



IPC-A-640A

# Acceptance Requirements for Optical Fiber, Optical Cable, and Hybrid Wiring Harness Assemblies

Developed by the Fiber Optic Cable Acceptability Task Group (7-31m) of  
the Product Assurance Committee (7-30) of IPC.

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Users of this publication are encouraged to participate in the  
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# Acceptance Requirements for Optical Fiber, Optical Cable, and Hybrid Wiring Harness Assemblies

## 1 GENERAL

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

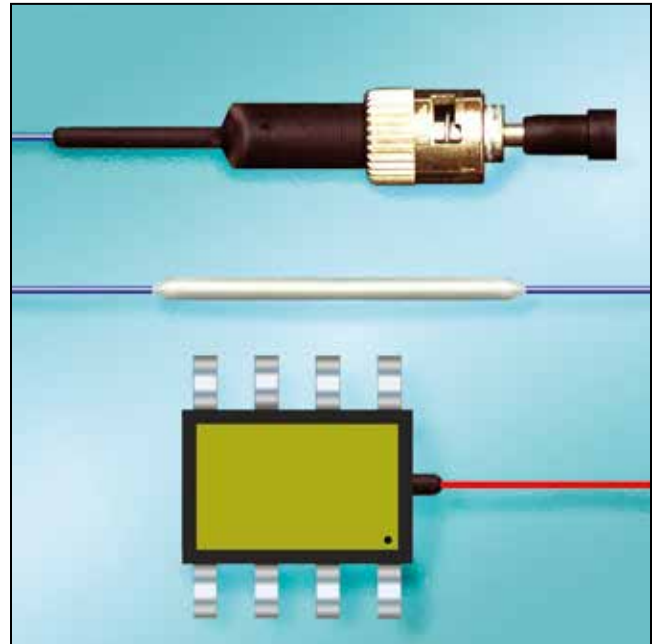
**1.2 Purpose** This standard is intended to provide information on design and acceptance requirements for optical fiber, optical cable, hybrid wiring harness assemblies and fiber optic communications systems (FOCS) to the extent that they can be applied to the broad spectrum of optical cable and wiring harness design.

Neither this document nor its Appendices provide detailed procedures for the test, acceptance, commissioning and /or maintenance of FOCS.

This document is intended for use by the design engineer, manufacturing engineer, quality engineer or other individual(s) responsible for tailoring specific requirements of this document to the applicable performance class.

- a. This document defines acceptability criteria and limits for “New/Beginning of Life” hardware. It is not the intent of this document to establish or define “In Service” acceptance criteria to address performance or reliability issues caused by aging or use. However, the acceptability criteria and limits that are 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 acceptance of “In Service” hardware conditions **shall [D1D2D3]** be as agreed between User and Supplier (AABUS).
- b. It is not the intent of this document to exclude any alternate documents or processes that meet or exceed the baseline requirements established by this document. Use of alternate documents or processes **shall [D1D2D3]** require review and prior approval of the User.
- c. For purposes of this document:
  - 1) The Designer is the design agent for the User.
  - 2) 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 product and any variation or restrictions to the requirements of this document (e.g., the originator/custodian of the contract detailing these requirements). The User is considered the Design Authority.
  - 3) 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).
  - 4) The Manufacturer is considered the entity that provides a service or product to the User.

*Note: In some instances, the Manufacturer may also be considered the Supplier to the User.*



**Figure 1-1 Optical Fiber Assemblies, Cables And Wiring Harnesses Connector, Splice and Transmitter**  
Image credit: NASA

**1.3 Performance / Product Classification** This document recognizes that optical wiring harnesses and cable 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.

- a. It should be recognized that there may be requirement overlaps between performance / product classifications.
- b. The User is responsible for defining the performance / product classification.
- c. The contract **shall [D1D2D3]** specify the performance / product classification required, whether compliance to any of the Appendices is required and indicate any exceptions to specific parameters where appropriate.

#### 1.3.1 Performance / Product Classification – Definitions

##### 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 for which 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 / Hazardous Applications

Includes products from Class 3, with additional considerations for unique materials requirements (e.g., flammability, outgassing), exposure to extreme operational conditions (e.g., vibration and thermal cycling, shock, gravitational-loading), and extreme or sensitive operational environments (e.g., oil and gas exploration, petrochemical, food, pharmaceutical). Space / Military / Hazardous Application deviations to IPC-A-640A requirements are defined and listed in Appendix A, “Space / Military / Hazardous Applications Requirements.”

**1.4 Definition of Requirements** The imperative form of action verbs are used throughout this document to identify acceptance requirements that may require compliance, depending upon the Performance Classification of the hardware.

- a. **SHALL / SHALL NOT** – The words **shall** or **shall not** are used whenever a requirement is intended to express a provision that is mandatory.
  - 1) To assist the users of this standard (e.g., User, Manufacturer, Designer), the action verbs **shall** and **shall not** are displayed in **bolded text**.
  - 2) 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 / SHOULD NOT** – The words “should” or “should not” are used whenever a requirement is intended to express a provision that is non-mandatory, and which reflects general industry practice and/or procedure. The words “should” or “should not” are displayed in unbolded text.

#### 1.4.1 Requirement Format (N/A/D)

To assist the User, each requirement is identified by its Performance Classification (x1x2x3) and applicability, where “x” represents:

N = No requirement has been established for this Class

A = Acceptable

D = Defect

Examples:

- [N1N2D3] is Requirement Not Established Class 1 or 2, Defect Class 3
- [N1D2D3] is Requirement Not Established Class 1, Defect Classes 2 and 3
- [N1A2D3] is Requirement Not Established Class 1, Acceptable Class 2, Defect Class 3
- [A1A2D3] is Acceptable Classes 1 and 2, Defect Class 3
- [D1D2D3] is Defect for all Classes.
- A defect for a Class 1 product means that the characteristic is also a defect for Class 2 product and Class 3 product.
- A defect for a Class 2 product means that the characteristic is also a defect for a Class 3 product but may not be a defect for a Class 1 product where less demanding criteria may apply.