IEC PAS 61191-10

Edition 1.0 2022-07

PUBLICLY AVAILABLE SPECIFICATION

colour inside

Printed board assemblies – Part 10: Application and utilization of protective coatings for electronic assemblies

IEC PAS 61191-10:2022-07(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.180; 31.190

ISBN 978-2-8322-3981-0

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PRINTED BOARD ASSEMBLIES –

Part 10: Application and utilization of protective coatings for electronic assemblies

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IEC-PAS 61191-10, submitted by GfKORR – Gesellschaft für Korrosionsschutz e.V. was processed by IEC technical committee 91: Electronics assembly technology. It is based on *Guidelines for the application and utilization of protective coatings for electronic assemblies – Selection, fields of application, requirements and application recommendations – provided by the working party "Corrosion protection in electronics and microcircuitry"*. 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
91/1781/DPAS	91/1788/RVDPAS

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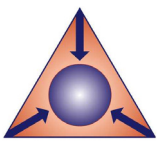
G U I D E L I N E S

for the

APPLICATION AND UTILIZATION OF PROTECTIVE COATINGS FOR ELECTRONIC ASSEMBLIES

Selection, fields of application, requirements and application recommendations

Provided by the working party
“Corrosion protection in electronics and microcircuitry”



GfKORR – Gesellschaft für Korrosionsschutz e.V.

CONTENT

Part D Film properties of protective coatings

1 Mechanical properties

- 1.1 Adhesion
- 1.2 Elasticity
- 1.3 Hardness
- 1.4 Further mechanical properties

2 Electrical properties

- 2.1 Insulation and moisture resistance

3 Thermal properties

- 3.1 Stress factors
- 3.2 Thermal mismatch
- 3.3 Fatigue - the Wöhler curve and its consequences
- 3.4 Thermal stress load
- 3.5 Thermal shock resistance

4 Condensation

5 Water absorption and water vapor permeability

- 5.1 Requirements
- 5.2 Transport of moisture

6 Thermal resistance

7 Flexibility (modulus of elasticity) and CTE

Part E INFLUENCE OF THE ASSEMBLY ON THE PROTECTIVE COATING

1 Base material

2 Component and circuit board layout

3 Solder resist

4 Soldering materials and soldering process

- 4.1 Flux types
- 4.2 Composition of NoClean fluxes
- 4.3 Residues from the soldering process
- 4.4 Detection of residues

5 Drying parameters

6 Keeping areas clear and exposing areas

FOREWORD

GfKORR and its working group "Corrosion protection in electronics and microsystems technology" as initiators of this guideline

GfKORR - Gesellschaft für Korrosionsschutz e.V., a non-profit technical-scientific association, which was formed in 1995 from the merger of two predecessor organizations, has set itself the goal of collecting, expanding and disseminating knowledge about corrosion, corrosion mechanisms and corrosion protection possibilities to prevent corrosion damage with the participation of all persons, institutes, companies and facilities involved in corrosion and corrosion protection. This project is to be realized on the one hand through joint conferences, seminars and workshops and on the other hand through constructive work in working groups with special orientation and topics. Further information about GfKORR and its work can be found at http://www.gfkorr.de

The constantly increasing number of different electronic assemblies and miniaturized systems made of various materials and their use, especially in motor vehicles, telecommunications, aircraft, building services and even toys, is also associated with increasing expectations for the functional reliability and long-term stability of the products. In addition, the progressive miniaturization of components places ever greater demands on purity during manufacture and assembly. Furthermore, both electronics and the microcomponents are increasingly exposed to changing climatic conditions such as humidity, temperature changes and temperature shock. Based on long-term warranty requirements and worldwide marketing, an effective assurance of the reliability of electronic products is only conceivable with the help of in-depth knowledge of the mechanisms of action of corrosion of electronic and microsystem components and corresponding corrosion protection measures.

In the spring of 1998, GfKORR founded the working group "Corrosion protection in electronics and microsystems technology" with a view to discussing such ever-increasing issues and problems. It is currently headed by Dr. Helmut Schweigart, Dr. O.K. Wack Chemie GmbH, Ingolstadt; his deputy is Dr. Michael Popall, Fraunhofer Institute for Silicate Research, Würzburg. The working group meets twice a year in Würzburg in spring and autumn (for further information and contact details, see the list of authors and the Internet on the GfKORR homepage).

The working group includes representatives from industry (such as ALTANA Chemie AG, CiS Institut für Mikrosensorik gGmbH, Continental AG, Dage Electronic Europa Vertriebs GmbH, Dow Corning GmbH, GTL Knödel GmbH, Hella KGaA, ISO-ELEKTRA Elektrochemische Fabrik GmbH, KC-Kunststoff-Chemische Produkte GmbH, Lackwerke Peters GmbH & Co. KG, Nordson-Asymtek, Specialty Coating Systems, Stannol GmbH, Wevo-Chemie GmbH, Würth Elektronik GmbH & Co. KG, Zollner Elektronik AG...) as well as employees of various research institutions and service providers (such as the Fraunhofer Institute for Applied Materials Research (IFAM), for Silicate Research (ISC) and for Silicate Technology (ISiT) and the Karlsruhe Research Center GmbH).

The goals of the working group are:

- the deepening of the understanding of the mechanisms leading to functional hazards,
- the interdisciplinary exchange on the state of science and technology in the working fields of the working group in cooperation with industry and other scientific-technical societies,
- damage assessment and prevention, and
- the provision of competent contact persons for acute questions.

An important point that the working group has already dealt with in the past and must continue to deal with is the current test methods for characterizing the protective coatings applied to printed circuit boards and components. Here it is important to make further developments, which, however, can only be pursued jointly by coating manufacturers and users.

The GfKORR working group "Corrosion protection in electronics and microsystems technology" has in recent years focused its work on the compilation of the present guideline and discussed individual points controversially. This guideline, entitled "Application and processing of protective coatings for electronic assemblies - selection criteria, areas of application, requirement profiles and application notes", is based on the knowledge that a comprehensive and fundamental understanding of the coating and its function on electronic assemblies is required. For this, it is necessary to analyze the entire process. This guideline is intended to provide practical assistance in considering this process, starting with the layout up to the functional test of the assembly after the coating.

In order to achieve optimum results in the application of protective coatings, it is also desirable that both manufacturers and assemblers of electronic assemblies and users of protective coatings discuss and implement the desired properties and the necessary and possible process steps together with the manufacturers of protective coatings. Only with such "round-table" discussions can successful solutions be developed for each individual application. It is then also possible to update and improve this guideline at regular intervals through such meetings and discussions.

September 2018
The authors of the guideline

INTRODUCTION

During their production and use in the field, electronic equipment and assemblies are exposed to the influence of moisture and environmental conditions (air, weather, location of the assembly, storage and cleaning) Air, humidity and water lead to an electrical conductive connection of adjacent metal surfaces, which may have different electrical potentials and may thus cause disorder of the electrical insulation by developing additional electrical pathes. Other influences like fluctuations of temperature or strain caused by harmful substances, vibrations and mechancial strain lead to changes in the electrical conduction properties and changes and destruction of the conductor and insulation materials.

Disorder caused by water or moisture often disappears in a dry environment. Also changes of the electrical conductivity caused by temperature disappear when used at modereate ambient temperatures. However, the material, which was destroyed by thermal or mechanical strain, remains in its destroyed condition. A disorder caused by moisture may therefore disappear in favourable cases, however, in view of functional safety considerations of electronic assemblies also such damages must be avoided.

An electronic assembly is only suitable if a safe performance is guaranteed for a specified time. The majority of assemblies is installed in final equipment without any insulation and operate throughout their lifetime without failure. However, the assembly is increasingly used under more difficult conditions. In such cases, safe operation of an assembly is only guaranteed by a protective coating.

Reliability of an electronic product and customer satisfaction are of utmost importance for the success on the market. Product liability requires the manufacturers to take the necessary steps in order to ensure safe operation of electronic equipment also under such heavy conditions. This mainly applies to assemblies which are used in space technology and aviation , defence technology, medicine and automotive industry.

Generally, the coating of the assembly is the last step in the value-added chain of the assembly. Any fault during this step may become very cost intensive and in the worst case may cause disastrous results in the field. Therefore, these guidelines represent a cooperative effort by design engineers, producers, coating engineers and users of electronic equipment. It was decided to establish these guidelines because of the fact that comprehensive and elementary knowledge of the coating and its performance on electronic assemblies is vital. For this purpose, it is necessary to analyse the entire process critically.

These guidelines shall help control in practice the application of protective coatings from the layout to the functional test of the assembly after coating.

Nowadays, coating materials for electronic assemblies are nearly exclusively available in liquid form. The application of powder to certain components as well as full body or partial application of molten foils is limited to exceptional cases. Besides the complete sealing of electronic assemblies, the protective coating offers a cost-effective and user-friendly alternative.