SEWS Supplier PCB Standard

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Tabe of Contents

1. Introduction

1.1 Purpose

This document establishes the standard requirements for the design, fabrication, and inspection of printed circuit boards (PCBs) supplied to Sumitomo Electric Wiring Systems, ensuring compliance with automotive industry-recognized standards set by the IPC (Association Connecting Electronics Industries).

1.2 Scope

The scope of this document is to guide and provide PCB Suppliers with understanding and the expectation of SEWS PCB requirements. Any specific requirements agreed upon by

SEWS and Supplier for the product being produced will supersede and document the requirements defined by this standard.

1.2.1 Any changes to this document will be highlighted in blue color. The changes from previous revisions shall revert to **black**.

1.2.2 PCB Supplier is responsible for obtaining the latest version of all Supplier Engineering Standards (Https://sewsus.com/supplier-portal)

1.2.3 This document is used in conjunction with SQS-001.

2. Applicable Standards

All PCBs must comply with the latest revisions of the following standards:

Standard	Title
IPC-6011	Generic Performance Specification for Printed Boards
IPC-6012D	Qualification and Performance Specification for Rigid Printed Boards
IPC6012DA	Automotive Applications Addendum to IPC-6012D
IPC-A-600	Acceptability of Printed Boards
IPC-SM-840	Qualification and Performance Specification of Permanent Solder Mask and Flexible Cover Materials
IPC-4101	Specification for Base Materials for Rigid and Multilayer Printed Boards
IPC-4554	Specification for Immersion Tin Plating for Printed Circuit Boards
IPC-4555	Performance Specification for High Temperature Organic Solderability Preservatives (OSP) for Printed Boards
IPC-9252	Requirements for Electrical Testing of Unpopulated Printed Boards

Standard	Title
IPC-TM-650	Test Methods Manual

- PCB manufacturers shall always follow the most recent revisions of these standards and demonstrate compliance upon request.

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3. PCB Classification

All PCBs supplied must be at least at **IPC Class 2 or higher** requirements unless otherwise specified in PCB drawing.

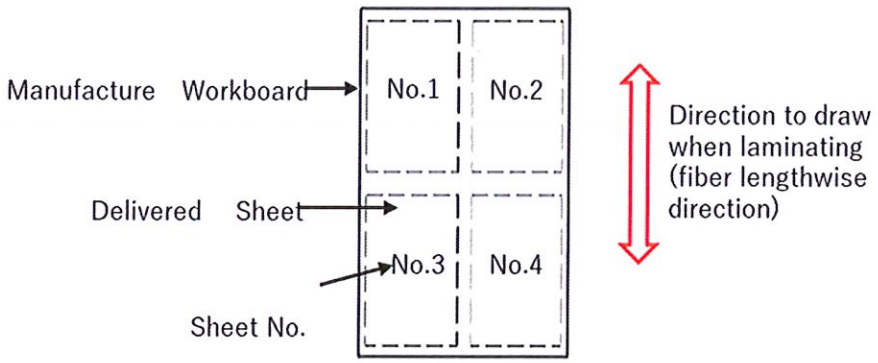
4. Material Requirements

- **Laminate & Prepreg**: Shall meet IPC-4101 and UL94-V0 flammability rating.
- **Temperature Range**: Operable from -40°C to 125°C.
- **Mid-Tg:** IPC-4101/99 (Tg 150°C or better) as defined by design requirements.
- **High-Tg materials**: IPC-4101/126 (Tg 170°C or better) as defined by design requirements.
- **Copper Foil Purity**: ≥ 99.5%, as per IPC-6012D.
- **Fiber Direction**
    - The supplier shall provide workboard details to Sumitomo Electric Wiring System as outlined below:
        1. Delivered sheet per workboard
        2. Pannel size
        3. Each delivered sheet location in workboard

4. Fiber lengthwise direction (Drawer direction at the time of laminating as a fiber lengthwise direction.)

Please attach workboard details and fiber lengthwise direction.

e.g.

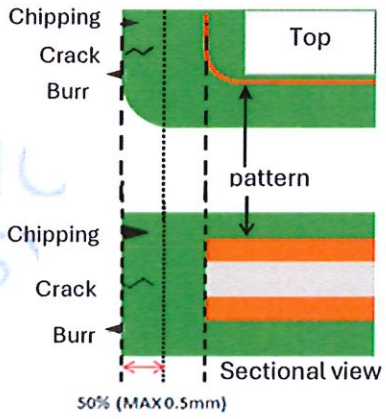


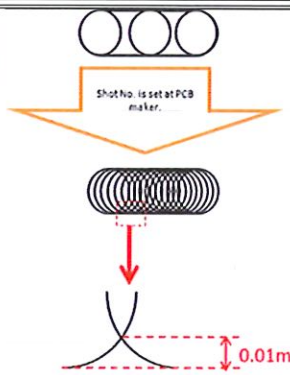
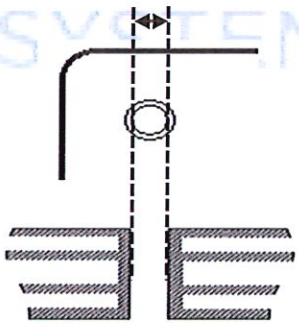
- **PCB Layer Structure**
  - PCB outline drawing shall define the Layer structure and other specific information (eg. Impedance control, LS/LW, etc..) if required.
  - **SEWS and PCB suppliers must consult to select the optimal layer structure to satisfy PCB design requirements.**

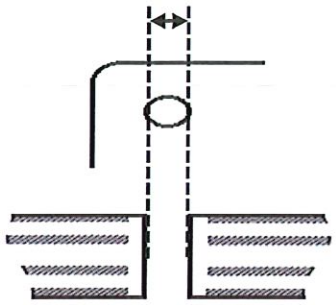
Silk Print		Silk-less	
4-layers	2-ayers	4-layers	2-ayers
Silk Solder mask Plated Copper Layer-1 PP Layer-2 Core Layer-3 PP Layer-4 Plated Copper Solder mask Silk	Silk Solder mask Plated Copper Layer-1 Core Layer-2 Plated Copper Solder mask Silk	Solder mask Plated Copper Layer-1 PP Layer-2 Core Layer-3 PP Layer-4 Plated Copper Solder mask	Solder mask Plated Copper Layer-1 Core Layer-2 Plated Copper Solder mask

- **Interlaminar reliability**
  - Shall follow and conform to IPC-A-6012 & IPC-A-600.

5. PCB Outline Tolerance

Parameter	Tolerance	Detail
Board Outline X ≤ 100mm X > 100mm	 ±0.10mm ±0.15mm	
Board Cutout & Process: **Delamination: Not allowed** **Chipping / Crack:** From a board edge(outline), 0.5mm or less, and less than ½ of the shortest distance between a board edge and the conductor. **Burr:** 0.1mm or less, and within the range of drawing dimensional tolerance.		 • Router processing is mandatory for cutouts.

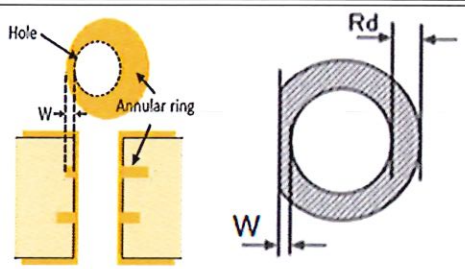
Parameter	Tolerance	Detail
Drill Hole Process		 **Drill data** from Sumitomo Electric Wiring System uses 3 points output for the long hole. (1 at the center, 2 at both ends) **PCB supplier** needs to make the smooth long hole without unevenness, the concave areas created by drilling shall be 0.01mm or less.
Hole Diameter (PTH) 0.25≤x≤2.00mm 2.0mm ≤ x	 ±0.05mm ±0.05mm	

Parameter	Tolerance	Detail
Hole Diameter (NPTH) 0.25 ≤x≤2.00mm 2.0mm ≤ x	 ±0.025mm ±0.025mm	
Hole Position	±0.10mm	
Pattern Feature Position	±0.10mm	
Hole to Hole X ≤ 150mm X ≥ 150mm	 ±0.10mm ±0.15mm	

Parameter	Tolerance	Detail

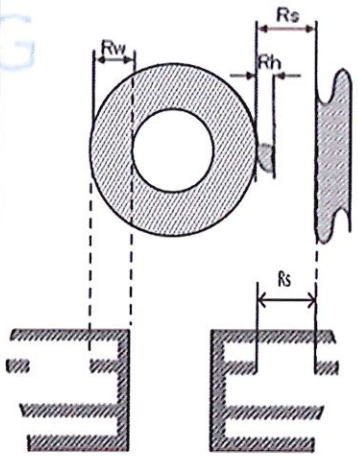
Annular Ring

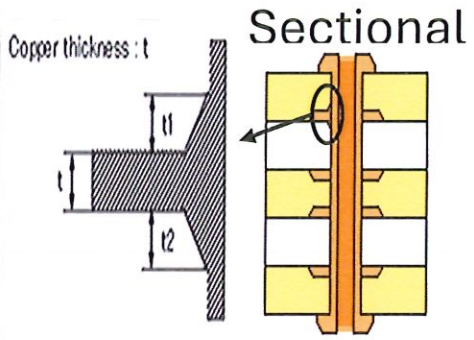
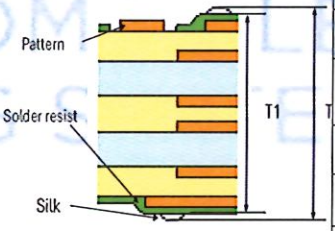
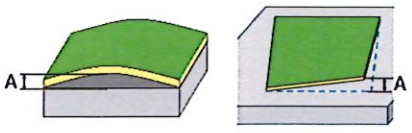
Annular Ring width (Rd).	Minimum annular ring(W).
Rd ≦ 0.3mm	W ≧0.02mm
0.3mm < Rd < 0.4mm	W ≧0.03mm
0.4mm ≦ Rd	W ≧0.05mm



Interval & Protrusion

Interval (Rs)	Gerber ±0.1mm
Protrusion (Rh)	



Parameter	Tolerance	Detail
Nail Head		
Thickness	±10% of nominal	 PCB Drawing shall define the desired Stack up selection.
Bow and Twist	X ≤ 0.75% (IPC-TM-650 2.4.22)	

T1	T2
	Silk Screen
Solder Mask	Solder Mask
Copper	Copper
Prepreg	Prepreg
Copper	Copper
Core	Core
Copper	Copper
Prepreg	Prepreg
Solder Mask	Solder Mask
	Silkscreen

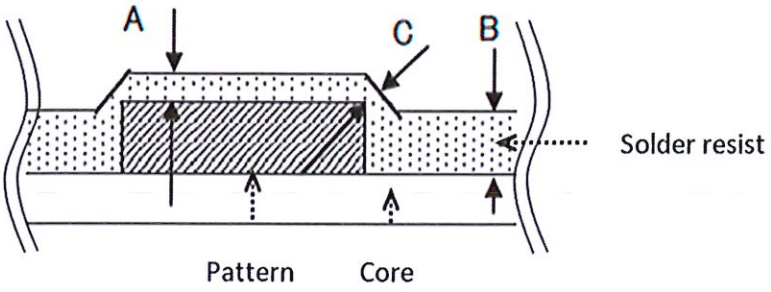
Note: If PCB drawing states otherwise, please follow PCB Drawing.

6. Plating ,Pattern, Etching and Surface Finish

- **Through-hole Plating**: Minimum 25µm of copper plating as per IPC-6012D.
- **Surface Finish Options**:
  - **Immersion Tin**: IPC-4554, thickness 1–100µm
  - **OSP (Organic Solderability Preservative)**: IPC-4555, thickness 0.2–0.5µm
- **Finish Shelf Life**: Minimum 6 months from application date.

7. Solder Mask

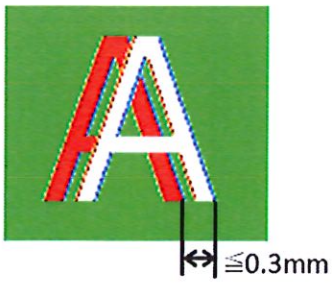
- **Specification**: Shall meet IPC-SM-840 Class T & H
  - Pcb supplier is required to provide evidence (upon request) of all testing and evaluation performed in accordance with IPC TM 650.
- **Approved Product Example**: Taiyo PSR-4000 Series (Automatic Screen Print)
  - Selected material shall be confirmed in the PCB drawing and ETQ.
- **Color**: Green Matte (unless otherwise specified)
- **Thickness**: shall be checked and confirmed as per IPC-TM-650, (Method 2.1.1 or Method 2.1.1.2.) Supplier(s) must provide Microsection report(s) as evidence to SEWS.
  - Over pattern: ≥25µm
  - Over laminate: 25~65µm
  - Over edge: ≥15µm



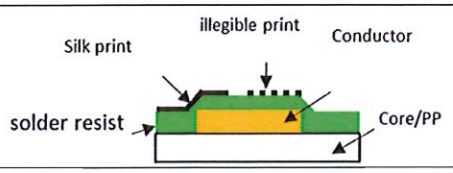
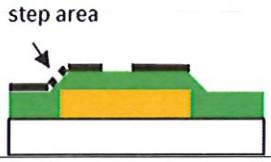
- **Adhesion Strength :** No peeling (tested per IPC-TM-650 2.4.28.1).
- **Durability:** Pencil hardness ≥ 4H
- **Appearance:** Matte

8. Silkscreen

- **Ink Type:** Thermosetting (e.g., TAIYO S-200W)
- **Color:** White, Black
- **Minimum Line Width:** 0.18mm
- **Misalignment:** ≤ 0.3mm
    - Red: Position of Gerber data.
    - White: Position of workmanship



- **Hardness:** ≥ 4H
- **Prohibited Areas:** Pads, barcode areas, thin copper traces

Prohibition	illegible print	
	illegible print of the step area in copper pattern.	

- **Foreign Substance**: Contamination of foreign substances is prohibited.
- **Adhesion Strength**: Shall follow IPC-TM-650 section 2.4.1.

9. Electrical Testing

- Must conform to IPC-9252 and IPC-6012D Class 2:
  - **Continuity:** ≤ 50 Ω
  - **Isolation Resistance:** ≥ 10 MΩ
  - **Test voltage:** ≥ 250V
- 100% electrical testing required for each board and each net.

10. Insulation Resistance

- Ionic contamination < 1.56 µg NaCl/cm^2 (IPC-6012D).
- MIR (Moisture & Insulation Resistance) ≥ 500 MΩ.
- Results required in PPAP.

11. Inspection Requirements

- Visual Inspection: 100% AVI (Automated Visual Inspection)
- AOI: Mandatory for all layers
- Final Appearance: Must satisfy IPC-A-600
- Results must be traceable and available on request

12. Repair & Rework

- All repairs and reworks must be recorded.
- No pattern additions allowed; pattern cutting only.
- OSP **re**-application is **not allowed**.
- Solder mask repair must meet original thickness and criteria.
- Supplier must provide full detailed report of rework record upon request.

13. Packaging & Marking (Comply with SEWS Corporate QA Standard) (https://sewsus.com/supplier-portal)

- **Packaging**: Vacuum-sealed with desiccant; packed in anti-static boxes for transport.
- **Marking**: Must include lot number, position ID, date code. No marking on pads or vias. (to be confirmed via ETQ's)
- **Labeling of PCB**: Must include SEWS PN, supplier PN, quantity, surface finish date, and barcode if applicable. (to be confirmed via ETQ's)

14. Documentation Requirement

- **Communication**

From SEWS To Supplier: Via email or Secure File Transfer

  - Design Release Packet(pdf)
  - Official PCB Drawing (Signed and Approved PDF from SEWS Engineering)
  - Gerber Data

From Supplier to SEWS: Via E-mail or Secure file transfer

  - Confirmation of Receipt (Supplier has received the Data successfully)
  - Engineering Technical Queries -ETQ (MS,Excel)
  - Confirmation of ETQ closed. (via email)

- **Engineering Technical Queries:**

- All technical queries shall be issued with respect to the PCB part number defined in the drawing and Gerber data.
- Supplier shall not state similar answered questions referenced from other projects.
- Technical Queries must be concise and clear to understand.

- Note: Supplier shall fabricate PCB according to the Gerber Data and PCB Drawing provided by SEWS.
- **PPAP documentation:** (As per **SEWS Corporate QA Standard**) **(https://sewsus.com/supplier-portal)**

15. Appendix 1: Individual Specifications document for special request on Hole dimensions

1. **General**

a). The PCB outline drawing defines the PCB relays and terminals holes dimensions for special request on Hole dimensions.

16. Appendix 2: Reliability testing

1. **General**

a). The PCB supplier must notify SEWS of all changes in material, production processes, etc. (which affect SEWS products) prior to any products being manufactured. Supplier and SEWS shall discuss and determine which test items shall be performed. SEWS approval is required before any change is implemented.

b) . SEWS requires PCB supplier to provide Reliability report of the laminate material with respect to the tests listed in the chart below. PCB supplier must notify SEWS if any of the tests cannot be performed and provide explanation.

2. **Reliability test items:**

＊1. Measure before and after the test and confirm changes in characteristics. (1: Peeling test of copper foil, 2: Stress-resistance of a through hole).

＊2. In addition to *1, no crack on a through hole up to 1000 cycles.

＊3. Shift from a condensation test to a functioning test at high temperature and high humidity promptly, then start the test after wiping off the waterdrops on the resist coated surface. (Wipe off only front and back. Do not wipe off the sides).

＊4. Only insulation resistance measurement shall be performed by 2 patterns as follows; (1) Measure it immediately after the test, (2) Measure it within 1 (one) hour after finishing the test.

＊5 Carry out tests with two kinds of samples varying in the fiber direction. (2 patterns * N3)

No	Item	Condition	Criteria	Method	Note		Sample Amount	
1	Peeling test of copper foil (Both sides)	Measure at RT. for 10sec. 260 deg C. flow soldering	≧11.7N/cm (1.2Kg/cm)	JIS C 5012-8.1			3	Actual
2	Stress-resistance of a through hole	Solder a wire to a through hole and measure the pulling-out strength. (For land on both sides)	≧98N（10Kgf）	JIS C 5012-8.3 Three through holes with inner diameters of MAX, MID, MIN must be selected and measured.			3	Actual
3	Solderability	①Dry at 120℃ for 2 min ②Apply flux ③Flow soldering at 245±5deg for 3 sec	≧90% solder (surface) ≧90% solder (Height of TH)	JIS C 5012-10.3			3	Actual
4	High Temp Exposure	125℃, 1000Hr	Conductivity change ≦±20%	JIS C 60068-2-2	*1		3	Actual
5	Low Temp Exposure	−40℃, 1000Hr	Conductivity change ≦±20%	JIS C 60068-2-1	*1		3	Actual
6	High temperature and high humidity Exposure	60℃, 90%RH, 1000Hr	Conductivity change ≦±20% Insulation resistance ≧500MΩ	JIS C 60068-2-78 Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage.)	*1	*4	3	Actual
7	Functioning at high temperature and high humidity	Perform a functioning test at high temperature and high humidity after the condensation test (*3). −5℃2hr⇔35℃85%RH10min 70cycle(Condensation test) 85℃, 85%RH, 1000Hr, DC30V(Migration tes)	Conductivity change ≦±20% Insulation resistance ≧500MΩ	JIS C 60068-2-78 Measure the insulation resistance within one hour after the examination end. Monitor the insulation resistance during the test. (No insulation breakdown> 1MΩ)	*1	*4 *5	3	Actual
8	(Cold) Thermal shock	−65℃(30 min) ⇔ 125℃(30 min) 1000 cycles	Conductivity change ≦±20%	JIS C 5012-9.2	*2	*5	3	Actual
9	Oil resistance	260℃(10sec) silicone oil ⇔20℃(10sec) 50 cycles	Conductivity change ≦±20%	JIS C 5012-9.3	*1	*5	3	Actual
10	PCT Pressure Cooker Test	121℃, 97%RH, 2atm, 100Hr	Conductivity change ≦±20% Insulation resistance ≧500MΩ	Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage)	*1	*4 *5	3	Actual
11	Boiling test	Boil water for 2 hrs ⇔ at RT for 22 hrs, 4 cycles	Conductivity change ≦±20% Insulation resistance ≧500MΩ	Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage)	*1	*4	3	Actual
12	Drop test	コンクリート上1mから落下、6面 Drop onto the concrete floor from 1m in height. 6 directions	Insulation resistance ≧500MΩ	Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage)	*1		3	Actual
13	Salt Mist	5%-NaCl, 35℃, 96Hr	Conductivity change ≦±20% Insulation resistance ≧500MΩ	JIS C 60068-2-11 Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage)	*1	*4	3	Actual
14	Humidity cycle	JIS C 60068-2-38, 10 cycles	Conductivity change ≦±20% Insulation resistance ≧500MΩ	JIS C 60068-2-38 Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage)	*1	*4	3	Actual
15	Soldering heat resistance	260℃, 20sec	Conductivity change ≦±20% Insulation resistance ≧500MΩ No Measling or Delamination.	JIS C 5012-10.5 Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage)		*4 *5	3	Actual
16	Bending	Bend 5% to the longer dimension, and release. 100 cycles	Insulating resistance ≧500MΩ No crack or delamination	Measure the insulation resistance within one hour after the examination end. (Conform to the table "A" below for the measurement voltage.)		*5	3	Actual
17	Withstand Voltage	Apply voltage for 1min, based on table B below	No short circuit	JIS C 5012-7.5 JIS C 5012-7.6		*5	3	Actual
18	Solvent resistance	Dip in IPA for 5 min.	Noo resist lifting or delamination.	JIS C 5012-10.2 JIS C 5012-8.6	*1		3	Actual

17. Revision Control

This document is monitored by SEWS INC., Engineering and reviewed on a periodic basis or as standards are updated. It is the responsibility of the suppliers to obtain and comply with the latest version of this document.

Ver. No.	Date	Revised by:	Content of revision:	Approved by:
0	06/27/2025	E.Kadi, Guan.Li	Initial Document Release	V.Singh
1	3/23/2026	J. Godsey	Controlled by ED	M. DeWeese