G15K4D489 Solderability

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1/ BACKGROUND:

In November 2005 Astrium SAS discovered that one of its customers has a solderability issue with the G15K4D425 (489) type probes. The problem described was that, during mounting of the Betatherm G15K4D425 parts, a yellowish substance had been detected on the wires that prevented an acceptable tinning/soldering. This problem only occurred on parts which had the lead wires cut to less than the first 50 mm of the wires.

Initial investigations by Betatherm, using FT-IR (Fourier Transform Infrared Spectrometry), confirmed that the substance found was epoxy. Betatherm also performed burn-in on the part type and then stripped the wires to the thermistor bead. The visual result was that the substance was present in the wires near the thermistor. This implies that the substance **appears at burn in and could occur in any Date Code**.

On the basis of a sampling of completed devices over a wide time frame, Betatherm determined that the maximum distance from the thermistor bead for which the effect was observed was 30mm. As a consequence of this it was agreed to put an application note on the data sheet limiting the cutting of the lead to a distance of 50 mm from the thermistor bead. **It must be emphasised that the majority of applications do not cut the lead to less than 30mm from the bead.**

Astrium SAS, on the basis of the investigations, determined that the substance detected in the wires is the epoxy used for sealing, which diffuses between the sleeve and the wire during burn-in. They recommended the following:

Incorporated Material or Product (e.g. Mounted Parts)
No action required.

Current Activities or Stock Items (include Lots under Procurement)
When mounting the thermistor, it is recommended to ensure that the length of the wires of the thermistor is larger than 5 cm.
This mounting recommendation shall be sent with the parts and the user informed to be exposed to meet soldering problem if he doesn't follow it.
In case of crimping process, the minimum of 5 cm length shall be respected.

New Procurement

Betatherm thermistors may be procured as are but, when mounting the thermistor, it is recommended to ensure that the length of the wires of the thermistor is larger than 5 cm.

This mounting recommendation shall be sent with the parts and the user informed to be exposed to meet soldering problem if he doesn't follow it.

In case of crimping process, the minimum of 5 cm length shall be respected.

With respect to G15K4D489 type probes with the leads cut to less than 50 mm, Alcatel Cannes conducted assembly tests with crimping and found that the epoxy on leads effect had no influence on the quality of the crimped connections. Alcatel Toulouse conducted similar tests but with soldered joints. As expected the quality of the solder joint was affected but when thermally cycled (-55°C TO + 125°C) for 500 cycles both the Thermistor assembly and solder joint showed no degradation.

2/ FURTHER INVESTIGATIONS:

Betatherm have verified that the epoxy bonding process; including material definition and control, shelf-life, epoxy mixing, epoxy curing and control of curing ovens, remains as defined in the PID and has not been subjected to any change or degradation.

Betatherm have also potted parts in the normal method and, after the normal two stage curing procedure, then cut the lead wire at the bead and then put the leads in the oven at + 160°C. On investigation the lead wires, at less than 30 mm from the thermistor bead, were discoloured after168 hours. This simulation of burn in indicated that traces of **epoxy were drawn up the lead under the insulation during potting** and that this epoxy only became fully visible at +160°C after 168 hours.

3/ POTENTIAL CORRECTIVE ACTIONS:

Betatherm are committed to fully investigate and institute corrective actions to prevent traces of epoxy on the lead wires of the G15K4D489 devices. We are obviously aware that the process is under PID control and that any proposed changes will be disclosed, discussed and agreed with the ESCC Executive prior to implementation. We are also aware that any proposed change must ensure that the reliability of the epoxy to aluminium housing bond is maintained.

We are currently investigating and carrying out experiments using the following solutions:

- Adjusting the Epoxy / catalyst mix.
- Allowing a specific time elapse before the mix is used to pot the probe.

4/ SHIPMENTS OF ESCC QUALIFIED PARTS.

Investigation by Betatherm, as described in paragraph 2 above, would indicate that this epoxy issue is present on all ESCC 4006/014 parts that have been manufactured. Since we started to manufacture the ESCC 4006/014 parts the epoxy specification and process has not been changed. The only difference between variants 01to 05 and variant 08 is the gauge of the wire.

Samples of ESCC 4006/014/04 parts taken from 2003 show evidence of the effect.
It is probable that the smaller diameter wire used in the variant 08 parts means that the effect is more likely to occur.

Since the original qualification a total of 565 parts have been shipped. As discussed previously if any of these parts had the wire stripped to less than 30mm from the thermistor bead, the effect would have been visible and solderability would have been affected - **we have received no indication that this is the case from any of our customers for these parts.**

Betatherm have informed all the ESCC 4006/014 Variants 01 – 05 customers of the potential of the solderability issue if the parts are stripped to less than 30mm and a similar Application Note to G15K4D489 devices has been added to the ESCC 4006/014 Variants 01 to 05 data sheets.