printed board assembly



Satisfactory

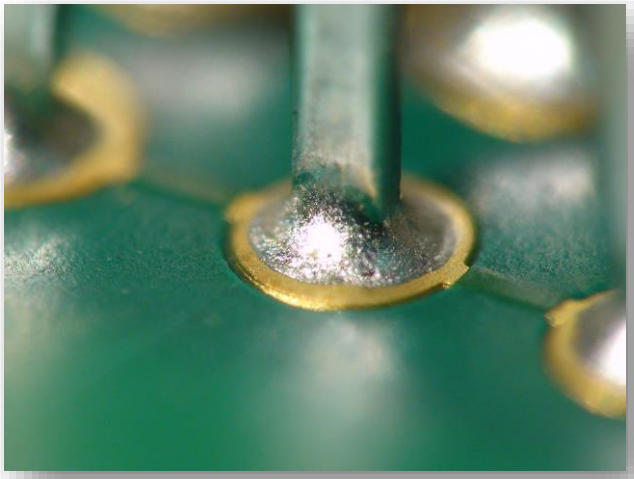
Solder joint produced with SnBi alloy and a robotic iron soldering process at 240°C. The solder has formed satisfactory solder joints on the top side of the board. The solder has not fully wetted the nickel/gold pad surface



High Temperature Solder Joint Inspection Criteria

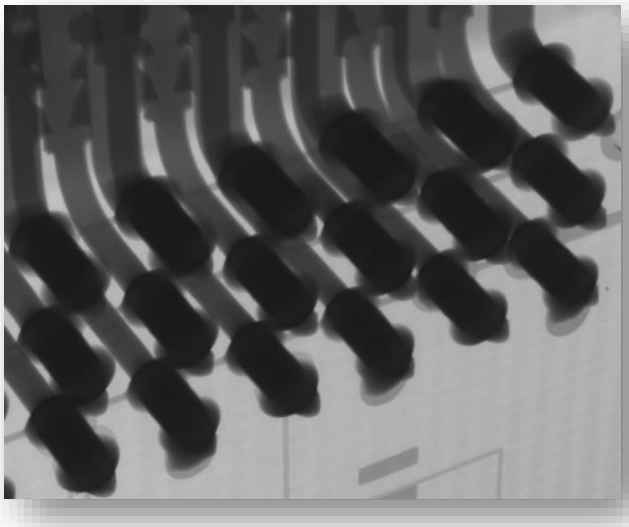
Satisfactory

Solder joints produced with SnSb on a selective soldering process at 340°C. Although the solder does not cover all of the gold pad, this is perfectly acceptable



Satisfactory

Satisfactory joints formed with SnSb solder alloy during selective soldering. X-ray inspection was used to show the degree of the through hole fill on a gold finish printed board assembly



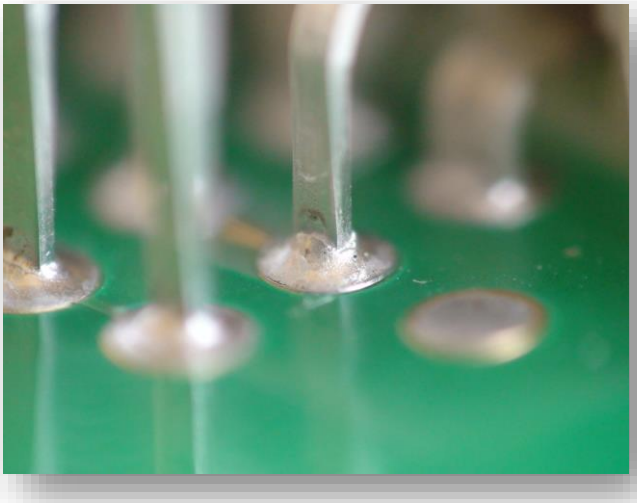
Satisfactory

Solder joints produced with SnSb alloy and a selective soldering process at 340°C. The solder has formed a perfect solder joint with a concave fillet formation

High Temperature Solder Joint Inspection Criteria

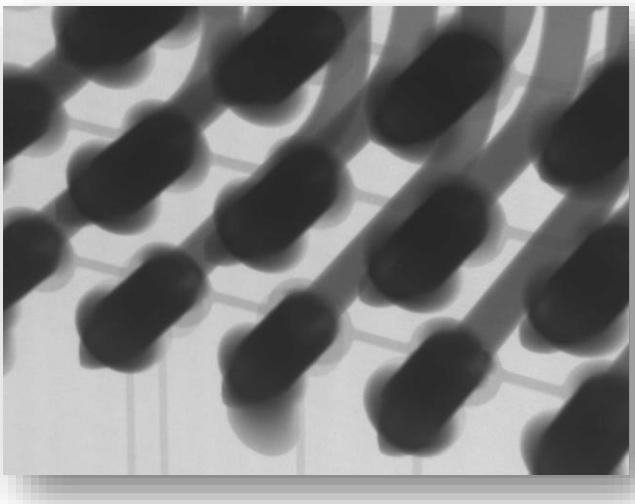
Satisfactory

Solder joints produced with High Melting Point (HMP) on a selective soldering process at 360°C. The solder has filled the plated through hole and wetted the surface of the pad



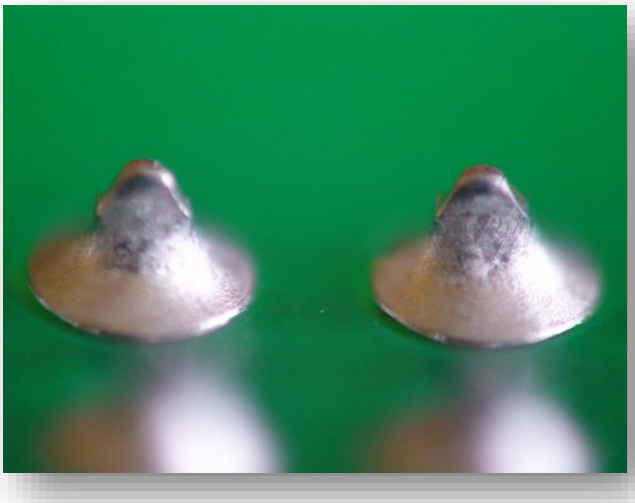
Satisfactory

Satisfactory joints formed with HMP solder alloy during selective soldering. X-ray inspection was used to show the degree of the through hole fill on a gold finish printed board assembly



Satisfactory

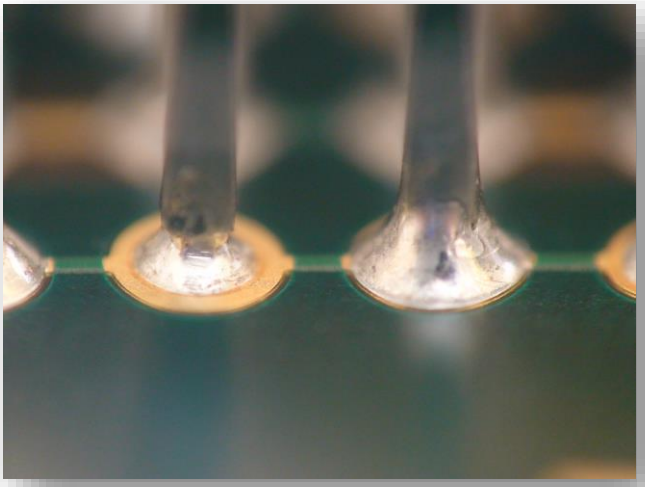
Solder joints produced with HMP alloy and a selective soldering process at 360°C. The solder has formed a perfect solder joint with a concave fillet formation, the satin finish on the joint is not uncommon on this alloy



High Temperature Solder Joint Inspection Criteria

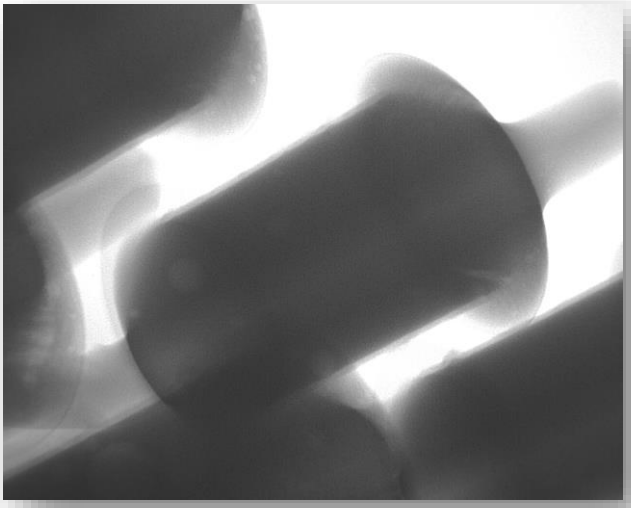
Satisfactory

Solder joints produced with tin/copper on a laser soldering process. Although the solder does not cover all of the pad, this is perfectly acceptable. There is variation in the solder volume per joint which is not uncommon with automated wire feed process



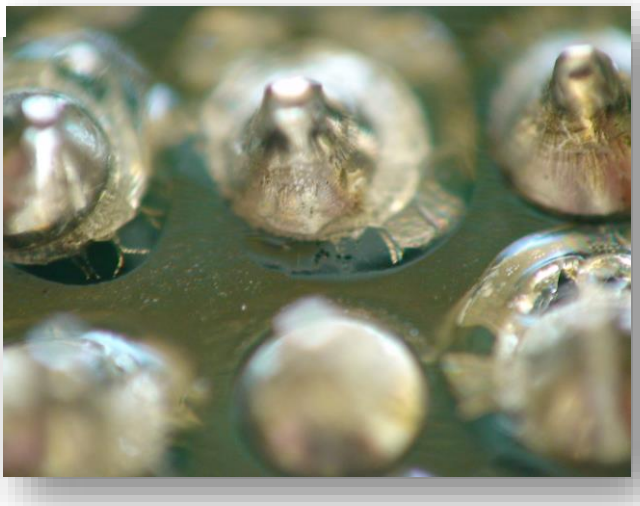
Satisfactory

Satisfactory joints formed with tin/copper with laser soldering. X-ray inspection was used to show the degree of the through hole fill on the printed board assembly



Satisfactory

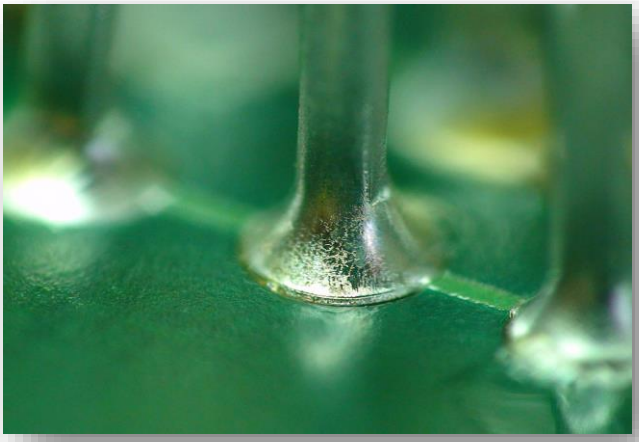
Solder joints produced with tin/copper with laser soldering process. The solder has formed a perfect solder joint with a concave fillet formation. There is excess flux present on this example but if cleaning is used this would not be a problem



High Temperature Solder Joint Inspection Criteria

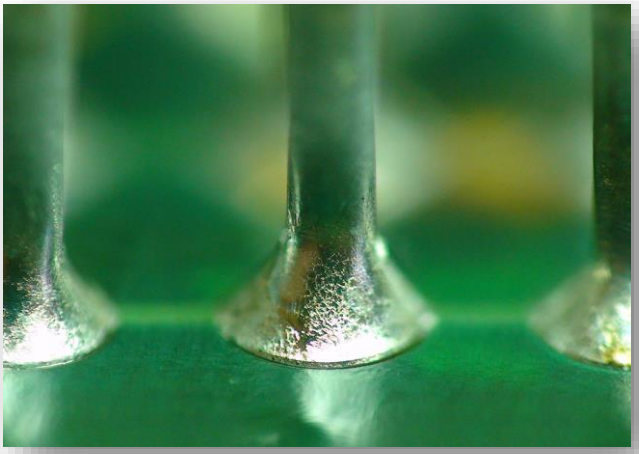
Satisfactory

Solder joints produced by robotic iron soldering using tin/copper alloy with good solder penetration



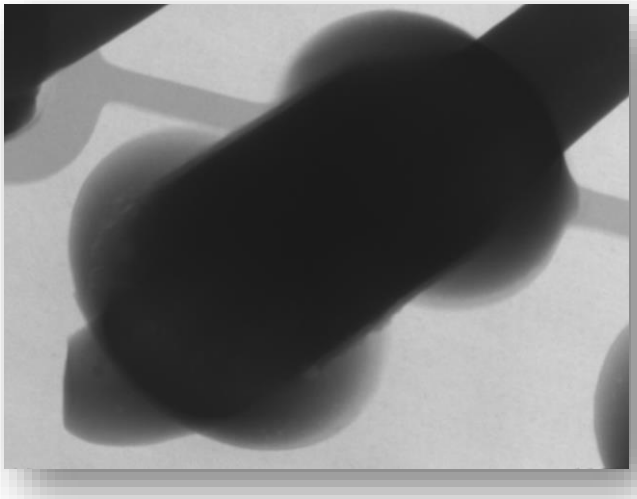
Satisfactory

Solder joints produced with tin/copper and robotic iron soldering. The solder has formed a perfect solder joint with a concave fillet formation



Satisfactory

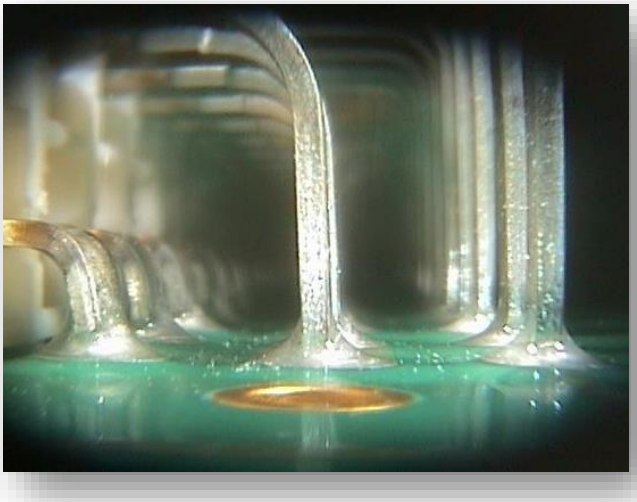
Satisfactory joints formed with tin/copper and automated iron soldering. X-ray inspection was used to show the degree of the through hole fill on the printed board assembly



High Temperature Assembly & Soldering Criteria

Satisfactory

Solder joints formed with tin/copper/nickel solder paste and intrusive reflow. The solder fill and wetting are satisfactory on the gold finish

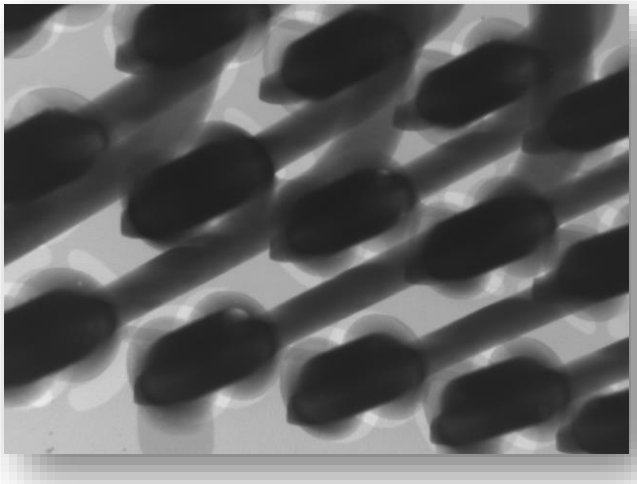


Satisfactory

Intrusive reflow joints using tin/copper/nickel solder alloy reflowed in air

Satisfactory

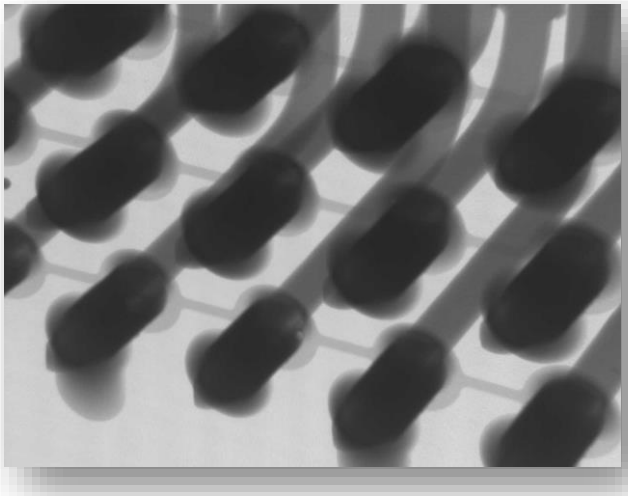
Solder fill on plated through hole under X-ray inspection. The solder fill exceeds 100% of the barrel



High Temperature Assembly & Soldering Defects

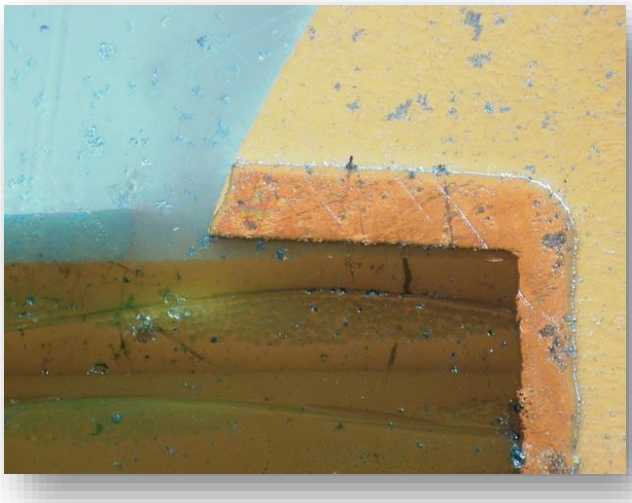
Unacceptable

Solder joint produced with SnCu during laser soldering. The X-ray inspection shows some variation in fill of the plated through holes and negative solder fillets on the nickel gold board. Variation in solder wire feed needs to be considered



Unacceptable

Solder joint produced with SnCu and soldered with a robotic soldering iron. The soldering iron temperature, dwell time or pressure may have caused the pad to lift from the surface of the laminate or it is a function of PCB expansion and contraction and should be investigated



Unacceptable

Evidence of solder not fully wetting the connector pin as it flowed into the plated through hole. Soldering parameters were not optimised for this laser soldered joint produced with SnSb alloy. Heat input to the PCB was probably more than the pin

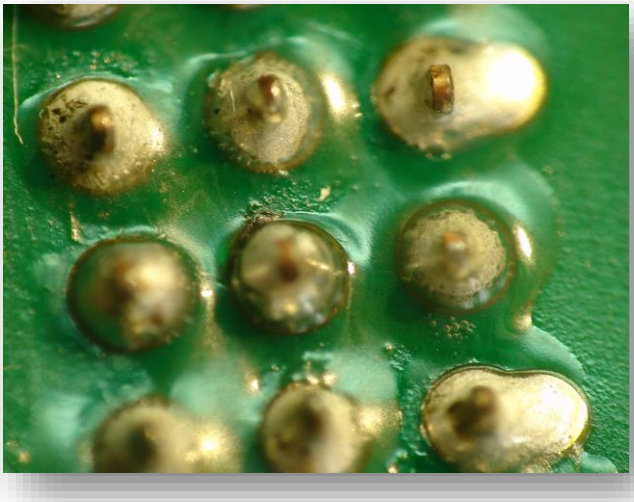
High Temperature Assembly & Soldering Defects

Unacceptable

During automated iron soldering the program that defines the tip's contact position and force must be well refined. Due to change in position of the board, change of tip, poor product tooling or system drift, the soldering iron tip may cause damage to the board. The image shows damage to the surface of the solder mask caused by the tool

Unacceptable

In most cases soldering with high temperature wire will generate much higher amounts of residue. The residues from different vendors' products can be soft or brittle and very easily displaced but not as soluble in cleaning solutions



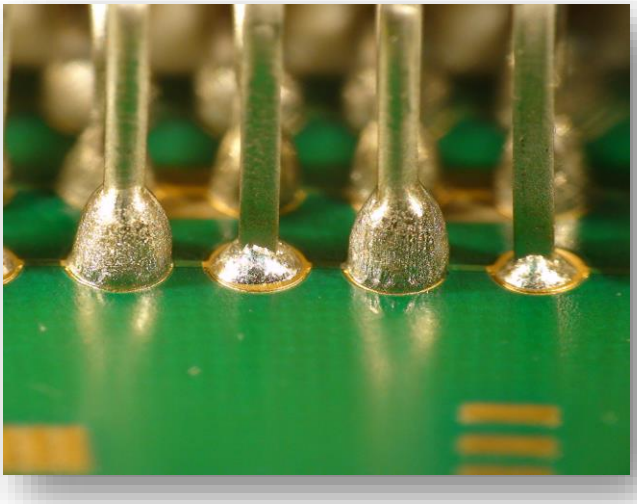
Unacceptable

Bubbles most commonly seen on laser soldering are probably related to speed of temperature rise. If the flux is removed there should not be a problem. If the boards are conformally coated on flux it would be difficult to differentiate the flux bubbles with bubbles from conformal coating

High Temperature Assembly & Soldering Defects

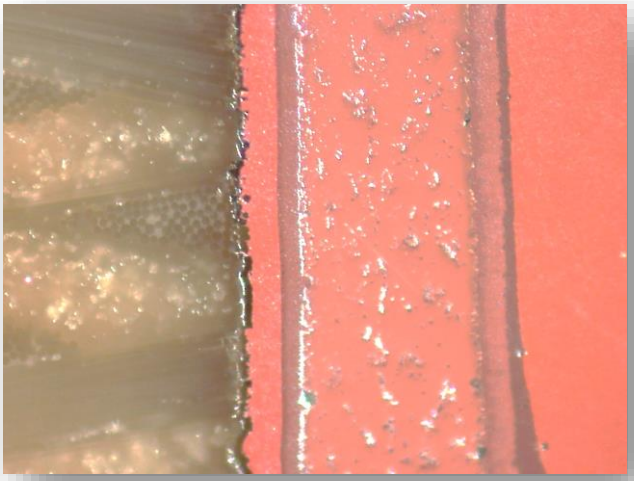
Unacceptable

During automated assembly solder volume variation from pin to pin needs to be investigated. As the plated through hole size and thermal demand on boards are fairly consistent this is probably related to solder feed variations



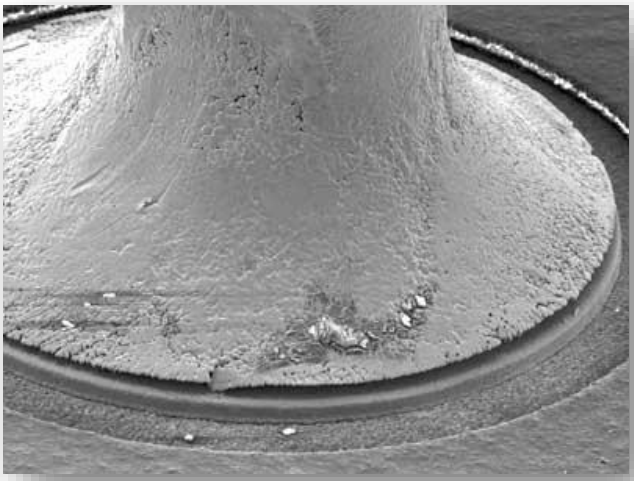
Unacceptable

During soldering if excessive heat or long soldering times are used the copper barrel plating can separate from the fiberglass. This can occur where the adhesion of the copper is poor in manufacture, but in the example it was related to the soldering parameters used



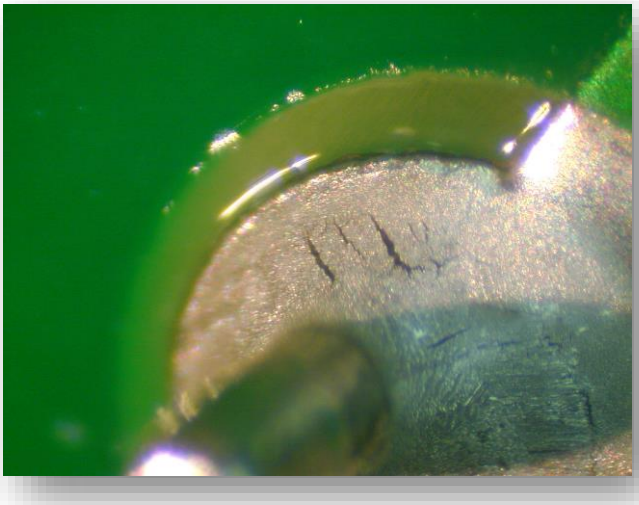
Unacceptable

Solder fillet lifting was first experienced in lead-free soldering on selective, wave and intrusive reflow. It has not, to date, been seen to cause a reliability problem and not associated with all joints on a single board. It is mostly related to PCB expansion and contraction during soldering



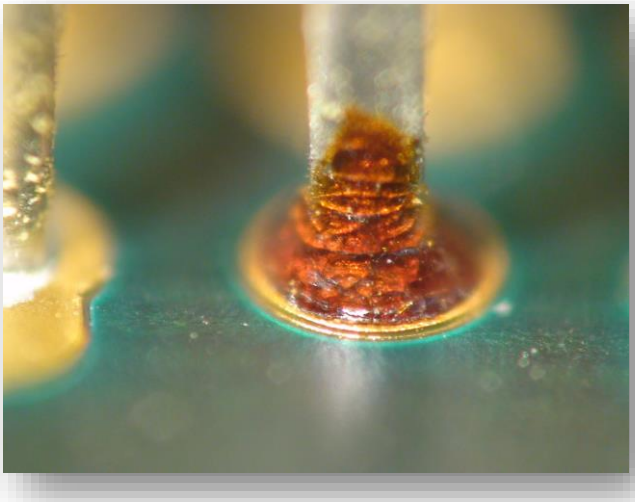
High Temperature Assembly & Soldering Defects

Acceptable



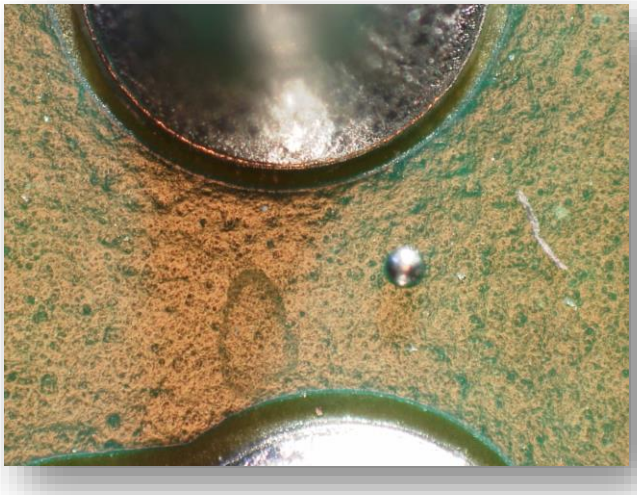
Solder fillet tearing is a process phenomenon we have seen with different alloys. It is not seen on tin/copper but on SAC, more commonly on higher silver alloys. Tearing is seen on the surface of robotic laser and iron soldered joints but did not increase in size after static ageing or during temperature cycling

Acceptable



Flux residues on the surface of joints after ageing at 200°C, it is the same appearance you would see with any high solids flux residues. It is the impact of high temperature storage on the inert residues. In the majority of cases products of this type would be cleaned during assembly

Acceptable



Solder balls can be seen on high temperature selective soldering and can be eliminated. They are common with robotic laser and iron soldering but can be reduced. Take care in the selection of the wire, the process parameters, but most of all, pre-indenting of the cored solder wire

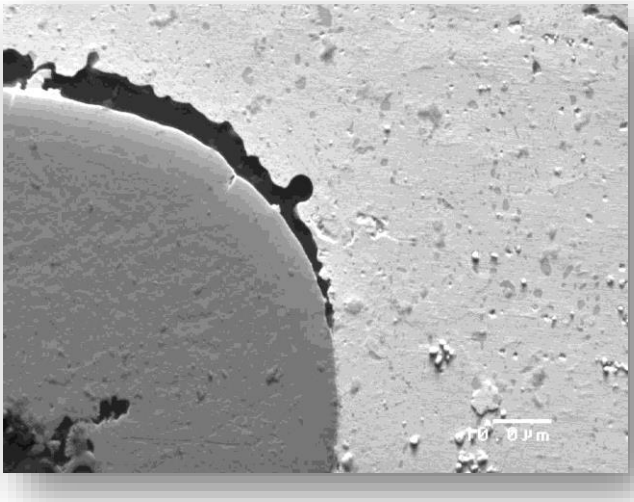
High Temperature Assembly & Soldering Defects

Unacceptable

Plated through hole solder joint and barrel pulled out of the PCB during pull strength measurement. The surface of the copper barrel plating shows significant discolouration most likely due to overheating during contact soldering

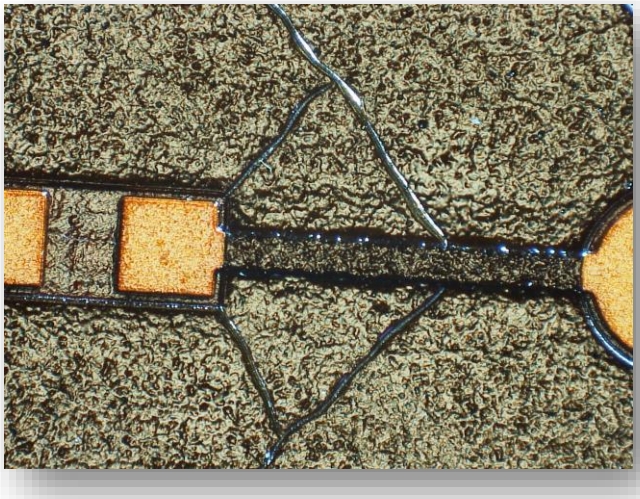
Acceptable

Example microsection of fillet lifting on a SnSb solder joint. The solder joint and the intermetallic formed on the rest of the joint were satisfactory. It is not uncommon to see fillet lifting on high temperature joints. They are often not noticed due to the magnification typically used during manual inspection



Unacceptable

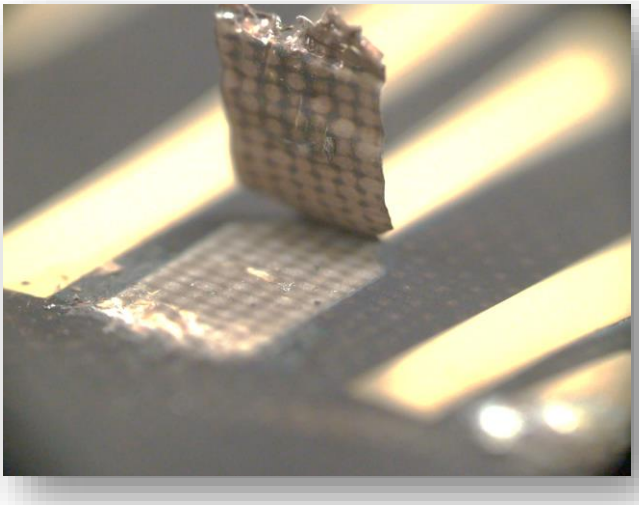
Conformal coating exposed to high temperature storage at 200°C shows evidence of cracking. Care need to be taken when selecting a coating for high temperature and the need for any pre-treatment to the boards prior to coating to get the best results



High Temperature Assembly & Soldering Defects

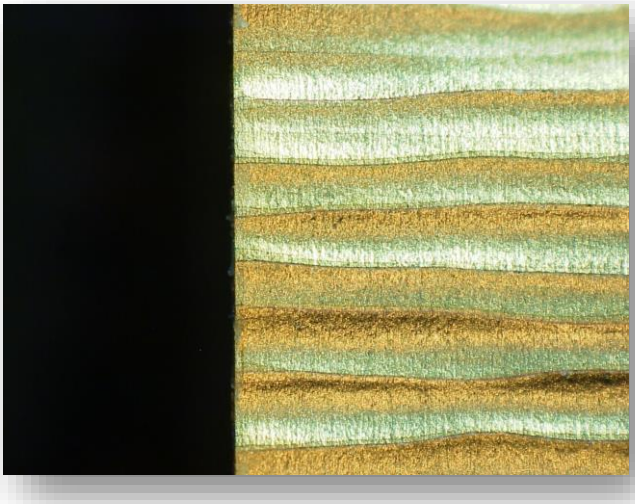
Unacceptable

PCB track peel strength is affected by soldering temperatures and also high temperature storage. It is important to confirm the performance of the substrate material for these applications. The bond between the base laminate and the copper tracking had broken on this example



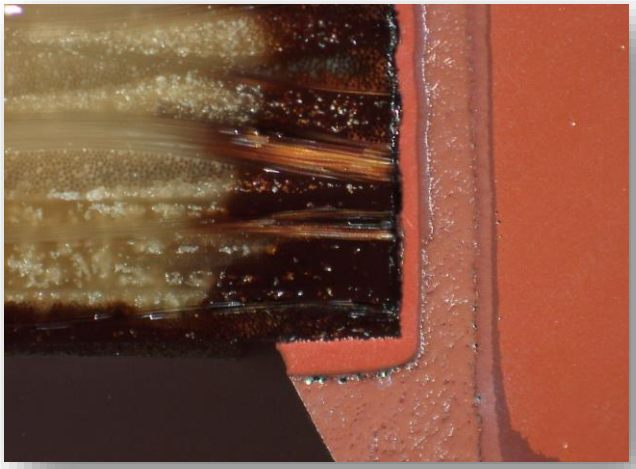
Unacceptable

Exposing test boards with gold over nickel to high temperature storage then peel testing has shown nickel cracking. The example shows the track surface after peeling, during testing there is a distinct sound from the sample. It is not clear if the plating process has caused this effect



Unacceptable

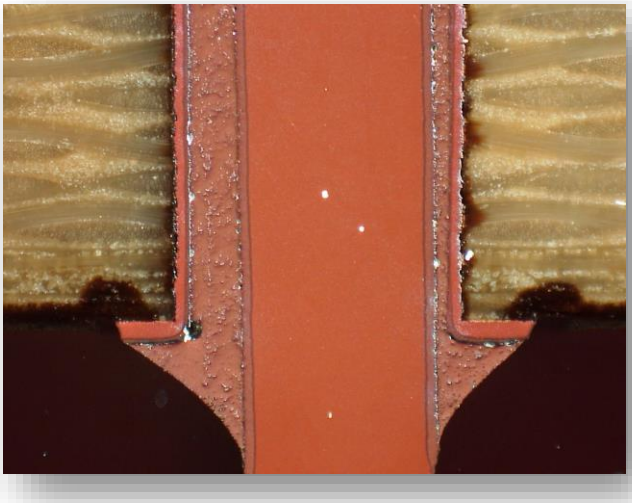
Microsection shows significant charring of the laminate around the joint area. This will have been caused by excessing temperature or the duration of the soldering operation. It can lead to reduces barrel strength and internal corrosion like CAF



High Temperature Assembly & Soldering Defects

Unacceptable

Microsection shows some overheating between the copper barrel and the laminate and more around the surface of the pad. This may be the result of incorrect laser soldering parameters or fluctuation in the process



Unacceptable

Example of high temperature laminate after exposure to 200°C for 1000hrs. There is evidence of the fibre bundles visible between 0.2mm via holes. The reason for this effect was not clear as the board had not been through an assembly process

Acceptable

Void in the solder joint due to outgassing during soldering which would have also resulted in solder spitting. Volatile material in the board will have outgassed through voids in the plating during the soldering process. With vapour escaping the solder solidifies and a void forms