



Printed Circuit Board Workmanship Criteria

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PURPOSE & SCOPE

This Workmanship Standard details the workmanship acceptance criteria to be applied to all deliverable printed circuit board products. This standard outlines the microsection, solder sample, and plug and cap requirements and acceptance criteria as applied to L3 Communication Systems-West (CSW), Salt Lake City facility products.

It is the responsibility of all personnel involved with build, inspection, and purchasing to ensure that all printed circuit board product meets the minimum acceptance criteria during all phases of product realization.

WORKMANSHIP STANDARD

1. MICROSECTION AND SOLDER SAMPLE REQUIREMENTS

1.1. General Requirements

1.1.1. Representative microsections and a solder sample shall be delivered with each new manufacturing date code/lot number by part number.

1.1.2. Microsection requirements are as follows:

- For criteria and feature requirements in microsections with standard plated through holes see [section 1.2.](#)
- For criteria and feature requirements in all HDI features and plated through holes with plug and cap technology see [section 1.3.](#)
- Multiple microsections may be needed to provide representative samples of all required features.
- Multiple samples and/or features may also be included within a single microsection.

1.1.3. Solder sample requirements are as follows:

- Solder sample may be a nonfunctional PCB from the same part number and manufacturing date code/lot number.
- Solder sample shall be representative of product quality and compliance to manufacturing specifications.

1.2. Standard Plated Through-Holes

1.2.1. Microsection requirements for Printed Circuit Boards with plated through holes are as follows:

- Microsection(s) shall be per IPC-TM-650 method 2.1.1 or 2.1.1.2.
- Test specimens may be removed from a printed circuit board or test coupon.
- All specimens shall be thermally stressed per IPC-TM-650, method 2.6.8, test condition B for 5 stress cycles.
- If A/B coupons are used, they must be designed per IPC-2221.
- A minimum of 2 holes of the plated through hole with the greatest aspect ratio (typically the smallest via) and 2 holes of the largest component hole (up to .070 inches) must be included in the microsection(s) provided.

1.3. HDI Features & PTHs With Plug & Cap Technology

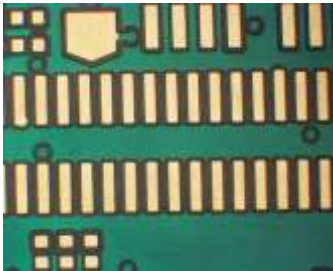
1.3.1. HDI features are defined as any blind or buried via that has been drilled either mechanically or by laser.

1.3.2. Microsection requirements for Printed Circuit Boards with HDI features and/or plated through holes with plug and cap technology are as follows:

- Microsection(s) shall be per IPC-TM-650 method 2.1.1.
- Test specimens may be removed from a printed circuit board or test coupon.
- All specimens shall be thermally stressed per IPC-TM-650, method 2.6.8, test condition B for 5 stress cycles.
- Microsections of HDI features shall include a minimum of 3 specimens representing each feature/hole size.
- Microsections of plated through holes with plug and cap technology shall include a minimum of 3 specimens representing the hole with the greatest aspect ratio (typically the smallest via).

2. NON-CONDUCTIVE VIA FILL & PLATED COPPER CAP (PLUG & CAP) REQUIREMENTS

2.1. Visual Inspection Plug & Cap Acceptance Criteria



Target Condition

- Feature is free of indentations, pin holes and surface nodules
- Cap is centered to through hole with no breakout.



Acceptable

- Cap indentation is completely plated with no exposed plug material and/or lamination materials.
- No separation or lifting of cap from base copper.
- No cap breakout from land.
- Surface imperfections shall be in accordance with applicable performance specification as detailed in IPC 6010 series.



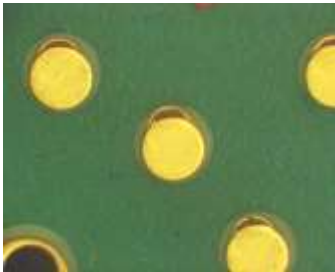
Acceptable

- Indentation within cap is less than .005" in diameter and meets the previous requirements.
- Indentation is not in a BGA or fine pitch (less than .025" from reference pad center to adjacent pad center) surface mount pad.



Nonconforming

- Cap has a void in center of solderable land and continuous plating cannot be seen at the base of the opening.



Nonconforming

- Cap is miss-registered with the through hole resulting in breakout.

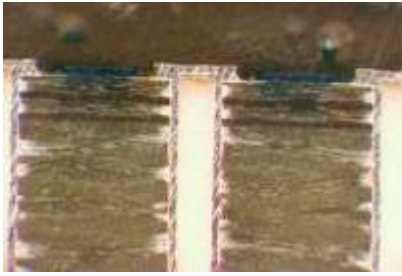
2.2. Microsection Inspection Plug & Cap Acceptance Criteria

2.2.1. General Cross Section Inspection



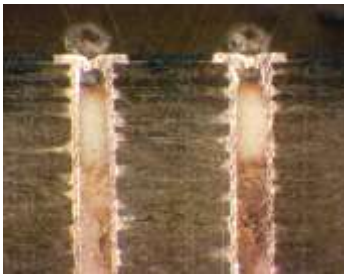
Target Condition

- Plug is free of voids and is continuous throughout the length of the plated through hole.
- Cap is centered to the hole with no evidence of peeling at the interface between the cap and base copper.
- Minimum copper plating thickness requirements are met.
- There are no dents or voids in the cap plating.



Acceptable

- Plug may have up to 10% voiding so long as plug material has been fully cured and does not adversely affect formation of cap.
- Minimum of .002" overlap between cap and capture land preferred, misregistration is acceptable so long as minimum plating requirements are met throughout the hole-wall and extending on to the plating surface.
- Cap indentation is completely plated with no exposed plug material and/or lamination materials.
- All other imperfections shall be in accordance with applicable performance specifications as detailed in IPC 6010 series.



Nonconforming

- Void in cap material that has exposed plug material.
- Plug has greater than 10% voiding.
- Hole wall copper has been reduced just below the knee of the hole in the voided area.

2.2.2. Copper Interface Cross Section Inspection



Target Condition

- No separation between copper cap and base copper before or after thermal stress.
- No separation between copper cap and via fill material before or after thermal stress.
- No separation between via fill material and hole wall copper.



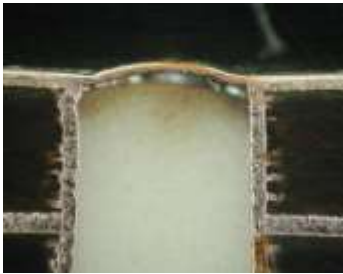
Acceptable

- Cap indentation is completely plated with no exposed plug material and/or lamination materials.
- No separation between copper cap and base copper before or after thermal stress.
- No separation between copper cap and via fill material before or after thermal stress.



Nonconforming

- Copper separation has been identified between the copper cap and base copper following thermal stress.
- Separation can be seen between the via fill material and copper cap following thermal stress.



Nonconforming

- Copper separation from via fill material following thermal stress is unacceptable even though there is no evidence of separation between copper cap and copper base.

RECORDS

There are no records associated with this document.

END OF DOCUMENT

DOCUMENT INFORMATION

Responsible Organization:	Operations
Function/Sub-function:	Workmanship Standards
Governing Document(s):	Y-001, Quality Management System
Subordinate Document(s):	N/A
Related Document(s):	IS-005, Printed Wiring Board Workmanship & Design Criteria P-047, Inspection WS-000, Workmanship Standards Introduction IPC-A-600, Acceptance of Printed Boards
Related Training:	N/A
Approval Requirements:	Manager, Engineering Management Sr. Manager, Supply Chain Management Scientist, Mechanical Engineering
Review Requirements:	Associate Manager, Quality Management Supervisor, Quality Management Manager, Manufacturing Engineering Manager, engineering Management

Revision History Summary

Revision #	Description of Change	Date
New	Initial Release	12-12-2007
NA	Added records section. No revision upgrade necessary.	03/16/2017
NA	Reformatted in accordance with new template format. Update L3 naming throughout. No revision upgrade necessary.	05/23/2017
01	Updated logo and proprietary in footer. Updated sub-sections 4.1.1 through 4.1.3 and 4.2.1 and 4.2.2.	7/28/2021
02	Incorporated subsections (separate files) into this single document. Updated review and approval requirements.	10/24/2022