



PCB

Requirements &

Specifications

Version 2016.1

IMI Group

PCB – Requirements & Specifications

1. INTRODUCTION

1.1. Application

This document establishes the generic technical and qualitative requirements necessary for the printed boards manufactured for the IMI group. It applies to all the types of printed boards.

It will be supplemented, where necessary by a specific schedule of requirements, according to particular IMI requests.

This document is to be read in conjunction with the IMI group SQA manual.

1.2. General Information

The manufacturer/supplier is to produce a uniform quality, free from any defect and/or flaw which could affect the lifespan, the appearance or the performance of the product.

Minimum IPC A 600 class 2 acceptance criteria is applied, IPC A 600 class3 will also apply for incoming and outgoing inspection according IMI or IMI's Customer specification.

Specifications may be supplemented/replaced by IMI or IMI's Customer requirements.

If the manufacturer/supplier is uncertain of the application of the Printed Board, the manufacturer/supplier must consult the IMI SQE representative without hesitation so that the requirements can be determined.

2. Manufacturing process requirements

2.1. Generic Manufacturing Process Requirements

All the Printed Board manufactured must be according to the IMI or IMI's Customer Gerber files and specification requirements. Prior to Change/Changes/deviation to original Gerber files and/or specification requirements which will/may impact to part functionality must officially written application/notification to IMI and officially receive written approval/acceptance reply from IMI (see IMI SQA manual).

The Printed Board manufacturer/supplier is responsible for choosing the manufacturing processes respectively process chemicals and machines and to formally qualify them unless otherwise specified. Environmentally friendly processes should be preferred. The choice has to be compliant to local legislation and to regulations of countries where the product will be used so far process chemistry traces remain.

The Printed Board manufacturer/supplier is responsible for choosing the control steps and control machines respectively tools unless otherwise specified and to formally qualify them. Its choice has to be adapted to the required performance, quality and reliability level of the product and in accordance to the process FMEA.

The manufacturer/supplier has the responsibility to identify all critical process, machine and base material parameters which impact or risk impacting yield, quality, reliability, functional performance and capacity. All critical parameters

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have to be monitored and used for active controlling of production and product performance, using SPC.

2.2. Base Material Requirements

The manufacturer/supplier is responsible for the choice of all materials necessary to produce the Printed Boards for a by IMI or IMI’s Customer defined working and assembly profile unless otherwise specified hereafter or by the project team. Manufacturer/Supplier has to qualify the used base materials and to demonstrate that they are in accordance to required working and assembly profiles. All materials have to be qualified using the volume production processes and machines used for production of products intended to be used or be used directly or indirectly on IMI or IMI’s Customer products as described in the present specification. General requirements for used materials are listed below:

J-STD-609	Marking
IPC 1751, IPC 1752	Material declaration
IPC SM 840	Solder Mask / Cover layer
IPC 4101, IPC 4103, IPC 4202, IPC-CF-152	Laminate, Prepreg
IPC 4562	Copper and Nickel foils
IPC 4552, IPC 4553, IPC 4554, IPC 4556	Surface Treatment
IPC-FC-234, IPC 4202, IPC 4203, IPC 4204	Flexible board materials
IPC-SG-141, IPC-A-142, IPC-QF-143, IPC 1731, IPC 4110, IPC 4121, IPC 4130, IPC 4411, IPC 4412	Reinforcements
IPC 2316, IPC 4811, IPC 4821	Embedding
UL94 V0	Flammability

Counterfeit material infiltration prevention requirements

To reduce the risk of counterfeit material infiltration following requirements has to be fulfilled:

1. List of validated distributors and manufacturers must be available on site with contract numbers.
2. A copy of initial sample packing label must be available on site
3. A photo of initial sample packing must be available on site
4. A reference analysis of initial sample must be available on site
5. Systematically for each supplied raw material shipment respectively production batch a CoC check has to be done
6. Half yearly photos of label and packing have to be send to the original manufacturer for confirmation
7. Half yearly a material samples has to be send to the original manufacturer for confirmation

2.2.1. Foil

Foil must qualify to corresponding IPC-4562 specification

2.2.2. Solder Mask

Thickness: Min 10 μm *; Max 30 μm

* Thickness 10 μm min, measurement to be taken at center of trace surface. Minimum thickness of 5 μm is acceptable at trace edges.

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- Solder mask must according to IPC-SM-840 and IPC-6012, section 3.8
- Visual Acceptability guidelines per IPC-A-600 section 2-9 (minimum class 2)
- Masked board must meet 500VDC withstanding voltage test done to IPC TM-650, TM 2.5.6.1

2.2.3. Copper Thickness

Inner layer copper thickness after process:

Must exceed min. value in IPC-6012 Table 3-7

Outer layer copper thickness after process:

Must exceed min. value in IPC-6012 Table 3-8

- As per IPC-6012, section 3.6

2.2.4. Surface Treatment/Finish

Type:	Minimum Thickness:	Maximum Thickness:
Silver Immersion	0.2 μm	0.64 μm
HASL / LF-HASL	2 μm	25 μm
ENIG	Ni 3.5 μm ; Au 0.05 μm	Ni 7 μm ; Au 0.15 μm
Immersion Tin	1.0 μm	1.3 μm

- As per IPC-6012, section 3.2.6

2.3. Board Dimensional Requirements

Unless specified on the drawing/specification, Printed Boards must meet the minimum dimensional requirements listed in IPC-6012B Section 3.4 or the following, whichever is less:

2.3.1. Hole and Pattern Accuracy

- Insertion, interconnection (via), holes for mechanical assembly, locating holes, and tooling holes shall be located within 0.1 mm of specified location at maximum material condition.
- Pattern shall be located within 0.05 mm of specified location at maximum material condition.

2.3.2. Inner and Outer Annular Ring

- Must meet all requirements under IPC-A-600 (minimum class 2), section 2.10 for annular rings. [Supported and unsupported hole ring values can be found in IPC-6012, Table 3-5] (Ring and hole design shall be such that ring is 0.3mm greater in diameter than nominal hole)
- Must meet all requirements under IPC-A-600 (minimum class 2), section 3.3 for internal annular rings

2.3.3. Bow and Twist

- The Printed Board must meet 0.75% as defined in IPC-TM-650, TM 2.4.22
- IPC-2615 to be adopted for any measurements taken. Minimum Dielectric Thickness shall meet IPC-6012, section 3.6.2.14.

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2.4. Protocol for Delivery of the Printed Boards to IMI

It is the responsibility of the manufacturer/supplier to guarantee the conformity of the parts delivered to IMI with the contractual requirements previously formalized. The manufacturer/supplier is not allowed to deliver non-conforming parts to IMI.

2.4.1 Electrical Test

The electrical test has to be performed in accordance to IPC 9252 specification guidelines testing processes, 100% of the networks on the board have to be tested for continuity and isolation.

Specific Test Requirement	Non-Auto & Non-Safety	Safety Automotive
Resistive Continuity Testing (definition of continuity threshold)	≤50 Ω (IPC9252 level B)	≤30 Ω
Resistive Isolation Testing (definition of short threshold)	≥2 MΩ (IPC9252 level B)	≥10 MΩ (IPC9252 level C)
Adjacency (for isolation testing)	Yes (IPC9252 level B)	Yes (IPC9252 level B)
Required Testing of accessible Midpoints	Yes (IPC9252 level B)	Yes (IPC9252 level C)
Test Voltage	≥150VDC for operating Voltage <50V*	≥250VDC for operating Voltage >50V*
Golden board for production release	Yes	Yes
Comment	* for pattern spacing ≥ 100μm, in case of < 100μm spacing choice of test voltage has to prevent electrical break down, in case of PCBs containing embedded active or passive components , the test voltage and polarity has to be in accordance to the component requirements	

2.4.2 Automatic Optical/Visual Inspection

IPC A-600 class 3 criteria have to be applied for Automotive Parts unless otherwise specified.

Specific test requirements	Requirement
Inner Layers AOI	100%
Outer Layers AOI	100%
Automatic hole inspection	100%
Automatic Visual inspection	100%
Final Visual Inspection / Final Quality Check (FQC)	100%
Golden board conditioning inspection tool release for production	Yes

2.4.3 X-Out/Repair/Rework

- Defect PCB's (X-out's) -- Not allowed
- Repair – Not allowed**
- Rework – Not allowed**

**Repair/Rework proposal to be provided to IMI for review if supplier cannot meet this requirement. Repair/Rework proposal can be placed under Other Requirements section of the PPAP submission. IMI will review proposal and will grant approval at this point only, not in advance.

2.4.4 Shelf-Life/Expiry Date

The manufacturer/supplier must clearly state the shelf-life/expiry date of all types of surface treatment/surface finish in an official document.

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The Printed Board must preserve its solder-ability features for minimum 6 months

(the duration will be extended to 12 months for ENIG, ENEPIG, HASL and LF-HASL).

The Printed Boards must be subjected to 3 consecutive soldering operations as per J-STD-003.

2.4.5 Documents Traceability Requirements

Document traceability (raw materials, CoC, production data, test/inspection results, test coupons, solder-ability test results, etc.) must be kept by the Printed Board manufacturer/supplier for a minimum of 15 years for Automotive & Medical application products, and a minimum of 5 years for Non-Automotive application products, after delivery of the conforming Printed Boards, and must be readily available upon requested by IMI.

3 Functional Requirements of Printed Board

3.1. Solder-ability

All the batches of the Printed Boards delivered to IMI must be subjected to solder-ability testing, as per IPC-TM-650 requirements.

Test records for solder-ability must be able to be presented to IMI covering a period of 6 months, when upon requested by IMI.

IMI has the right to carry out the solder-ability test for verification/justification purpose.

Poor Solder-ability (angle of meniscus $> 55^\circ$) is regarded as a MAJOR defect.

3.2. Ionic Contamination

The measurement method must be accordance with IPC-TM-650. All the batches of the Printed Boards delivered to IMI must be subjected to ionic contamination testing.

Test records for ionic contamination must be able to be presented to IMI covering a period of 6 months, when upon requested by IMI.

The maximum allowed residual pollution is $0.5 \mu\text{g}/\text{cm}^2$ (NaCl equivalent) for all surface treatment/surface finish except HASL where the maximum shall be $0.8 \mu\text{g}/\text{cm}^2$ (NaCl equivalent).

4. Ship To Stock (STS) Reception of the Printed Boards

4.1. Initialization of STS for Printed Boards

From the time that IMI deems that the Printed Boards delivered by the manufacturer/supplier can be put directly into store without receiving inspection (depending on satisfactory historical delivery quality data), the manufacturer/supplier will be informed officially of this decision (mail, fax, E-mail). The manufacturer/supplier will from then on, starting with the next delivery following this information, to identify all packaging of the printed circuits by a label "STS".

This label will be clearly visible (on the outside of the packaging), in black Arial font (ref. Microsoft Word), height of font to be minimum 50 (ref. Microsoft Word). Important: The application of STS relates only to the products mentioned in the official information sent by IMI. It does not apply to all Printed Boards delivered by the manufacturer/supplier to IMI.

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4.2. Withdrawal of the Application of STS

As with the initialization of STS, the possible withdrawal of STS for one or more products will be notified to the supplier in an official way (mail, fax, E-mail). From then on, and from the first delivery following the official information from IMI regarding withdrawal of STS, the manufacturer/supplier will have to withdraw all reference to STS from the packaging of the products concerned.

5. Packaging

5.1. Packaging Quality

The Printed Boards delivered to IMI must be packed in a way in which they cannot be damaged, and must be protected against humidity. There must, however, be a protective layer between the circuits and the outside package (bubble wrap etc). All packing must remain intact and preserve its original shape until its point of use, whatever the climatic conditions.

The principal conditioning and packaging of the printed circuits must be sufficiently robust so that they can be transported on pallets. The panels must be wrapped in thermoplastic film (except flexible circuits), and the Printed Boards be vacuum packed. Packaging must ensure that the Printed Boards are held in place and are kept flat throughout transportation. Packaging must be free of grease and/or marks of acid.

5.2. Loading

The weight of principal package should not exceed 10 kg. All packaging must be manageable and be able to be handled manually. Any palletized load should not exceed 800 kg, unless previously agreed with IMI. The height of the palletized loads should not exceed 1m.

5.3. Storage of Printed Boards

The storage of the Printed Board with the manufacturer/supplier must be carried out using thermoplastic film, in a temperature controlled room (20°C±5°C) with the level of humidity not exceeding 60%. The date codes of manufacture of the printed circuits which will be delivered to IMI should not be greater than 6 months old.

The manufacturer/supplier is requested to provide to IMI their expiry date commitment for the shelf-life expectancy for each surface finish type provided by the manufacturer/supplier. This document is required at the same time as the approval submission.

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Applicable Documents

Reference ID	Document Name
IPC-A-600	Acceptability of printed circuit boards
IPC-4761	Design Guide for protection of Printed Board Via Structures
J-STD-0201	Environmental Acceptance Requirements for tin whisker susceptibility of tin and tin alloy surface finishes
AEC Q 100	Failure mechanism based stress test qualification for integrated circuits
JEP122	Failure Mechanisms and Models for Semiconductor Devices
FMVSS 302	Federal Motor Vehicle Safety Standards and Regulations
IPC 6011	Generic Performance Specification of Printed Board
IPC-2221	Generic Standard on Printed Board Design
IPC-9252	Guidelines and requirements for Electrical Testing of unpopulated Printed Boards
JESD22-A110-B	Highly-Accelerated Temperature and Humidity Stress Test (HAST)
IMDS	International Material Data System
SMD J-STD-020	Moisture/Reflow Sensitivity Classification for Non-hermetic Solid State
IPC 6013	Qualification and Performance Specification for Flexible Printed Boards
IPC-6016	Qualification & Performance Specification for High Density Interconnect
IPC-6018	Qualification & Performance Specification for High Frequency Printed Boards
IPC 6015	Qualification & Performance Specification for Organic Multichip Module Mounting and Interconnecting Structures
IPC-6017	Qualification and Performance Specification for Printed Boards containing Embedded Passive Devices
IPC 6012	Qualification and Performance Specification for Rigid Printed Boards
IPC-SM-840	Qualification and Performance of Permanent Solder Mask
IPC 4556	Specification for Electroless Nickel/Electroless Palladium/Immersion Gold (ENEPIG) Plating for Printed Circuit Boards
IPC 4552	Specification for Electroless Nickel/Immersion Gold (ENIG)Plating for Printed Circuit Boards
IPC 4553	Specification for Immersion Silver Plating for Printed Circuit Boards

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IPC 4554	Specification for Immersion Tin Plating for Printed Circuit Boards
IPC-4101	Specification for Base Materials for Rigid and Multilayer Printed Boards
J-STD-003	Solder-ability Tests for Printed Boards
JS-001-2010	Standard for Electrostatic Discharge Sensitive Testing
JSTD033	Standard for Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices
UL 796	Standard for Printed-Wiring Boards
ISO 9455-17	Soft soldering fluxes - Test methods - Part 17: Surface insulation resistance comb test and electrochemical migration test of flux residues
IPC-TM-650	Test manual
IEC 61189-5	Test methods for electrical materials, interconnection structures and assemblies - Part 5: Test methods for printed board assemblies
JESD22-A121A	Test Method for Measuring Whisker Growth on Tin and Tin Alloy Surface Finishes
IPC-5701	User Guide for Cleanliness

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APPROVAL

(BLOCK CAPITALS)

Company name: _____

Job Title: _____

Your name: _____

Document read and approved

Or

Document read and approved with addendum

Signed: _____

Date: _____

The name of your SQE contact at IMI: _____

Within one month of receiving this document, please complete the above form, sign it and return a scanned copy by email or a hard copy by post to your SQE contact at IMI.

Any other comments should be sent to IMI in a separate Vendor Addendum.