Acceptability of Printed Boards
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Acceptability of Printed Boards

Developed by the IPC-A-600 Task Group (7-31a) of the Product Assurance Committee (7-30) of IPC

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

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Supersedes:
IPC-A-600J - May 2016
IPC-A-600H - April 2010
IPC-A-600G - July 2004
IPC-A-600F - November 1999

If a conflict occurs between the English and translated versions of this document, the English version will take precedence.
Any document involving a complex technology draws material from a vast number of sources across many continents. While the principal members of the A-600 Task Group (7-31a) of the Product Assurance Committee (7-30) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of IPC extend their gratitude. Special thanks goes to the members of the Rigid Printed Board Committee (D-30) for their efforts in establishing acceptance criteria for printed boards.

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**Acknowledgment**

IPC-A-600K  
July 2020
A special note of thanks goes to Curtis Ricotta of Lockheed Martin Space Systems Company and Denise Charest of Amphenol Printed Circuits, Inc. for supplying a significant amount of new photographs for this revision.
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1 INTRODUCTION

Introduction

1.1 SCOPE
This document describes the target, acceptable, and nonconforming conditions that are either externally or internally observable on printed boards. It represents the visual interpretation of minimum requirements set forth in various printed board specifications, e.g.; IPC-6010 series, J-STD-003, etc.

1.2 PURPOSE
The visual illustrations in this document portray specific criteria of the requirements of current IPC specifications. In order to properly apply and use the content of this document, the printed board should comply with the design requirements of the applicable IPC-2220 series document and the performance requirements of the applicable IPC-6010 series document. In the event the printed board does not comply with these or equivalent requirements, then the acceptance criteria should be as agreed between user and supplier (AABUS).

1.3 APPROACH TO THIS DOCUMENT
Characteristics are divided into two general groups:

- Externally Observable (section 2)
- Internally Observable (section 3)

“Externally observable” conditions are those features or imperfections which can be seen and evaluated on or from the exterior surface of the board. In some cases, such as voids or blisters, the actual condition is an internal phenomenon and is detectable from the exterior.

“Internally observable” conditions are those features or imperfections that require microsectioning of the specimen or other forms of conditioning for detection and evaluation. In some cases, these features may be visible from the exterior and require microsectioning in order to assess acceptability requirements.

Specimens should be illuminated during evaluation to the extent needed for effective examination. The illumination should be such that no shadow falls on the area of interest except those shadows caused by the specimen itself. It is recommended that polarization and/or dark field illumination be employed to prevent glare during the examination of highly reflective materials.

The illustrations in this document portray specific criteria relating to the heading and subheading of each page, with brief descriptions of the acceptable and nonconforming conditions for each product class. The visual quality acceptance criteria are intended to provide proper tools for the evaluation of visual anomalies. The illustrations and photographs in each situation are related to specific requirements. The characteristics addressed are those that can be evaluated by visual observation and/or measurement of visually observable features.

Supported by appropriate user requirements, this document should provide effective visual criteria to quality assurance and manufacturing personnel.

This document cannot cover all of the reliability concerns encountered in the printed board industry; therefore, attributes not addressed in this issue shall be AABUS. The value of this document lies in its use as a baseline document that may be modified by expansions, exceptions, and variations which may be appropriate for specific applications.

When making accept and/or reject decisions, the awareness of documentation precedence must be maintained.

This document is a tool for observing how a product may deviate due to variation in processes. Refer to IPC-9191.

IPC-A-600 provides a useful tool for understanding and interpreting Automated Inspection Technology (AIT) results. AIT may be applicable to the evaluation of many of the dimensional characteristics illustrated in this document.

IPC-9121 is a useful troubleshooting guideline for problems, causes and possible corrective actions related to printed board manufacturing processes.

1.4 CLASSIFICATION
This standard recognizes that electrical and electronic products 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 product between classes.
3.2 CONDUCTIVE PATTERNS – GENERAL

3.2.5 Solder Mask Thickness

Target Condition/Acceptable – Class 1, 2, 3
- Specified: The solder mask thickness meets the thickness requirements on the procurement documentation (cannot be visually assessed).

Nonconforming – Class 1, 2, 3
- Observed conditions do not meet procurement documentation requirements.

Figure 325a
Note 1: Tmin, if specified.

Figure 325b

Figure 325c

Figure 325d

Visual observations made on cross-sections only.
3.3 PLATED-THROUGH HOLES – GENERAL

3.3.5 Innerlayer Inclusions

Target Condition – Class 1, 2, 3
- No inclusions present.

Acceptable – Class 2, 3
- No inclusions evident.

Acceptable – Class 1
- Inclusions(s) on one side of hole wall at each land location on no more than 20% of each available land.

Nonconforming – Class 1, 2, 3
- Observed conditions either do not meet or exceed above criteria.

Visual observations made on cross-sections only.
4.1.7 Solder Wicking/Plating Penetration Under Coverlay

**Target Condition – Class 1, 2, 3**
- Solder or plating on land covers all exposed metal and stops at coverlay.
- Solder wicking or plating penetration does not extend into the bend or flex transition area.

**Acceptable – Class 3**
- Solder wicking/plating penetration does not extend under coverlay more than 0.3 mm [0.0118 in].
- Solder wicking or plating penetration does not extend into the bend or flex transition area.
- Meets conductor spacing requirements.

**Acceptable – Class 2**
- Solder wicking/plating penetration does not extend under coverlay more than 0.5 mm [0.0197 in].
- Solder wicking or plating penetration does not extend into the bend or flex transition area.
- Meets conductor spacing requirements.

**Acceptable – Class 1**
- Solder wicking/plating penetration AABUS.
- Solder wicking or plating penetration does not extend into the bend or flex transition area.
- Meets conductor spacing requirements.

**Nonconforming – Class 1, 2, 3**
- Observed conditions do not meet or exceed above criteria.
This section shows the voids and cracks that may be present in flexible or rigid-flex printed boards. The requirements for the flexible portion differ from the rigid-flex portion and are defined in the text even though only a rigid-flex section is shown.

Figure 418a

Note 1: Thermal zones are defined by a 0.08 mm [0.0031 in] perimeter around the entirety of each via or through-hole structure (including internal and external lands). For lands that are increased in size to accommodate an offset (staggered) structure, the thermal zone is governed by the offset (staggered) structure.
Note 2: Rigid Printed Board Area.
Note 3: Flexible Printed Board Area.
Note 4: Plating.
Note 5: Copper Foil.
Note 6: Laminate voids and cracks fully encapsulated within the thermal zones are not evaluated on specimens which have been exposed to thermal stress or rework simulation.
Note 7: Multiple voids or cracks between PTHs in the flex area and in the same plane shall not have a combined length exceeding the limit.

Target Condition – Class 1, 2, 3

- No laminate voids or cracks.
5.1 SOLDERABILITY TESTING

5.1.1 Plated-Through Holes (Applicable to Solder Float Test)

Target Condition – Class 1, 2, 3
- Solder has risen in all plated holes.
- There is no nonwetted or exposed base metal.

Acceptable – Class 3
(for printed boards of thickness \( \leq 3.0\ \text{mm} \) [0.118 in])
- Solder has risen in all plated holes.
- Solder fully wets the walls of the hole.
- There is no evidence of nonwetting or exposed base metal on any PTH.

Acceptable – Class 1, 2
(for printed boards of thickness \( \leq 3.0\ \text{mm} \) [0.118 in])
- Solder fully wets the wall area of the PTH holes.
- Solder shall plug holes less than 1.5 mm [0.0591 in] diameter (complete filling is not necessary).

Acceptable – Class 2, 3
(for printed boards of thickness > 3.0 mm [0.118 in])
- Hole fill \( \geq 75\% \).
5.1.1 Plated-Through Holes (Applicable to Solder Float Test) (cont.)

Acceptable – Class 1
(for printed boards of thickness > 3.0 mm [0.118 in])
• Hole fill ≥ 50%.

Nonconforming – Class 1, 2, 3
(for printed boards of thickness ≤ 3.0 mm [0.118 in])
• Observed conditions do not meet or exceed above criteria.

Nonconforming – Class 1, 2, 3
(for printed boards of thickness > 3.0 mm [0.118 in])
• Observed conditions do not meet or exceed above criteria.
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# Standard Improvement Form

The purpose of this form is to provide the Technical Committee of IPC with input from the industry regarding usage of the subject standard.

Individuals or companies are invited to submit comments to IPC. All comments will be collected and dispersed to the appropriate committee(s).

If you can provide input, please complete this form and return to:

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