

## Straightforward Explanation of the MIL-I-46058C Specification for Conformal Coatings

During your selection of conformal coating you ran in to a specification that you have seen before but not fully understood, MIL-I-46058C. Conformal coating choices are vast, but with so many available, how does a user pick the correct one? Are there minimum standards that define what a conformal coating is supposed to do? Thankfully, yes there are. This article will focus on one such standard: MIL-I-46058C.

The official title for the specification is MIL-I-46058C, Insulating Compound (For Coating Printed Circuit Assemblies). The standard serves as a *material* standard, used to evaluate and document that a particular coating meets a list of specific performance attributes (more on those later). The MIL-I-46058C was developed to define a uniform set of test methods and performance requirements for conformal coatings and gives users confidence that the material they select will perform.

### The MIL-I-46058C standard is managed by the Defense Logistics Agency (DLA).

DLA manages the standard and maintains the Qualified Products List (QPL) associated the standard. For a coating to be placed on (and stay on) the QPL, it must be tested annually, by a DLA-certified laboratory. The data is reviewed annually by DLA to ensure that each coating proposed for inclusion on the QPL still meets the requirements of the standard. The latest version of the Qualified Products List is available from [www.dsc.dla.mil](http://www.dsc.dla.mil).

MIL-I-46058C evaluates conformal coatings to an extensive list of properties. The tests are explained below.

1. Curing Time & Temperature: Coating must meet the requirements of the standard when cured according to the manufacturer's instructions.
2. Appearance: When cured per manufacturer's instructions, coating should be smooth, homogenous, transparent, free of bubbles, pinholes, etc.
3. Coating Thickness: The recommended coating thickness shall be 1-3 mils for acrylic, urethane and epoxy coatings; 2-8 mils for silicone coatings; 0.5-0.7 mils for parylene coatings.
4. Fungus Resistance: The coating cannot support the growth of fungus.
5. Insulation Resistance: The average insulation resistance of all coated specimens shall be a minimum of  $2.5 \times 10^{12}$  ohms, with no specimens having a measured value below  $1.5 \times 10^{12}$  ohms.
6. Dielectric Withstanding Voltage (DWV): Coated specimens subjected to 1500 VAC for 1 minute shall exhibit no disruptive electrical discharge (spark over, flashover or breakdown). The measured leakage current shall not exceed 10 microamperes.

7. Q (Resonance): The resonance values for the coating, measured before and after immersion in DI water, must not change beyond specified limits.
8. Thermal Shock: Coating materials are subjected to 50 cycles of thermal shock. After thermal shock, coating must meet the Appearance and DWV requirements.
9. Moisture Resistance: The Insulation Resistance of the coating is measured under high temperature and humidity and must meet minimum specified values. After temperature / humidity exposure, the coating must meet the Appearance, Insulation Resistance and DWV requirements.
10. Flexibility: Coating is applied to a test substrate, cured per manufacturer's instructions and bent 180 degrees over a 0.0125" diameter mandrel. There shall be no evidence of cracking, crazing or adhesion loss of the coating.
11. Hydrolytic Stability: Coated specimens are subjected to four 28-day exposures of 85C / 90% RH. After this exposure, the coating can show no evidence of softening, chalking, blistering, cracking, tackiness, adhesion loss or reversion to liquid state. The coating must also remain transparent enough to view nomenclature and color codes used to identify the components over which the coating is applied.
12. Flame Resistance: Coating shall be self-extinguishing and non-burning when subjected to a flame test.
13. Shelf Life: Coating must meet Appearance, Insulation Resistance and DWV when tested after storage for six months at 25C.

## **MIL-I-46058C was declared "inactive" in November 1998.**

This deactivation meant the standard was "inactive for new designs, except for replacement purposes". This certainly does not mean however that MIL-I-46058C disappeared from the landscape. Today, the MIL-I-46058C standard persists for coating users and specifiers due to its requirement for independent third party certification and still being the only published conformal coating standard with an associated Qualified Product List.

Caution! As an applicator, you have many choices of conformal coatings that are on MIL-I-46058C, however there are many materials that claim to 'meet the requirements' of MIL-I-46058C. These are coatings have probably not been fully tested to the rigorous standard required to obtain and maintain MIL-I-46058C qualification. Treat these coatings with caution, "meets" does not mean "is" on the QPL. There is only one way to verify this and that's through the DLA website [www.dscc.dla.mil](http://www.dscc.dla.mil).

Conformal coating selection process involves a check list of many variables. One of these variables is the need for MIL-I-46058C qualified coating. We hope that this article helps you understand not only how to find such a coating, but also what is behind this qualification.