IEC PAS 61249-8-1

Edition 1.0 2014-06

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Qualification and performance of electrical insulating compound for printed wiring assemblies



IEC PAS 61249-8-1:2014-06(en)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

IEC PAS 61249-8-1

Edition 1.0 2014-06

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Qualification and performance of electrical insulating compound for printed wiring assemblies

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE R

ICS 31.180

ISBN 978-2-8322-1632-3

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

INTERNATIONAL ELECTROTECHNICAL COMMISSION

QUALIFICATION AND PERFORMANCE OF ELECTRICAL INSULATING COMPOUND FOR PRINTED WIRING ASSEMBLIES

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public.

IEC PAS 61249-8-1, submitted by IPC has been processed by IEC technical committee 91: Electronics assembly technology. It is based on IPC-CC-830B with Amendment 1. It is published as a double-logo PAS. The structure and editorial rules used in this PAS reflect the practice of the organization which submitted it.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
91/1156/PAS	91/1173/RVD

Following publication of this PAS, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single period up to a maximum of 3 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

IPC-CC-830B
with Amendment 1
Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies

October 2008
Supersedes IPC-CC-830B
August 2002

A standard developed by IPC

Association Connecting Electronics Industries

The Principles of Standardization

In May 1995 the IPC's Technical Activities Executive Committee (TAEC) adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

Standards Should:

- Show relationship to Design for Manufacturability (DFM) and Design for the Environment (DFE)
- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

Standards Should Not:

- Inhibit innovation
- Increase time-to-market
- Keep people out
- Increase cycle time
- Tell you how to make something
- Contain anything that cannot be defended with data

Notice

IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards and Publications shall not in any respect preclude any member or nonmember of IPC from manufacturing or selling products not conforming to such Standards and Publication, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IPC members, whether the standard is to be used either domestically or internationally.

Recommended Standards and Publications are adopted by IPC without regard to whether their adoption may involve patents on articles, materials, or processes. By such action, IPC does not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Recommended Standard or Publication. Users are also wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

IPC Position Statement on Specification Revision Change

It is the position of IPC's Technical Activities Executive Committee that the use and implementation of IPC publications is voluntary and is part of a relationship entered into by customer and supplier. When an IPC publication is updated and a new revision is published, it is the opinion of the TAEC that the use of the new revision as part of an existing relationship is not automatic unless required by the contract. The TAEC recommends the use of the latest revision. Adopted October 6, 1998

Why is there a charge for this document?

Your purchase of this document contributes to the ongoing development of new and updated industry standards and publications. Standards allow manufacturers, customers, and suppliers to understand one another better. Standards allow manufacturers greater efficiencies when they can set up their processes to meet industry standards, allowing them to offer their customers lower costs.

IPC spends hundreds of thousands of dollars annually to support IPC's volunteers in the standards and publications development process. There are many rounds of drafts sent out for review and the committees spend hundreds of hours in review and development. IPC's staff attends and participates in committee activities, typesets and circulates document drafts, and follows all necessary procedures to qualify for ANSI approval.

IPC's membership dues have been kept low to allow as many companies as possible to participate. Therefore, the standards and publications revenue is necessary to complement dues revenue. The price schedule offers a 50% discount to IPC members. If your company buys IPC standards and publications, why not take advantage of this and the many other benefits of IPC membership as well? For more information on membership in IPC, please visit www.ipc.org or call 847/597-2872.

Thank you for your continued support.

©Copyright 2008. IPC, Bannockburn, Illinois, USA. All rights reserved under both international and Pan-American copyright conventions. *Any copying, scanning or other reproduction of these materials without the prior written consent of the copyright holder is strictly prohibited and constitutes infringement under the Copyright Law of the United States.*



IPC-CC-830B with Amendment 1

Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies

Developed by the Conformal Coating Task Group (5-33a) of the Cleaning and Coating Committee (5-30)

Supersedes:
IPC-CC-830B - August 2002
IPC-CC-830A with Amendment 1 - July 1999
IPC-CC-830A - October 1998
IPC-CC-830 - January 1984

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

Contact:

IPC
3000 Lakeside Drive, Suite 309S
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105

Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the Conformal Coating Task Group (5-33a) of the Cleaning and Coating Committee (5-30) 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 the IPC extend their gratitude.

Cleaning and Coating Committee

Chair
Douglas O. Pauls
Rockwell Collins

Vice Chair
Debora L. Obitz
Trace Laboratories - East

Conformal Coating Task Group

Chair
John P. Waryold
HumiSeal Division of Chase Corporation

Vice Chair
Debora L. Obitz
Trace Laboratories - East

Technical Liaisons of the IPC Board of Directors

Peter Bigelow
IMI Inc.

Sammy Yi
Flextronics International

Conformal Coating Task Group

David Adams, Rockwell Collins
Greg Alexander, Ascentech, LLC
Gustavo Arredondo, Para Tech Coating Inc.
Paul Berry, Dow Corning Corporation
Gerald Leslie Bogert, Bechtel Plant Machinery, Inc.
Calette Chamness, U.S. Army Aviation & Missile Command
David Corbett, Defense Supply Center Columbus
Rudiger Dietrich, Lackwerke Peters GmbH & Co KG
Mahendra Gandhi, Northrop Grumman Space Technology
Hue Green, Lockheed Martin Space Systems Company
Michael Green, Lockheed Martin Space Systems Company
Amy Hagnauer, Raytheon Company
Steve Henly, Acota Limited
Christopher Hunt, National Physical Laboratory
Joseph Kane, BAE Systems Platform Solutions
Jason Keeping, Celestica International Inc.
William Kenyon, Global Centre Consulting
Phil Kinner, HumiSeal Division of Chase Corporation
Sven Kramer, Lackwerke Peters GmbH & Co KG
Richard Kraszewski, Plexus Corp.
Vijay Kumar, Lockheed Martin Missile & Fire Control
Kenneht Manning, Raytheon Company
Renee Michalkiewicz, Trace Laboratories - East
Roger Miedico, Raytheon Company
Graham Naisbitt, Gen3 Systems Limited
David Nelson, Raytheon Company
Lynn Norman, Continental Automotive Systems US, Inc.
Victor Powell, L-3 Communications Aviation Recorders
Barry Ritchie, Dow Corning Corporation
John Rohlfing, Delphi Electronics and Safety
Henry Sanftleben, Delphi Electronics and Safety
Jeffrey Sargeant, HumiSeal
Lowell Sherman, Defense Supply Center Columbus
Gordon Sullivan, Huntsman Advanced Technology Center
Manfred Suppa, Lackwerke Peters GmbH & Co KG
Crystal Vanderpan, Underwriters Laboratories Inc.
David Vaughan, Taiyo America Inc.
Fonda Wu, Raytheon Company
Lamar Young, Specialty Coating Systems Inc.

Table of Contents

1 SCOPE 1
1.1 Scope 1
1.2 Purpose 1
1.3 Classification 1
1.3.1 Types 1
1.3.2 Classes 1
1.4 Interpretation 1

2 APPLICABLE DOCUMENTS 1
2.1 IPC 1
2.2 Government 2
2.3 American Society for Testing of Materials 2
2.4 Underwriters Laboratories 2
2.5 ANSI 2
2.6 ISO 2

3 REQUIREMENTS 2
3.1 General Requirements 2
3.1.1 Terms and Definitions 2
3.1.2 Conflict 2
3.2 Inspection and Testing Requirements 2
3.2.1 Qualification Inspection and Testing 2
3.2.2 Qualification Retention Inspection and Testing ... 2
3.2.3 Quality Conformance Inspection Testing 3
3.2.4 Additional Testing 3
3.3 Materials Requirements 3
3.3.1 Materials 3
3.3.2 Shelf Life 3
3.3.3 Cure 3
3.4 Chemical Requirements 3
3.4.1 Fourier Transform Infrared Spectroscopy Test (FTIR) 3
3.5 Physical Requirements 4
3.5.1 Viscosity 4
3.5.2 Appearance 4
3.5.3 Fluorescence 4
3.5.4 Fungus Resistance 4
3.5.5 Flexibility 4
3.5.6 Flammability 4
3.6 Electrical Requirements 4
3.6.1 Dielectric Withstanding Voltage (DWV) 4
3.7 Environmental Requirements 4
3.7.1 Moisture and Insulation Resistance 4
3.7.2 Thermal Shock 4
3.7.3 Temperature and Humidity Aging (Hydrolytic Stability) 4
3.8 Special Requirements 5

4 QUALITY ASSURANCE PROVISION 5
4.1 Responsibility for Inspection 5
4.2 Categories of Inspection and Frequency 5
4.2.1 Qualification Inspection 5
4.2.2 Qualification Retention Inspection 5
4.2.3 Quality Conformance Inspection 5
4.3 Product Change 5
4.4 Test Equipment and Inspection Facilities 5
4.4.1 Standard Laboratory Conditions 5
4.4.2 Permissible Temperature Variation in Environmental Chambers 6
4.4.3 Reference Conditions 6
4.5 Inspection Routine 6
4.6 Inspection Sampling 6
4.6.1 Test Vehicles 6
4.6.2 Sample Size 6
4.6.3 Preparation Prior to Coating 6
4.6.4 Coating 7
4.7 Failures 7
4.8 Inspection Reporting 7
4.8.1 Qualification Reporting 7
4.8.2 Qualification Retention Reporting 7
4.8.3 Quality Conformance Reporting 7

5 PREPARATION FOR DELIVERY 7
5.1 Containers 7
5.2 Packaging 8
5.3 Marking 8

6 NOTES 8
6.1 Order Data 8
6.2 Formulation Change 8
6.3 Conditioning 8
6.4 Cleanliness 8
6.5 Adhesion 8
6.6 Solvent Compatibility 8
6.7 Identification of Solvent Sensitive Conformal Coatings 8

Appendix A Example of Qualification Inspection Report 9

Appendix B Example of Qualification Retention Inspection Report 10

Appendix C Example of Quality Conformance Inspection Report 11

Figures

Figure 4-1 IPC-B-25A 7

Figure 4-2 Test Coupon with “Y” Shape Pattern 7

Tables

Table 3-1 Requirements for Qualification, Qualification Retention and Quality Conformance of Conformal Coating Products 3

Table 4-1 Test Vehicles and Sample Sizes 6

Table 4-2 Thickness Requirements on Test Vehicle 7

Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies

1 SCOPE

1.1 Scope This standard establishes qualification and conformance requirements for electrical insulating compounds (conformal coatings). It has been designed and constructed with the intent of obtaining maximum confidence in the materials with minimum test redundancy. This standard covers:

- The qualification and qualification retention of the conformal coating material (Table 3-1, Column A and B).
- The quality conformance of conformal coating material properties (Table 3-1, Column C).

For the purpose of this standard, the term conformal coating is used herein when referring to a type of protective coating for use on printed wiring assemblies. The conformal coating is intended to provide protection from moisture and contamination and provide electrical insulation; not as a sole source of mechanical support.

For the purpose of this standard, inspections are performed on standardized test vehicles instead of real production assemblies. A standardized test vehicle refers to the test vehicle specified per test method indicated, coated with the conformal coating under inspection.

1.2 Purpose With standardized testing on standardized test vehicles under test conditions specified in test methods listed herein, this standard enables a manufacturer to qualify his conformal coating product and express the qualification it possesses. This standard also enables the manufacturer to attest the conformance of the quality of production to the qualification of each product.

1.3 Classification

1.3.1 Types Conformal coatings **shall** be categorized into types by the cured chemistry of the coating. The type for multifunctional materials **shall** be based on the chemistry type which is the highest percentage by weight.

Conformal coatings **shall** be of the following types:

Type AR — Acrylic
Type ER — Epoxy
Type SR — Silicone
Type UR — Polyurethane
Type XY — Paraxylylene

1.3.2 Classes Although previous versions of IPC-CC-830 made reference to Class A and Class B coating classifications, these classifications have been removed. To be qualified to this specification, a coating must be hydrolytically stable (formerly Class B). Non-hydrolytically stable coatings (formerly Class A) no longer meet the requirements of this specification and usage will only be As Agreed Between User and Supplier (AABUS). Coatings that meet the requirements of Class B coatings in previous document revisions meet the requirements of this revision.

Note: Earlier versions of this specification, as well as other IPC documents, made reference to ''Class 1,'' ''Class 2,'' and ''Class 3'' inspection and testing requirements for these classes that were not directly correlated to the previous Class A and B requirements.

1.4 Interpretation ''**Shall**,'' the imperative form of the verb, is used throughout this standard whenever a requirement is intended to express a provision that is mandatory. Deviation from a ''**shall**'' requirement may be considered if sufficient data is supplied to justify the exception.

The words ''should'' and ''may'' are used whenever it is necessary to express nonmandatory provisions. ''Will'' is used to express a declaration of purpose.

To assist the reader, the word ''**shall**'' is presented in bold characters.

2 APPLICABLE DOCUMENTS

The following documents of the issue currently in effect form a part of this standard to the extent specified herein.

2.1 IPC[1]

IPC-B-25A Multipurpose Test Board

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-TM-650 Test Methods Manual[2]

2.4.5.1 Flexibility
2.5.7.1 Dielectric Withstanding Voltage - Polymeric Conformal Coating
2.6.1.1 Fungus Resistance - Conformal Coating
2.6.3.4 Moisture and Insulation Resistance - Conformal Coating

1. www.ipc.org
2. Current and revised IPC Test Methods are available through IPC-TM-650 subscription and on the IPC Web site (www.ipc.org/html/testmethods.htm).

2.6.7.1 Thermal Shock - Conformal Coating

2.6.11.1 Hydrolytic Stability - Conformal Coating

IPC-4101 Specification for Base Materials for Rigid and Multilayer Printed Boards

IPC-6012 Sectional Standard for Qualification of Rigid Printed Boards

2.2 Government[3]

MIL-I-46058 Insulating Compound, Electrical (For Coating Printed Circuit Assemblies)

MIL-STD-1188 Commercial Packaging of Suppliers and Equipment

FED-STD-141 Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing, Method 4061 and Method 2012

2.3 American Society for Testing of Materials[4]

ASTM-D-1005 Measurement of Dry Film Thickness of Organic Coatings

ASTM-D-1084 Viscosity of Adhesives, Tests for

2.4 Underwriters Laboratories[5]

UL 94 Flammability

2.5 ANSI[6]

NCSL Z540-1 Calibration Laboratories and Measuring and Test Equipment

2.6 ISO[7]

ISO 10012-1 Quality Assurance Requirements for Measuring Equipment - Part 1: Metrological Confirmation System for Measuring Equipment

3 REQUIREMENTS

3.1 General Requirements

3.1.1 Terms and Definitions Definitions of terminology applicable to this standard **shall** be in accordance with IPC-T-50 and as stated in 3.1.1.1.

3.1.1.1 AABUS This is an acronym for ''As Agreed Between User and Supplier.'' Indicates additional or alternate requirements to be decided between the user and 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.

3.1.2 Conflict In the event of a conflict between the requirements of this standard and procurement document, the procurement document **shall** take precedence. In the event of a conflict between the test parameters of this standard and the test methods, or a conflict between the requirements in this standard and the applicable documents listed in Section 2, this standard **shall** take precedence.

3.2 Inspection and Testing Requirements Groups of inspection and test listed in Table 3-1 **shall** be performed to verify the ability of a conformal coating product to meet the qualification and/or conformance requirements of this standard using the test methods described herein.

3.2.1 Qualification Inspection and Testing Qualification to this standard is achieved when a conformal coating product meets the requirements listed in Column A of Table 3-1. Tests **shall** be performed in accordance with the test methods specified using test specimens prepared in compliance with 4.6. A qualification inspection report **shall** be completed in accordance with 4.8 and relevant test data retained as substantiation for the qualification. An example of qualification inspection report format is shown in Appendix A.

When a primer material is used in conjuction with a coating in qualification testing, the primer used will be documented in the qualification report.

Conformal coatings presently qualified to MIL-I-46058 **shall** also be recognized as meeting the requirements of IPC-CC-830. These products currently qualified or in the process of being requalified to MIL-I-46058 prior to the publish date of this document will also be recognized as meeting the requirements of this document. It should be noted that MIL-I-46058 is inactive for new designs.

3.2.2 Qualification Retention Inspection and Testing Qualification to this standard can be retained when a conformal coating product meets the requirements listed in Column B of Table 3-1. Tests **shall** be performed in accordance with the test methods specified using test specimens prepared in compliance with 4.6 at a frequency defined in 4.2.2.1. Pertinent test results **shall** be compared with the

3. http://astimage.daps.dla.mil/quicksearch/
4. www.astm.org
5. www.ul.com
6. www.ansi.org
7. www.iso.org