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October 1, 2008

MEMORANDUM FOR MILITARY/INDUSTRY DISTRIBUTION

SUBJECT: Engineering Practices Study Concerning Proposed change in the high temperature solder.
Project number 5910-2008-014

The subject engineering practices study is dated 1 October 2008. If you have any questions please contact the project officer Ken Bernier by email at Kenneth.Bernier@dla.mil , or by phone at 614-692-0563.

Michael A. Radecki
Chief
Electronics Components Team



ENGINEERING PRACTICE STUDY
TITLE: PROPOSED CHANGE TO HIGH TEMPERATURE SOLDER FOR MIL-PRF-39003
PROJECT NUMBER 5910-2008-014

1 October 2008
(approval date)

STUDY PROJECT (SEE ENCLOSED)

FINAL REPORT

Study conducted by Ken Bernier

Prepared by:

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DSCC-VAT

Approved by:

Michael Radecki
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Objective

This engineering practices study is being conducted to determine if lead-free, high temperature solders are being used to manufacture [MIL-PRF-39003](#) parts and if so, what actions should be taken.

Background

The current pure tin prohibition in [MIL-PRF-39003](#) is as follows:

3.4.4 **Pure tin.** The use of pure tin is prohibited both **internally** and **externally**. Tin content of capacitor components and solder shall not exceed 97 percent. Tin shall be alloyed with a minimum of 3 percent lead (see 6.8).

The G-11 committee reported, at the September 2007 meeting, that some [MIL-PRF-39003](#) parts had failed DPA testing because the high temperature solder used did not contain the required 3% lead (Pb).

The lead-free, high temperature solders used are typically tin-silver (SnAg) alloys.

This prohibition statement has evolved slowly over time from a simple pure tin prohibition on the lead finish to language which includes undercoating, internal components, hardware, and finally solder.

The proper design of many components, including tantalum capacitors, requires the use of high temperature solders at specific locations. In fact, [MIL-PRF-39003](#) has a stated requirement for the use of high temperature solder for lead attachment. High temperature solders available include those that have a high lead content and some that are lead-free, such as tin silver (SnAg). The designs of these capacitors and the solder used have been in place for many years, perhaps decades; longer than the initial introduction of the pure tin prohibition and certainly longer than the inclusion of "solder" into this prohibition.

A conflict exists between DSCC's current pure tin prohibition and the use of lead-free high temperature solders. The pure tin prohibition requires that tin be alloyed with a minimum of 3 percent lead. In effect, this prohibits the use of a SnAg high temperature solder. This conflict was brought to DSCC's attention with the DPA failure of some [MIL-PRF-39003](#) capacitors. The SnAg high temperature solder used did not meet the tin-lead alloy requirement.

The QPL suppliers to the above specifications were surveyed regarding the high temperature solder used in their QPL product.

RESULTS

The survey of the QPL tantalum capacitor manufacturers revealed that at least one manufacturer is using a lead-free high temperature solder. This manufacturer stated that they have had no known failures with regard to the high temperature solder used.

RECOMMENDATION

It is not DSCC's intent to place restrictions on proven designs of QPL product using SnAg high temperature solder. In order to accommodate SnAg high temperature solder, language needs to be incorporated into the specifications to allow its use with the approval of the qualifying activity. The language should include the requirement that the tin content of the high temperature solder not exceed 97 percent.