To: Distribution Date: October 15, 1996

From: Jay Brusse/Unisys Corp. supporting NASA/GSFC Code 311

Subject: Trip Report for Military Resistor Specification Coordination Meeting

A coordination meeting to discuss and resolve proposed changes to various military resistor specifications was held at the Defense Supply Center Columbus (DSCC) in Columbus, OH from 09/30/96 to 10/04/96. Andrew Ernst and Dennis Cross of DSCC, formerly known as the Defense Electronics Supply Center (DESC), hosted the meeting along with the Preparing Activity (PA) representative for 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 Army military specifications discussed during this coordination meeting.

Table I: Army Military Specifications Reviewed During Coordination Meeting

Specification Number	Part Type
MIL-PRF-55182	Resistor, Fixed, Film
MIL-PRF-39017	Resistor, Fixed, Film
MIL-PRF-55342	Resistor, Fixed, Film, Chip
MIL-PRF-914	Resistor Network, Surface Mount
MIL-PRF-39007	Resistor, Fixed, Wirewound, Power Type
MIL-PRF-39009	Resistor, Fixed, Wirewound, Power Type, Chassis Mounted
MIL-PRF-39015	Resistor, Variable, Wirewound
MIL-PRF-39035	Resistor, Variable, Non-Wirewound

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.

Interpretation of what constitutes a “Performance” requirement vs. a “How to” requirement has been left up to the individual preparing activities (PA). In some cases these conversions require little more than a simple cover page change. However, in the case of these resistor specifications, the Army (PA for these documents) has taken a strict stand on removing the “How to” requirements. As an example, detailed visual inspection criteria have been de-emphasized in favor of allowing each manufacturer to determine which visual anomalies will impact their product’s performance or reliability.

Category II: Addition of "C" Level Product Option

The Department of Defense (DoD) has developed a new quality level option for several of the resistor specifications known as "C" level. 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, power conditioning). 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) 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., RNR55E1003F **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 ("T" Level) Requirements

Previous attempts to develop stand alone space level specifications for resistors have not been very successful. Therefore, the space community decided to use this coordination opportunity to introduce space level requirements, known as "T" level, into the key specifications for resistors. Typically, these additional requirements include:

- Outgassing Certification
- Qualification to Extensive Thermal Shock Cycling (100 cycles)
- Power Conditioning/Burn-in (100% Screening Inspection)
- Destructive Physical Analysis, Detailed Pre-Cap Inspection, and/or Radiographic Inspection (all lots)
- Capability to Meet Critical Performance Parameters (i.e., Resistance Noise)

The requirements to qualify to the "T" level include maintenance of ER qualification to a minimum failure rate level (usually "R" [0.01%/1000 hours or "S" [0.001%/1000 hours]) and demonstration of the ability to meet the additional space level testing requirements as shown above. "T" level product is typically identified in the part number by placing a "T" in the designator reserved for the failure rate (ex., RNR55E1003F **T**).

Category IV: General Changes

Several general changes were also made to the resistor 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 DC resistance tolerance checks only (no visual or mechanical checks). For the non-ER "C" level product the manufacturer is given the freedom to devise their own PPM assessment sampling procedure. Space level product is exempt from PPM assessment due to the extremely low volume of space level product being procured.

Many of the detailed visual/mechanical, DPA, and radiographic inspection accept/reject criteria were moved from the detail requirements section of the specifications into appendices. The Army and several suppliers advocated removing these criteria from the specifications entirely because many could be considered

"non-performance" based and too prescriptive in terms of how the supplier must make their product. In order to salvage the intent of these criteria, the space community representatives and DSCC successfully lobbied to have the criteria moved into appendices to be used as mandatory accept/reject criteria. As a tradeoff, the manufacturers were given the option to replace the appendix criteria with their own internally developed accept/reject criteria tailored to their specific product. These in-house criteria must be approved by the qualifying activity before they can be instituted and they must be under strict document control as part of the supplier's MIL -STD-790 program.

Table II summarizes the major changes introduced into the military specifications for resistors as a result of this coordination meeting.

Table II. Summary of Basic Changes Made to Resistor Specifications

Specification	"C" Level Added?	Space Level ("T")Added?	Other Critical Changes
MIL-PRF-55182	Yes	***Yes***	
MIL-PRF-39017	Yes	No	
MIL-PRF-55342	Yes	***Yes***	More focused visual inspection guidelines were introduced to account for differences between thick and thin film technologies
MIL-PRF-914	Yes	***GSFC Proposed***	GSFC recommended addition of package related tests such as die shear, constant acceleration and PIND for hermetically sealed networks only.
MIL-PRF-39007	Yes	***Yes***	
MIL-PRF-39009	Yes	No	
MIL-PRF-39015	Yes	No	
MIL-PRF-39035	Yes	No	

Table III highlights changes introduced specifically for space level resistors.

Table III. Summary of Specific Space Level Requirements Introduced

Specification	Additional Qualification Requirements	Additional QCI Requirements
MIL-PRF-55182	• Outgassing Certification • Thermal Shock (100 cycles)	• Power Conditioning (Rated Power, 125°C, 100 hrs) • Resistance Noise Measurements • Destructive Physical Analysis
MIL-PRF-55342	• Outgassing Certification • Thermal Shock (100 cycles)	• Power Conditioning (1.5 x Rated Power, 70°C, 1.5 hrs on, 0.5 hrs off for 100 hrs duration)
MIL-PRF-39007	• Outgassing Certification • Thermal Shock (100 cycles)	• Thermal Shock • Short-time Overload • Dielectric Withstanding Voltage • Radiographic Inspection • Destructive Physical Analysis

Due to recent package related failure experiences with hermetically sealed resistor networks, NASA/GSFC made an informal proposal to introduce package related test requirements into the resistor network specifications (MIL-PRF-914 and MIL-PRF-83401). Currently, these specifications do not require such tests as constant acceleration, die shear or PIND which are commonly specified for microcircuits using similar package constructions. The proposal was well accepted by the two hermetically sealed resistor network manufacturers represented in the meeting (State of the Art and Vishay-Ohmtek). Further investigation needs to be performed in order to formalize a proposal for such requirements such as frequency of testing, acceptable acceleration levels, applicability of tests for non-space level product, etc.

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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