

IPC J-STD-006C

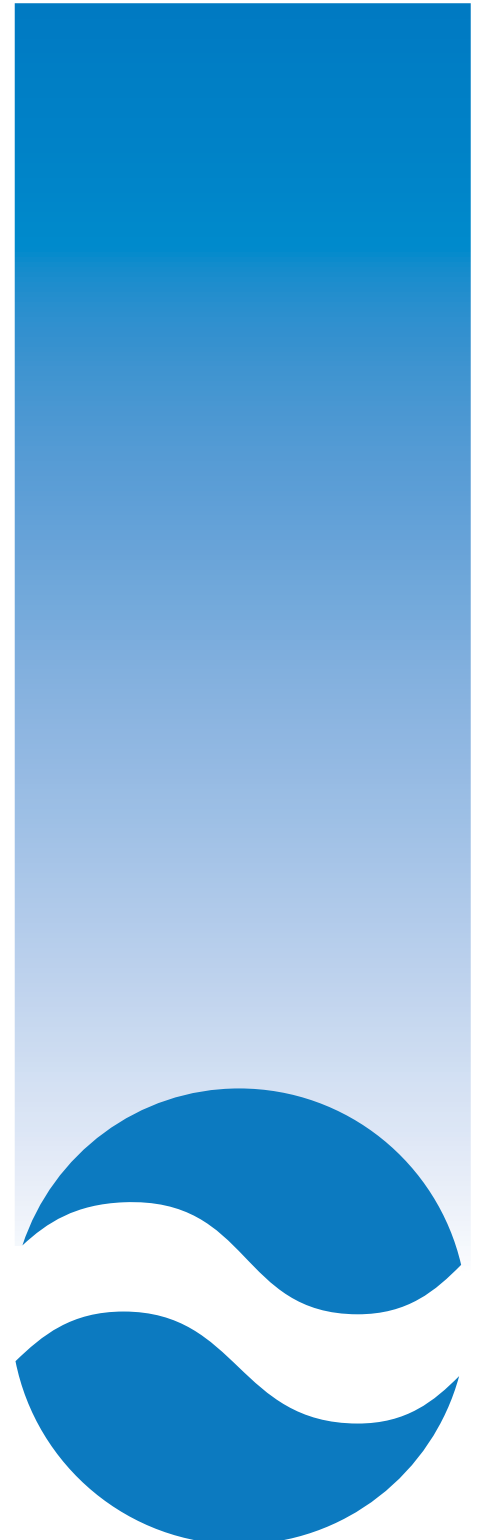
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October 2009

JOINT INDUSTRY STANDARD

Requirements for
Electronic Grade
Solder Alloys
and Fluxed and
Non-Fluxed Solid
Solders for Electronic
Soldering Applications



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IPC J-STD-006C

Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications

Developed by the Solder Alloy Task Group (5-24c) of the Assembly and Joining Committee (5-20) of IPC

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

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Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the Solder Alloy Task Group (5-24c) of the Assembly and Joining Committee (5-20) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications

1 PREFACE

1.1 Scope This standard prescribes the nomenclature, requirements and test methods for electronic grade solder alloys; for fluxed and non-fluxed bar, ribbon, wire, and powder solders, for electronic soldering applications; and for “special form” (see 1.2.3) electronic grade solders. This is a quality control standard and is not intended to relate directly to the material’s performance in the manufacturing process. Solders for applications other than electronics should be procured using ASTM B-32.

This standard is one of a set of three joint industry standards that prescribe the requirements and test methods for soldering materials for use in the electronics industry. The other two joint industry standards are:

J-STD-004 Requirements for Soldering Fluxes

J-STD-005 Requirements for Soldering Pastes

1.2 Classification Soldering alloys covered by this standard shall be classified by alloy composition and impurity level, solder form and dimensional characteristics peculiar to the solder form, flux percentage and flux classification, if applicable. These classifications shall be used as part of the standard description of solder products. (See 6.3.)

1.2.1 Alloy Composition The solder alloys covered by this standard include, but are not limited to, the alloys listed in Appendix A, including pure tin and pure indium. Each alloy is identified by an alloy name, which is composed of a series of alphanumeric characters that identify the component elements in the alloy by chemical symbol and nominal percentage by mass.

The percentage of each element in an alloy shall be determined by any standard analytical procedure with sufficient resolution. Wet chemistry shall be used as the reference procedure. The tolerance & impurity levels of the alloy shall conform to the current version of J-STD-006, or equivalent.

All manufacturers designed alloy additions as agreed between user and supplier (AABUS) shall be identified as a fraction of the weight of the alloy.

1.2.2 Alloy Impurity Level The allowable impurity level of the solder alloys covered by this standard is identified in 3.3. See 3.3.1 for the description of Variation D alloys. The alloy variation letter D is added to the end of an alloy name and becomes part of the alloy’s name.

1.2.3 Solder Form The forms of solder materials covered by this set of standards include paste (cream), bar, powder, ribbon, wire and special electronic grade solders which do not fully comply with the requirements of standard solder alloys and forms listed herein. Some examples of special form solders are anodes, ingots, preforms, bars with hook and eye ends, and multiple-alloy solder powders. A single-letter identifying symbol as defined below may be used.

P – Paste (Cream)

B – Bar

D – Powder

R – Ribbon

W – Wire

S – Special

H – Sphere

1.2.4 Dimensional Characteristics Standard bar solders are further classified by unit mass. Wire solders are further classified by wire size (outside diameter) and unit mass. Ribbon solders are further classified by thickness, width and unit mass. Powder solders are further classified by powder particle size distribution and unit mass. See 3.4.1 to 3.4.6

1.2.5 Flux Percentage and Metal Content The nominal percentage of flux by mass in solid-form solder products shall be specified. For solder paste products, metal content shall be specified instead. "Metal content" refers to the percentage of metal in solder paste by mass. See 3.4.1 to 3.4.5.

1.3 Definition of Requirements The word shall is used in the text of this document wherever there is a requirement for materials, preparation, or process control.

1.4 Order of Precedence The contract always takes precedence over this standard, referenced standards and drawings.

1.5 Conflict In the event of conflict between the requirements of this standard and the applicable assembly drawing(s)/documentation, the applicable user approved assembly drawing(s)/documentation govern. 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 an assembly drawing(s)/documentation that has not been user approved, this standard governs.

1.6 Clause References When a clause in this document is referenced, its subordinate clauses also apply.

1.7 Appendices Except for Tables A-1 through A-3, appendices to this Standard are for reference unless separately and specifically required by the applicable contracts, assembly drawing(s), documentation or purchase orders.

1.8 Terms and Definitions Other than the following, terms and definitions applicable to this specification shall conform to IPC-T-50. Terms marked with an asterisk (*) are direct excerpts of IPC-T-50 and are reprinted here for convenience.

***Acceptance Tests** Those tests deemed necessary to determine acceptability of a product and as agreed to by both purchaser and vendor.

***Base Metal (Solder)** The underlying metal surface to be wetted by solder, also referred to as basis metal.

Corrosion The deterioration of a metal due to moisture, chemical or electrochemical reaction with its environment.

***Density (Material)** The mass of a substance per unit volume.

***Dewetting** A condition that results when molten solder coats a surface and then recedes to leave irregularly shaped mounds of solder that are separated by areas that are covered with a thin film of solder and with the basis metal not exposed.

Eutectic (Solder) A solder alloy that melts and solidifies at a single temperature that is the lowest temperature of solidification for any mixture of specified constituents.

***Flux** A chemically- and physically-active compound that, when heated, promotes the wetting of a base metal surface by molten solder by removing minor surface oxidation and other surface films and by protecting the surfaces from reoxidation during a soldering operation.

Flux Characterization Flux characterization consists of a series of specific tests for fluxes and flux residues in order to determine their impact on product reliability. These tests include determination of basic corrosive and conductive properties of flux and flux residues. (See J-STD-004.)

Flux Residue The (non-volatile) portion of the flux material that remains on and around the solder joint after soldering.

***Liquidus (Solder)** The temperature at which a solder alloy is completely melted.

Nonwetting A condition whereby a surface has contacted molten solder, but the solder has not adhered to the entire surface; base metal remains exposed.

Solder A metal alloy with a melting temperature that is below 427°C [800.6°F] that wets and bonds to other metals. This standard allows some specialty alloys which have melting points up to 485°C [905.0°F] which would not be considered as a solder under normal circumstance.

***Solidus (Solder)** The temperature at which a solder alloy begins to melt.

***Wetting (Solder)** The formation of a relatively uniform, smooth, unbroken, and adherent film of solder to a basis metal.

1.9 Health and Safety The use of some materials referenced in this standard may be hazardous. To provide for personnel safety, follow the applicable local and federal Occupational, Safety and Health Administration (OSHA) regulations.

2 APPLICABLE DOCUMENTS

The following documents form a part of this standard to the extent specified herein. Unless a specific issue is cited herein or in the contract or purchase order, the issue in effect on the date of invitation for bids or request for proposal shall apply.

2.1 Joint Industry Standards¹

J-STD-004 Requirements for Soldering Fluxes

J-STD-005 Requirements for Soldering Pastes

J-STD-609 Lead-Free and Leaded Marking, Symbols and Labels

2.2 International Standards Organization (ISO)²

ISO 9001 Quality Management Systems - Requirements

ISO 10012 Part 1 Quality Assurance Requirement for Measuring Equipment - Part 1: Metrological Confirmation Systems for Measuring Equipment

ISO 9453 Soft Solder Alloys - Chemical Compositions and Forms

2.3 IPC³

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

IPC-TM-650 Test Methods Manual⁴

2.2.14 Solder Powder Particle Size Distribution - Screen Method for Types 1-4

2.2.14.1 Solder Powder Particle Size Distribution - Measuring Microscope Method

2.2.14.2 Solder Powder Particle Size Distribution - Optical Image Analyzer Method

2.2.14.3 Determination of Maximum Solder Powder Particle Size

2.3.34.1 Percentage of Flux on/in Flux-Coated and/or Flux-Cored Solder

2.4.47 Flux Residue Dryness

2.4.48 Spitting of Flux-Cored Wire Solder

2.4.49 Solder Pool Test

2.4 American Society for Testing and Materials (ASTM)⁵

ASTM B-32 Standard Specification for Solder Metal

3 REQUIREMENTS

3.1 Materials Materials shall be used which permit the solder product to conform to the specified requirements. The use of recovered or recycled materials is encouraged. Recovered or recycled materials shall conform to or exceed comparable standards for pure (previously unalloyed) metals. To the maximum extent feasible and unless otherwise specified, solder alloy metal, including solder powder, shall be a homogenous mixture of the component elements of the alloy, such that each particle of the metal is the same alloy.

1. www.ipc.org

2. www.iso.org

3. www.ipc.org

4. Current and revised IPC Test Methods are available on the IPC Web site (www.ipc.org/html/testmethods.htm)

5. www.astm.org