



IPC-1601A

Printed Board Handling and Storage Guidelines

Developed by the Printed Board Storage and Handling Subcommittee
(D-35) of the Rigid Printed Board Committee (D-30) of IPC

Supersedes:
IPC-1601 - August 2010

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

Contact:

IPC

Table of Contents

1 INTRODUCTION	1	3.4.2 Baking Environment	7
1.1 Background	1	3.4.3 Baking Considerations	7
1.2 Scope	1	3.4.4 Establishing Baking Profiles	7
1.3 Application	1	4 PACKAGING, STORAGE, AND SHIPMENT	8
1.4 Terms and Definitions	1	4.1 Packaging Evaluation	8
1.4.1 Humidity Indicator Card (HIC)	1	4.1.1 Moisture Absorption	8
1.4.2 Moisture Barrier Bag (MBB)	1	4.1.2 Physical Attributes	8
1.4.3 Subcomposite	1	4.1.3 Effects on Final Finish Solderability	8
1.4.4 Water Vapor Transmission Rate (WVTR)	1	4.1.4 Storage and Packaging Environment	10
1.4.5 Sulfur Free	1	4.1.5 ESD Concerns	10
1.4.6 Dry Packaging	1	4.2 Packaging Materials	10
1.5 Revision Level Changes	1	4.2.1 Water Vapor Transmission Rate (WVTR)	10
2 APPLICABLE DOCUMENTS	2	4.2.2 Typical Packaging Material Types	10
2.1 IPC	2	4.2.3 Desiccant Material	11
2.2 Joint Industry Standards	2	4.2.4 Humidity Indicator Card (HIC)	11
2.3 Electrostatic Discharge Association (ESD)	2	4.2.5 Laminate Witness Coupons	11
2.4 Europa	2	4.3 Packaging Methods	12
2.5 SAE International	3	4.3.1 Internal (Dry Packaging)	12
2.6 International Organization for Standardization	3	4.3.2 External Packaging	12
2.7 ASTM	3	4.3.3 Marking	12
3 PRINTED BOARD FABRICATION AND PACKAGING (HANDLING)	3	4.4.1 Lead-Free/ RoHS compliance	12
3.1 Printed Board Materials	3	4.4.2 ESD	13
3.1.1 Bonding Materials, Prepreg and Resin Coated Foils	3	4.4.3 Moisture	13
3.1.2 Copper Clad Laminates	3	4.4.4 Other Markings	13
3.2 Inner Layer Production	4	5 PRINTED BOARD RECEIVING, STORAGE AND ASSEMBLY	13
3.2.1 Phototooling	4	5.1 Before Opening	13
3.2.2 Process Equipment	4	5.2 Storage Location (Stock Room)	13
3.2.3 Moisture Concerns: Etched Cores and Subcomposites	4	5.3 Upon Opening A Moisture Barrier Bag	14
3.3 Manufacture of the Laminated Panels/ Printed Boards	5	5.4 Production Environment (Temperature, Humidity, and Atmosphere)	14
3.3.1 Processing Validation and Control	5	5.5 Storage Containers (Shop Floor)	14
3.3.2 Handling and Transport of Product	5	5.6 Soldering Operations	14
3.3.3 Environment	5	5.7 Maximum Acceptable Moisture Content (MAMC)	14
3.3.4 Test	6	5.8 Evaluating Moisture Content	15
3.3.5 Inspection	6	APPENDIX A Example Flowdown of Packaging/Handling Requirements to a Printed Board Supplier	16
3.3.6 Recommended Moisture Levels Prior to Packaging	6	APPENDIX B Desiccant Required As a Function of Moisture Barrier Bag (MBB) Size	19
3.4 Baking for Moisture Removal	6		
3.4.1 Problems Caused By Baking	6		

Figures

Figure 3-1	Examples of Clips used for Resealing Opened Bags	3
Figure 4-1	Humidity Indicator Card (HIC) Example	11
Figure 4-2	ANSI/ESD S8.1 Protective Symbol	13
Figure 4-3	Moisture Sensitivity Caution Symbol	13
Figure A-1	Usage of Heat Sealed Polyethylene Bag in Conjunction with MBB	18

Tables

Table 3-1	Recommendations for Printed Board Baking Profiles	8
Table B-1	Desiccant Bag Quantities Based on MBB Size	19

Printed Board Handling and Storage Guidelines

1 INTRODUCTION

1.1 Background Historically, the printed board industry has relied on military specifications and guidelines to define packaging methods to preserve the quality and reliability of printed boards during shipment and storage. However, many of these documents are obsolete, incomplete, do not address Pb-free assembly processes, or do not cover newer laminate or final finishes.

1.2 Scope This document provides suggestions for proper handling, packaging materials and methods, environmental conditions, and storage for printed boards. These guidelines are intended to protect printed boards from contamination, physical damage, solderability degradation, electrostatic discharge (ESD) (when necessary), and moisture uptake. Moisture absorbed in printed board laminates expands at soldering temperatures, and in some cases, the resulting vapor pressure can cause internal delamination or excessive strain on plated-hole walls and other structures. This is especially challenging with the higher temperatures used for Pb-free soldering.

This document covers all phases from the manufacture of the bare printed board, through delivery, receiving, stocking, assembly, and soldering. As a guideline, this information is to be used with, and is secondary to, established requirements in such documents as the IPC-4550 series for final finishes.

1.3 Application The target audience includes those involved in all phases of printed board design, manufacture, assembly, shipping, storage, and possible warranty activities. Information herein has been supplied for all of these functions.

1.4 Terms and Definitions The definition of all terms used herein are as specified in IPC-T-50 and as defined in 1.4.1 through 1.4.6.

1.4.1 Humidity Indicator Card (HIC) An indicator of relative humidity in the form of a card with printed deposits of moisture-sensitive chemicals, usually as round dots arranged in sequence, each changing color at a higher relative humidity. Color will change (depending on the chemical) either from blue to pink or from brown to azure) when humidity exceeds the value printed on the dot. When humidity decreases, color will change back (to blue or brown).

1.4.2 Moisture Barrier Bag (MBB) A bag designed to restrict the transmission of water vapor and used to pack moisture sensitive devices. An MBB is made of material with a low Water Vapor Transmission Rate (WVTR) (see 4.2.1). An MBB includes a metallized layer (aluminum), making the bag appear shiny and opaque.

1.4.3 Subcomposite In sequential lamination, a structure composed of more than two layers that have been laminated together, and which will subsequently be laminated with other layers into a complete printed board.

1.4.4 Water Vapor Transmission Rate (WVTR) A measure of the permeability of plastic film or metallized plastic film material to moisture, an important rating for moisture barrier bags (MBBs).

1.4.5 Sulfur Free Materials that are unlikely to express corrosive sulfur compounds like H₂S or SO₂.

1.4.6 Dry Packaging Packaging that consists of desiccant material and a Humidity Indicator Card (HIC) sealed with the printed boards inside a Moisture Barrier Bag (MBB) (See 4.3.1).

1.5 Revision Level Changes Changes incorporated into the current revision of this standard are indicated throughout by gray shading of the relevant subsection(s). Changes to a figure or table are indicated by gray shading of the figure or table header and applicable content.