GEA Mission

The Global Electronics Association promotes industry growth and strengthens supply chain resilience.

About IPC Standards by Global Electronics Association

IPC standards and publications by Global Electronics Association are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for their particular need. Existence of such standards and publications shall not in any respect preclude any entity from manufacturing or selling products not conforming to such standards an publications, nor shall the existence of such standards and publications preclude their voluntary use.

IPC standards and publications by Global Electronics Association are approved by committees without regard to whether the standards or publications may involve patents on articles, materials or processes. By such action, Global Electronics Association does not assume any liability to any patent owner, nor does Global Electronics Association assume any obligation whatsoever to parties adopting a standard or publication. Users are wholly responsible for protecting themselves against all claims of liabilities for patent infringement.

Global Electronics Association Position Statement on Specification Revision Change

The use and implementation of IPC standards and publications by Global Electronics Association are voluntary and part of a relationship entered into by customer and supplier. When a standard or publication is revised or amended, the use of the latest revision or amendment as part of an existing relationship is not automatic unless required by the contract. Global Electronics Association recommends the use of the latest revision or amendment.

Standards Improvement Recommendations

Global Electronics Association welcomes comments for improvements to any standard in its library. All comments will be provided to the appropriate committee.

If a change to technical content is requested, data to support the request is recommended. Technical comments to include new technologies or make changes to published requirements should be accompanied by technical data to support the request. This information will be used by the committee to resolve the comment.

To submit your comments, visit the Status of Standardization page at www.electronics.org/status.

©Copyright 2025. IPC International, Inc., Bannockburn, Illinois. All rights reserved under both international and Pan-American copyright conventions. *Any copying, scanning or other reproduction of these materials without the prior written consent of the copyright holder is strictly prohibited and constitutes infringement under the Copyright Law of the United States.*

by Global Electronics Association

IPC J-STD-001JA/IPC-A-610JA

Automotive Addendum to IPC J-STD-001J Requirements for Soldered Electrical and Electronic Assemblies and IPC-A-610J Acceptability of Electronic Assemblies

If a conflict occurs between the English language and translated versions of this document, the English version will take precedence.

Developed by the J-STD-001 and IPC-A-610 Automotive Addendum Task Group of the Product Assurance Committee (7-30) of Global Electronics Association

Global Electronics Association Standards and Artificial Intelligence (AI) Statement

Global Electronics Association is the trading name of IPC International, Inc., which owns the copyright to all IPC Standards and other IPC materials.

The Global Electronics Association explicitly prohibits:

- The integration or transfer of any data whether in the form of IPC books, standards, metadata, or other formats — into AI engines or algorithms by any person or entity, including authorized distributors and their end users.
- Activities involving data harvesting, text and data mining, enrichment, or the creation of derivative works based on this data, including the use of automated data collection methods or artificial intelligence.

Any breach of these provisions is considered a copyright infringement unless expressly authorized in advance in writing by the Global Electronics Association.

Supersedes:
IPC J-STD-001HA/IPC-A-610HA – October 2021
IPC J-STD-001GA/IPC-A-610GA – February 2020

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

Contact:

Global Electronics Association
3000 Lakeside Drive, Suite 105N
Bannockburn, Illinois
60015-1249
Tel 847 615.7100
Fax 847 615.7105

Table of Contents

The following topics are addressed in this Addendum.

0.1 Scope
0.2 Purpose
0.3 Existing or Previously Approved Designs
0.4 Use

The following reference numbers are to J-STD-001J Clauses that are modified or added in this Addendum.

1.1	Scope
1.3.1 (NEW)	Inspection Personnel and Product Requirements
1.6	Process Control Requirements
1.7	Order of Precedence
1.7.2 (NEW)	Conflict
1.8	Terms and Definitions
1.8.8	Manufacturer
1.8.9	Objective Evidence
1.8.17	User
1.8.20 (NEW)	Design Authority
1.8.21 (NEW)	Solder Coverage Percentage
1.8.22 (NEW)	Voiding (Percentage)
1.9	Requirements Flowdown
1.10	Personnel Proficiency
1.11	Acceptance Requirements
1.12.1 (NEW)	Minimum Electrical Clearance (MEC)
1.12.2 (NEW)	Minimum Creepage Clearance (MCC)
1.13.1	Process Verification Inspection
1.13.2 (NEW)	Process Verification Methodologies
1.13.2.2	Magnification Aids
1.15	Electrostatic Discharge (ESD)
2.0	APPLICABLE DOCUMENTS
2.1	IPC
2.2	JEDEC
2.3	Joint Industry Standards
2.4	ASTM
2.5	EOS/ESD Association, Inc.
2.6	International Electrotechnical Commission
2.7	SAE International
2.8	Military Standards
2.9 (NEW)	Aerospace Industries Association / National Aeronautics Standards
3.1	Materials
3.2	Solder
3.2.1	Solder – Pb-Free
3.2.2	Solder Purity Maintenance
3.6	Components
3.6.1	Component and Seal Damage
4.1	Solderability
4.6	Preprocessing Cleanliness Requirements
4.13.1.1.1 (NEW)	Wave/Selective Soldering Machine Controls
4.13.2	Reflow Soldering
4.14.3	Partially Visible or Hidden Solder Connections
5.0.1 (NEW)	Wire and Terminal Requirements
6.2.2	Supported Through-Hole Soldering
7.0	SURFACE MOUNTING OF COMPONENTS
7.0.1 (NEW)	Voiding and Solder Coverage
7.0.1.1 (NEW)	Solder Coverage Requirements for Thermal Pads
7.0.1.2 (NEW)	Solder Coverage Requirements for I/O Pins of Bottom-Termination Components
7.0.1.3 (NEW)	Solder Coverage Requirements for Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s)
7.0.1.4 (NEW)	Voiding Requirements for Ball Grid Array Components with Collapsing Balls
7.0.1.5 (NEW)	Solder Coverage Requirements for Land Grid Array (LGA) Components
7.1.1	Plastic Components
7.4	Installation of Surface Mount Components
7.5	Soldering Requirements
7.5.4	Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s)
7.5.5	Cylindrical End Cap Terminations
7.5.6	Castellated Terminations
7.5.7	Flat Gull Wing Leads
7.5.8	Round or Flattened (Coined) Gull Wing Leads
7.5.11	Flat Lug Leads
7.5.13	Inward Formed L-Shaped Ribbon Leads
7.5.14	Surface Mount Area Array Packages
7.5.14.1 (NEW)	Ball Grid Array Components with Collapsing Balls
7.5.14.2 (NEW)	Ball Grid Array Components with Noncollapsing Balls
7.5.14.3 (NEW)	Column Grid Array Components
7.5.15	Bottom Termination Components (BTC)
7.5.16	Components with Bottom Thermal Pads (D-Pak)
7.5.19	Vertical Cans with Outward L-Shaped Lead Terminations
7.5.20	Wrapped Terminals
7.5.21	Flexible and Rigid-Flex Printed Circuitry with Flat Unformed Leads
7.5.22 (NEW)	Odd-Shaped Components with Hidden Terminations
7.5.23 (NEW)	Half-Moon Shape Ferrite Termination – Coil Terminal
7.5.24 (NEW)	Coil Terminals (Coated) Wire
7.5.25 (NEW)	“L” Type (Fuses/Shunt Resistors) Terminals

©Copyright 2025. IPC International, Inc., Bannockburn, Illinois.

7.5.26 (NEW)	“C” Type Terminal with Thermal Pad
8.4	Foreign Object Debris (FOD)
9.0.1 (NEW)	Printed Circuit Board and Assembly Damage
9.2	Bow and Twist (Warpage)
12.0	REWORK AND REPAIR
12.1	Rework
12.2	Repair
12.3	Post Rework/Repair Cleaning
APPENDIX D	Void Categories
APPENDIX E	Solder Coverage Recommendations for SMT Components Not Covered Within 7.0.1 Voiding and Solder Coverage

©Copyright 2025. IPC International, Inc., Bannockburn, Illinois.

0.1 Scope This Addendum provides requirements to be used in addition to, and in some cases, in place of, those published in J-STD-001J to ensure the reliability of mission-critical soldered automotive electrical and electronic assemblies in the field under harsh environments, considering the conditions of automated high-volume production.

0.2 Purpose When required by procurement documentation/drawings, this Addendum supplements or replaces specifically identified requirements of J-STD-001J.

0.3 Existing or Previously Approved Designs This Addendum **shall not** constitute the sole cause for the redesign of previously approved designs. When drawings for existing or previously approved designs undergo revision, they should be reviewed and changes made that allow for conformance with the requirements of this Addendum.

0.4 Use This Addendum is not to be used as a standalone document.

Where criteria are not supplemented, the Class 3 requirements of J-STD-001J **shall** apply. Where J-STD-001J criteria are supplemented or new criteria are added by this Addendum, the clause is listed in J-STD-001JA, and the entire J-STD-001J clause is replaced by this Addendum except as specifically noted.

The clauses modified by this Addendum do not include subordinate clauses unless specifically stated, e.g., 1.4 does not include 1.4.1. Clauses, Tables, Figures, etc., in J-STD-001J that are not listed in this Addendum are to be used as published. J-STD-001JA must be used with J-STD-001J.

This Addendum **shall** be used only in conjunction with the corresponding automotive addendum pertaining to IPC-A-610J.

In the context of this Addendum, IPC-A-610 **shall** be used as a companion document to J-STD-001. The revisions of J-STD-001 and IPC-A-610 **shall** correspond, e.g., J-STD-001J and IPC-A-610J. The likelihood of criteria not aligning increases when different revisions are used together.

If there is a conflict between the documents referenced in this section, the order of precedence is documented in 1.7 Order of Precedence.

©Copyright 2025. IPC International, Inc., Bannockburn, Illinois.

Table of Contents

The following topics are addressed in this Addendum.

0.1 Scope
0.2 Use

The following reference numbers are to IPC-A-610J Clauses that are modified or added in this Addendum.

1.0	GENERAL
1.2	Purpose
1.3	Classification
1.4.1	Verification of Dimensions
1.5	Requirements
1.5.1.2	Defect
1.5.1.4	Conditions Not Specified
1.5.1.7 (NEW)	Combined Conditions
1.6	Process Control Methodologies
1.7	Order of Precedence
1.7.1	Clause References
1.8.26	User
1.8.27 (NEW)	Design Authority
1.8.28 (NEW)	Objective Evidence
1.9	Requirements Flowdown
1.10	Personnel Proficiency
1.11	Acceptance Requirements
1.12	Minimum Electrical Clearance (MEC)
1.12.1 (NEW)	Minimum Creepage Clearance (MCC)
1.13	Inspection Methodology
1.13.1	Lighting
1.13.2	Magnification Aids
1.13.3 (NEW)	Field Assembly Operations
2.0	APPLICABLE DOCUMENTS
2.1	IPC Documents
2.2	Joint Industry Documents
2.3	Electrostatic Association Documents
2.4	International Electrotechnical Commission
2.5	ASTM
2.6	Military Standards
2.7	SAE International
2.8 (NEW)	JEDEC
2.9 (NEW)	Automotive Electronics Council (AEC)
2.10 (NEW)	Automotive Industry Action Group (AIAG)
3.0	HANDLING ELECTRONIC ASSEMBLIES
3.1 (NEW)	Gloves and Finger Cots
4.0	HARDWARE
4.1.5.4 (NEW)	Threaded Fasteners and Other Threaded Hardware – Self-Tapping Fasteners
4.3.2	Connector Pins – Press Fit Pins
4.3.3	Standalone Pins
4.3.4	Press-Fit Pins Inserted into Housing
5.0	SOLDERING
5.1	Soldering Acceptability Requirements
5.2.7.1	Soldering Anomalies – Excess Solder – Solder Balls and Solder Particles
5.2.7.2	Bridging
5.2.7.3	Solder Webbing/Splashes
5.2.10	Fractured Solder
5.2.11	Solder Projections
5.2.14	Probe Marks and Other Similar Surface Conditions in Solder Joints
5.2.16 (NEW)	Tilted or Raised Component
5.3	Partially Visible or Hidden Solder Connections
6.0	TERMINAL CONNECTIONS
6.0.1	Wire and Terminal Connections
7.0	THROUGH-HOLE TECHNOLOGY
7.3.5	Supported Holes – Solder
7.3.5.1	Vertical Fill (A)
7.5 (NEW)	Plated Through-Holes with Peg Leads
8.0	SURFACE MOUNT ASSEMBLIES
8.1	Staking Adhesive
8.1.2	Mechanical Strength
8.2	Surface Mount Assemblies – SMT Leads
8.2.1	Plastic Components
8.3	SMT Connections
8.3.2	Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s)
8.3.2.6	Minimum Fillet Height (F) End Cap Configuration
8.3.2.10	3 Side Terminations – Termination Variations – Center/Lateral Termination(s)
8.3.2.10.1	Maximum Side Overhang of Termination (As)
8.3.2.10.2	End Overhang of Termination (Bs)
8.3.2.10.3 (NEW)	End Joint Width of Termination (Cs)
8.3.2.10.4 (NEW)	Minimum Fillet Height of Termination (Fs)
8.3.2.10.5 (NEW)	Solder Thickness of Termination (Gs)
8.3.3	Cylindrical End Cap Terminations
8.3.4	Castellated Terminations
8.3.4.6	Minimum Fillet Height (F)
8.3.5	Flat Gull Wing Leads
8.3.5.2	Toe Overhang (B)
8.3.5.6	Minimum Heel Fillet Height (F)
8.3.5.9 (NEW)	Lifted Component Body

©Copyright 2025. IPC International, Inc., Bannockburn, Illinois.

Table of Contents (cont.)

8.3.5.9.1 (NEW)	Solder Wicking
8.3.9	Flat Lug Leads
8.3.9.4 (NEW)	Maximum Fillet Height (E)
8.3.11	Inward Formed L-Shaped Ribbon Leads
8.3.11.1 (NEW)	Maximum Fillet Height (E)
8.3.11.2 (NEW)	Minimum Fillet Height (F)
8.3.12	Surface Mount Area Array
8.3.12.2	Solder Ball Spacing
8.3.12.4	Voids
8.3.13	Bottom Termination Components (BTC)
8.3.13.1	Minimum Toe (End) Fillet Height (F)
8.3.14	Components with Bottom Thermal Pad Terminations
8.3.14.1 (NEW)	Terminations of TO Components
8.3.14.1.1 (NEW)	Thermal Pad Minimum End Joint Width (Ct)
8.3.14.1.2 (NEW)	Thermal Pad Side Joint Length (Dt)
8.3.14.1.3 (NEW)	Thermal Pad Solder Fillet Thickness (Gt)
8.3.14.2 (NEW)	Terminations of QFPs and SOPs
8.3.14.3 (NEW)	Terminations of BTCs
8.3.17	Vertical Cans with Outward L-Shaped Lead Terminations
8.3.18	Flexible and Rigid Flex Printed Circuitry with Flat Unformed Leads
8.3.21 (NEW)	Odd-Shaped Components with Hidden Terminations
8.3.21.1 (NEW)	Maximum Side Overhang (A)
8.3.21.2 (NEW)	Minimum End Joint Width (C)
8.3.21.3 (NEW)	Minimum Side Joint Length (D)
8.3.21.4 (NEW)	Maximum Fillet Height (E)
8.3.22 (NEW)	Half-Moon Shape Ferrite Termination – Coil Terminal
8.3.22.1 (NEW)	Maximum Side Overhang (A)
8.3.22.2 (NEW)	End Overhang (B)
8.3.22.3 (NEW)	Minimum Side Joint Length (J)
8.3.22.4 (NEW)	Minimum End Joint Width (C)
8.3.22.5 (NEW)	Minimum Fillet Height (F)
8.3.23 (NEW)	Coil Terminals (Coated Wire)
8.3.23.1 (NEW)	Maximum Side Overhang (A)
8.3.23.2 (NEW)	Maximum Toe Overhang (B)
8.3.23.3 (NEW)	Minimum End Joint Width (C)
8.3.23.4 (NEW)	Minimum Side Joint Length (D)
8.3.23.5 (NEW)	Minimum Heel Fillet Height (F)
8.3.23.6 (NEW)	Minimum Side Joint Height (Q)
8.3.24 (NEW)	“L” Type (Fuses/Shunt Resistors) Terminals
8.3.24.1 (NEW)	Maximum Side Overhang (A)
8.3.24.2 (NEW)	Maximum Toe Overhang (B)
8.3.24.3 (NEW)	Minimum End Joint Width (C)
8.3.24.4 (NEW)	Minimum Side Joint Length (D)
8.3.24.5 (NEW)	Maximum Fillet Height (E)
8.3.24.6 (NEW)	Minimum Fillet Height (F)
8.3.24.7 (NEW)	Solder Fillet Thickness (G)
8.3.25 (NEW)	“C” Type Terminal with Thermal Pad
8.3.25.1 (NEW)	Maximum Side Overhang (A)
8.3.25.2 (NEW)	Maximum Toe Overhang (B)
8.3.25.3 (NEW)	Minimum End Joint Width (C)
8.3.25.4 (NEW)	Minimum Side Joint Length (D)
8.3.25.5 (NEW)	Maximum Heel Fillet Height (E)
8.3.25.6 (NEW)	Minimum Heel Fillet Height (F)
8.3.25.7 (NEW)	Solder Thickness (G)
8.5.2 (NEW)	Pegs
8.5.2.1 (NEW)	Horizontal Pegs
8.5.2.2 (NEW)	Vertical Pegs
8.5.2.3 (NEW)	Hybrid Pegs
8.5.2.3.1 (NEW)	Vertical Pegs
8.5.2.3.2 (NEW)	Horizontal Pegs
8.5.2.4 (NEW)	J Lead Pegs
10.0	PRINTED CIRCUIT BOARDS AND ASSEMBLIES
10.8	Conformal Coating
10.8.2.1 (NEW)	Coverage
10.8.2.1.1 (NEW)	Silicon Base Coatings
10.8.3	Thickness
10.9	Electrical Insulation Coating
10.9.1	Coverage
10.9.2	Thickness
10.10	Encapsulation (Potting)

©Copyright 2025. IPC International, Inc., Bannockburn, Illinois.

Table of Contents (cont.)

0.1 Scope This Addendum provides a collection of visual acceptability criteria for electronic assemblies to be used in addition to and in some cases, in place of, those published in IPC-A-610J intended to ensure the reliability of mission-critical soldered automotive electrical and electronic assemblies in the field under harsh environments, considering the conditions of automated high-volume production. The Addendum does not provide criteria for cross-section evaluation or evaluation of images generated by automated optical and/or x-ray inspection systems. X-ray guidelines are in J-STD-001J Appendix C.

0.2 Use This Addendum is not to be used as a standalone document.

Where criteria are not supplemented, the Class 3 requirements of IPC-A-610J **shall** apply. Where IPC-A-610J criteria are supplemented or new criteria are added by this Addendum, the clause is listed in IPC-A-610 Automotive Addendum Acceptability section and the entire IPC-A-610J clause is replaced by this Addendum except as specifically noted.

The clauses modified by this Addendum do not include subordinate clauses unless specifically states, e.g., 1.4 does not include 1.4.1. Clauses, Tables, Figures, etc., in IPC-A-610J that are not listed in this Addendum are to be used as published. IPC-A-610JA must be used with IPC-A-610J.

This Addendum **shall** be used only in conjunction with the corresponding automotive addendum pertaining to J-STD-001J, J-STD-001JA.

In the context of this Addendum, IPC-A-610 **shall** be used as a companion document to J-STD-001. The revisions of J-STD-001 and IPC-A-610 **shall** correspond, e.g. J-STD-001J and IPC-A-610J. The likelihood of criteria not aligning increases when different revisions are used together.

For the order of precedence, see clause 1.7 Order of Precedence.

©Copyright 2025. IPC International, Inc., Bannockburn, Illinois.