IPC-4555

Performance Specification for High Temperature Organic Solderability Preservatives (OSP) for Printed Boards

Developed by 4-14E Final Finishes for Printed Boards – OSP Task Group of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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1.0 SCOPE

This performance specification sets requirements for High Temperature Organic Solderability Preservatives (OSP-High Temperature) for Pb-free soldering. It is intended for use by chemical suppliers, printed board manufacturers, electronics manufacturing services (EMS) and original equipment manufacturers (OEM).

1.1 Purpose This standard may be used to specify acceptance criteria to meet performance requirements in addition to those found in the IPC-6010 family (IPC-6011, IPC-6012 and IPC-6013) of standards. The OSP deposit specified by using this document will meet the highest coating durability rating for OSP as specified in the J-STD-003 printed board solderability specification.

This specification is based on three critical factors:

1.1.1 The OSP coating process is in control producing a normal distribution for organic film coating thicknesses.

1.1.2 That the tool used to measure the deposit and therefore control the process is accurate and reproducible for the thickness range specified.

1.1.3 That the OSP process results in uniform deposit characteristics.

If any of these three critical factors are not met, then the deposit produced will not meet the performance criteria defined herein.

1.2 Feature Size for Thickness Measurement This performance specification has been generated based on a deposit thickness measured ONLY on feature sizes per each supplier's procedure. Measurement of non-standard feature sizes and/or a combination of different feature sizes will prevent compliance to the statistical requirements of this specification. Requirements to measure non-standard sized features is AABUS and the supplier of the printed board is not responsible for the performance of the deposit as specified in this document.

1.3 Description OSP is an organic containing coating that is applied directly to a bare copper surface. It is a single use surface finish typically used for soldering. It may be used in conjunction with gold, both electrolytic gold and ENIG/ENEPIG. In such cases use of a so-called selective OSP is necessary to avoid formation of OSP deposits on the gold surfaces. The OSP layer protects the underlying copper from oxidation. Some OSP processes have been validated for use with press fit applications (IPC-9797).

1.4 OSP Chemical Descriptions: High Temperature OSP processes are compatible with the higher temperatures of lead-free assembly.

OSP processes (for higher temperatures of lead-free assembly) are typically acidic and the main functional material is a nitrogen containing organic molecule. Each supplier of the OSP process **shall** ensure that its particular formulation is compatible with lead-free assembly. It is the function of the OSP coating to minimize oxygen penetration to the base metal during multiple thermal excursions.

1.5 Classification

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically, the end-use environment would not cause failures.

CLASS 3 High Performance/Harsh Environment Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment **shall** function when required, such as life support or other critical systems.

1.6 Measurement Units This Standard uses International System of Units (SI) units per ASTM SI10, IEEE/ASTM SI 10, Section 3 [Imperial English equivalent units are in brackets for convenience]. The SI units used in this Standard are millimeters (mm) [in] for dimensions and dimensional tolerances, Celsius (°C) [°F] for temperature and temperature tolerances, grams (g) [oz] for weight, and lumens (lm) [footcandles] for illuminance.

Note: *This Standard uses other SI prefixes (ASTM SI10, Section 3.2) to eliminate leading zeroes (for example, 0.0012 mm becomes 1.2 µm) or as an alternative to powers-of-ten (3.6 x 103 mm becomes 3.6 m).*

1.7 Definition of Requirements The words **shall** or **shall not** are used in the text of this document wherever there is a requirement for materials, preparation, process control or acceptance. The word "should" reflects recommendations and is used to reflect general industry practices and procedures for guidance only. Line drawings and illustrations are depicted herein to assist in the interpretation of the written requirements of this Standard. The text takes precedence over the figures.

1.8 Process Control Requirements The primary goal of process control is to continually reduce variation in the processes, products, or services to provide products or processes meeting or exceeding User requirements. Process control tools such as IPC-9191, JESD557 or other User-approved system may be used as guidelines for implementing process control.

Manufacturers of Class 3 products **shall** develop and implement a documented process control system.

A documented process control system, if established, **shall** define process control and corrective action limits. For Class 1 and 2 products, the use of "statistical process control (SPC)" **shall** be optional and should be based on factors such as design stability, lot size, production quantities, and the needs of the manufacturer. See paragraph 4.6.2 for the quality assurance section regarding SPC.

Process control methodologies **shall** be used in the planning, implementation and evaluation of the manufacturing processes used to produce soldered electrical and electronic assemblies. The philosophy, implementation strategies, tools and techniques may be applied in different sequences depending on the specific company, operation, or variable under consideration to relate process control and capability to end product requirements.

When a decision or requirement is to use a documented process control system, failure to implement process corrective action and/or the use of continually ineffective corrective actions be grounds for disapproval of the process and associated documentation..

1.9 Order of Precedence The contract **shall** take precedence over this Standard, referenced standards and drawings.

In the event of conflict, the following order of precedence applies:

1) Procurement as agreed and documented between customer and supplier.

2) Master drawing reflecting the customer's detailed requirements.

3) When invoked by the customer or per contractual agreement, this standard.

When documents other than this standard are cited, the order of precedence **shall** be defined in the procurement documents.

The User has the opportunity to specify alternate acceptance criteria.

1.9.1 Conflict In the event of conflict between the requirements of this standard and the applicable drawing(s) and documentation, the applicable user-approved drawing(s) and documentation govern.

Some examples of documentation include the contract, purchase order, technical data package, engineering specification or performance specification. In the event of a conflict between the text of this standard and the applicable documents cited herein, the text of this standard takes precedence. In the event of conflict between the requirements of this standard and drawing(s) and documentation that has not been user approved, this standard governs.

1.9.2 Clause References When a clause in this document is referenced its subordinate clauses apply, unless the requirement references specific subordinate clauses.

1.9.3 Appendices Appendices to this standard are not binding requirements unless separately and specifically required by this standard, the applicable contracts, assembly drawing(s), documentation or purchase orders.

1.9.3.1 Appendix A Abbreviations and Acronyms

1.9.3.2 Appendix B Coating Thickness of OSP

1.10 Use of "Lead" For readability and translation, this document uses the noun lead only to describe leads of a component. The metallic element lead is always written as Pb.