

ENGINEERING PRACTICE STUDY

TITLE: [MIL-PRF-49470](#) LEAD FRAME COMPOSITION

25 February 2026

FINAL REPORT

Study Conducted by DLA Land and Maritime

Project Number: 5910-2025-033

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I. **OBJECTIVE:** An engineering practices study has been conducted to solicit feedback from stacked ceramic capacitor manufacturers and users regarding the lead frame materials used in the construction of MIL-PRF-49470 (Capacitor, Fixed, Ceramic Dielectric, Switch Mode Power Supply (General Purpose and Temperature Stable), Standard Reliability and High Reliability, General Specification for) capacitors. This study was initiated in response to CE11 (Component Parts Committee) task 24-202.

II. **BACKGROUND:** An Original Equipment Manufacturer (OEM) of space equipment presented to the CE11 Committee that they believe there is enough difference in the solder fatigue performance across the MIL-PRF-49470 qualified product that the lead frame material should either be specified or that a character should be added to the part number to select the lead frame composition.

From the OEM's perspective, the lead frame materials Phosphor Bronze Alloy 510 and 519 are preferred over Alloy 42 due to solder fatigue issues with Alloy 42. The OEM has been procuring T level MIL-PRF-49470 capacitors from a subset of the qualified suppliers to ensure they get the Phosphor Bronze Alloy lead frames. This has reduced the number of "standard" MIL-PRF-49470 part numbers that they have in their designs due to the need to control the source through program specific or internal drawings. This results in the creation and usage of custom part numbers rather than part numbers from the Qualified Products List (QPL).

Their recommendation is to either require Phosphor Bronze Alloy 510 or 519 lead frame materials or add a character in the part number to select the lead frame composition in MIL-PRF-49470.

III. **RESULTS:** Recipients of this study were asked to provide concurrence, objection, or comments regarding the recommendation to either require Phosphor Bronze Alloy 510 or 519 lead frame materials or add a character in the part number to select the lead frame composition in MIL-PRF-49470. The following responses were received:

1. NASA: The lead frame alloy is chosen to have a Coefficient of Thermal Expansion (CTE) that best matches that of the various materials in the stack which includes the plating, the solder alloy used to attach the lead frame to the stack, the Ag-frit, the ceramic, etc. The user's concern seems to be focused on the solder joint fatigue between the lead frame and the PWB. ALL of these factors are important to manage. And I would simply advocate that it is necessary to be cautious about dictating ONE thing for ONE reason, that may end up causing unintended consequences with some other important aspect of the entire assembly.
2. KEMET (Qualified manufacturer): We have some concerns about both proposals in the EP Study. First, we don't think it is a good idea to add another character to the part number. The part number is already very long, and additional characters may not be available in all Material Requirements Planning (MRP) systems. I anticipate this situation would be true for multiple manufacturers and users. If we then tried to eliminate characters to make room for a lead frame character, this would also create problems because we anticipate that there would be push back from the industry about making changes to the part numbers that have been used in Bills of Materials (BOM), etc. for years. Second, since this product has been in existence for many years, we don't think it is a good idea to try and force the Phosphor Bronze lead frame material onto suppliers who may have been qualified for many years using alternate materials.
3. KYOCERA AVX (Qualified manufacturer): We are opposed to distinguishing lead frame material and part number designation. This will impact our manufacturing system with new part numbers and qualification management.
4. Presidio Components (Qualified manufacturer): With regards to "Their recommendation is to either require Phosphor Bronze Alloy 510 or 519 lead frame materials or add a character in the part number to select the lead frame composition in MIL-PRF-49470", Presidio recommends that similar to MIL-PRF-32535, there should be a character option to order a specific lead frame type or a no character option for users who are happy with the status quo and don't want to have to change every MIL-PRF-49470 BOM/AVL part number to accommodate one OEM. The first option is a nonstarter in that manufacturers have already qualified one, or several, lead frame alloy(s) to MIL-PRF-49470. Also, there are many Phosphor Bronze alloys beyond Alloys 510/519. And finally, if different lead frame styles were to be added to MIL-PRF-49470 in the future, such as S leads, they might require a different alloy.

After thinking more about this EP study, Presidio thinks that doing anything to accommodate the OEM's request should be contingent on the OEM giving us a test procedure to test the solder fatigue performance of the lead frame material for the new stacked cap drawing (MIL-PRF-STACK). It's too late to add a test to 49470 but it's definitely something that we might want to consider adding to this new spec.

5. Air Force 85: We concur with adding a character in the part number to select the lead frame composition in [MIL-PRF-49470](#) capacitors.

IV. CONCLUSIONS: After receiving the feedback above, DLA Weapons Support (Columbus) decided to delay the final report of this study while the coordination of MIL-PRF-STACK is ongoing. MIL-PRF-STACK is being developed to specify the requirements and quality assurance provisions for stacked capacitor assemblies utilizing extended range ceramic capacitors like those in [MIL-PRF-32535](#). The same concerns regarding lead frame materials apply.

During our bi-weekly meetings for MIL-PRF-STACK, it was decided that the initial draft for MIL-PRF-STACK will include an allowance for the user to specify a lead frame material in the part number. It was also decided that no changes will be made to [MIL-PRF-49470](#) at this time.

V. RECOMMENDATIONS: Based on the feedback received in response to this EP Study and discussions conducted during coordination of MIL-PRF-STACK, DLA Weapons Support (Columbus) provides the following recommendations:

1. **No Immediate Revision to [MIL-PRF-49470](#):** No changes to [MIL-PRF-49470](#) are recommended at this time. While concerns were raised regarding potential differences in solder fatigue performance between lead frame materials, the responses from qualified manufacturers and technical stakeholders indicate that:
 - Lead frame material selection is part of a broader thermo-mechanical system design.
 - Existing products have been qualified using multiple alloy systems.
 - Immediate modification of the specification could introduce unintended qualification, configuration control, and supply chain impacts.
 - A standardized solder fatigue test methodology applicable to this product class has not been established.
2. **Implementation of Optional Lead Frame Selection in MIL-PRF-STACK:** The initial draft of MIL-PRF-STACK will include an allowance for users to specify lead frame material in the part number designation. This approach provides user-level configurability where mission-specific reliability requirements warrant material control and establishes a controlled implementation path within a new specification framework.
3. **Future Reassessment of [MIL-PRF-49470](#):** DLA Weapons Support (Columbus) may revisit potential modification of [MIL-PRF-49470](#) to include optional lead frame material designation if technical data supports a reliability benefit and implementation within MIL-PRF-STACK proves feasible and useful.