

To: Distribution Date: March 17, 1997
 From: Jay Brusse/Unisys Corp. supporting NASA/GSFC Code 311
 Subject: Trip Report for Military Capacitor Specification Coordination Meeting

A coordination meeting to discuss and resolve proposed changes to various military capacitor specifications was held at the Defense Supply Center Columbus (DSCC) in Columbus, OH from 02/10/97 to 02/14/97. Dave Moore, Pat Kyne and Ken Bernier of DSCC, formerly known as the Defense Electronics Supply Center (DESC), hosted the meeting along with the Preparing Activity (PA) representative for the most of the subject specifications, Jeffrey Carver from the U.S. Army Communications-Electronics Command. Representatives from NASA (GSFC, JPL), the Aerospace Corp. (U.S. Air Force) and the various qualified suppliers were also in attendance to defend their particular interests in these specifications. See the attached attendance lists for details.

Table I lists the military specifications discussed during this coordination meeting.

Table I: Military Specifications Reviewed During Coordination Meeting

Specification Number	Part Type
MIL-PRF-55365	Capacitor, Fixed, Tantalum, Chip
MIL-PRF-49467	Capacitor, Fixed, Ceramic, High Voltage
MIL-PRF-39014	Capacitor, Fixed, Ceramic
MIL-PRF-20	Capacitor, Fixed, Ceramic, Temperature Compensating
MIL-PRF-55681	Capacitor, Fixed, Ceramic, Chip
MIL-PRF-123	Capacitor, Fixed, Ceramic, Space Grade

The primary changes proposed for these specifications fall into four basic categories:

Category I: Conversion to "Performance" (PRF) Specification

Conversion of military specifications to "Performance" specifications has been driven by the well-known Department of Defense initiative to utilize "Best Commercial Practices". The general philosophy is to focus the detailed requirements on end-item performance attributes and to remove requirements which dictate to a supplier "How to" make their product. This shift is intended to give the supplier more latitude to utilize the necessary materials or processes to meet the performance requirements of the specification.

Category II: Addition of "C" Level ("A" Level for MIL-PRF-55365) Product Option

The Department of Defense (DoD) has developed a new quality level option for several of the capacitor specifications known as "C" level (in the case of MIL-PRF-55365, this level will be called "A" level because the "C" is already defined in accordance with the Weibull failure rate system). A "C" level part is one which is manufactured on the supplier's military qualified product line utilizing the same materials and processes as their established reliability (ER) product. The primary difference between the "C" level and ER parts is that the "C" level part does not receive the end-item government mandatory Quality Conformance Inspections (QCI) required for ER level product (i.e., thermal shock, voltage conditioning). Each supplier is given the latitude to specify their own

test and release system. In order to be a qualified source for the "C" level product the manufacturer MUST be qualified to a minimum failure rate level (usually "P" level - 0.1%/1000 hours or Weibull "B" level - 0.1%/1000 hours) for the same product. "C" level product is typically identified in the part number by placing a "C" in the designator reserved for the failure rate (ex., CDR01BP100BJU C).

The "C" level option should benefit the manufacturers by allowing them to market a less costly "C" level product to military and hi-rel users who do not require QCI. The DoD hopes that addition of the "C" level will help to maintain a healthy supplier base for ER resistors since maintenance of ER level qualification is a mandatory requirement to remain qualified to supply the "C" level.

Category III: Addition of Space Level Requirements

The representatives for the space community successfully lobbied to add surge current test requirements (with PDA limits) to MIL-PRF-55365/4 and /8 to cover high reliability tests normally called out in Source Control Drawings (SCD). Currently, users can specify surge current testing by adding the letter "A" or "B" to the end of the part number in order to specify room temperature surge current testing ("A") or -55°C, 25°C and +85°C surge current testing ("B").

MIL-C-123 is the stand-alone space level specification for multilayer ceramic capacitors. The specification has detail slash sheets which cover the basic styles offered in the ER ceramic capacitor specifications such as chip, axial lead, radial lead and DIP configurations. MIL-C-123 imposes the strict requirements (such as in-process inspections, DPA, X-ray, lot sample life testing, lot traveler data retention, etc.) on the supplier in order to assure device reliability. Because of the success of MIL-C-123 as a space level (high reliability) specification, there is no need (nor interest) in adding space level requirements to any of the other ceramic capacitor specifications such as MIL-C-39014, MIL-C-20 or MIL-C-55681.

Category IV: General Changes

Several general changes were also made to the capacitor specifications. In particular, a new PPM assessment requirement has been introduced which follows the newly released EIA 554-1. The new requirement is based on simple room temperature parametric checks such as capacitance, dissipation factor (DF), insulation resistance (IR) and dielectric withstanding voltage (DWV). No PPM checks are required for visual or mechanical defects. For the non-ER "C" level product the manufacturer is given the freedom to devise their own PPM assessment sampling procedure.

The following sections briefly describe the changes being introduced into the capacitor specifications.

MIL-PRF-55365: Tantalum Chip Capacitors

- Adding "A" level product option (see Category II change above) only for suppliers who maintain Weibull "B" failure rate level or better. Initially, "A" level products will only be offered for cap values and voltage ratings currently offered via Weibull graded parts.
- New slash sheets to be developed for the low ESR tantalum chip styles
- Proposal to add new slash sheets for "fused" styles was rejected by the manufacturers due to lack of demand for these styles
- Tightening the surge current test requirements in /4 and /8 as follows:
 - Only suppliers who maintain Weibull "B" failure rate level or better may offer surge current tested parts
 - Procedures for performing surge current testing will be rewritten to follow the methods called out in MIL-C-39003/9 (for surge current option "A") and MIL-C-39003/10 (for surge current option "B").
 - A 10% Percent Defective Allowable (PDA) will be imposed on the surge current test. Lots which exceed the PDA cannot be supplied in accordance with MIL-PRF-55365.
- Several suggestions were raised for changing the part numbering scheme to deal with the following:
 - Making case size a variable to allow suppliers to make existing parts in smaller packages
 - Making the character for the optional surge current testing a mandatory character in the part number. For example, the part number must have the "A" or "B" for surge current tested parts or some other character (to be determined; possibly "X") to specify NO surge current testing.
 - Introducing a way to specify the new low ESR part numbers

Example Proposal for New Part Numbering Scheme for MIL-PRF-55365

CWR06	B	A	225	J	M	A	X
<i>Style: Replace "R" with "L" for low ESR styles</i>	Voltage	Term. Finish	Cap.	Tolerance	Failure Rate Level	<i>Case Size: Slash sheets will specify allowable case sizes. QPL will show who has qualified various case sizes</i>	<i>Surge Current: This field will be mandatory. "A"-Surge A "B"-Surge B "X"-No Surge</i>

- Proposal was made to consider adding new Resistance to Soldering Heat test methods from MIL-STD-202 Method 210 which now include test conditions which simulate IR Reflow and Vapor Phase Reflow. No final decisions were made on whether to include any of these new methods at this time.

MIL-PRF-49467: High Voltage Ceramic Capacitors

- This specification has been in coordination for several years without a source ever having qualified. The intent of the discussions on this specification at this meeting were only to tie up the final loose ends.
- A new qualification approach was agreed upon due to the prohibitive number of qualification samples needed in order to qualify all styles of all voltage ratings. The new approach will grant qualification to intermediate voltage ratings based on qualification as follows:
 - Qualification of BP styles must be done separately from BZ and BR
 - Qualification of 5 kV (highest voltage rating offered in this spec) and 3 kV styles will automatically cover 4 kV styles
 - Qualification of 600 V (lowest voltage rating offered in this spec) and 3 kV styles will automatically cover 1 kV and 2 kV styles
 - Manufacturers may elect to qualify one voltage rating at a time (for example, manufacturer may opt to qualify the 1 kV styles only, then later qualify the 2 kV styles, etc.)

MIL-PRF-39014: General Purpose Ceramic Capacitors

- Adding "C" level product option (see Category II change above) only for suppliers who maintain "R" failure rate level or better. Initially, "C" level will be introduced for the CKR05, 06, 22, 23, and 24 styles only. "C" level products will only be offered for cap values and voltage ratings currently offered via Established Reliability parts. "C" level part numbers would likely replace the "-" in the current part number with a "C" (for example, M39014/02 C1350 instead of M39014/02 -1350). Due to space limitations for actual part marking, a "C" level part may be marked as " C39014". Part marking details have not yet been finalized.
- NOTE: A proposal to add "C" level product to MIL-PRF-20 was put on hold for the time being. MIL-PRF-20 contains both ER (CCR) and non-ER (CC) product levels which may confuse the "C" level issue.
- Manufacturer will be given the option to define their own in-process solderability check in lieu of performing the current Group A solderability check. The manufacturer's procedure must be validated by the qualifying activity.

MIL-PRF-55681: Ceramic Chip Capacitors

- Adding "C" level product option (see Category II change above) only for suppliers who maintain "P" failure rate level or better. "C" level products will only be offered for cap values and voltage ratings currently offered via Established Reliability parts. "C" level parts will be identified by replacing the failure rate level designator with a "C" (for example, CDR01BP100BJU C).
- Proposal was made to consider adding new slash sheets to cover the 0603, 0504 and possibly 0402 chip sizes. Manufacturers will submit existing data sheets for these styles to DSCC for consideration.
- Proposal was made to consider adding new Resistance to Soldering Heat test methods from MIL-STD-202 Method 210 which now include test conditions which simulate IR Reflow and Vapor Phase Reflow. No final decisions were made on whether to include any of these new methods at this time.

MIL-C-123: High Reliability Ceramic Capacitors

- Will be "performance converted" via Amendment 4 to Revision B. The Amendment will be followed by a full revision which may incorporate some additional changes which are being investigated in the interim.
- Increased the allowable dielectric constant minimum to 3000 from 2400.
- Will be amending MIL-C-123/2 (CKS06) to add values up to and including 1 uF. Special wording will be added to /2 which defines how the manufacturer can qualify to the extended range values. Wording will look like:

"Extension of Qualification Option: For MIL-PRF-123/2 manufacturers that are currently qualified to a subset of the full capacitance range for a given voltage rating and voltage-temperature characteristic; qualification to additional capacitance values may be granted based upon successfully meeting MIL-STD-790 requirements, in-process inspection and Group A and B inspections for those values. This qualification option is restricted to a given voltage rating and voltage-temperature characteristic. The highest capacitance value qualified can be the basis for qualifying lower capacitance values of the same voltage rating and voltage-temperature characteristic."

This wording was added because the manufacturers were not interested in investing in performing "full" qualification for the extended values for such a low volume business line. Instead, this wording allows the suppliers to take an SCD order which mirrors MIL-C-123 requirements, build the product for their SCD customer and use the results of testing as a basis for qualification.

- Any MIL-C-123 slash sheets which do not currently have a QPL source or for which no supplier is currently expressing an interest in supplying will be canceled.
- Body Insulation Test (which is a subparagraph test for DWV) will be specifically called a qualification test only. The full revision of MIL-C-123 will address modifying the qualification table to move Body Insulation into a subgroup where far less samples are required. Currently, the qualification table requires testing 170+ parts for body insulation.
- X-ray Appendix will be turned into a "guideline" only for the manufacturer who can submit a procedure to the qualifying activity which will accomplish the intent of this appendix.
- Preparing activity offered the suppliers the option to stock MIL-C-123 parts through distributors. Currently, MIL-C-123 has strict prohibitions against this practice. The suppliers were not interested in "stocking" of MIL-C-123 part types mainly due to concerns with having the distributors copy and ship the test data packages to the customers. Additionally, they saw no real time savings with allowing distributor stocking unless we as users can forecast our demand.
- Issue was raised by DSCC as to why MIL-C-123 does not require solderability as a Group A test as is the case in all other ceramic specifications. This issue will be revisited for the full revision of MIL-C-123.
- Changed wording for solder temperatures to say "liquidus" temperature shall be 260°C minimum instead of "plastic" temperature shall be 260°C.
- N-ray inspection method has been deleted. Ultrasonic scanning method has been retained, although specific details about the type of equipment and methods has been removed.
- Reworded data retention paragraph 4.1.3 to say

"Manufacturing lot performance information. Lot performance information relating to material, process, lot conformance, inspections and product shall be retained by the vendor for 10 years from date of manufacture of parts."

- Split up the Group C inspection table as follows:

Subgroup 1 - leaded devices

a) Terminal Strength	6	
b) Solderability	6	accept on 1 reject for all tests
c) Resistance to Solder heat	6	
Resistance to Solvents		

Subgroup 2 - non-leaded devices

a) Terminal Strength	6	
b) Solderability	6	accept on 1 reject for all tests
c) Resistance to Solder heat	6	

- Dropped the pre-encapsulation terminal strength test sample quantity to 5 pieces from 10 pieces.
- Post Voltage Conditioning, the supplier may perform room IR at any time as long as it follows DWV and capacitance and DF are the final electrical tests in the sequence. Currently, test says manufacturer shall perform room IR, DWV, capacitance and DF. Then heat parts up to 125°C and do hot IR, cap and DF.
- Allow supplier to perform DWV at up to 400% of rated voltage. This allows the manufacturer to use a more stringent internal in-process test voltage level which still meets the intent of the specification. Current requirement is for DWV at 250% of rated voltage.
- Life test sample size will be fixed at 25 pieces when the full revision of MIL-C-123 is released. Current requirement is for 25 pieces for lots up to 1200 pieces, then 80 pieces for up to 10,000 pieces. In reality, the suppliers rarely, if ever, produce lots larger than 1200 pieces.
- Appendix G was deleted. This appendix was for "Baseline" and "Audit" activity requirements.

Before submitting these new performance specifications up the Army chain of command for approval, DSCC plans to circulate final drafts for rapid review. It is unclear how long this process will take since the Army PA representative is unsure how the Army approval chain will react to the changes made during this revision cycle. There is a possibility that the Army review office will reject the specifications "as modified" because they remain too prescriptive.

If you have any questions or need additional details, please do not hesitate to contact Jay Brusse at (301) 286-2019 or by e-mail at jbrusse@pop300.gsfc.nasa.gov.

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