



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES®

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Guidelines for Design, Selection and Application of Conformal Coatings

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

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

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Guidelines for Design, Selection and Application of Conformal Coatings

1 SCOPE

1.1 Introduction Conformal coatings are used in conjunction with printed circuit assemblies (PCAs). The designer and the users of conformal coatings for electronics applications should be aware of the properties of various types of conformal coatings and their interactions with PCAs to protect the PCAs in the end-use environment for the design-life of the PCA (or beyond). This document has been written to assist the designers and users of conformal coatings in understanding the characteristics of various coating types, as well as the factors that can modify those properties when the coatings are applied. Understanding and accounting for these materials can ensure the reliability and function of electronics.

1.2 Purpose The purpose of this handbook is to assist the individuals who either make choices regarding conformal coating or who work in coating operations. This handbook represents the compiled knowledge and experience of the IPC Conformal Coating Handbook Task Group. It is not enough to understand the properties of the various conformal coatings, the user needs to understand what is to be achieved by applying the conformal coating and how to verify that the desired results have been realized.

1.3 Scope Conformal coating, for the purpose of this document, is defined as a thin, transparent, polymeric coating that is applied to the surfaces of PCAs to provide protection from the end-use environment. Typical coating thickness ranges from 12.5 μm [0.49 mil] to 200 μm [7.9 mil].

Processing characteristics and curing mechanisms are dependent on the coating chemistries used. The desired performance characteristics of a conformal coating depend on the application and should be considered when selecting coating materials and coating processes. Users are urged to consult the suppliers for detailed technical data.

This guide enables a user to select a conformal coating based on industry experience and pertinent considerations. It is the responsibility of the user to determine the suitability, via appropriate testing, of the selected coating and application method for a particular end use application.

A conformal coating may have several functions depending on the type of application. The most common are:

- To inhibit current leakage and short circuit due to humidity and contamination from service environment.
- To inhibit corrosion.
- To improve fatigue life of solder joints to leadless packages.

- To inhibit arcing, corona and St. Elmo's Fire.
- To provide mechanical support for small parts that cannot be secured by mechanical means, to prevent damages due to mechanical shock and vibration.

1.4 Terms and Definitions

Acetone – A volatile fragrant flammable liquid ketone $\text{C}_3\text{H}_6\text{O}$ used chiefly as a solvent and in organic synthesis.

Adhesion promotion – The chemical process of preparing a surface to enhance its ability to be bonded to another surface, i.e., a layer of conformal coating.

Adhesion failure – The rupture of an adhesive bond such that the separation appears to be at the adhesive-adherent interface.

Anisotropic – Having properties that vary depending on the direction of measurement.

Anthropogenic – Relating to or resulting from the influence of human beings on nature.

ARUR – Abbreviation standing for acrylic resin and urethane resin combination chemistries.

Bridging – Fillet or meniscus formation of coating around the leads of a component caused by capillary action.

Creep – Strain, deformation, or movement of coatings caused by time and/or temperature.

Cross-linking – The formation of chemical bonds between molecules in a thermosetting resin during a polymerization reaction.

CTE – (Coefficient of Thermal Expansion) Linear dimensional change with respect to an original dimension due to a change in temperature.

Cure – A change in the physical properties of a polymer by a chemical reaction.

Degradation – Decrease in quality or integrity. Loss of desired physical, chemical or electrical properties.

Delamination – A separation between a conformal coating layer and the surface it is adhering to.

De-masking – The process of removing or disengaging a maskant film, tape, boot or plug.

De-wetting – The propensity of the coating material to refuse to wet the surface evenly.

Dielectric constant – The ratio of the capacitance of a configuration of electrodes with a specific material as the dielectric between them to the capacitance of the same