IPC-J-STD-003D

Solderability Tests for Printed Boards

Developed by the Printed Circuit Board Solderability Specifications Task Group (5-23a) of the Assembly and Joining Committee (5-20) of IPC

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IPC-S-803
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Users of this publication are encouraged to participate in the development of future revisions.

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1 SCOPE

This standard prescribes test methods, defect definitions, and illustrations for assessing the solderability of printed board surface conductors, attachment lands, and plated-through holes (PTHs). This standard is intended for use by both user and supplier.

This standard is not intended to verify the potential of successful processing at assembly or to evaluate design impact on wettability. This standard describes procedures or methods to determine the acceptable wettability of a surface finish. Wettability can be affected by handling, finish application, and environmental conditions.

1.1 Purpose This standard describes solderability determinations that are made to verify that the printed board fabrication processes and subsequent storage have had no adverse effect on the solderability of those portions of the printed board intended to be soldered. Reference coupons or representative portions of a printed board may be used. Solderability is determined by evaluation of a test specimen which has been processed as part of a panel of boards and subsequently removed for testing per the method selected.

1.2 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 must function when required, such as life support or other critical systems.

The coating durability rating of the surface finish to be tested for solderability as per this document is NOT related to the classification product as detailed above. The default coating durability rating is 2 for surface finishes containing Pb and A for Pb-free and all other surface finishes. It is noted that these default coating durability ratings do not requires stressing prior to solderability testing.

This standard relies on input from participants in standards development and the IPC-4500 family of printed-board-surface finish documents to determine the durability rating potential for each specified finish. This document and the appropriate IPC-4500 family of documents should be considered complimentary to one another.

1.3 Measurement Units All dimensions and tolerances in this specification are expressed in hard SI (metric) units and bracketed soft imperial [inch] units. Users of this specification are expected to use metric dimensions. All dimensions $\geq$ 1 mm [0.0394 in] will be expressed in millimeters and inches. All dimensions < 1 mm [0.0394 in] will be expressed in micrometers and microinches.

1.4 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.

1.5 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.

This may or may not be a statistical process control system. The use of “statistical process control” (SPC) is optional and should be based on factors such as design stability, lot size, production quantities, and the needs of the Manufacturer, see Section 7 Statistical Process Control.

Process control methodologies should 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 **shall** be grounds for disapproval of the process and associated documentation.

1.6 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.

1.6.1 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.

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

1.6.3 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.

1.6.3.1 Appendix A Acryonyms and Abbreviations

1.6.3.2 Appendix B Calculation of Maximum Theoretical Force for a Rectangular Cross-Section

1.6.3.3 Appendix C Calculation of Area under the Wetting Curve

1.6.3.4 Appendix D Calculation of Correction for Buoyancy

1.6.3.5 Appendix E Test Protocol for Wetting Balance Gauge Repeatability and Reproducibility (Gauge R&R) Using Copper Foil Coupons

1.6.3.6 Appendix F J-STD-002/J-STD-003 Activated Solderability Test Flux Rationale Committee Letter

1.7 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.

1.8 Abbreviations and Acronyms Periodic table elements are abbreviated in the standard. See Appendix A for full spellings of abbreviations (including elements) and acronyms used in this standard.

1.9 Terms and Definitions Other than those terms listed below, the definitions of terms used in this standard are in accordance with IPC-T-50.

1.9.1 Contact Angle, Soldering The angle of a solder fillet that is enclosed between a plane that is tangent to the solder/basis-metal surface and a plane that is tangent to the solder/air interface (see Figure 1-1).

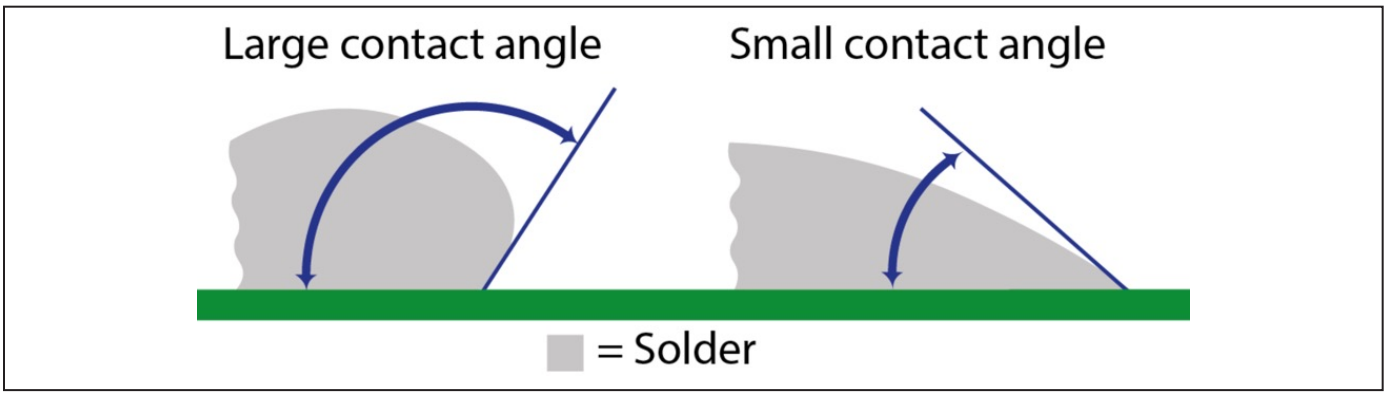

Figure 1-1 Contact Angle