1.0 PURPOSE and SCOPE

This document defines Axiom's requirements for printed circuit board (PCB) fabrication, handling, and storage. Industry standards are referenced where appropriate. This document covers the fabrication of PCBs used for SnPb and Pb-free soldering. Statements that use the word "shall" are mandatory. Statements that use the word "should" reflect industry best practice; their use is highly recommended but not mandatory.

2.0 APPLICATION

This procedure affects Engineering, Quality, and Procurement departments.

The Engineering Manager is the owner of this procedure.

3.0 DEFINITIONS

Refer to IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

4.0 ASSOCIATED DOCUMENTS

Generic Performance Specification for Printed Boards IPC-6011

Qualification Specification for Rigid Multilayer Printed Boards.....IPC-6012

Acceptability of Printed Boards..... IPC-A-600

Moisture Sensitive Devices..... AWI000029

Other industry standards and related documents are listed in Appendix A and referenced throughout this document

5.0 RECORDS

5.1 Refer to AOP000002 (Control of Records)

6.0 PROCEDURE

6.1 Deviation from Requirements

6.1.1 On occasion it may be necessary to deviate from these requirements. All requests to deviate from these requirements shall be submitted in writing to the Axiom buyer.

6.2 Reference Documentation (in descending order of precedence)

6.2.1 Purchase order

6.2.2 Design documentation (fabrication documents, Gerber/drill data, etc.).

6.2.3 Axiom Rigid Printed Circuit Board Fabrication Requirements

6.2.4 IPC-6011 Generic Performance Specification for Printed Boards

6.2.5 IPC-6012 Qualification and Performance Specification for Rigid Multilayer Printed Boards.

Note: Any data discrepancies shall be reported immediately to the Axiom buyer. No changes shall be made without prior written authorization from Axiom.

6.3 Agency and Country of Origin Marking Requirements

6.3.1 PCBs shall be marked with fabricators UL identification per UL796.

6.3.2 Flammability rating shall be 94V-O per UL94. Flammability rating shall be copper etched on the secondary side of the PCB. If this is not allowed by customer requirements it shall be added to the silkscreen.

6.3.3 The country of origin (i.e. made in xyz) shall be copper etched, preferably on the secondary side of the PCB. If this is not allowed by customer requirements it shall be added to the silkscreen.

6.3.4 PCB's manufactured in a foreign country (e.g. not the United States) shall be marked (made in xyz) with the Country of Origin in accordance with U.S. Government Regulations (19CFR; Part 134). Copper etching on the secondary side is preferred. If this is not allowed by customer requirements it shall be added to the silkscreen.

6.4 **Metal Foil Requirements**

6.4.1 Metal foils shall meet the requirements in IPC-4562 Metal Foil for PCB Applications.

6.5 **Laminate Requirements**

6.5.1 Laminates shall meet the requirements in IPC-4101 Specification for Base Materials for Rigid and Multilayer Printed Boards and/or IPC-4103 Specification for Base Materials for High Speed High Frequency Applications. Raw materials are moisture sensitive; they should be handled in accordance with IPC-1601 Printed Board Handling and Storage Guidelines.

6.6 **Solderable Surface Finish Requirements – Table 6.1**

6.6.1 Preferred, approved and not recommended surface finishes are listed in Table 6.1.

6.6.2 PCBs shall meet the solderibility requirements of J-STD-003 Solderibility Tests for Printed Boards.

6.6.3 Immersion Gold finishes shall meet the requirements specified in IPC-4556 Electroless Nickel Immersion Gold Plating for PCBs.

6.6.4 Immersion Silver finishes shall meet the requirements specified in IPC-4553 Immersion Silver Plating for PCBs.

Table 6.1 – Solderable Surface Finish Recommendations

Coating	Single Sided SMT with Thru-hole	Double Sided SMT with Thru-hole	Double sided SMT	Thru-Hole Only
Electrolytic gold	Not recommended	Not recommended	Not recommended	Not recommended
SnPb hot air solder leveling (HASL)	Approved	Approved	Approved	Approved
Immersion gold (ENIG)	Preferred	Preferred	Preferred	Preferred
Immersion silver (ImAg)	Preferred	Preferred	Preferred	Preferred
Immersion tin (ImSn)	Not recommended	Not recommended	Not recommended	Not recommended

Organic surface protection(OSP)	Approved	Approved	Approved	Approved

Notes:
1.) Preferred surface finishes are the first choice.
2.) Approved surface finishes are the second choice.

6.7 Solder Mask Requirements

6.7.1 Solder mask shall be liquid photo-imageable (LPI) matte finish or semi-matte finish on both sides of the PCB. Solder mask shall conform to IPC-SM-840 Permanent Solder Mask and Flexible Cover Materials. Color shall be green unless otherwise noted on the fabrication drawing or Axiom purchase order. Minimum solder mask thickness shall be 0.0076mm (0.0003") measured on a metal surface.

6.8 Thieving

6.8.1 Any proposed thieving to be added onto the outer layers to even the plating distribution must have written approval from Axiom. Thieving shall be at least 0.51mm (0.020") away from any feature. Partial thieving squares are not allowed. Exposed copper on PCB edges is not allowed.

6.9 Electrical Testing Requirements

6.9.1 All PCBs shall be electrically tested to ensure that all conductors are continuous and that no electrical connection has been made which is not indicated in the CAD data.

6.9.2 IPC-9252 Requirements for Electrical Testing of Unpopulated Printed Boards should be used as a reference.

6.9.3 Impedance requirements will be specified on the fabrication drawing. Single-ended and differential impedance measurements shall be made on fabricators coupons. Impedance testing is required an all panels within a work order. Results of the test to be provided with the shipment of boards, and retained electronically for at least 1 year.

6.9.4 Note – All ESD controlled areas shall meet the requirements called out in the ANSI ESD s20.20 document, "Protection of Electrical and Electronic Parts, Assemblies and Equipment."

6.10 Array X-Outs

6.10.1 X-Out is defined as a defective PCB that is part of an array of PCBs. Inspection and/or test has determined the X-Out PCB is defective.

6.10.2 Each X-Out PCB shall be marked in a manner that makes the X-Out obvious. Marking shall be indelible and on both sides of the PCB.

6.10.3 Arrays that contain X-Out PCBs shall be packaged separately and grouped by PCB location in the array. They shall not be mixed intermittently with arrays that have no X-Outs.

6.10.4 X-Outs per Array: the maximum number of x-outs allowed on each array. See Table 6.2 for specific quantities.

6.10.5 X-Out Arrays per Purchase Order (PO): the maximum percent of arrays allowed with at least 1 x-out. See Table 6.2 for specific percent's.

Table 6.2 – X-Outs Allowed per Array and per PO

PCBs per Array	**X-Outs per Array (*Maximum Number Allowed Per Array)***	**X-Out Arrays per PO *(Maximum Percent of Arrays Allowed with at Least 1 X-Out)***
2 to 3	1	20%
4 to 5	2	20%
6 to 10	3	20%
11 to 15	4	20%
16 to 20	5	20%
> 20	6	25%

6.11 Packaging Requirements

6.11.1 PCBs shall be shipped and stored in moisture barrier bags (MBB). The MBBs shall meet the requirements established in J-STD-033 Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices.

6.11.2 Desiccant shall be placed in each package of PCBs. Desiccant shall be sulfur free.

6.11.3 A humidity indicator card shall be placed in each package of PCBs.

6.12 Storage, Shelf Life, and Baking Recommendations – Table 6.2

6.12.1 PCBs are moisture sensitive devices and shall be handled as such. PCB shelf life is driven by moisture sensitivity (rather than surface finish aging). Unless noted otherwise by Axiom, PCB shelf life is manufacturing date code plus 12 months.

6.12.2 IPC-1601 Printed Board Handling and Storage Guidelines shall be used as a reference to establish shelf life and baking recommendations.

6.12.3 When a package is opened the PCBs can be used without baking if the humidity indicator card reading is less than 30%.

6.12.4 PCBs shall be baked according to Table 6.2 if:

6.12.4.1 The humidity indicator card reading is greater than 30%.

6.12.4.2 The package does not contain a humidity indicator card.

6.12.4.3 The PCBs were not stored in a moisture barrier bag.

6.12.4.4 The shelf life (Date Code plus 12 months) has been exceeded.

6.12.4.5 PCBs that are made of Polyimide and other moisture sensitive materials shall be baked within 48 hours of reflow soldering. Reference AWI000029 Moisture Sensitive Devices.

6.12.4.6 After a moisture barrier bag is opened all unused PCBs shall be resealed in a moisture barrier bag with desiccant and a humidity indicator card.

6.12.4.7 Regardless of storage conditions, PCBs older than 12 months shall be reviewed and dispositioned by Axiom Quality or Manufacturing Engineering.

Table 6.2 – PCB Baking Recommendations

Finish	Gap or Stack(1)	Bake Temperature	Bake Time
HASL and ENIG	Gap ≥3mm (0.120”)	125ºC (257º F)	4 hours
ImAg and OSP(2)	Gap ≥3mm (0.120”)	115ºC (239º F)	6 hours
HASL and ENIG	Stacked ≤50mm (2.0”)	125ºC (257º F)	6 hours
ImAg and OSP(2)	Stacked ≤50mm (2.0”)	115ºC (239º F)	8 hours

(1) Minimum gap between racked PCBs or maximum PCB stack height.
(2) OSP coated PCBs shall be re-coated after baking; only one recoat cycle is allowed.

6.13 Material Information

6.13.1 Information about laminates, B-stage and core materials, etc. shall be provided when requested by Axiom. The information shall be submitted to the Axiom buyer.

6.14 Fabrication Quality

6.14.1 Cross Section Reports shall be provided when requested by Axiom. Reports shall be submitted to the Axiom buyer. Cross section reports should contain the following:

6.14.1.1 Cross section pictures

6.14.1.2 Base copper thickness

6.14.1.3 Plated copper thickness (surface)

6.14.1.4 Plated copper thickness (smallest hole)

6.14.1.5 Dielectric thicknesses

6.14.1.6 Hole roughness

6.15 Archiving Information and Reports

6.15.1 Documents received with a shipment of PCB's shall be placed with the packing list and scanned into the customer's materials directory in DocuXplorer.

6.16 Applicable Documents – Appendix A

6.16.1 Unless otherwise noted in this document or in the Axiom purchase order these industry standards shall be used and followed.

APPENDIX A
IPC Reference Documents
Note: use latest revision

Document(1)	Document Name
J-STD-003	Solderibility Tests for Printed Boards
J-STD-033	Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices.
IPC-SM-840	Permanent Solder Mask and Flexible Cover Materials
IPC-A-600	Acceptability of Printed Boards
IPC-1601	Printed Board Handling and Storage Guidelines
IPC-7721	Repair and Modification of Printed Boards and Electronic Assemblies
IPC-4553	Immersion Silver Plating for PCBs
IPC-4556	Electroless Nickel Immersion Gold Plating for PCBs
IPC-4562	Metal Foil for Printed Board Applications
IPC-4101	Base Materials for Rigid and Multilayer Printed Boards
IPC-4503	Base Materials for High Speed High Frequency Applications
IPC-6011	Generic Performance Specification for Printed Boards
IPC-6012	Qualification and Performance Specification for Rigid Printed Boards
IPC-6016	Qualification and Performance Specification for High Density Interconnect (HDI) Layers or Boards
IPC-2615	Printed Board Dimensions and Tolerances
IPC-9252	Requirements for Electrical Testing of Unpopulated Printed Boards
IPC-2226	Sectional Design Standard for Hi-Density Interconnects
IPC 4761	Design Guide for Protection of Printed Board Via Structures
ANSI/ESD s20.20	Protection of Electrical and Electronic Parts, Assemblies and Equipment