IPC/EIA J-STD-001C

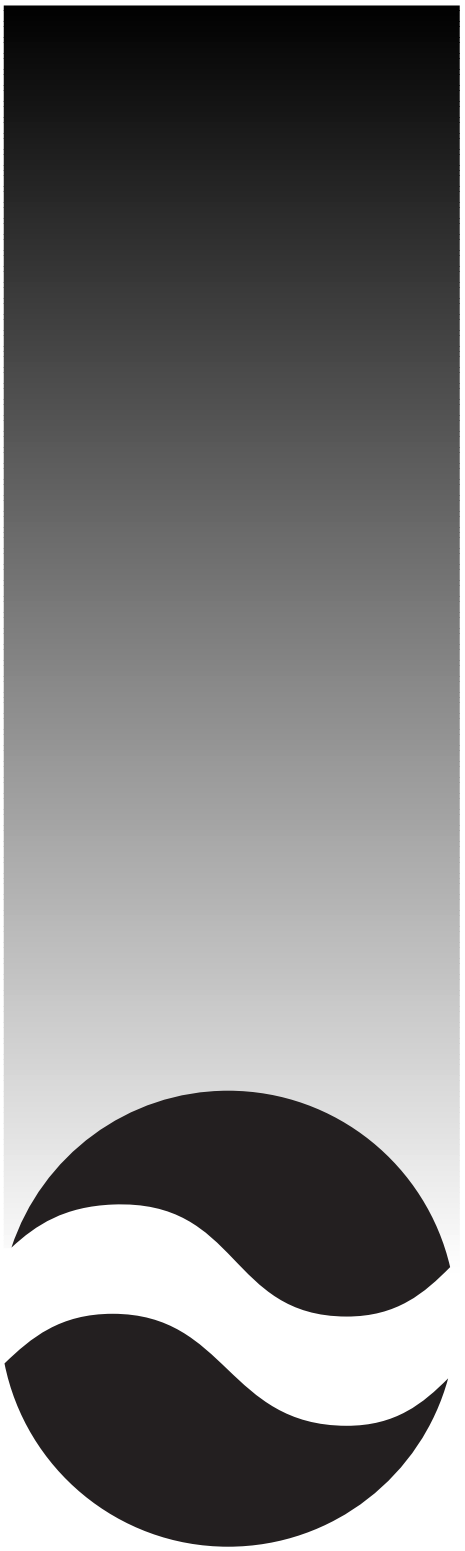
MARCH 2000

Supersedes Revision B October 1996

Original Publication April 1992

JOINT INDUSTRY STANDARD

Requirements for Soldered Electrical and Electronic Assemblies



IPC

EIA

Electronic Industries Alliance

Table of Contents

Figures

Tables

Requirements for Soldered Electrical and Electronic Assemblies

1 SCOPE

This standard prescribes practices and requirements for the manufacture of soldered electrical and electronic assemblies. Historically, electronic assembly (soldering) standards contained a more comprehensive tutorial addressing principles and techniques. For a more complete understanding of this document's recommendations and requirements, one may use this document in conjunction with IPC-HDBK-001 and IPC-A-610.

When IPC/EIA J-STD-001 is cited or required by contract, the requirements of IPC-A-610 do not apply unless separately or specifically required. When IPC-A-610 is cited along with IPC/EIA J-STD-001, the order of precedence is to be defined in the procurement documents.

1.1 Purpose This standard describes materials, methods and acceptance criteria for producing soldered electrical and electronic assemblies. The intent of this document is to rely on process control methodology to ensure consistent quality levels during the manufacture of products. It is not the intent of this standard to exclude any procedure for component placement or for applying flux and solder used to make the electrical connection; however, the methods used **shall**[1] produce completed solder joints conforming to the acceptability requirements described in this standard.

The requirements for assembly, soldering, soldered connections, cleaning, coating/encapsulation, rework, and verification are defined in general terms.

(1) Requirement See 1.4

1.2 Classification This standard recognizes that electrical and electronic assemblies are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in producibility, complexity, functional performance requirements, and verification (inspection/test) frequency. It should be recognized that there may be overlaps of equipment between classes.

The user (see 3.2.10) and manufacturer (see 3.2.3) **shall** agree on the class to which the product belongs. The product class should be stated in the procurement documentation package.

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 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.

1.3 Measurement Units and Applications All dimensions and tolerances, as well as other forms of measurement (temperature, weight, etc.) in this standard are expressed in SI (System International) units (with Imperial English equivalent dimensions provided in brackets). Dimensions and tolerances use millimeters as the main form of dimensional expression; micrometers are used when the precision required makes millimeters too cumbersome. Celsius is used to express temperature. Weight is expressed in grams.

1.3.1 Verification of Dimensions Actual measurement of specific part mounting and solder fillet dimensions and determination of percentages are not required except for referee purposes. For the purposes of determining conformance to this specification, all specified limits in this standard are absolute limits as defined in ASTM E29.

1.4 Definition of Requirements The word **shall** is used throughout this document whenever a requirement is intended to express a provision that is binding.

Where the word **shall** leads to a hardware defect for at least one class, the requirements for each class are annotated in text boxes located adjacent to that occurrence in the text. These boxes are summarized in Table 11-1. Table 11-1 identifies each listed condition for each class as either ''Defect,'' ''Process Indicator,'' ''Acceptable,'' or ''No Requirement Specified.'' In case of a discrepancy between requirements in the text boxes and Table 11-1, requirements listed in the text boxes take precedence.

Line drawings and illustrations are depicted herein to assist in the interpretation of the written requirements of this standard. When tables or figures provide details of the requirements, the tables or figures take precedence over the text of this standard.

IPC-HDBK-001, a companion document to this specification, contains valuable explanatory and tutorial information compiled by IPC Technical Committees that is relative to this specification. Although the Handbook is not a part of

this specification, when there is confusion over the specification verbiage, the reader is referred to the Handbook for assistance.

Note: In previous revisions of this standard, the words ''must'' and ''shall'' had special meanings. In this revision (IPC/EIA J-STD-001C), the word ''shall'' has no special meaning beyond that commonly used in other IPC standards as stated above.

1.4.1 Hardware Defects and Process Indicators Hardware characteristics or conditions that do not conform to the requirements of this specification that are detectable by inspection or analysis are classified as either hardware defects or hardware process indicators. Hardware defects listed in the applicable text boxes **shall**[1] be identified and **shall**[1] be dispositioned, e.g., rework, scrap, use as is, repair. Not all process indicators specified by this standard are listed in the text boxes. Hardware process indicators should be monitored (see 11.3) but the hardware need not be dispositioned.

It is the responsibility of the user (see 3.2.10) to define unique defect categories applicable to the product. It is the responsibility of the manufacturer (see 3.2.3) to identify defects and process indicators that are unique to the assembly.

(1) Requirement
See 1.4

1.4.2 Material and Process Nonconformances Hardware found to be produced using either materials or processes that do not conform to the requirements of this standard **shall**[2] be dispositioned when the condition is a defect listed in the applicable text box. This disposition **shall**[2] address the potential effect of the nonconformance on functional capability of the hardware such as reliability and design life (longevity).

Note: Material and process nonconformances differ from hardware defects or hardware process indicators in that the material/process nonconformances often do not result in an obvious change in the hardware's appearance but can impact the hardware's performance; e.g., contaminated solder, incorrect solder alloy (per drawing/procedure).

(2) Table 11-1 #1a
Class 1-Defect
Class 2-Defect
Class 3-Defect

1.5 Process Control Requirements Process control methodologies **shall**[3] be used (see 11.3) 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.

(3) Requirement
See 1.4

Class 3 **shall**[4] develop and implement a documented process control system. 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 company.

(4) Table 11-1 #1c
Class 1-No Reqt
Class 2-No Reqt
Class 3-Defect

2 APPLICABLE DOCUMENTS

The following documents, of the issue in effect on the date of invitation for bid, form a part of this specification to the extent specified herein.

2.1 Electronic Industries Alliance (EIA)[1]

EIA-557-1 Statistical Process Control Guidance for the Selection of Critical Manufacturing Operations for Use in Implementing an SPC System for Passive Components

2.2 IPC[2]

IPC-HDBK-001 Requirements for Soldered Electrical and Electronic Assemblies Handbook

IPC-A-36 Cleaning Alternatives Board

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

IPC-TR-467 Supporting Data and Numerical Examples for ANSI/J-STD-001B (Control of Fluxes)

IPC-A-610 Acceptability of Electronic Assemblies

IPC-OI-645 Standard for Visual Optical Inspection Aids

IPC-TM-650 Test Methods Manual

2.3.25 Detection and Measurement of Ionizable Surface Contaminants

2.3.27 Cleanliness Test Residual Rosin

2.3.28 Ionic Analysis of Circuit Boards Ion Chromatography Method

2.3.38 Surface Organic Contamination Detection Test

2.3.39 Surface Organic Contamination Identification Test (Infrared Analytical Method)

2.4.22 Bow and Twist

2.6.3 Moisture and Insulation Resistance, Rigid, Rigid/Flex and Flex Printed Wiring Boards

1. EIA, 2500 Wilson Blvd., Arlington, VA 22201-3834
2. IPC, 2215 Sanders Road, Northbrook, IL 60062

2.6.3.3 Moisture and Surface Insulation Resistance, Fluxes

IPC-SM-817 General Requirements for Dielectric Surface Mounting Adhesives

IPC-CC-830 Qualification and Performance of Electrical Insulating Compound for Printed Board Assemblies

IPC-2221 Generic Standard on PWB Design

IPC-2222 Sectional Standard on Rigid PWB Design

IPC-2223 Sectional Design Standard for Flexible Printed Boards

IPC-6011 Generic Performance Specification of Printed Boards

IPC-6012A Qualification and Performance Specification for Rigid Printed Boards

IPC-6013 Qualification and Performance for Flexible Printed Boards

IPC-9191 General Guidelines for Implementation of Statistical Process Control (SPC)

IPC-9201 Surface Insulation Resistance Handbook

2.3 Joint Industry Standards[2]

IPC/EIA J-STD-002 Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires

J-STD-003 Solderability Tests for Printed Boards

J-STD-004 Requirements for Soldering Fluxes

J-STD-005 Requirements for Soldering Paste

J-STD-006 Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications

IPC/JEDEC J-STD-020 Moisture/Reflow Sensitivity Classification for Plastic Integrated Circuit Surface Mount Devices

IPC/JEDEC J-STD-033 Standard for Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

2.4 ASTM[3]

ASTM E29 Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.5 Electrostatic Discharge Association[4]

ANSI/ESD-S-20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment

3 GENERAL REQUIREMENTS

The soldering operations, equipment, and conditions described in this document are based on electrical/electronic circuits designed and fabricated in accordance with the specifications listed in Table 3-1.

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

Table 3-1 Design and Fabrication Specification

Board Type	Design Specification	Fabrication Specification
Generic Requirements	IPC-2221	IPC-6011
Rigid Printed Boards	IPC-2222	IPC-6012
Flexible Circuits	IPC-2223	IPC-6013
Rigid Flex Board	IPC-2223	IPC-6013

3.1.1 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 **shall**[1] govern. In the event of conflict between the requirements of this standard and an assembly drawing(s)/documentation that has not been approved, this standard **shall**[1] govern.

(1) Requirement See 1.4

When IPC/EIA J-STD-001 is cited or required by contract, the requirements of IPC-A-610 do not apply unless separately or specifically required. When IPC-A-610 or other related documents are cited along with IPC/EIA J-STD-001, the order of precedence is to be defined in the procurement documents.

3.1.2 Specialized Processes and Technologies Mounting and soldering requirements for specialized processes and/or technologies not specified herein **shall**[2] be performed in accordance with documented procedures which are available for review.

(2) Requirement See 1.4

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

3.2.1 Defect A nonconformance to the requirements of this standard (listed in or referenced by Table 11-1) or other risk factors as identified by the manufacturer. A process and/or material nonconformance that could result in a reduction of functional capability, design life or reliability.

3. ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428
4. ESD Association, 7900 Turin Road, Bldg. 3, Ste. 2, Rome, NY 13440