



AEROSPACE MATERIAL SPECIFICATION

AMS59™-047

Issued

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Conformal Coatings for Panels, Printed Circuit and Panels, Electronic Circuit

RATIONALE

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FOREWORD

REVISION NOTE

This Defence Standard was raised to Issue 4 to update its content and incorporate the latest MoD/DSTAN policy in place at the time.

HISTORICAL RECORD

This Standard supersedes the following:

INTERIM Def Stan 59-47/Issue 1. Published 25 October 1971.

Def Stan 59-47/Issue 2. Published 24 June 1974 - incorporated the latest available information on conformal coatings for printed wiring boards and included a reference to the British Standard BS 4584 series of specifications.

Def Stan 59-47/Issue 3. Draft completed 1979 but withdrawn prior to publication as tests could now be met from British Standard BS 5917: 1980.

Def Stan 59-47 (Part 1)/Issue 1. Draft completed 1980 but withdrawn prior to publication. Contained MOD Qualification Approval procedures and tests detailed in BS 5917: 1980. Work held in abeyance until BS 5917: 1980 was revised.

INTERIM Def Stan 59-47/3. Published 17 June 1988. The scope was widened to include all of the solvent removable/resistant resin types in general use, test requirements were revised, and new test specimens introduced.

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1. SCOPE

- 1.1 This SAE Standard defines the general requirements and provides a system for the control of quality for conformal coatings suitable for application to printed circuit assemblies.
- 1.2 The material covered by this Standard is a thin transparent continuous contour coating applied to printed circuit assemblies to provide an electrical insulating protective barrier against deleterious environmental conditions. The thickness of the cured coating is within the range 0.010 to 0.075 mm, except for deposited from the vapor phase coatings which are within the range 0.005 to 0.020 mm.
- 1.3 This Standard does not include tests for special applications which will require extended testing for Qualification Approval, e.g., altitudes in excess of 20000 m and extended temperature limits.

2. WARNING

This section which appeared in DEF STAN 59-47 Issue 4 has been deliberately deleted.

3. RELATED DOCUMENTS

- 3.1 Reference is made in this Standard to:

AC7120/7	Conformal Coating of Printed Board Assemblies
AS/EN9100	Quality Management Systems-Requirements for Aviation, Space and Defence Organizations
BS509-1	Acetone for Industrial Use
BS 1595	Isopropyl Alcohol (Propan-2-ol)
BS EN 60068	Environmental testing
BS EN 60249	Base materials for printed circuits
BS EN 62631	Dielectric and resistive properties of solid insulating materials
MIL-I-46058	Insulating Compound, Electrical (for Coating Printed Circuit Assemblies)

- 3.2 This section which appeared in DEF STAN 59-47 Issue 4 has been deliberately deleted.

- 3.3 The following publications may also be found useful:

BS EN 61086-1	Specification for Conformal Coating Material for Use on Printed Circuit Assemblies
BS 6221	Printed Wiring Boards

- 3.4 This section which appeared in DEF STAN 59-47 Issue 4 has been deliberately deleted.

4. DEFINITIONS

- 4.1 For the purposes of this Standard, the following definitions apply.

4.2 BATCH

The quantity of material manufactured during one production run using the same base materials and the same processes and offered as one inspection quantity.

4.3 CONFORMAL COATING

A thin transparent continuous contour coating applied to printed circuit assemblies to provide an electrical insulating protective barrier against deleterious environmental conditions. The thickness of the cured coating on component free surface areas of the board shall be within the range 0.010 to 0.075 mm, except for parylene coatings which shall be within the range 0.005 to 0.020 mm.

4.4 ACCREDITED TEST LABORATORY

A laboratory or mechanical test house that holds certification issued by a National Authority that is a full member and signatory to an international mutual recognition agreement.

4.5 INSULATION AND FILLING COMPOUND

This is the Codification Approved Item Name (AIN) for this material which is applied because:

- a. what is held in store, i.e., the item of supply, is not a coating but a material to be used as a coating and
- b. the name conformal coating is only valid once the item of supply has been correctly applied as a coating material within the stated thickness

4.6 PRODUCT

An item, substance or material produced by natural process or manufacture having a distinctive function in an equipment assembly, sub-assembly, module or system.

4.7 PRODUCT APPROVAL

The process applied to demonstrate that a manufacturer is capable of producing a product meeting the requirements of this specification see 4.10 below.

4.8 PROCESS APPROVAL AUTHORITY

The process approval authority for the application of conformal coatings to AC7120/7 is the Performance Review Institute (Nadcap).

161 Thorn Hill Road,
Warrendale,
PA15086-7527
+1 (724)772-161

4.9 PRODUCT QUALITY CONTROL

All measures prescribed in this specification which show that the products produced by the manufacturer fulfil the requirements of this specification.

4.10 QUALITY ASSURANCE PROVISIONS

Any manufacturer supplying product against this specification will need a valid AS/EN 9100 quality approval.

4.10.1 RESPONSIBILITY FOR INSPECTION

The vendor of the product shall supply all samples for vendor's approval tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.10.2. The purchaser reserves the right to sample and perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirement of this specification.

4.10.2 REPORTS

The vendor shall furnish with each shipment a report showing the results of the tests to determine conformance to the acceptance test requirements and stating that the product conforms to all technical requirements of this specification. This report shall include the purchase order number, reference to AMS 59-047, vendor's compound number and item trade name, lot number and volumetric quantity supplied for testing.

4.11 QUALIFIED PROCESS MANUFACTURERS' DATABASE

Manufacturers are listed in www.eauditnet.com

Qualified Process Manufacturers are listed within the electronics section/conformal coatings in accordance with the AC7120/7 audit criteria (QML)

eauditnet (registration is required)

File path:

Resources (drop down menu)>Aerospace QML>Refine Search Based on Scope>Electronics>AC7120/7.

4.12 TEST SPECIMEN

A test specimen is a test panel prepared in accordance with the details given in Section 10.

4.13 VENDOR

The conformal coating manufacturer

5. CLASSIFICATION

5.1 Resin Types

The types of conformal coating materials covered by this Standard are identified by (a) code letters indicating the resin, and (b) suffix numbers relating to solvent resistance and "100% Solids" materials.

5.2 Code Letters

Code letters for the different types of resin and the methods of application are indicated in Table 1.

Table 1 - Resin classification

RESIN	AMS59-047	MIL-I-46058 CODE	METHOD OF APPLICATION
Acrylic	A	AR	)
Epoxy	EP	ER	)
Silicone	SI	SR	) By dipping,
Polyurethane	PUR	UR	) spraying or brushing
Polyester	P	-	)
Parylene (PARA-XYLYLENE)	XY	XY	) By deposition from the vapour phase

NOTE: Additional resins may be added later.

5.3 Suffix Numbers

Suffix numbers inserted after the code letters for each type of resin as follows:

Suffix 1 - Indicates that the conformal coating material when applied will not be deleteriously affected by organic solvents commonly used on printed circuit assemblies.

Suffix 2 - Indicates that the conformal coating is not resistant to solvents and is capable of being removed from the printed circuit assembly by means of solvents recommended by the coating manufacturer. Materials in this class are not required to comply with 10.4 of this Standard: Resistance to solvent cleaning liquid.

Suffix 3 - Indicates "100% solids" materials. These are materials composed entirely of constituents which are chemically active in the hardening process and which do not contain diluents intended to be lost by volatilization during that process. These materials are not required to comply with 10.15 of this Standard: Flexibility after ageing characteristics test.

5.4 Example

Designation A-2 indicates an Acrylic coating which is not resistant to solvents.

6. GENERAL REQUIREMENTS

6.1 Storage Properties

The coating materials, or their components when stored in their original sealed containers under the temperature conditions specified by the manufacturer shall retain the specified properties up to the final date for use (see 12.2(e)) which shall be not less than 12 months from the date of manufacture.

6.2 Pot Life

When removed from the original sealed container, or in the case of two-pack materials, after the two components are mixed, the resin shall remain suitable for use after exposure to a temperature of $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and a relative humidity of $50\% \pm 5\%$ for the period stated by the supplier.

6.3 Environmental Category

The minimum environmental classification for conformal coating to this standard is 55/125/21 as defined in BS EN 6068 Part 1. Where environmental requirements outside this classification are encountered, additional proving tests shall be carried out as agreed between the manufacturer/supplier and the user.

6.4 Fluorescent Tracer

The conformal coating material shall have a fluorescent tracer incorporated for examination by ultraviolet illumination. The tracer shall remain active for at least 12 months from the date of manufacture.

7. QUALIFICATION APPROVAL

All contents of this section have been deliberately deleted

8. VENDOR APPROVAL TESTS

8.1 All of the appropriate tests shown in Table 2 shall be applied. Where test specimens are required to undergo more than one test the tests shall be performed in the order listed in Table 2.

8.2 For the purposes of approval testing the five forms of test specimens prescribed in Section 11 will be required.

Quantity of test and control specimens:

Specimen A - 24	Specimen B - 12	Specimen C - 3
Specimen D - 4	Specimen E - 3	

8.3 Test specimens are required for use as control samples:

Quantity of test specimens:

Specimen A - 1
Specimen E - 1 (from 10.7.3(a), retained test specimen to be remeasured).

The Control test specimens shall be cleaned and coated as for standard specimens A (see 11.2) and E (see 11.6).

Then:

Carry out and record the initial measurement of Insulation Resistance (see 10.2.3) or Dissipation Factor (see 10.7.3 condition (a)) as applicable.

Then:

"Store" the Control test specimens in dust free standard laboratory conditions [$23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $50\% \pm 5\%$ relative humidity (RH)].

Then:

Remeasure and record relevant parameters of the Control test specimens after all other tests on standard specimens A and E have been completed.