IEC PAS 61249-8-5

Edition 1.0 2014-06

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Qualification and performance specification of permanent solder mask and flexible cover materials



IEC PAS 61249-8-5:2014-06(en)



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE U

ICS 31.180

ISBN 978-2-8322-1633-0

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QUALIFICATION AND PERFORMANCE SPECIFICATION OF PERMANENT SOLDER MASK AND FLEXIBLE COVER MATERIALS

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91/1157/PAS	91/1174/RVD

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IPC-SM-840E
2010 - December

Qualification and Performance Specification of Permanent Solder Mask and Flexible Cover Materials

Supersedes IPC-SM-840D
April 2007

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IPC-SM-840E

Qualification and Performance Specification of Permanent Solder Mask and Flexible Cover Materials

Developed by the Solder Mask Performance Task Group (5-33B) of the Cleaning and Coating Committee (5-30) and the Covercoat Materials Task Group (D-13B) of the Flexible Circuits Committee (D-10) of IPC

Supersedes:
IPC-SM-840D - April 2007
IPC-SM-840C -
Amendment 1 - June 2000
IPC-SM-840C - January 1995
IPC-SM-840B - May 1988
IPC-SM-840A - July 1983
IPC-SM-840 - November 1977

Users of this publication are encouraged to participate in the development of future revisions.

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Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the Solder Mask Performance Task Group (5-33B) of the Cleaning and Coating Committee (5-30) and the Covercoat Materials Task Group (D-13B) of the Flexible Circuits Committee (D-10) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of IPC extend their gratitude.

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Qualification and Performance Specification of Permanent Solder Mask and Flexible Cover Materials

1 SCOPE AND DESIGNATION

1.1 Scope This specification **shall** define the criteria for and method of obtaining the maximum information about and confidence in cured permanent solder mask and cover material under evaluation with the minimum of test redundancy.

This specification **shall** establish the requirements for:

- The evaluation of solder mask and cover materials
- The conformance of solder mask and cover material properties
- The qualification of the solder mask and cover material via the appropriate test substrate
- The qualification assessment of the solder mask and cover material in conjunction with the production printed board process

1.2 Purpose This specification **shall** establish the requirements, based on applicable test methods and conditions, for the evaluation of a solder mask and cover material and for the determination of the acceptability of use on a printed board. These same requirements **shall** also be used to qualify a printed board production process based on conformance criteria defined by the reliability requirements of the end use environment. Acceptability and/or verification criteria of the production printed board **shall** be determined in accordance with the applicable performance requirements (e.g., IPC-6012, IPC-6013, IPC-6018, etc.).

The solder mask materials described herein, when applied to the printed board substrate are intended to prevent and/or minimize the formation and adherence of solder balls, solder bridging, solder build-up and physical damage to the printed board substrate. The solder mask material **shall** retard electromigration and other forms of detrimental or conductive growth.

The cover materials described herein, when applied to the printed board substrate, **shall** provide a flexible dielectric protective layer over the etched conductors and other conductive features. The cover materials are intended to prevent and/or minimize the formation and adherence of solder balls, solder bridging, solder build-up and physical damage to the printed board substrate. The cover materials **shall** retard electromigration and other forms of detrimental or conductive growth.

NOTE: The determination of compatibility between solder mask and cover materials and post soldering products and processes is beyond the scope of this specification. The use of Test Methods specified herein to determine the compatibility and the requirement to do so **shall** be as agreed between user and supplier (AABUS).

This specification **shall** list the base requirements for solder mask and cover materials and their production processes. The solder mask and cover material **shall** be cured per the manufacturer's recommended process in accordance with those conditions specified for that product. Additional requirements or deviations from these requirements **shall** be AABUS.

1.3 Classes This specification provides four classes of requirements, T, FT, H, and FH to reflect functional performance requirements and testing severity based on industry/end use requirements. Qualification to a particular class **shall not** be extended to cover any other class.

Note: The reference of a single class does not preclude invoking or allowing specific requirements defined in other classes.

T — Telecommunication This includes computers, telecommunication equipment, sophisticated business machines, instruments, and certain non-critical military applications. Solder mask and cover material on printed boards in this class is suitable for high performance commercial and industrial products in which extended performance life is required but for which interrupted service is not life threatening.

H — High Reliability/Military This includes that equipment where continued performance is critical, equipment down-time cannot be tolerated and/or the equipment is a life support item. Solder mask and cover material on printed boards of this class is suitable for applications where high levels of assurance are required and uninterrupted service is essential.

FT — Flexible Printed Board Applications (Telecommunications) This applies to cover materials for flexible printed board applications used in Telecommunications applications.

FH — Flexible Printed Board Applications (High Reliability/Military) This applies to cover materials for flexible printed board applications used in High Reliability/Military Applications

Notes:

- ***Class Designations*** – Previous versions of this and other IPC specifications make reference to ‘‘Class 1,’’ ‘‘Class 2,’’ and ‘‘Class 3’’ end product classes. For all practical purposes there is no Class 1 solder mask. The requirements in this specification are not applicable for solder mask or cover material used in Class 1 end-product. Class 2 is equivalent to Class T/FT (Telecommunications). Class 3 is the equivalent of Class H/FH (Military/high reliability).
- Solder mask types were previously described as Type A for screen imaged (liquid) or coverlay for flex (dry), and type B for all types of photo defined solder mask (liquid or dry film). A Type B1 solder mask was identified as a liquid solder mask and a Type B2 solder mask was identified as a dry film solder mask.

1.4 Presentation Dimensions and tolerances **shall** be expressed in metric units. English units are shown in brackets [ ] and are not necessarily direct conversions or usable numbers. Reference information is shown in parentheses ( ). Deviations from this **shall** be AABUS.

1.5 Terms and Definitions The definition of terms **shall** be in accordance with IPC-T-50 and as stated in 1.5.1 through 1.5.19. Those terms marked with an asterisk (*) are in IPC-T-50, but are repeated here for clarity.

1.5.1 As Agreed Between User and Supplier (AABUS)* Indicates additional or alternate requirements to be decided between the user and the supplier in the procurement documentation. Examples include contractual requirements, modifications to purchase documentation, and information on the drawing. Agreements can be used to define test methods, conditions, frequencies, categories or acceptance criteria within a test, if not already established.

For reference in this specification, the manufacturer of the solder mask or cover material is the supplier. The fabricator of the printed board with the solder mask or cover material applied is the user, unless within the context, the fabricator is supplying it to the end user, in which case, the fabricator is the supplier.

1.5.2 Blistering* Delamination in the form of a localized swelling and separation between any of the layers of a laminated base material, or between base material and conductive foil, or its protective coating.

1.5.3 Chalking (Cured Solder Mask or Cover Material)* When the solder mask is degraded such that fine particulates can be removed from the surface.

1.5.4 Color Change (Cured Solder Mask or Cover Material)* Any change from the original color after the solder mask or cover material has been cured and the legend and final finish have been applied.

1.5.5 CoC This is an acronym for Certificate of Compliance.

1.5.6 Covercoat* Material deposited as a liquid onto the printed board that subsequently becomes a permanent dielectric coating. (See ‘‘Cover Material.’’)

1.5.7 Coverfilm* Material deposited as a photoimageable film onto the printed board, made from i) a homogeneous, single component; ii) separate layers of generically similar chemistries; or iii) as a composite blend. (See ‘‘Cover Material.’’)

1.5.8 Cover Material* A thin dielectric material used to encapsulate circuitry, most commonly for flexible circuit applications. For the purpose of this document, the term of “Cover Material” **shall** be used interchangeably to describe either “Covercoat” or “Coverfilm” and does not include “Coverlay.”

1.5.9 Crazing* (Conformal or Solder Mask or Cover Material) A network of fine cracks on the surface of or within the coating.

1.5.10 Delamination (Cured Solder Mask or Cover Material)* A separation between plies within a base material, between a base material and a conductive foil, or any other planar separation within a printed board.

1.5.11 FTIR This is an acronym for Fourier Transform Infra-Red (Spectroscopy).