AMCA
AMERICAN MANUFACTURING COMPLIANCE AUTHORITY

PRINTED CIRCUIT BOARD QUALITY STANDARD

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AMERICAN MANUFACTURING COMPLIANCE AUTHORITY (AMCA)

Quality Standards for Printed Circuit Boards (PCBs)

1. Purpose and Scope

These Quality Standards for Printed Circuit Boards (PCBs) issued by the American Manufacturing Compliance Authority (AMCA) establish minimum requirements for materials, fabrication, assembly, testing, and documentation. These standards apply to single-sided, double-sided, and multilayer rigid PCBs intended for commercial, industrial, and high-reliability applications.

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2. Materials and Construction Requirements

2.1 **Base Materials**

- PCB laminate materials shall comply with recognized FR-4 or equivalent specifications offering flame-retardant properties and thermal stability.
- Copper foil used in PCB manufacturing shall meet uniform thickness tolerances with no visible oxidation, pitting, or delamination.

2.2 **Layer Structure and Lamination**

- Layer stack-ups must be documented in advance, and all prepreg and core materials must be traceable to certified suppliers.
- Lamination cycles must ensure complete bonding without voids, blistering, or resin starvation.
- Multilayer boards must demonstrate consistent dielectric spacing as defined in the engineering documentation.

2.3 **Conductive Features**

- Traces, pads, and planes must be fabricated to meet dimensional tolerances of ±10% or as otherwise specified in design files.
- Copper thickness shall be uniform throughout the board, with minimum finished thickness compliant with specified current-carrying requirements.

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3. Drilling and Plating Standards

3.1 **Drilled Holes**

- Hole diameters shall maintain tolerances of ±0.075 mm unless otherwise specified.
- Drilled holes must be free of debris, delamination, or fracturing.
- Hole wall roughness must not exceed established limits that impede plating adhesion.

3.2 **Plated Through-Holes (PTH)**

- Copper plating in PTHs shall achieve a minimum finished thickness of 20 µm or as required by design.
- Void content shall not exceed 5% of the total wall area in any hole.
- PTHs must withstand thermal shock testing without cracks, separation, or blistering.

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4. Solder Mask and Surface Finish

4.1 **Solder Mask Application**

- Solder mask material shall be applied uniformly and cured completely to prevent peeling, cracking, or discoloration.
- Registration accuracy of ±0.1 mm is required to ensure exposure of copper pads without overlap onto traces.
- Solder mask openings must be free of contamination and maintain smooth edges.

4.2 **Surface Finishes**

- Acceptable surface finishes include HASL, ENIG, immersion silver, or other approved methods.
- Finishes shall comply with thickness and chemical composition requirements and exhibit no oxidation, pitting, or uneven deposition.
- ENIG boards must meet nickel-to-gold thickness ratios preventing black-pad formation.

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5. Dimensional and Mechanical Requirements

5.1 **Board Dimensions**

- Overall board dimensions shall meet design specifications with tolerances of ±0.15 mm unless otherwise documented.
- Cutouts, slots, and mechanical features must be routed cleanly, free of excessive burrs or charring.

5.2 **Warp and Twist**

- Maximum allowable PCB warpage shall not exceed 0.75% of board diagonal for boards under 2 mm thick.
- Boards thicker than 2 mm shall have a maximum warpage of 0.5%.

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6. Electrical Testing and Performance Requirements

6.1 **Continuity and Isolation**

- 100% electrical testing is required for continuity and isolation.
- Isolation resistance must exceed 10 MΩ unless a different value is specified by design requirements.
- No open circuits, shorts, or impedance deviations beyond ±10% are permitted.

6.2 **High-Voltage Testing**

- Boards intended for high-voltage applications must undergo dielectric withstand testing at specified voltage levels without breakdown or arcing.

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7. Cleanliness and Environmental Resistance

7.1 **Cleanliness**

- Ionic contamination must remain below acceptable industry thresholds to prevent corrosion or dendritic growth.
- All boards shall be free of flux residues, fingerprints, moisture, and particulates.

7.2 **Environmental Durability**

- Boards must withstand humidity, thermal cycling, and mechanical shock per application-appropriate environmental testing protocols.
- No cracking, delamination, blistering, or electrical degradation is permitted

after testing.

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8. Marking and Traceability

8.1 **Product Identification**

- Each PCB shall include legible markings identifying manufacturer, production batch, part number, and revision level.
- Markings must not interfere with conductive features or component placement.

8.2 **Traceability**

- Manufacturers must maintain traceability for materials, process parameters, inspections, and final test results for a minimum of five years or as required by contract.

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9. Documentation Requirements

9.1 **Design and Production Records**

- Fabricators must maintain copies of Gerber files, drill files, stack-up documentation, and fabrication notes.
- Any deviations from design data require documented approval from the customer or authorized representative.

9.2 **Quality Records**

- Inspection reports, test results, non-conformance records, and corrective actions must be preserved in accordance with AMCA record-keeping guidelines.

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10. Non-Conformance and Corrective Actions

10.1 **Identification of Defects**

- All detected defects shall be documented, classified by severity, and communicated to stakeholders.
- No PCB containing critical defects (e.g., opens, shorts, lifted pads, plating cracks) may be released.

10.2 **Corrective Action Process**

- Manufacturers must investigate root causes of failures and implement corrective actions to prevent recurrence.
- Corrective measures must be verified for effectiveness and documented in compliance files.

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11. Compliance and Audits

11.1 **Manufacturer Certification**

- PCB suppliers must maintain compliance with AMCA Quality Standards and may undergo regular audits.
- Certified manufacturers shall provide evidence of ongoing quality management system adherence.

11.2 **Audit Procedures**

- Audits may include on-site inspections, process reviews, sampling tests, and documentation assessments.
- Non-compliant findings must be resolved within specified timelines to maintain certification.

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12. Revision and Updates

These standards are reviewed periodically by AMCA and updated as necessary to reflect advancements in PCB manufacturing technology, materials, and regulatory requirements. Users are responsible for maintaining awareness of the latest revisions.

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