



IPC-6012EA

**Automotive Applications  
Addendum to IPC-6012E  
*Qualification and  
Performance Specification  
for Rigid Printed Boards***

Developed by the IPC-6012 Automotive Addendum Task Group (D-33AA)  
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.

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# **Automotive Applications Addendum to IPC-6012E, *Qualification and Performance Specification for Rigid Printed Boards***

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**0.1 Scope** This addendum provides requirements to be used in addition to, and in some cases, in place of, those published in IPC-6012E to ensure the reliability of printed boards that must survive the environments of electronic interconnects within the automotive industry.

**0.1.1 Purpose** When required by procurement documentation/drawings, this addendum replaces specifically identified requirements of IPC-6012E.

**0.1.2 Precedence** The procurement documentation takes precedence over this addendum and referenced standards. In the event of a conflict between this addendum and the applicable documents cited herein, this addendum takes precedence. Where referenced criteria of this addendum differ from the published IPC-6012E, this addendum takes precedence.

**0.1.3 Existing or Previously Approved Designs** This addendum **shall not** constitute the sole cause for the redesign of previously approved designs. When drawings for existing or previously approved designs undergo revision, they should be reviewed and changes made that allow for compliance with the requirements of this addendum.

**0.1.4 Use of this Addendum** This addendum **shall not** be used as a stand-alone document but **shall** be recognized as automotive electronic specific requirements that are in addition to or in place of IPC-6012E Class 3 requirements.

Where criteria are not supplemented, the Class 3 requirements of IPC-6012E **shall** apply. Where IPC-6012E criteria are supplemented or new criteria are added by this addendum, the clause is listed in IPC-6012EA, Table 1, Automotive Applications Requirements, and the entire IPC-6012E clause and its associated Table 4-3 entry is replaced by this addendum except as specifically noted.

The clauses modified by this addendum do not include subordinate clauses unless specifically stated (i.e., changes made to 3.5 do not affect 3.5.1 unless 3.5.1 is also addressed in this addendum).

Table 1 IPC-6012EA Automotive Application Requirements

IPC-6012E Reference	Automotive Applications Requirement (as changed by this Addendum)	Inspection/ Test Method	Sample	Test Frequency	
				Remarks	Frequency
3.3	<p><b>Visual Examination</b> Finished printed boards <b>shall</b> be examined in accordance with the following procedure. They <b>shall</b> be of uniform quality and <b>shall</b> conform to 3.3 of IPC-6012E.</p> <p>Visual examination for applicable attributes <b>shall</b> be conducted at 3 diopters (approx.1.75X). A 100% Automated Visual Inspection is recommended for mass production.</p> <p>Visual examination of microvia structures for applicable dimensional or workmanship attributes <b>shall</b> be conducted at 30X minimum.</p> <p>If confirmation of a suspected defect cannot be made at 3 diopters, it should be verified at progressively higher magnifications (up to 40X) to confirm that it is a defect. Dimensional requirements such as spacing or conductor width measurements may require other magnifications and devices with reticules or scales in the instrument, which allow accurate measurements of the specified dimensions. Contract or specification may require other magnifications.</p>	Visual + Automated Visual Inspection (AVI)	Printed Board		100%
3.3.4	<p><b>Lifted Lands</b> When visually examined in accordance with 3.3 of IPC-6012E, there <b>shall</b> be no lifted lands on the delivered (non-stressed) printed board. If observed after thermal stress when visually examined in accordance with 3.3 of IPC-6012E, separation between conductor or PTH land and laminate surface <b>shall not</b> be greater than one pad thickness. If press-fit pins are used, the printed boards <b>shall</b> be visually examined for lifted lands in accordance with 3.3 of IPC-6012E prior to the insertion of press-fit pins.</p>	Visual + Microsection	Printed Board	One for qualification and one for production lot. The examination <b>shall</b> be done after thermal stress before insertion of press-fit pins.	2 samples per lot
3.4.1	<p><b>Hole Size, Hole Pattern Accuracy and Pattern Feature Accuracy</b> The minimum hole and copper pattern feature location accuracy <b>shall</b> be as follows:</p> <p>Up to 300 mm [11.8 in]: ± 0.075 mm [0.0029 in] Up to 450 mm [17.7 in]: ± 0.112 mm [0.0044 in] Up to 600 mm [23.6 in]: ± 0.150 mm [0.0059 in]</p> <p>The finished hole size tolerance <b>shall</b> be ± 100 µm [3.937 µin]. Via holes <b>shall</b> be specified as minimum drilled size to secure a sufficient aspect ratio.</p> <p>Nodules or rough plating in PTHs <b>shall not</b> reduce the hole diameter below the minimum limits defined in the procurement document.</p> <p>Critical hole and pattern location tolerances <b>shall</b> be AABUS.</p>	Visual, Optical Measurement	Printed Board	Supplier Certification Allowed	Sample (4.0)
3.4.3	<p><b>Bow and Twist</b> Unless otherwise specified in the procurement documentation, when designed in accordance with IPC-2221, the printed board <b>shall</b> have a maximum bow and twist of 0.75%. For any product grouped in pallet arrays for assembly purposes, bow and twist requirements of the array <b>shall</b> be AABUS.</p> <p>Bow, twist, or any combination thereof, <b>shall</b> be determined by physical measurement and percentage calculation in accordance with IPC-TM-650, Method 2.4.22, Coordinate Measurement Machine (CMM) or equivalent method.</p> <p>A preconditioning <b>shall</b> be performed prior to the assessment for bow and twist in accordance with IPC-TM-650, Method 2.6.27, 260 °C reflow profile, at 2X Reflow.</p> <p>Bow and twist that may result from unbalanced construction <b>shall</b> be AABUS.</p>	IPC-TM-650 Method 2.6.27 Table 5-1	Printed Board	One for qualification and one for shipment	2 Samples Per Production Lot
3.5	<p><b>Conductor Definition</b> All conductive areas on printed boards including conductors, lands and planes <b>shall</b> meet the visual and dimensional requirements of the following sections. The conductor pattern <b>shall</b> be as specified in the procurement documentation. Verification of dimensional attributes <b>shall</b> be performed in accordance with 3.3 of IPC-6012E. AOI inspection methods are allowed, but conductor dimensional assessments by AOI <b>shall</b> be AABUS.</p> <p>Internal conductors are examined during internal layer processing prior to multilayer lamination.</p> <p>To secure conductor definition, all layers <b>shall</b> be tested 100% by AOI in accordance with 3.5.1 through 3.5.4 of IPC-6012E.</p>	AOI	Printed Board	All Conductive Layers	100%