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27 October 2010

MEMORANDUM FOR VSS

SUBJECT: Engineering Practices Study to improve surge current testing of tantalum capacitors.
MIL-PRF-55365 and MIL-PRF-39003.
Project number 5910-2010-025

The subject engineering practices study is dated 27 October 2010. 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
Electronic Components Team



ENGINEERING PRACTICE STUDY
TITLE: IMPROVE THE SURGE CURRENT TESTING OF TANTALUM CAPACITORS
PROJECT NUMBER 5910-2010-025

27 October 2010
(approval date)

STUDY PROJECT (SEE ENCLOSED)

FINAL REPORT

Study conducted by Ken Bernier

Prepared by:

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EP STUDY: THE SURGE CURRENT TESTING OF TANTALUM CAPACITORS
PROJECT NUMBER 5910-2010-025

Objective

EP study to update surge current test procedures in MIL-PRF-39003 and MIL-PRF-55365

Working with G11 and NASA to improve surge current test procedures and to make the testing the same in all specification sheets of MIL-PRF-39003 and MIL-PRF-55365. The study will modify the requirements to help ensure all capacitors receive an effective surge current screening to remove suspect parts.

Currently there are three different requirements for surge current testing: MIL-PRF-39003, MIL-PRF-39003/10, and MIL-PRF-55365. A summary of the recommended changes, reason for changes, and summary are below. The detailed changes to the two specifications follow.

Recommended changes to MIL-PRF-39003 and MIL-PRF-55365:

The minimum peak current should be at least $I_{pk} = V_r / (1.0 + ESR_{max})$ where ESR_{max} is specified at 25°C of the tested capacitor.

The maximum allowed circuit resistance shall be 1 ohm.

Each capacitor must reach target voltage in at most 10 times the capacitance value to be tested (e.g. 1ms for 100uF capacitor).

The test method shall require periodic verification of the minimum peak current.

Require the capacitor bank to be at least 50 times larger than the total capacitance tested by a single test.

*** This would improve the chances of properly testing parallel capacitors.***

Make the test method uniform for all tantalum specifications.

Reason for changes.

The purpose of the surge current testing is to identify and remove from the lot capacitors that cannot survive reasonable expected inrush currents.

Almost all customers expect the peak current to be at least $I_{pk} = V_r / (1.0 + ESR_{max})$.

The existing test methods are not consistent with each other in the Military Specifications MIL-PRF-39003 and MIL-PRF-55365.

Summary of what is to be achieved.

Minimum required peak current for each capacitor.

Maximum circuit resistance per capacitor.

Maximum time allowed for each capacitor to reach voltage.

Minimum size of capacitance bank for total tested capacitance.

Minimum voltage to be achieved during charge.

Maximum voltage remaining after discharge.

Minimum number of cycles and cycle duration

A method to verifying each capacitor receives the minimum peak surge current. "Do an equipment check each day".

Reduce the number of cycles required for each test cycle.

Conclusion:

The following changes will be made to MIL-PRF-55365H:

Minimum required peak current for each capacitor.

Maximum circuit resistance per capacitor.

Maximum time allowed for each capacitor to reach voltage.

Minimum voltage to be achieved during charge.

Maximum voltage remaining after discharge.

Minimum number of cycles and cycle duration

Reduce the number of cycles required for each test cycle.

RECOMMENDATIONS:

Revision H of MIL-PRF-55365 will have changes to the surge current testing. These changes are shown above in the conclusion statement.