IPC-D-620A

# Design and Critical Process Requirements for Cable and Wiring Harnesses

Developed by the Wire Harness Design Task Group (7-31k)
of the Product Assurance Committee (7-30) of IPC

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

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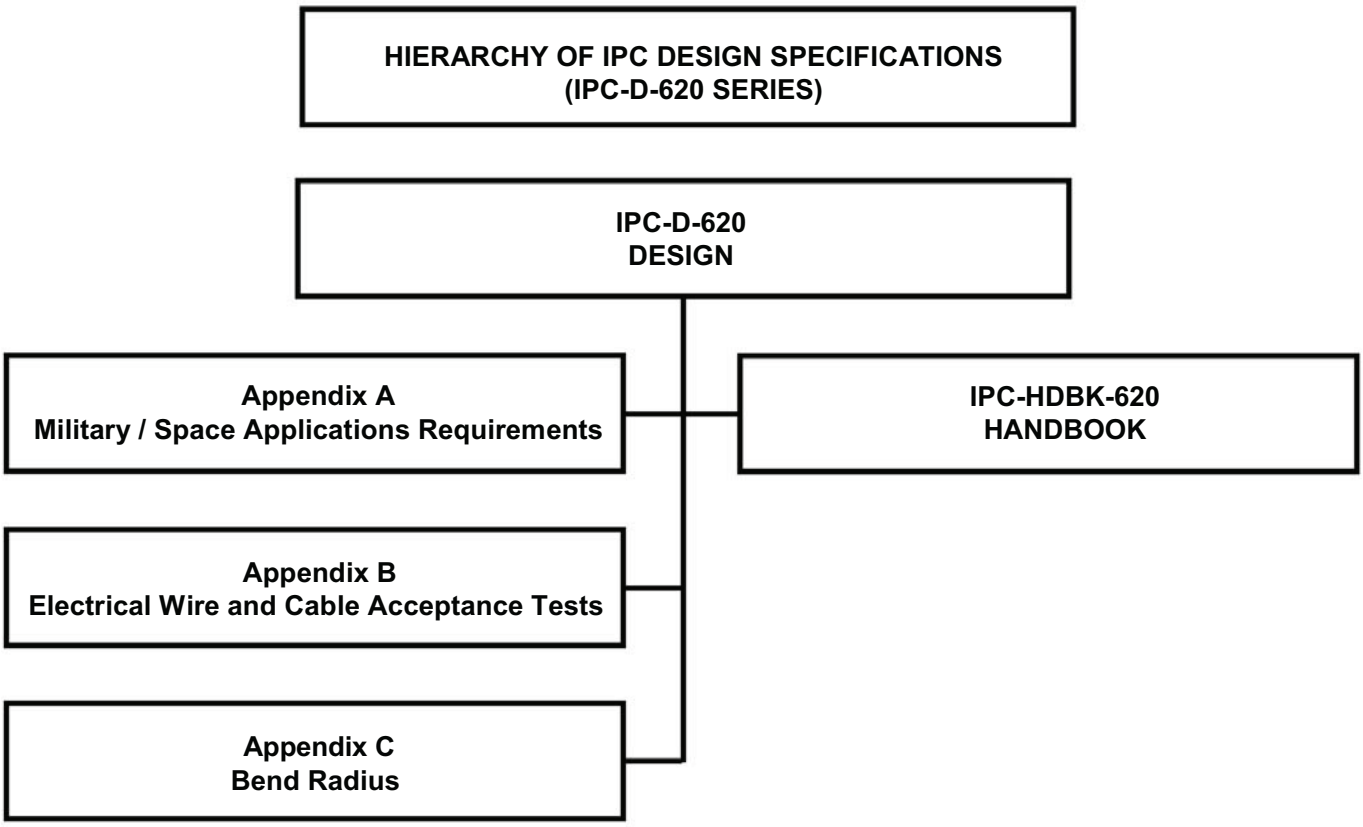


**FORWARD**

This standard is intended to provide information on the design requirements for cable and wiring harness design, to the extent that they can be applied to the broad spectrum of cable and wiring harness design.

It is therefore crucial that decisions concerning the choice of product classification, wiring technology, connectorization requirements, and performance and reliability requirements be made as early as possible.

IPC-D-620 is supplemented by Appendices A-C and a handbook (IPC-HDBK-620), which provide the engineering rationale and technical guidance on cable and wiring harness design. The User needs, as a minimum, the Design Requirements document (IPC-D-620), and the engineering description of the final product.

As wiring and connector technology changes, specific requirements will be updated or new requirements added to the document set.

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# Design and Critical Process Requirements for Cable and Wiring Harnesses

## 1 GENERAL

**1.1 Scope** This document provides design and critical process requirements and technical insight that have been removed from the acceptance standards for cable and wire harness assemblies. Reference materials listed in this text are among those considered as required reading. The User is encouraged to obtain all relevant referenced materials as this document cannot (nor can any single document) cover every material, process, environment, performance, or safety aspect that affect a given design.

**1.2 Purpose** This document is the cable and wiring harness and systems-level design requirements companion to IPC/WHMA-A-620 and its associated space addendum.

The intent of this document is to set forth the general design requirements for electrical wiring harnesses and cable assemblies. This document is intended for use by the design engineer, manufacturing engineer, quality engineer, or other individual responsible for the tailoring of specific requirements of this document to the applicable performance class.

a. In-Service Criteria. This document defines design requirements criteria to meet the expected performance and reliability for the expected product service life. It is not the intent of this document to establish or define "In Service" design requirements or acceptance criteria to address performance or reliability issues caused by aging or use. However, the criteria and limits that are currently detailed in this document may be considered to be wide enough to be applicable to the more common hardware degradation conditions caused by aging / use. Use of these criteria for "In Service" hardware conditions should be AABUS.

b. Alternate / Contractor-Proprietary Documents or Processes. It is not the intent of this document to exclude any alternate or contractor-proprietary documents or processes that meet or exceed the baseline of requirements established by this document. Use of alternate or contractor-proprietary documents or processes **shall [A1A2A3]** require review and prior approval of the User.

c. For purposes of this document:

- The Designer is the design agent for the User.
- The User is the individual, organization, company, contractually designated authority, or agency responsible for the procurement or design of electrical / electronic / electromechanical (EEE) hardware, and having the authority to define the class of equipment and any variation or restrictions to the requirements of this document (i.e., the originator / custodian of the contract detailing these requirements). The User is considered the Design Authority.
- The Supplier is considered the individual, organization or company which provides the Manufacturer (assembler) components (e.g., electrical, electronic, electromechanical, mechanical, printed boards) and/or materials (e.g., solder, flux, cleaning agents).
- The Manufacturer is considered the entity that provides a service or product to the User.

**1.3 Performance / Product Classification** This document recognizes that electrical wiring harnesses and cable assemblies are subject to performance / product 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 requirement overlaps between classes,

The User is responsible for defining the performance class required, whether compliance to any of the A through C Appendices is required, and to indicate any exceptions to specific parameters where appropriate.

**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.

**Space / Military**
Includes products from Performance Class 3 – High Performance/Harsh Environment Electronic, with additional considerations for unique materials requirements and more extreme operational environments, such as vibration and thermal cycling. Space classification deviations to IPC-D-620 requirements are defined and listed in Appendix A, "Military / Space Applications Requirements".

**1.4 Definition of Requirements** The imperative form of action verbs are used throughout this document to identify design requirements that may require compliance, depending upon the Performance Classification of the hardware. To assist the User, these action verbs are in bold text.

a. **SHALL / SHALL NOT**. The words **shall** or **shall not** are used whenever a requirement is intended to express a provision that is mandatory. Deviation from a **shall** or **shall not** requirement for a particular Performance Class may be considered if sufficient technical rationale / objective evidence (OE) is supplied to the User to justify the exception.

b. **SHOULD**. The word should is used whenever a requirement is intended to express a provision that is non-mandatory, and which reflects general industry practice and / or procedure.

c. **MAY**. The word MAY is intended to express an action or provision that is permissible.

**1.4.1 Design Requirement Format (A/N)**
This is a design document, and the requirements are formatted to allow verification and validation (V&V). As such, there are no quality acceptance conditions specified (see IPC/WHMA-A-620). To assist the User, each requirement is identified by its Performance Classification [x1x2x3] and applicability, where "x" represents:

**N** = Not Applicable
**A** = Applicable

**Examples:**
**[N1N2A3]** = Not Applicable for Class 1 or Class 2, Applicable for Class 3
**[N1A2A3]** = Not Applicable for Class 1, Applicable for Class 2 and Class 3
**[A1A2A3]** = Applicable for all Classes

**1.4.2 Requirements Flowdown** This document **shall not [A1A2A3]** be binding, unless separately and specifically included by the applicable contract, approved drawing(s), or purchase order.

a. When invoked, the applicable requirements of this document **shall [A1A2A3]** be imposed on all applicable subcontracts, assembly drawing(s), documentation and purchase orders.

**1.4.2.1 Notes / Italicized Text** Information provided in notes or presented as italicized text is for informational purposes only.

a. When invoked, the applicable requirements of this document **shall [A1A2A3]** be imposed on all applicable subcontracts, assembly drawing(s), documentation and purchase orders.

**1.4.3 Commercial Off-The-Shelf (COTS)** The requirements of this document **shall not [A1A2A3]** apply to suppliers of Commercial-Off-The-Shelf (COTS) or catalog items (e.g. components, assemblies, sub-assemblies, and/or hardware, etc.).

a. The design and workmanship of COTS items should be evaluated and modified as required to ensure that the use of COTS in wiring harnesses and cable assemblies meets contract performance and reliability requirements.

b. Modifications of COTS **shall [A1A2A3]** be documented.

c. All modifications **shall [A1A2A3]** meet the applicable requirements of this document for the specified Product Class, and be completed, inspected, and tested in accordance with IPC/WHMA-A-620 and/or IPC/WHMA-A-620X-S, unless otherwise specified by the User.

**1.4.4 Existing or Previously Approved Designs** The requirements of this document **shall not [A1A2A3]** constitute the sole cause for the redesign of previously approved designs.

a. When drawings for existing or previously approved designs undergo revision, they should be reviewed and changes made that allow for compliance with the requirements of this document.