



## **ESA/ SCC QUALIFICATION REPORT FOR**

### **NTC THERMISTOR PART TYPES:**

**ESA/SCC      4006/013 & 4006/014**

## **APPENDIX   E**

**Actual Causes of Non Conformance – NCCS. 2IEBET901**

**To:** Mr. John Howley: NETC, Enterprise Ireland.  
**CC:** Ian Pimm, ESA Representative, ESTEC, The Netherlands.  
**From:** Mr Jude Neylon, Chief Inspector, Betatherm Ireland. Ltd.  
**Re:** Actual Causes of Non conformance - NCCS. 2IEBET901  
**Date:** 12<sup>th</sup> April 2000

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## **1 Problem Definition:**

A non conformance was identified during pre-cap inspection. Pre-cap inspection was performed on ESA/SCC 4006 / 013 /01 and ESA/SCC 4006 / 013 / 05. The inspection was performed to the requirements of ESA/SCC 20400 Issue 2 and ESA/SCC 2044000 Issue 1 and to the criteria of Betatherm Internal Visual Inspection MFG-11-72-16.

ESA/SCC 4006/013 / 05 failed the inspection with 3 failures. The rejected units were 2 units with cracks in the ceramic of the thermistor and 1 unit with foreign material (flux) between the leads. The Betatherm Internal Visual Inspection criteria, contained in MFG-11-72-16 and Workmanship Standard 11-60-41, had not specified the magnification level to be used and did not contain all the relevant criteria outlined in ESA/SCC 20400 and ESA/SCC 2044000. Also Workmanship Standard 11-60-41 did not contain certain dimensions which were necessary to determine PASS / FAIL criteria.

The issue of flux residue was defined in MFG-11-72-16 and, as the product was 100% inspected prior to pre-cap by the authorised ESA/SCC Inspector, it is concluded that the training of the pre-cap operator was inadequate.

## **2 Causes of Non Conformances:**

The visual system of inspection that was in use is based on Manufacturing Work Instructions (MFG) and related Visual Workmanship Standard. The three non-conforming parts were not detected at Visual Inspection, for the following reasons.

- a) The Visual Workmanship Standards that were used for Visual Inspection were inadequate and did not show flux as an inspection criteria.
- b) The Visual Workmanship Standards did not adequately show cracks as a visual criteria.

- c) The Workmanship Standards were based on drawings and were not as clear as the Photographs that are now used.
- d) When the Visual Inspectors were trained there was not sufficient emphasis put on criteria such as Ceramics and contamination such as flux. The main emphasis was on the Quality of the solder pad.
- e) The Manufacturing Work Instructions did not include criteria for lead contamination and flux residue.

### **3 Ceramic Cracking:**

The two units that exhibited cracks / voids were examined using a camera with a magnification of x 30 . Inspection was also done with a much higher magnification but the x 30 system was determined to be the optimum. The higher magnification system was best suited to examinations of sections and not suitable for these parts.

The two parts are identified as A & B and are shown in Appendix 1 of this report.

#### **Sample A : (Void in centre of edge )**

This part has the void in the centre of the chip along the edge of the ceramic / metallisation bond. Where the ceramic meets the metallisation there are eight edges. One of these edges shows a void. It appears that the metallisation has partially lifted away from the ceramic.

#### **Sample B: (Void at corner of chip)**

This part has the void at the corner of the chip along the edge of the metallisation / ceramic.

#### **Conclusion:**

It is possible that the void was caused by damage to the metallization / ceramic layer during dicing . This would have been further exaggerated during the soldering process. However due to the limited inspection equipment it was not possible to determine fully what caused these defects. It was agreed to send these two parts to the Component Laboratory in ESTEC for further analysis.

The ESTEC failure analysis report MI0703 is included in Appendix 2.

### **4 Findings:**

Five findings were also documented by the ESA/SCC Inspector during the pre-cap inspection of 12 August 1999. There were:

**Finding 1** - The identification of the flux used, in the Manufacturing Route Sheet (MRS) for the 4006/013 devices, is Dupont 8718, part number P023. The actual material used is Alpha part number M038. This is hand-written in on the travellers and should be corrected on the MRS proforma.

**Cause:** This was a typing error and has been corrected, ECN No.4867.

**Finding 2** - The company is requested to update their internal visual inspection criteria.

**Cause:** This was dealt with in the problem definition section of this report.

**Finding 3** - The company is requested to consider defining internal visual inspection of the 4006/014 devices prior to brush coating the elements with epoxy.

**Cause:** As defined in the PID the brush coating of the Platinum leads was carried out before the visual inspection stage. Due to the non-opaque nature of the Epoxy (Stycast 2850 FT) this limits the effectiveness of the inspection.

**Finding 4** - The company is requested to investigate and comment on the efficacy of the x-ray and the cross section process monitors for the 4006/014 devices.

**Cause:** The probes are Radiographed as per ESA/SCC 20900. This is done in one plane only. The object of the exercise is to determine whether the outline of the chip falls within the glass envelope. The existing inspection of the devices using the Radiograph did not allow this inspection to be made.

**Finding 5** - The company is requested to consider defining a process monitor at the operation welding the Pt-Ir leads of the 4006/014 devices.

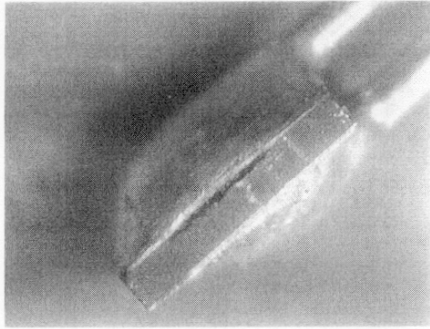
**Cause:** There was no process monitor in place to check the integrity of the Platinum Iridium wire / weld joints. The Manufacturing Route Sheet has been changed to include the Weld Pull Test.



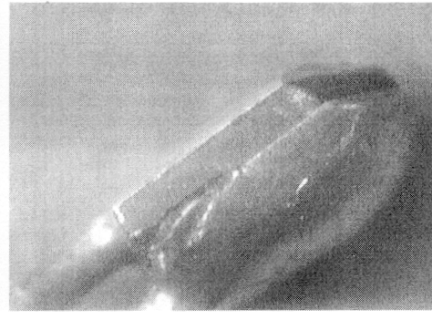
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**SAMPLE A**



**SAMPLE B**