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

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

Supersedes:
IPC J-STD-001GA/IPC-A-610GA - February 2020

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

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IPC J-STD-001HA

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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-001H 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-001H.

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-001H **shall** apply. Where J-STD-001H criteria are supplemented or new criteria are added by this Addendum, the clause is listed in J-STD-001HA, and the entire J-STD-001H 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-001H that are not listed in this Addendum are to be used as published. J-STD-001HA must be used with J-STD-001H.

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

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-001H and IPC-A-610H. 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.

1.1 Scope 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, such as for component placement or for applying flux and solder used to make the electrical connection.

Use of this Addendum implies that the product belongs to Class 3.

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 1-1HA.

Table 1-1HA Design, Fabrication and Acceptability Specifications

Board Type	Design Specification	Fabrication/Acceptability Specification
Generic Requirements	IPC-2221	IPC-6011
Rigid Printed Boards	IPC-2222	IPC-6012, IPC-6012 Automotive Addendum, IPC-A-600
Flexible Circuits	IPC-2223	IPC-6013
Rigid Flex Board	IPC-2223	IPC-6013

1.3.1 Inspection Personnel and Product Requirements The inspector **shall not** select the Product Class for the product under inspection. The selection of the product class **shall** be given by the engineering documentation. Documentation **shall** be available to the inspector, i.e., inspection instructions, process build requirements, customer specification, for the product under inspection.

1.6 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. Statistical Process Control documentations such as IPC-9191, JESD557 or other User-approved system may be used as guidelines for implementing statistical 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 1.6.2 Statistical Process Control.

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. The manufacturer **shall** maintain objective evidence of a current process control/continuous improvement plan that is available for review.

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.

1.7 Order of Precedence The contract **shall** take precedence over this Addendum, referenced standards and User-approved drawings.

1.7.2 Conflict In the event of a conflict between this Addendum and the applicable documents cited herein, this Addendum takes precedence. Where referenced criteria of this Addendum differ from J-STD-001H, this Addendum takes precedence. In the event of conflict between the requirements of this Addendum and the applicable assembly drawing(s)/documentation, the applicable User approved assembly drawing(s)/documentation take precedence.

In the event of conflict between the requirements of the J-STD-001H and the applicable assembly drawing(s) and documentation, the applicable User approved assembly 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 conflict between the requirements of the J-STD-001H and assembly drawing(s) and documentation that have not been User approved, the J-STD-001H governs.

In the case of a conflict between this Addendum and IPC-A-610HA, this Addendum takes precedence. See below for a summary of the order of precedence for using this Addendum.

User approved drawings → J-STD-001HA → J-STD-001H → IPC-A-610HA → IPC-A-610H

IPC-A-610HA

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2.8 (NEW)	JEDEC
2.9 (NEW)	Automotive Electronics Council (AEC)
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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-610H 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. This Addendum does not provide criteria for cross-section evaluation or evaluation of images generated by automated optical and/or x-ray inspection systems.

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-610H **shall** apply. Where IPC-A-610H 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-610H 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-610H that are not listed in this Addendum are to be used as published IPC-A-610HA must be used with IPC-A-610H.

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

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-001H and IPC-A-610H. 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.

1 General

1.2 Purpose The visual acceptability criteria in this document reflect the requirements of existing IPC and other applicable specifications. In order for the user to apply and use the content of this document, the assembly/product **shall** comply with other existing IPC requirements, such as IPC-7351, IPC-2220-FAM, IPC-6010-FAM and IPC-A-600 or customer unique/specified automotive standards, testing, reliability data, etc. If the assembly does not comply with these or with equivalent requirements, it **shall** be the shared responsibility of the User and the Design Authority to define, agree to, and document specific acceptance criteria.

In the case of a discrepancy, the description or written criteria, i.e., Tables, Notes addressing criteria, always takes precedence over the illustrations, e.g., photos, graphics.

Standards and Addendums may be updated at any time, including with the use of amendments. The use of an amendment or newer revision is not automatically required, unless it is agreed between customer and supplier.

Table 1-1HA is a summary of related documents.

Table 1-1HA Summary of Related Documents

Document Purpose	Spec.#	Definition
Design Standard	IPC-2220-FAM IPC-7351 IPC-CM-770	Design requirements reflecting three levels of complexity (Levels A, B, and C) indicating finer geometries, greater densities, more process steps to produce the product. Component and Assembly Process Guidelines to assist in the design of the bare board and the assembly where the bare board processes concentrate on land patterns for surface mount and the assembly concentrates on surface mount and through-hole principles which are usually incorporated into the design process and the documentation.
Printed Board Requirements	IPC-6010-FAM IPC-A-600	Requirements and acceptance documentation for rigid, rigid flex, flex and other types of substrates.
End Item Documentation	IPC-D-325	Documentation depicting bare board specific end product requirements designed by the customer or end item assembly requirements. Details may or may not reference industry specifications or workmanship standards as well as customer's own preferences or internal standard requirements.
End Item Standards	J-STD-001	Requirements for soldered electrical and electronic assemblies depicting minimum end product acceptable characteristics as well as methods for evaluation (test methods), frequency of testing and applicable ability of process control requirements.
Acceptability Standard	IPC-A-610	Pictorial interpretive document indicating various characteristics of the board and/or assembly as appropriate relating to desirable conditions that exceed the minimum acceptable characteristics indicated by the end item performance standard and reflect various out-of-control (process indicator or defect) conditions to assist the shop process evaluators in judging need for corrective action.
Training Programs (Optional)		Documented training requirements for teaching and learning process procedures and techniques for implementing acceptance requirements of either end item standards, acceptability standards, or requirements detailed on the customer documentation.
Rework and Repair	IPC-7711/7721	Documentation providing the procedures to accomplish conformal coating and component removal and replacement, solder resist repair, and modification/repair of laminate material, conductors, and plated through-holes.
Automotive Industry Action Group Standards	AIAG-CQI-17	Special Process: Electronic Assembly Manufacturing – Soldering System Assessment
Automotive Electronics Council Standards	AEC-Q100 AEC-Q101 AEC-Q102 AEC-Q104 AEC-Q200	Automotive Electronics Council – Failure Mechanism Based Stress Test Qualification

1 General (cont.)

1.3 Classification Accept and/or reject decisions **shall** be based on applicable documentation such as contracts, drawings, specifications, standards, addendums and reference documents. Criteria defined in this document reflects Class 3 visual criteria. Class 3 will not appear after the condition [Acceptable, etc.].

1.4.1 Verification of Dimensions Actual measurement of specific component placement, quantity and dimensions of the solder connection, and determination of percentages, **shall not** be used, except for referee purposes.

1.5 Definition of Requirements This document provides acceptance criteria for completed electronic assemblies. Where a requirement is presented that cannot be defined by the acceptable, process indicator, and defect conditions, the word ''**shall**'' is used to identify the requirement. Unless otherwise specified herein, the word ''**shall**'' in this document invokes a requirement for manufacturers of automotive product, and failure to comply with the requirement is a noncompliance to this Addendum.

1.5.1.2 Defect Condition A defect is a condition that may be insufficient to ensure the form, fit or function of the assembly in its end use environment. Defect conditions **shall** be dispositioned by the manufacturer based on design, service, and customer requirements. In this Addendum, if the defect condition is not defined, the default condition is Defect if it affects form, fit or function.

It is the shared responsibility of the User and the Design Authority to define complimentary, unique defect categories applicable to the product.

1.5.1.4 Combined Conditions Cumulative conditions **shall** be considered in addition to the individual characteristics for product acceptability even though they are not individually considered defective. The significant number of combinations that could occur does not allow full definition in the content and scope of this specification but manufacturers should be vigilant for the possibility of combined and cumulative conditions and their impact upon product performance.

Conditions of acceptability provided in this specification are individually defined and created with separate consideration for their impact upon reliable operation for the defined production classification. Where related conditions can be combined, the cumulative performance impact for the product may be significant, e.g., minimum solder fillet quantity when combined with maximum side overhang and minimum end overlap may cause a significant degradation of the mechanical attachment integrity. The Manufacturer is responsible for identification of such conditions.

It is the shared responsibility of the User and the Design Authority to identify complimentary combined conditions where there is significant concern based upon end use environment and product performance requirements.

1.5.1.5 Conditions Not Specified See 1.11.2 Conditions Not Specified.

1.6 Process Control Methodologies 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. The Manufacturer **shall** maintain objective evidence of a current process control/continuous improvement plan that is available for review. Also refer to 1.8.27 Objective Evidence and 1.11 Acceptance Requirements of this IPC-A-610HA Addendum for further J-STD-001 requirements.

1.7 Order of Precedence The contract **shall** take precedence over this Addendum, referenced standards and User-approved drawings. Where referenced criteria of this Addendum differ from IPC-A-610H, this Addendum takes precedence. In the event of a conflict between this Addendum and the applicable documents cited herein, this Addendum takes precedence, except for J-STD-001HA and J-STD-001H. For the latter, J-STD-001HA takes precedence.

In the event of conflict between the requirements of this Addendum and the applicable assembly drawing(s)/documentation, the applicable User approved assembly drawing(s)/documentation take precedence.

In the event of conflict between the requirements of the IPC-A-610H Standard and the applicable assembly drawing(s) and documentation, the applicable User approved assembly 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 conflict between the requirements of the IPC-A-610H and assembly drawing(s) and documentation that has not been User approved, IPC-A-610H governs.

In the case of a conflict between this Addendum and J-STD-001H, J-STD-001HA takes precedence.