IPC-D-640A

Design and Critical Process Requirements for Optical Fiber, Optical Cable and Hybrid Wiring Harness Assemblies

Developed by the Fiber Optic Cable Acceptability Task Group (7-31m) of the Acceptability Subcommittee (7-31) of IPC

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

Contact:

IPC

Tel 847 615.7100
Fax 847 615.7105

Table of Contents

Tables

Figures

Design and Critical Process Requirements for Optical Fiber, Optical Cable and Hybrid Wiring Harness Assemblies

1 GENERAL

1.1 Scope This document provides design and critical process requirements and technical insight 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 referenced materials, as this document cannot (nor can any single document) cover every material, process, environment, performance, or safety aspect, that impact a given design.

1.2 Purpose This standard is intended to provide information on the general design 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.

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.

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 [A1A2A3]** require review and prior approval of the User.

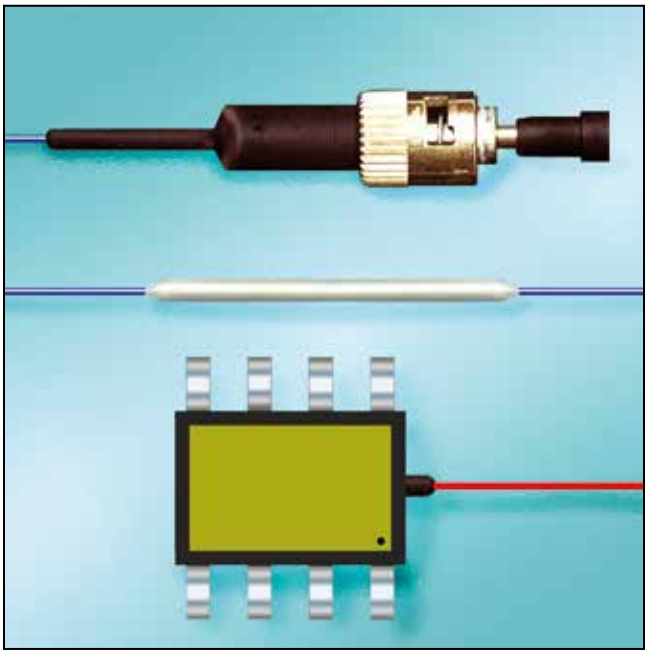

Figure 1-1 Optical Fiber Assemblies, Cables And Wiring Harnesses Connector, Splice and Transmitter
Image credit: NASA

For purposes of this document:

a. The Designer is the design agent for the User.

b. 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 (i.e., the originator / custodian of the contract detailing these requirements). The User is considered the Design Authority.

c. The Supplier is considered the individual, organization or company which provides the Manufacturer (assembler) components (electrical, electronic, electromechanical, mechanical, printed boards) and/or materials (solder, flux, cleaning agents).

d. The Manufacturer is considered the entity that provides a service or product to the User.

1.3 Performance / Product Classification This document recognizes that optical 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 product class. The contract **shall [A1A2A3]** specify the performance class required, whether compliance to any of the Appendices is required, and 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 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 / 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 classification deviations to IPC-D-640A requirements are defined and listed in Appendix A.

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 nonmandatory, and which reflects general industry practice and/or procedure. The words "should" or "should not" are displayed in unbolded text.

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 in the document. To assist the User, each requirement in the design section of the document 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.

1.4.3 Note(s) / Italicized Text Information provided in Notes or presented as italicized text is for informational purposes only.

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

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 this document, unless otherwise specified by the User.

1.4.5 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.