ENGINEERING PRACTICES STUDY

TITLE: TO SURVEY MILITARY AND INDUSTRY ON DOUBLING THE GROUP B INSPECTION DELTA RESISTANCE MEASUREMENT ERROR CRITERIA OF MIL-PRF-49465.

21 January 2022

STUDY PROJECT

FINAL

Study Conducted by DLA LAND AND MARITIME

Prepared by:

Andrew Ernst

I. OBJECTIVES: DLA Land and Maritime-VAT is conducted a survey on Doubling the Group B Inspection Delta Resistance Measurement Error Criteria of MIL-PRF-49465. The purpose of this survey is to obtain input from the manufacturers, military services, and user communities to determine if the communities have any concerns on doubling the group B inspection resistance measurement error for this specification.

II. BACKGROUND: DLA Land and Maritime-VAT received an email from one of our OEM who was trying to define the Group B delta resistance % requirements on a 3 milliohm, 0.1% wire resistor, but the supplier wants to use the 0.0005 ohms measurement error which is ~17% of the parts resistance…arguably this is quite high. Looking at the three M49465 slash sheets, they have resistances as low as 0.01ohms. The 0.0005 ohms measurement error allowance is 5% of 0.01 ohms.

Whereas M49465 section 4.8.2b "Limit or error of measuring apparatus: ±(0.1 percent + 0.00001 ohm), but not exceeding one-fourth of the resistor tolerance or the resistance change limit for which the measurement is being made. Manufacturers, at their option, may use an apparatus of less accuracy, provided the limits are reduced to fully compensate for accuracy deviation." Therefore, the measurement accuracy is 0.20% for a 0.01ohm, 1% tolerance part < 5%.

M49465 section 4.8.2b calculations:

Calcs for 0.01ohm 1% tolerance part:

± (0.1 percent + 0.00001 ohm)	0.20%
one-fourth of the resistor tolerance	0.25%
thermal shock +/- (0.2% + 0.0005 ohms)	5.02%

Proposal:

For the Group B delta resistance % measurement error, a criterion of **doubling** the M49465 section 4.8.2b is proposed as follows:

"4.8.2b Limit or error of measuring apparatus: ±(0.1 percent + 0.00001 ohm), but not exceeding one-fourth of the resistor tolerance or the resistance change limit for which the measurement is being made. For Group B inspection: ± (0.2 percent + 0.00002 ohm), but not exceeding **one-half** of the resistor tolerance. Manufacturers, at their option, may use an apparatus of less accuracy, provided the limits are reduced to fully compensate for accuracy deviation."

III. RESULTS: The responses to the survey were low with 3 military responses stating they were interested in the results, and 2 responses from manufacturers. One manufacturer disagreed with the with the survey believing that the change to group B inspection would be measuring the parts with a less accurate bridge. The other manufacturer stated that the 0.0005-ohm adder to the allowed change in the resistance (0.1% to 2.0% in MIL-PRF-49465 and 0.1% to 0.5% in DLA Land and Maritime drawings 07011 & 07012 (which references MIL-PRF-49465 group B inspection)), is reflecting the different condition of the resistors during measurements. The proposed error for Group B inspection *(0.2% + 0.00002 ohm),* but not exceeding one-half of the resistor tolerance, would work for resistance value of 0.008 ohm and higher and 1% tolerance (<0.5%, that is ½ of 1% tolerance). For lower values and lower tolerance, the calculated error will exceed the proposed maximum allowed limit of ½ of tolerance, meaning that the recorded resistance shifts will exceed the test limits. Such situation would be result of miss consideration of the conducted test impact on measurement as well as different measurement methods applied in test lab comparing with measurements done at final QC. This manufacturer did give a proposal for the measurement error for Group B inspection being that an adder of **0.00005** ohm to the allowed change in resistance, for resistance values up to and including 0.050 ohm, and adder of **0.0005** ohm for values higher than 0.050 ohm. In all cases, the error shall not **exceed 0.5%**

IV. CONCLUSIONS: After discussing the survey results with the requesting OEM, it was determined that with the lack of support from the other OEMs and two manufacturers disagreeing with the proposed change, that the specification shall remain as is.

V. RECOMMENDATIONS: DLA Land and Maritime recommends that MIL-PRF-49465 group B inspection measurement error criteria remain as is and the proposal from the manufacturer be looked at again later.