

IPC-1602

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Standard for Printed Board Handling and Storage

Supersedes IPC-1601A
June 2016

An international standard developed by IPC



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IPC-1602

Standard for Printed Board Handling and Storage

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

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

Contact:

IPC
3000 Lakeside Drive, Suite 105N
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105

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Rigid Printed Board Committee

Chair
Clifford R. Maddox
Boeing Company

Printed Board Storage and Handling Subcommittee

Chair
Joseph E. Kane
BAE Systems Platform Solutions

Vice-Chair
Don Dupriest
Lockheed Martin Missiles & Fire Control

Technical Liaison of the IPC Board of Directors

Bob Neves
Microtek (Changzhou) Laboratories

Printed Board Storage and Handling Subcommittee

Lance Auer, Conductor Analysis Technologies, Inc.
Erik Bjerke, BAE Systems
Albert Block, National Instruments
Gerald Bogert, Bechtel Plant Machinery, Inc.
Scott Bowles, Lockheed Martin Corporation
Steven Bowles, DuPont SVTC
Michael Carano, RBP Chemical Technology, Inc.
Denise Charest, Amphenol Printed Circuits, Inc.
Eddie Chao, Enthone Inc. Taiwan Branch
Patrice Chetanneau, Sagem
Beverley Christian, HDP User Group
Michael Collier, Teledyne Leeman Labs
Harold Ellison, Quantum Corporation
Gary Ferrari, FTG Circuits
Symon Franklin, Custom Interconnect Ltd

Tim Gallagher, BAE Systems
Andrew Goddard, ZF Automotive UK Limited
Vicka Hammill, Honeywell Inc. Air Transport Systems
Philip Henault, Raytheon
David Hillman, Collins Aerospace
Mei Ming Khaw, Keysight Technologies
Kelly Kovalovsky, BAE Systems
Christina Landon, NSW Crane
Nga Man Jennifa Li, Nga Man Jennifa Li
Dan Loew, L3Harris
Seth Maitlen, TTM Technologies
Matthew McQueen, NSW Crane
Thi Nguyen, Lockheed Martin Missile & Fire Control
Naji Norder, National Instruments
Gerard O'Brien, Solderability Testing & Solutions, Inc.
Agnieszka Ozarowski, BAE Systems

Gerry Partida, Summit Interconnect - Anaheim
Jan Pedersen, Elmatica AS
Jose Rios, Raytheon
Robert Roessler, ABB Power Electronics Inc.
Tom Rovere, Lockheed Martin Mission Systems & Training
Christina Rutherford, Honeywell Aerospace
Douglas Schueller, AbelConn, LLC
Bhanu Sood, NASA Goddard Space Flight Center
Brian Stevens, Collins Aerospace
John Trelford, ABB Power Electronics Inc.
Juan Vasquez, Henkel US Operations Corp.
Casey White, Amphenol Printed Circuits, Inc.
Michael Peng, DEKRA iST Reliability Service INC.

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Standard for Printed Board Handling and Storage

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 laminates or final finishes.

1.2 Scope This standard provides requirements and recommendations for proper handling, packaging materials and methods, environmental conditions, and storage for printed boards. The requirements and recommendations 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.

Note: This standard includes requirements for the handling, packaging and storage of printed boards and directly supersedes IPC-1601 Revision A from 2016.

This document covers all phases from the manufacture of the bare printed board, through delivery, receiving, stocking, assembly, and soldering.

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 Other than those terms listed below, the definitions of terms used in this Standard are in accordance with IPC-T-50.

1.4.1 Assembler The entity that receives a completed printed board and performs subsequent assembly, wiring, or soldering operations.

1.4.2 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 4.2).

1.4.3 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 chemicals, 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).

1.4.4 Manufacturer (Printed Board Fabricator or Assembler) The individual, organization, or company responsible for the applicable printed board fabrication or assembly process, and verification operations necessary to ensure full compliance of printed boards or assemblies to this Standard.

1.4.5 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.

1.4.6 Shall The words “**shall**” and “**shall not**” are used in this document to establish a requirement, which is a provision that is mandatory. To assist the reader, the words “**shall**” and “**shall not**” are presented in bold characters.

1.4.7 Should The words “should” and “should not” indicate suggestions, recommendations, best practices, or generally accepted industry methods or procedures, and are intended for guidance only.

1.4.8 Sub-Lam (Subcomposite) In sequential lamination, a printed board subassembly 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.

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

1.4.10 Supplier The individual, organization or company that provides the Manufacturer (printed board fabricator) with components and/or materials (printed board materials of construction, inks, plating chemistry, cleaning agents, etc.).

1.4.11 User The individual, organization, company, contractually designated authority, or agency responsible for the procurement or design of electrical/electronic hardware and having the authority to define any variation or restrictions to the requirements of this Standard, i.e., the originator/custodian of the contract detailing these requirements. The User is not always the design authority, the customer placing the purchase order, or the assembler.

1.4.12 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).

1.5 Superseded Documents This document supersedes and replaces IPC-1601 Revision A from June 2016. Originally envisioned as a Revision B to IPC-1601, with the expansion of scope from a guidelines document to a standard with requirements for printed board storage and handling, this document has been released with a new document number of IPC-1602. Changes from the IPC-1601 Revision A guideline that are incorporated into this new 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.

1.6 Order of Precedence

1.6.1 Conflict In the event of conflict between the requirements of this standard and the applicable procurement documentation, the applicable User approved documentation **shall** govern. In the event of conflict between the requirements of this standard and documentation that has not been User approved, this standard **shall** govern.

In the event of a conflict between the requirements of this standard and the applicable documents cited in Section 2, the text of this standard takes precedence.

1.6.2 Clause References When a clause in this document is referenced, its subordinate clauses also apply.

1.6.3 Appendices Appendices to this standard are not binding requirements unless separately specified by the User.

1.7 Requirements Flowdown When this standard is contractually required, the applicable requirements of this standard **shall** be imposed on all applicable subcontracts, assembly drawing(s), documentation, and purchase orders. Unless otherwise specified, the requirements of this standard are not imposed on the procurement of commercial-off-the-shelf (COTS or catalog) materials or components.

2 APPLICABLE DOCUMENTS

2.1 IPC¹

IPC-HDBK-001 Handbook and Guide to Supplement J-STD-001

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

IPC-A-311 Process Controls for Phototool Generation and Use

IPC-TR-585 Time, Temperature and Humidity Stress of Final Board Finish Solderability

IPC-TM-650 Test Methods Manual²

2.6.27 Thermal Stress, Convection Reflow Assembly Simulation

2.6.28 Moisture Content and/or Moisture Absorption Rate, (Bulk) Printed Board

IPC-2221 Generic Standard on Printed Board Design

IPC-4552 Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Circuit Boards

IPC-4553 Specification for Immersion Silver Plating for Printed Boards

1. www.ipc.org

2. www.ipc.org/test-methods.aspx

IPC-4554 Specification for Immersion Tin Plating for Printed Circuit Boards

IPC-4556 Specification for Electroless Nickel/Electroless Palladium/Immersion Gold Plating for Printed Circuit Boards

IPC-6010-FAM Printed Board Performance Specifications

IPC-6017 Qualification and Performance Specification for Printed Boards Containing Embedded Passive Devices

IPC-7092 Design and Assembly Process Implementation for Embedded Components

NCMS Solderability Component Long Term Storage Report - "Moisture Measurement in PCB's and Impact of Design on Desorption Behaviour"

2.2 Joint Industry Standards³

J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies

IPC/JEDEC J-STD-033 Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

IPC/JEDEC J-STD-609 Marking and Labeling of Components, PCBs and PCBAs to Identify Lead (Pb), Lead-Free (Pb-Free) and Other Attributes

2.3 Electrostatic Discharge Association (ESD)⁴

ANSI/ESD S8.1 Protection of Electrostatic Discharge Susceptible Items - Symbols - ESD Awareness

ANSI/ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)

ANSI/ESD S541 Packaging Materials for the Protection of Electrostatic Discharge Susceptible Items

2.4 Europa⁵

DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast)

2.5 SAE International⁶

SAE AS9100 Quality Management Systems - Requirements for Aviation, Space and Defense Organizations

SAE AS9102 Aerospace First Article Inspection Requirement

2.6 International Organization for Standardization⁷

ISO 9001 Quality Management Systems - Requirements

2.7 ASTM⁸

ASTM F1249 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

2.8 Military Specifications⁹

MIL-PRF-81705 Performance Specification: Barrier Materials, Flexible, Electrostatic Protective, Heat-Sealable

MIL-STD-3010 Test Method 2065 Puncture Resistance Test of Packaging

3. www.ipc.org

4. www.esda.org

5. ec.europa.eu

6. www.standards.sae.org

7. www.iso.org

8. www.astm.org

9. www.dla.mil