Management Specification for Shipping, Storage and Transportation of PCB Products

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1. Purpose

This specification standardizes the whole-process operation of storage, shipping and transportation of self-produced PCB finished products, semi-finished PCB products and outsourced PCB products of the company. It aims to prevent quality abnormalities such as moisture oxidation, static damage, surface scratches, board deformation, material mixing, contamination and damage of PCB products during warehousing, circulation and delivery. It ensures compliant product storage conditions, standardized shipping procedures, safe and stable transportation and delivery, guarantees high-quality product delivery to customers, and meets the requirements of the quality management system and customer audits.

2. Scope of Application

This specification applies to the on-site storage, warehousing management, outbound loading, shipment, logistics transportation, in-transit protection and arrival handover of all self-produced finished PCBs, incoming-inspection semi-finished PCBs and outsourced incoming PCB products of the company. It covers the Warehouse Department, Production Department, Logistics Department, Quality Department, all relevant operators and cooperative logistics suppliers.

3. Responsibility Division

3.1 Warehouse Department

Responsible for incoming inspection and acceptance of PCB products, classified and zoned storage, warehouse environment control, daily inventory protection and account registration management; responsible for outbound product verification, stock preparation, loading assistance and 5S management of warehouse areas, implementing standardized product storage operations, and timely eliminating potential safety and quality hazards in warehousing.

3.2 Logistics Department

Responsible for the selection, evaluation and management of logistics suppliers, transportation vehicle scheduling, shipment scheme formulation and on-site loading supervision; responsible for tracking product transportation status, handling transportation abnormalities, arrival docking and logistics document filing, ensuring full-process controllability and traceability of transportation.

3.3 Quality Department

Responsible for supervising the compliance of quality control in product storage, shipping and transportation links; conducting random inspection and verification on warehouse environment, packaging protection, loading specifications and transportation protection measures; judging, tracing and following up the rectification of product quality abnormalities occurring in the process.

3.4 Production Department

Responsible for compliant packaging and label pasting of finished PCB products, cooperating with warehouse incoming and loading operations, ensuring that factory-delivered products have intact packaging and accurate information and meet the pre-requirements for storage and shipment.

3.5 Logistics Suppliers

Shall strictly implement product transportation, loading and unloading, and in-transit protection operations in accordance with the requirements of this specification, ensure compliant transportation vehicles and safe transportation process, complete product delivery on time and in good condition, and cooperate with the company in abnormality verification and reconciliation and delivery work.

4. PCB Product Storage Management Specification

4.1 Basic Storage Requirements

All PCB products can be stored in the warehouse only after passing inspection by the Quality Department, being affixed with qualified labels and completing vacuum moisture-proof packaging. Under-inspected PCBs, unqualified PCBs, reworked PCBs and qualified finished PCBs must be stored in separate zones and shelves with clear identification signs, and mixing of different materials is strictly prohibited to ensure consistency of accounts, materials and cards. The storage of all PCB products shall follow the principles of "light on top, heavy at bottom, neat arrangement, first-in-first-out, anti-static and anti-extrusion". Over-height, over-width and over-weight stacking is forbidden to avoid plate deformation caused by compression.

4.2 Warehouse Environment Control

The warehouse shall be dry, ventilated, clean, dark, corrosion-free, dust-free and free of static interference. Stacking of flammable, explosive, corrosive and polluting articles is prohibited to prevent dust and oil stains from adhering to PCB surfaces. The standard storage environment for PCB products is controlled at a temperature of 18℃-28℃ and a relative humidity of 40%-60% to avoid copper foil oxidation, surface moisture and substrate whitening of PCBs caused by high humidity. All PCB products shall be independently sealed in vacuum packages with built-in desiccants and moisture-proof bags. High-precision PCBs, multi-layer PCBs and ultra-thin PCBs shall be additionally equipped with anti-static bags and buffer protective accessories. Warehouse floors and shelves shall be treated with anti-static measures. Regular cleaning and disinfection shall be carried out to prevent product pollution by mosquitoes and rodents and avoid residual stains and scratches on board surfaces.

4.3 Stacking Standards

PCB products must be stacked on anti-static shelves or special anti-static pallets. Direct floor stacking of bare PCB boards is strictly prohibited. The stacking height of standard packaged full-box PCBs shall not exceed 1.2 meters. Ultra-thin PCBs, high-precision dense PCBs and sample products are forbidden to be stacked and must be stored in single-layer flat placement or special vertical storage. PCB products on pallets shall be placed in the center with uniform stress and no overhanging or tilting edges to prevent plate warping, delamination and deformation caused by local compression. Shelf storage shall strictly distinguish specifications, batches and layers, with large full-box PCBs placed at the bottom and small sample and precision PCBs at the top to avoid extrusion and collision.

4.4 Inventory Protection and Maintenance

Warehouse personnel shall inspect the inventory status of PCB products daily, focusing on checking the integrity of vacuum packages, air leakage, moisture, damage, surface oxidation, scratches and deformation, and record warehouse temperature and humidity data daily for filing and inspection. Regular inspection and ventilation shall be carried out for PCB products stored for a long time, and failed desiccants and moisture-proof accessories shall be replaced in a timely manner. Labels of product batches, part numbers, specifications and quantities shall be kept clear and complete, and blurred or fallen labels shall be reprinted and pasted immediately. Unauthorized opening of PCB vacuum packages and random movement of PCB storage areas are prohibited, and mixing of PCB products of different batches and customers is forbidden.

5. PCB Product Shipment Management Specification

5.1 Pre-Shipment Verification

Before outbound shipment of PCB products, the Warehouse Department, Quality Department and Logistics Department shall complete triple verification: verify that the batch, part number, specification, layer count and quantity of PCB products are consistent with the outbound order and customer order; verify that the vacuum and anti-static packaging of PCBs are intact with complete labels and no quality defects such as surface scratches, oxidation and deformation; verify that moisture-proof and anti-static protection measures are in place without moisture, damage or contamination. PCB products with damaged packaging, missing protection, no labels or inconsistent information are prohibited from outbound shipment.

5.2 Loading Packaging Protection

All PCB products must be kept with complete vacuum moisture-proof and anti-static packaging before shipment, and bare board loading and transportation are strictly prohibited. Full-box PCB products shall have tightly sealed cartons and fastened packing belts, with buffer pearl cotton and bubble film filled inside the boxes to prevent friction and surface scratches of boards caused by shaking in the box. Precision multi-layer PCBs, ultra-thin PCBs and sample products shall be individually packaged with additional corner protectors and shockproof buffer materials to focus on protecting corner damage and

plate deformation. PCB products of different customers, batches and specifications shall be packaged separately and placed in isolation with obvious distinguishing labels to avoid mixed loading and wrong delivery.

5.3 Loading Operation Specifications

Loading operators shall wear anti-static gloves and handle products with care. Throwing, dragging, impacting and extruding PCB products are strictly prohibited to prevent surface scratches, board delamination and deformation caused by rough loading and unloading. Loading shall follow the principles of "heavy at bottom, light on top, full at bottom, scattered on top and stable and symmetrical placement". Large full-box PCBs shall be placed at the bottom of the carriage, and scattered samples and precision small PCBs on the upper layer. All products shall be arranged closely and neatly without looseness or overhanging shaking to avoid board friction and collision damage caused by transportation bumps. After loading, the cartons shall be fixed with binding belts and buffer pads to fill gaps and prevent displacement and extrusion of cartons.

5.4 On-Site Shipment Control

The whole loading process shall be supervised by special personnel from the Logistics Department and Warehouse Department, and the Quality Department shall conduct random inspection on the compliance of PCB product protection and loading. The operation site shall be kept clean, dry, dust-free and oil-free. Open-air unprotected loading is prohibited in rainy, high-humidity and dusty weather. For shipment in special weather, a protective shed must be built with rainproof, moisture-proof and dust-proof measures to prevent moisture from entering the PCB packaging. After loading, the quantity, batch, part number and order information of PCB products shall be verified and confirmed before signing for confirmation and keeping loading records.

6. PCB Product Transportation Management Specification

6.1 Transportation Vehicle Requirements

All transportation vehicles shall be in good condition with clean, dry, odorless, oil-free, dust-free carriages free of corrosive residues, and have intact closed structures with rainproof, dust-proof, moisture-proof, shockproof and anti-static transportation conditions. All PCB products must be transported by closed van trucks. Open-top vehicles and shabby and dirty vehicles are strictly prohibited for PCB transportation to avoid moisture, dust, rain and sunlight exposure during transportation. The Logistics Department shall inspect the dryness, cleanliness and tightness of vehicles before each departure, and unqualified vehicles are forbidden for carriage.

6.2 In-Transit Protection Requirements

Logistics suppliers shall drive stably during transportation, avoiding rapid acceleration, sudden braking, severe bumps and sharp turns to prevent violent shaking and extrusion deformation of PCB cartons. Full-time rainproof, sun-proof, moisture-proof, shockproof and anti-extrusion protection shall be implemented, and direct sunlight and water ingress and moisture of the carriage are prohibited. For

long-distance transportation of PCB products, carriers shall inspect the fixing and sealing status of cartons midway and handle potential risks such as looseness and damage in a timely manner. Mixing transportation of PCB products with flammable, explosive, corrosive, humid and odorous goods is strictly prohibited to avoid board contamination, oxidation and corrosion.

6.3 Transportation Tracking and Abnormality Handling

The Logistics Department shall track the whole transportation progress of PCB products, grasp the real-time vehicle location and transportation status, and synchronize delivery and arrival information to relevant departments and customers in a timely manner. In case of transportation abnormalities such as traffic jams, delays, carton damage, package air leakage and product moisture or loss, the Logistics Department shall immediately contact logistics suppliers to identify causes, take remedial measures, report to the company, complete abnormality records, trace problems and close rectification loops to prevent the outflow of batch PCB quality abnormalities.

6.4 Arrival Handover Specifications

After the arrival of PCB products at the destination, the carrier shall cooperate with the customer in unloading, counting and acceptance. Both handover parties shall verify the batch, part number, quantity, packaging integrity and board surface status of PCB products, and sign handover documents after confirming no moisture, deformation, scratches or damage. In case of arrival problems such as damaged and air-leaking packages, board deformation, surface scratches, moisture oxidation, shortage and wrong delivery, records and photos shall be taken on site to clarify responsibility, followed up by claims, replenishment and rectification. All logistics documents and handover records shall be filed uniformly and retained for no less than 3 years.

7. Violation Management and Assessment

All operators and cooperative logistics suppliers shall strictly abide by the provisions of this specification. Illegal storage, rough loading and unloading and irregular transportation are prohibited to prevent PCB quality problems such as moisture damage, static damage, surface scratches and board deformation. Personnel responsible for quality abnormalities, scrapping and delivery delays of PCB products caused by improper operation and inadequate control, as well as cooperative parties, shall be held accountable in accordance with company management systems and logistics cooperation agreements for punishment and claims. Regular inspections shall be conducted on the whole process of PCB warehousing, shipment and transportation, and special rectification training shall be carried out for recurring protection problems.

8. Document Management and Continuous Improvement

This specification is a special regular management document for PCB products of the company, centrally managed, updated and interpreted by the Administration/System Department. All departments shall strictly implement it, regularly summarize quality problems in PCB storage, shipment and transportation, and continuously optimize the protection and control process and

improve anti-static, moisture-proof and anti-deformation protection measures in combination with PCB industry control standards, special customer requirements and actual operation conditions, so as to comprehensively improve the circulation and delivery quality of PCB products.

9. Supplementary Provisions

This specification shall take effect from the date of issuance. Any previous relevant provisions on product storage, shipment and transportation that are inconsistent with this document shall be subject to this specification.