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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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1 PREFACE

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:

a. To inhibit current leakage and short circuit due to humidity and contamination from service environment.

b. To inhibit corrosion.

c. To improve fatigue life of solder joints to leadless packages.

d. To inhibit arcing, corona and St. Elmo's Fire.

e. To provide mechanical support for small parts that cannot be secured by mechanical means, to prevent damage due to mechanical shock and vibration.

1.4 Classification This standard recognizes that electrical and electronic assemblies are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in producibility, complexity, functional performance requirements and verification (inspection/test) frequency. It should be recognized that there may be overlaps of equipment between classes.

The user is responsible for defining the product class. The product class should be stated in the procurement documentation package.

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically the end-use environment would not cause failures.

CLASS 3 High Performance Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems.