

April 29, 2005

International Rectifier Hi-REL
205 Crawford Street
Leominster, MA 01453
Phone: (978) 514-6180

Attn: Mr. Paul Herbert

Reference : GIDEP FV5-P-05-01 March 29, 2005
Subject: Nemco response – P/N PCT4.7/10AK

Dear Mr. Herbert,

Thank you, for communicating your GIDEP alert to us, allowing us an opportunity to respond.

The subject alert describes an issue with regard to a potential problem with a tantalum capacitor part number PCT4.7/10AK. There was no failure of the device. The concern regards a 100% Sn termination finish on the product and the potential tin whisker growth that could result over time. The problem description of the alert suggests the application is Hi-Rel related and refers to NASA requirements.

The device in question is a commercial device. Commercial parts are supplied in accordance with catalog data or EIA specifications. The EIA does not specify material content of termination material as long as the termination is solderable. Catalog specifications on commercial devices are subject to change without notice especially in the interest of product improvement and/or mandates/directives/initiatives as was in this case. If a user has a specific material content requirement on a commercial device, this needs to be communicated to the supplier. This was not accomplished in this case.

Further, we are advised that these devices were purchased from a distributor; however, we have not been able to confirm the details of the transaction due to a lack of information provided and question whether the distributor may have been authorized at the time the product was purchased.

In any event, and based on description, we believe the product is Nemco brand and no negative reports have been filed relating to performance for these devices.

The development of Legislation began as early as 2001 worldwide to reduce the lead content and other hazardous substances in electronic products. This is being taken to reduce environmental impact when such products are discarded. Nemco (as well as all other global component suppliers) began introducing 100% Sn termination finishes to achieve complete conversion of all surface mount devices by July 2006. Our hard date for full conversion was January 1, 2004. This was accomplished. Accordingly, we are proud to report we are in compliance with lead free and RoHS initiatives.

Nemco Electronics Corp. believes it pursued reasonable methods of conveying this information to the market by modifying its part numbering system with the addition of optional suffix codes so customers could specify termination finish of 100% Sn or 90% Sn / 10% Pb. New catalogs were prepared, memos were sent throughout our sales organization including distributor network and our Web site www.nemcocaps.com was up-dated.

It should be noted that suppliers of commercial components to the electronics industry are handling the lead free conversion and communication of their conversion to the market in different ways. There is no organized approach among suppliers of passive components in the commercial sector.

At the component level, under reflow conditions, the solder paste into which the component is placed will wet most of the termination surface. This area will not be susceptible to whisker growth, as the additional elements alloyed in the solder paste will also alloy with the tin from the termination plating. Only a minor portion of the termination area may remain pure tin coated. Hence the whisker growth is related to pure tin present on board such as pad plating rather than component termination finish.

There have been no noted incidences of Sn whiskers in millions of component hours for tantalum capacitors in solder (wave or reflow) applications.

The reported test in the advisory shows 5-micron max growth - NEMI has a threshold of 10 microns as defining onset of whiskers.

Although we believe whisker growth can be significantly reduced by preventative actions, a 100% whisker free surface cannot be guaranteed when pure tin is used. Both MIL and NASA specifications for tantalum capacitors continue to require a minimum of 3% lead content in termination finish to guarantee a whisker free surface. In response, Nemco continues to make 90/10 Sn/Pb available by adding the suffix code PB to part numbers.

For background information, due to the lack of any whiskers documented in pcb applications, the EIA/ ECA posted a white paper on their web site as pertaining to capacitors.

“Have you seen Tin Whiskers? The Facts about Tin Whiskers” dated July 22, 2004 is attached.

Respectfully submitted,

Philip Kansky
Vice President

C: James Rapoport – Nemco
: Quality Team distribution list NQP3295 – Nemco

Attachment:

Have You Seen Tin Whiskers? The Facts about Tin Whiskers

A Statement Issued by members of ECA/EIA Passive Components Group

(Approved by ECA member companies, Jul 22, 2004)

Due to environmental regulations the push towards lead free products has gained momentum in the past couple of years. However, with the shift towards lead free products, we have seen a re-emergence of the “***Fear of Tin Whiskers***”. We use the word “FEAR” intentionally, because it is in the best interest for the whole passive SMT component industry and their users not over react, but to understand and evaluate any risks based on facts and data.

Over 30 years ago, when attempts were first made to plate electronic components with pure tin (mostly on copper or copper-alloy surfaces), there were reports of tin whisker growth. With that prior knowledge, the SMT component manufacturers conducted numerous studies (published and unpublished) on this subject and effective countermeasures were put in place to eliminate or mitigate the growth of tin whiskers. In fact, tin whiskers have not been a problem for the surface mount components ever since pure tin plating really took off (about 15 years ago). It is not possible to delve into all the publications and studies on this subject within the scope of this paper, however we shall highlight some very effective countermeasures taken by the whole industry. These include: using matte tin finish rather than bright (to reduce residual stresses), applying uniform nickel undercoating (which acts to suppress whisker growth besides acting as a solder barrier), and having parts with rounded corners (to avoid stress points). On the processing side too, care is taken to control grain size of tin, use high purity tin, annealing, use controlled current densities for deposition for both nickel and tin, high process control via SPC, control additives, stabilizers, etc. However, the above countermeasures may not be all inclusive, because every manufacturer may have their own process for tin whisker mitigation.

And what does the component industry have to show for it? Just for surface mount ceramic capacitors, in the past 5-7 years alone, over 2 TRILLION have been shipped worldwide. Most of them had pure tin terminations. To our knowledge, in commercial applications, there have been no documented cases to date of equipment malfunction, field failures or surface mount parts being returned because of tin whiskers. By any measure this is an impressive record.

However, two questions remain to be answered. Under what conditions and why do whiskers grow? It is easier to answer the first question, because some of our member companies have been able to reliably grow whiskers under specific accelerated conditions. As to the second question, there are some good hypotheses in literature to which many people subscribe to, but again for sake of brevity they are excluded from this paper. Controlled experiments have shown that whisker formation is initiated and accelerated by residual stresses. In practice, thermal cycling is the single biggest contributor to whisker growth. Maximum growth has been observed when thermal cycling between -40C and 85C, BUT the maximum whisker length observed is about 50 um (some studies have shown maximum growth to approach 100 um) after 2500 cycles. Whisker growth is reported to reach a plateau after 2000 cycles. In fact some of us have done tests up to 8000 cycles with similar conclusions. Diffusion of nickel into the tin layer is hypothesized to prevent whisker formation (it is hypothesized to relieve stresses in tin layer). Humidity and long term room temperature storage by themselves have not been found to initiate whisker growth.

So is there an easy way to control this fear of whiskers? Yes, there is. If NONE the conditions noted below apply, you should stop worrying about whiskers. If any of these conditions DO apply, please discuss with your vendor, as they do not in themselves automatically constitute a risk of whiskers.

1. Your products *are exposed* to extreme thermal cycling conditions repeatedly and well beyond accepted industry standards.
2. Your products *are used in extremely dense circuits* where the spacing between individual components becomes extremely critical.
3. Your parts *are used* in extreme conditions requiring established reliability products (such as space or special military applications).
4. You *have not followed the manufacturer's recommended assembly guidelines*. For example, you have assembled tin coated parts with epoxy or glue or other polymeric conductors (such assemblies should use parts having non-plated or precious metal plated terminations).
5. You *source parts* from reputable component manufacturers (with a long history of providing high quality and reliable parts) or via their authorized distribution channels.

Note that despite the trend towards lead free products and an impressive record of reliability for pure tin plated parts, some manufactures still offer options for providing tin-lead plated parts (in many cases at a premium). These parts are recommended for applications or conditions where the possibility of whisker growth is real and high. It should be emphasized that switch to lead free soldering does not lead to tin whisker formation. Under any circumstances please discuss your applications with your vendor of choice.

The passive component industry would once again like to emphasize that the safety, performance and reliability of your products is our main concern and we have developed technologies and processes to provide you very high quality parts at very competitive prices. And we all stand behind our products.