

IPC-A-600

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Supersedes Revision J
May 2016

Acceptability of Printed Boards

Developed by



BUILD ELECTRONICS BETTER

participants from

14 countries

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IPC-A-600K

Acceptability of Printed Boards

If a conflict occurs between the English and translated versions of this document, the English version will take precedence.

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

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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. (See 1.4.) 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

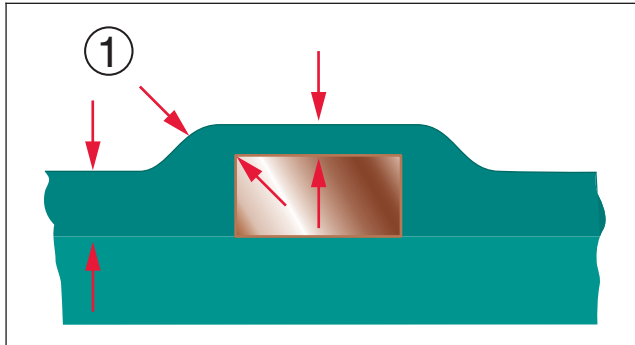


Figure 325a

Note 1: T_{min}, if specified.

Target Condition/Acceptable – Class 1, 2, 3

- Specified: The solder mask thickness meets the thickness requirements on the procurement documentation (cannot be visually assessed).

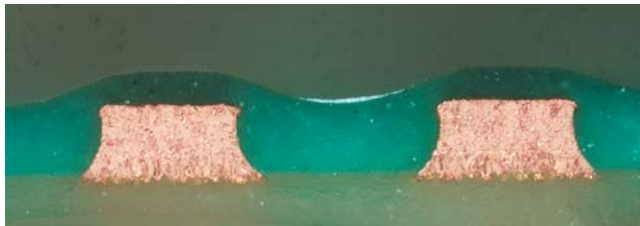


Figure 325b

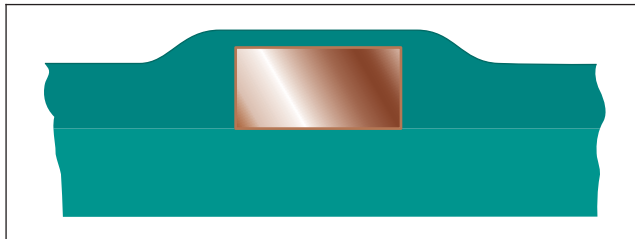


Figure 325c

Nonconforming – Class 1, 2, 3

- Observed conditions do not meet procurement documentation requirements.



Figure 325d

Visual observations made on cross-sections only.

3.3 PLATED-THROUGH HOLES – GENERAL

3.3.5 Innerlayer Inclusions

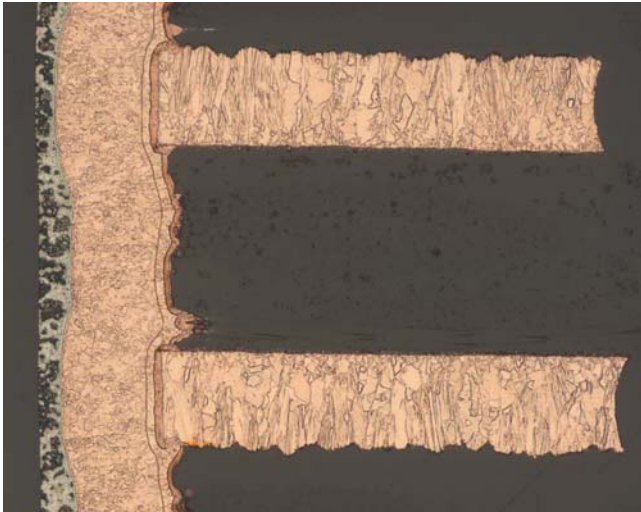


Figure 335a

Target Condition – Class 1, 2, 3

- No inclusions present.

Acceptable – Class 2, 3

- No inclusions evident.

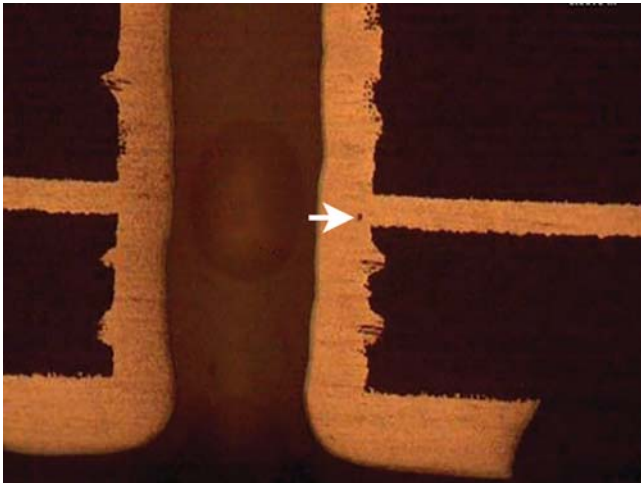


Figure 335b

Acceptable – Class 1

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

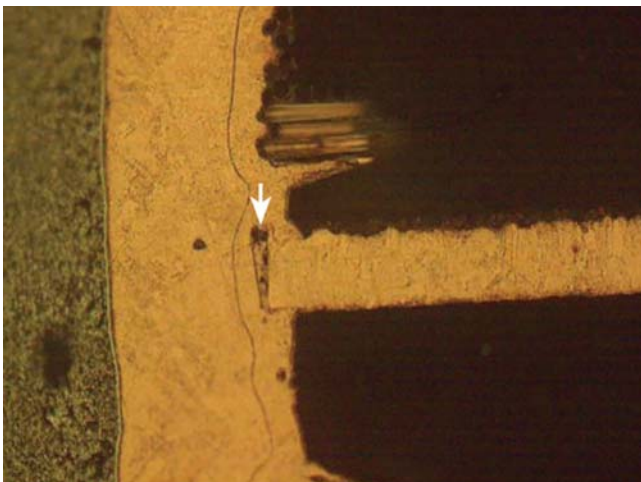


Figure 335c

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

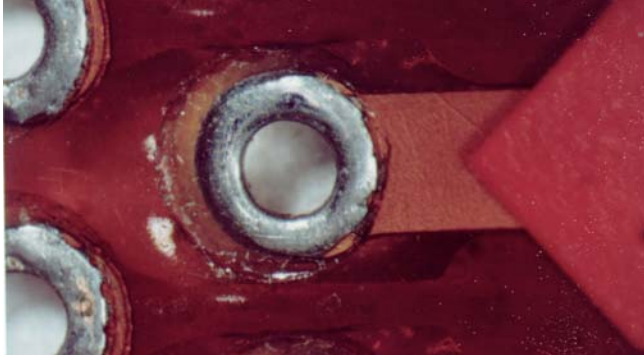


Figure 417a

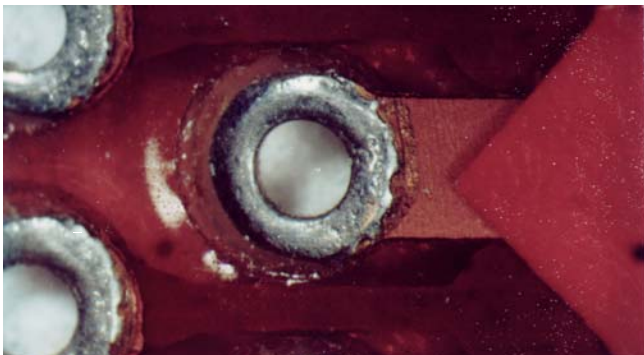


Figure 417b

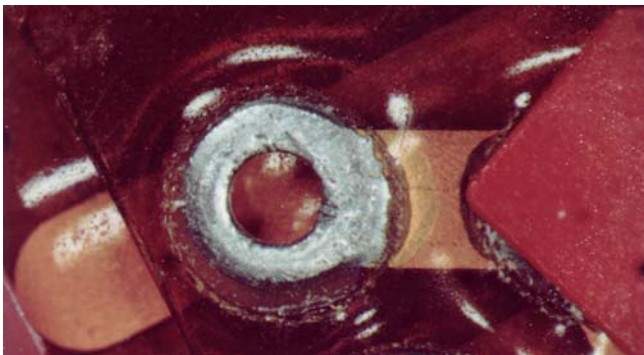


Figure 417c

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.

4.1 FLEXIBLE AND RIGID-FLEX PRINTED BOARDS

4.1.8 Laminate Integrity

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.

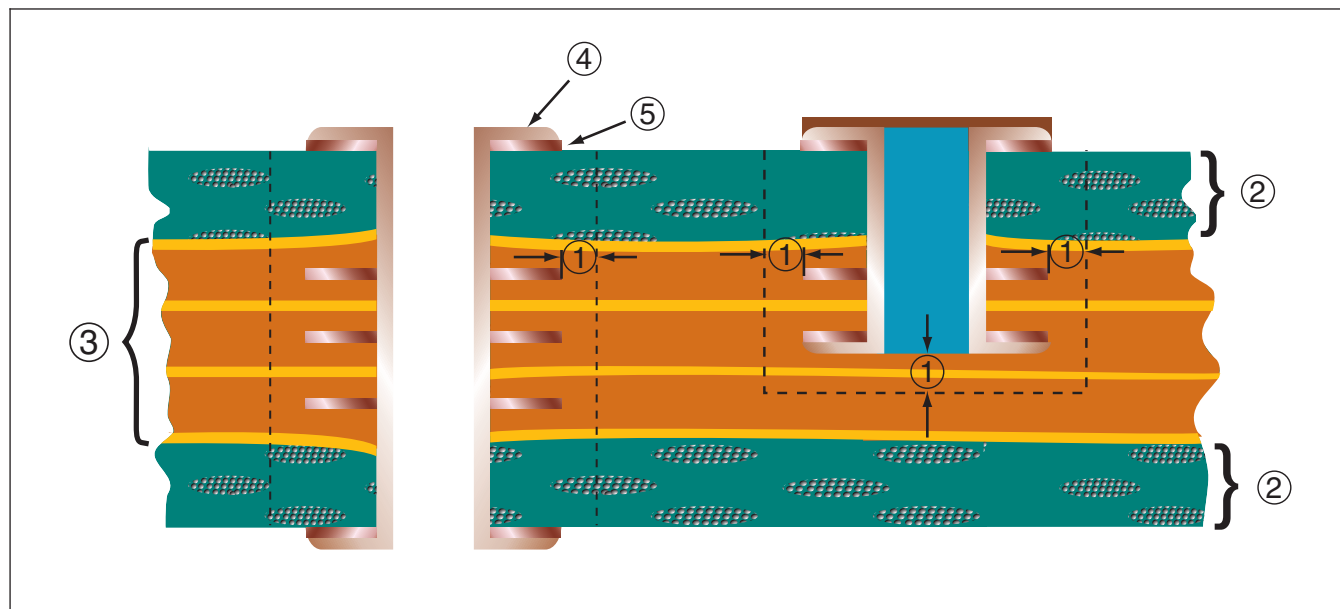


Figure 418a

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)

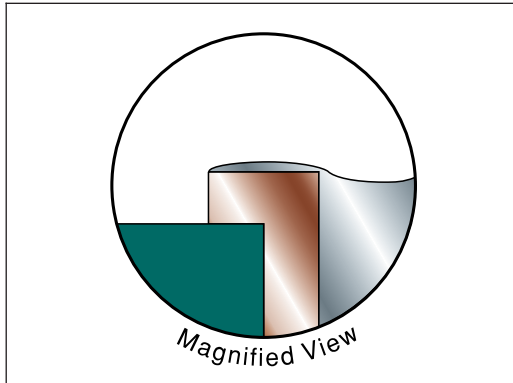


Figure 511a

Target Condition – Class 1, 2, 3

- Solder has risen in all plated holes.
- There is no nonwetted or exposed base metal.

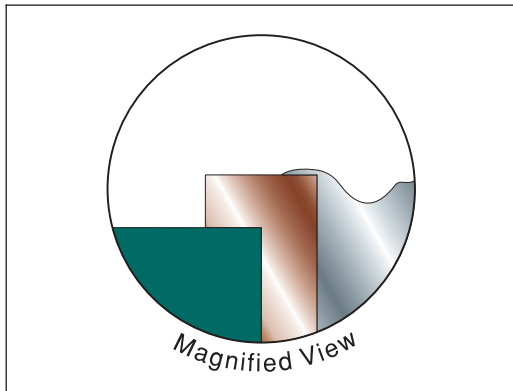


Figure 511b

Acceptable – Class 3

(for printed boards of thickness ≤ 3.0 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 ≤ 3.0 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 $\geq 75\%$.

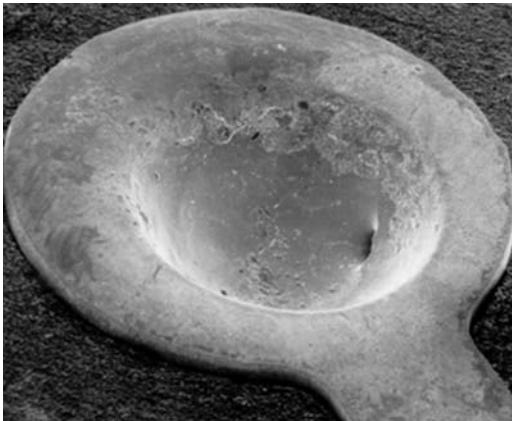


Figure 511c

5.1 SOLDERABILITY TESTING

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

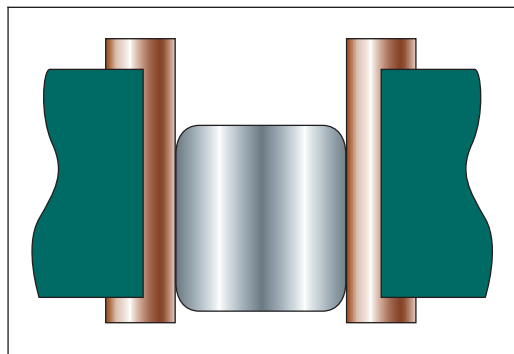


Figure 511d

Acceptable – Class 1

(for printed boards of thickness > 3.0 mm [0.118 in])

- Hole fill $\geq 50\%$.

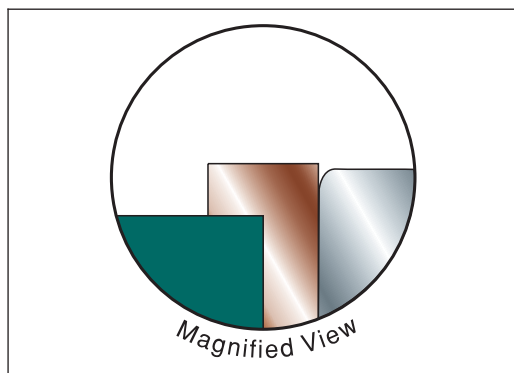


Figure 511e

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.

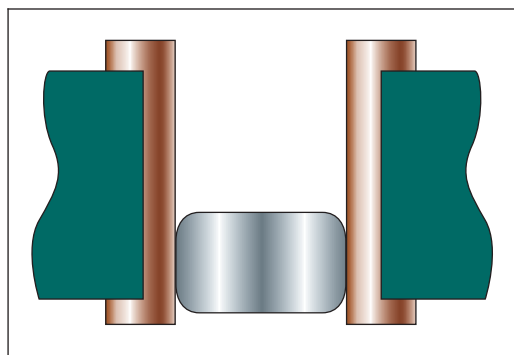


Figure 511f

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

IPC-A-600K

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

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1. I recommend changes to the following:

___ Requirement, paragraph number _____
___ Test Method number _____, paragraph number _____

The referenced paragraph number has proven to be:

___ Unclear ___ Too Rigid ___ In Error
___ Other _____

2. Recommendations for correction:

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