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TIA/EIA STANDARD

Optical Fiber Cabling Components Standard

TIA/EIA-568-B.3

(Revision of TIA/EIA-568-A)

APRIL 2000

TELECOMMUNICATIONS INDUSTRY ASSOCIATION

Representing the telecommunications industry in association with the Electronic Industries Alliance

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(From Standards Proposal Nos. 3894 and 3894-A, formulated under the cognizance of the TIA TR-42 Committee on User Premises Telecommunications Infrastructure.)

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OPTICAL FIBER CABLING COMPONENTS STANDARD
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FOREWORD

(This foreword is not a part of this Standard.)

This Standard was developed by TIA/EIA Subcommittee TR-42.8.

Approval of Standard

This Standard was approved by TIA/EIA Subcommittee TR-42.8, TIA/EIA Engineering Committee TR-42, and the American National Standards Institute (ANSI).

ANSI/TIA/EIA reviews standards every 5 years. At that time, standards are reaffirmed, rescinded, or revised according to the submitted updates. Updates to be included in the next revision should be sent to the committee chair or to ANSI/TIA/EIA.

Contributing Organizations

More than 30 organizations within the telecommunications industry contributed their expertise to the development of this Standard (including manufacturers, consultants, end users, and other organizations).

Documents Superseded

This Standard replaces, in part, ANSI/EIA/TIA-568-A, published October, 1995 and TIA TSB-72, published October, 1995.

Significant technical changes from the previous edition

— This foreword has been changed per the requirements of the TIA style manual.

— All definitions have been harmonized across all of TIA's telecommunications infrastructure standards.

— Provides performance specifications for 50/125 μm optical fiber cables.

— Provides a minimum bend radius and maximum pulling tensions for horizontal cable, inside plant cable, and outside plant optical fiber cable.

— Allows for the use of alternate connector designs in addition to the 568SC.

— Provides complete generic performance specifications for optical fiber connectors.

— Specifies requirements for connecting hardware in support of centralized cabling.

Relationship to other TIA standards and documents

- Commercial Building Telecommunications Cabling Standard, Part 1, General Requirements (ANSI/TIA/EIA-568-B.1);

- Commercial Building Standard for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A);

- Residential Telecommunications Cabling Standard (ANSI/TIA/EIA-570-A);

- Administration Standard for the Telecommunications Infrastructure of Commercial Buildings (ANSI/TIA/EIA-606);

- Commercial Building Grounding and Bonding Requirements for Telecommunications (ANSI/TIA/EIA-607).

- Customer-Owned Outside Plant Telecommunications Cabling Standard (ANSI/TIA/EIA-758).

The following documents may be useful to the reader:

a) National Electrical Safety Code® (NESC®)
(IEEE C 2)

b) National Electrical Code® (NEC®)
(NFPA 70)

Useful supplements to this Standard are the Building Industry Consulting Service International (BICSI) *Telecommunications Distribution Methods Manual,* the *Customer-owned Outside Plant Methods Manual,* and the *Cabling Installation Manual*. These manuals provide practices and methods by which many of the requirements of this standard are implemented.

Other references are listed in annex B.

Annexes

Annex A is normative and is considered a requirement of this Standard. Annex B is informative and not considered a requirement of this Standard.

1. INTRODUCTION

1.1 Purpose

This Standard specifies the component and transmission requirements for an optical fiber cabling system (e.g., cable, connectors). 50/125 μm and 62.5/125 μm multimode, and singlemode optical fiber cables are recognized cables.

1.2 Specification of criteria

In accordance with EIA Engineering Publication, EP-7B, two categories of criteria are specified; mandatory and advisory. The mandatory requirements are designated by the word "shall"; advisory requirements are designated by the words "should", "may", or "desirable" which are used interchangeably in this Standard.

Mandatory criteria generally apply to protection, performance, administration and compatibility; they specify the absolute minimum acceptable requirements. Advisory or desirable criteria are presented when their attainment will enhance the general performance of the cabling system in all its contemplated applications.

A note in the text, table, or figure is used for emphasis or offering informative suggestions.

1.3 Metric equivalents of US customary units

The majority of the metric dimensions in this Standard are soft conversions of US customary units; e.g., 100 millimeters (mm) is the soft conversion of 4 inches (in).

1.4 Life of the Standard

This Standard is a living document. The criteria contained in this Standard are subject to revisions and updating as warranted by advances in building construction techniques and telecommunications technology.

2. SCOPE

2.1 Applicability

This Standard specifies minimum requirements for optical fiber components used in premises cabling, such as cable, connectors, connecting hardware, patch cords and field test equipment.

2.2 Normative references

The following standards contain provisions that, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision; parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated. ANSI and TIA maintain registers of currently valid national standards published by them.

- ANSI/EIA/TIA-455-A-1991, Standard Test Procedures for Fiber Optic Fibers, Cables and Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components

- ANSI/ICEA S-83-596-1994, Fiber Optic Premises Distribution Cable

- ANSI/ICEA S-87-640-2000, Fiber Optic Outside Plant Communications Cable

- ANSI/TIA/EIA-526-7-1998, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant-OFSTP-7

- ANSI/TIA/EIA-526-14-A-1998, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant OFSTP-14A

- ANSI/TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard: Part 1, General Requirements

  NOTE: -- The Commercial Building Telecommunications Cabling Standard: Part 1, General Requirements was under development at the time of this Standard being approved and is expected to be published as ANSI/TIA/EIA-568-B-1.

- ANSI/TIA/EIA-598-A-1995, Optical Fiber Cable Color Coding

- ANSI/TIA/EIA-604-3-1997, FOCIS 3 Fiber Optic Connector Intermateability Standard

- ANSI/TIA/EIA-606-1993, Administration Standard For The Telecommunications Infrastructure Of Commercial Buildings

3. DEFINITIONS, ABBREVIATIONS AND ACRONYMS, UNITS OF MEASURE

3.1 General

This clause contains definitions of terms, acronyms, and abbreviations that have a special meaning or that are unique to the technical content of this Standard. The terms that are used in only one clause may be defined within, and at the beginning of, that clause.

3.1.1 Definitions

The generic definitions in this subclause have been formulated for use by the entire family of telecommunications infrastructure standards. As such, the definitions do not contain mandatory requirements of the Standard. Specific requirements are to be found in the normative subclauses of the Standard.

adapter; optical fiber duplex: A mechanical device designed to align and join two duplex optical fiber connectors (plugs) to form an optical duplex connection.

administration: The method for labeling, identification, documentation and usage needed to implement moves, additions and changes of the telecommunications infrastructure.

backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.

cable: An assembly of one or more insulated conductors or optical fibers, within an enveloping sheath.

cable run: A length of installed media, which may include other components along its path.

cable sheath: A covering over the optical fiber or conductor assembly that may include one or more metallic members, strength members, or jackets.

cabling: A combination of all cables, jumpers, cords, and connecting hardware.

campus: The buildings and grounds having legal contiguous interconnection.

centralized cabling: A cabling configuration from the work area to a centralized cross-connect using pull through cables, an interconnect, or splice in the telecommunications room.

connecting hardware: A device providing mechanical cable terminations.

connector (plug), duplex; optical fiber: A remateable device that terminates two fibers and mates with a duplex receptacle.

consolidation point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

cross-connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

cross-connection: A connection scheme between cabling runs, subsystems, and equipment using patch cords or jumpers that attach to connecting hardware on each end.

equipment cable; cord: A cable or cable assembly used to connect telecommunications equipment to horizontal or backbone cabling.

fiber optic: See **optical fiber**.

horizontal cabling: The cabling between and including the telecommunications outlet/connector and the horizontal cross-connect.

horizontal cross-connect: A cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone, equipment.

hybrid optical fiber cable: An optical fiber cable containing two or more fiber types (e.g., multimode and singlemode).

infrastructure (telecommunications): A collection of those telecommunications components, excluding equipment, that together provide the basic support for the distribution of all information within a building or campus.

interconnection: A connection scheme that employs connecting hardware for the direct connection of a cable to another cable without a patch cord or jumper.

intermediate cross-connect: A cross-connect between first level and second level backbone cabling.

keying: The mechanical feature of a connector system that guarantees correct orientation of a connection, or prevents the connection to a jack, or to an optical fiber adapter of the same type intended for another purpose.

link: A transmission path between two points, not including terminal equipment, work area cables, and equipment cables.

listed: Equipment included in a list published by an organization, acceptable to the authority having jurisdiction, that maintains periodic inspection of production of listed equipment, and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

main cross-connect: A cross-connect for first level backbone cables, entrance cables, and equipment cables.

media (telecommunications): Wire, cable, or conductors used for telecommunications.

mode: A path of light in an optical fiber.

multimode optical fiber: An optical fiber that carries many paths of light.

open office: A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

optical fiber: Any filament made of dielectric materials that guides light.

optical fiber cable: An assembly consisting of one or more optical fibers.

outlet box (telecommunications): A metallic or nonmetallic box mounted within a wall, floor, or ceiling and used to hold telecommunications outlets/connectors or transition devices.

outlet cable: A cable placed in a residential unit extending directly between the telecommunications outlet/connector and the distribution device.

outlet/connector (telecommunications): A connecting device in the work area on which horizontal cable or outlet cable terminates.

outside plant: Telecommunications infrastructure designed for installation exterior to buildings.

patch cord: A length of cable with a plug on one or both ends.

patch panel: A connecting hardware system that facilitates cable termination and cabling administration using patch cords.

pathway: A facility for the placement of telecommunications cable.

pull strength: See **pull tension**.

pull tension: The pulling force that can be applied to a cable.

sheath: See **cable sheath**.

shield: A metallic layer placed around a conductor or group of conductors.

singlemode optical fiber: An optical fiber that carries only one path of light.

splice: A joining of conductors in a splice closure, meant to be permanent.

telecommunications: Any transmission, emission, and reception of signs, signals, writings, images, and sounds, that is, information of any nature by cable, radio, optical, or other electromagnetic systems.

work area (work station): A building space where the occupants interact with telecommunications terminal equipment.

3.1.2 Abbreviations and acronyms

ANSI	American National Standards Institute
BICSI	Building Industry Consulting Service International
EIA	Electronic Industries Alliance
FOCIS	Fiber Optic Connector Intermateability Standard
FOTP	Fiber Optic Test Procedure
ICEA	Insulated Cable Engineers Association
LED	light emitting diode
N/A	not applicable
NEC®	National Electrical Code®
NESC®	National Electrical Safety Code®
TIA	Telecommunications Industry Association
TSB	Telecommunications System Bulletin

3.1.3 Units of measure

dB	decibel
ºC	degrees Celsius
ºF	degrees Fahrenheit
g	gram
in	inch
kg	kilogram
km	kilometer
lb	pound
lbf	pound-force
MHz	megahertz
mm	millimeter
N	Newton
nm	nanometer
µm	micrometer or micron

4. OPTICAL FIBER CABLES

4.1 General

This clause contains the performance specifications for the optical fiber cables recognized in premises cabling standards.

4.2 Cable transmission performance

The outside plant telecommunications cable shall comply with ANSI/ICEA S-87-640. Inside plant optical fiber telecommunications cable shall comply with ANSI/ICEA S-83-596.

Each cabled fiber shall meet the graded performance specifications of table 1.

Table 1 – Optical fiber cable transmission performance parameters

Optical fiber cable type	Wavelength (nm)	Maximum attenuation (dB/km)	Minimum information transmission capacity for overfilled launch (MHz•km)
50/125 µm multimode	850	3.5	500
	1300	1.5	500
62.5/125 µm multimode	850	3.5	160
	1300	1.5	500
singlemode inside plant cable	1310	1.0	N/A
	1550	1.0	N/A
singlemode outside plant cable	1310	0.5	N/A
	1550	0.5	N/A

NOTE - The information transmission capacity of the fiber, as measured by the fiber manufacturer, can be used by the cable manufacturer to demonstrate compliance with this requirement.

4.3 Physical cable specifications

The optical fiber cable construction shall consist of 50/125 µm or 62.5/125 µm multimode optical fibers or singlemode optical fibers, or a combination of these media. Individual fibers and groups of fibers shall be identifiable in accordance with ANSI/TIA/EIA-598-A. The cable shall be listed and marked as required under the applicable electrical code and local building code requirements.

4.3.1 Inside plant cable specifications

The mechanical and environmental specifications for inside plant optical fiber cable shall be in accordance with ANSI/ICEA S-83-596.

2- and 4-fiber cables intended for horizontal or centralized cabling shall support a bend radius of 25 mm

(1 in) under no-load conditions. 2 and 4-fiber cables intended to be pulled through horizontal pathways during installation shall support a bend radius of 50 mm (2 in) under a pull load of 222 N (50 lbf). All other inside plant cables shall support a bend radius of 10 times the cable outside diameter when not subject to tensile load, and 15 times the cable outside diameter when subject to tensile loading up to the cable's rated limit.

4.3.2 Outside plant cable specifications

The mechanical and environmental specifications for outside plant optical fiber cable shall be in accordance with ANSI/ICEA S-87-640.

Outside plant optical fiber cables shall be of a water-block construction and meet the requirements for compound flow and water penetration as established by ANSI/ICEA S-87-640. Outdoor cable shall have a minimum pull strength of 2670 N (600 lbf).

Outside plant cables shall support a bend radius of 10 times the cable outside diameter when not subject to tensile load, and 20 times the cable outside diameter when subject to tensile loading up to the cable's rated limit.

4.3.2.1 Drop cable

Drop cables are typically small diameter, low fiber count cables with limited unsupported span distances. They are used to feed a small number of fibers from a higher fiber count cable into a single location. Drop cable shall have a minimum pull strength of 1335 N (300 lbf).

5. CONNECTING HARDWARE

5.1 General

This clause contains the performance specifications for the optical fiber connectors, connecting hardware and splices recognized in premises cabling standards. These requirements apply to connecting hardware at the main cross-connect, intermediate cross-connect, horizontal cross-connect, centralized cabling interconnection and splice, consolidation point and work area.

Various connector designs may be used provided that the connector design satisfies the performance requirements specified within annex A. These connector designs shall meet the requirements of the corresponding TIA Fiber Optic Connector Intermateability Standard (FOCIS) document. The duplex SC connector and adapter (referred to as the 568SC) are used for references and illustrative purposes in this Standard.

> NOTE - The term adapter, when used in reference with optical fiber, should not be confused with its definition when used in reference with other media types, such as twisted-pair cabling. The term adapter has been adopted by the optical fiber industry and standards organizations to define a mechanical termination device designed to align and join two like optical connectors.

5.2 Connector and adapter

5.2.1 Physical design

Connector designs shall meet the requirements of the corresponding TIA FOCIS document. For example, the 568SC connector and adapter shall meet the requirements of ANSI/TIA/EIA-604-3; designation FOCIS 3P-0-2-1-1-0 for singlemode plugs, designation FOCIS 3P-0-2-1-4-0 for multimode plugs, and designation FOCIS 3A-2-1-0 for adapters. No means to prevent mating singlemode to multimode fibers is required.

5.2.2 Performance

The performance of the connector designs shall meet the requirements specified in annex A.

5.2.3 Multimode and singlemode identification

The multimode connector or a visible portion of it shall be beige in color. The multimode adapter or outlet shall be identified by the color beige. The singlemode connector or a visible portion of it shall be blue in color. The singlemode adapter or outlet shall be identified by the color blue.

5.2.4 Keying and labeling

5.2.4.1 568SC Connector

The two fiber positions in a 568SC connector and the corresponding 568SC adapter shall be referred to as Position A and Position B. Figure 1 shows the locations of Position A and Position B in the 568SC connector and adapter with respect to the keys and keyways. As the figure indicates, the 568SC adapter shall perform a pair-wise crossover between connectors. Additionally, the plane (frontal) view inset in figure 1 shows Position A and Position B in the two possible horizontal and two possible vertical orientations. The shading used in figure 1 is for clarification only and is not a specified identification scheme. The two positions of the 568SC adapter shall be identified as Position A and Position B by using the letter designators A and B respectively. Labeling may be either field or factory installed.

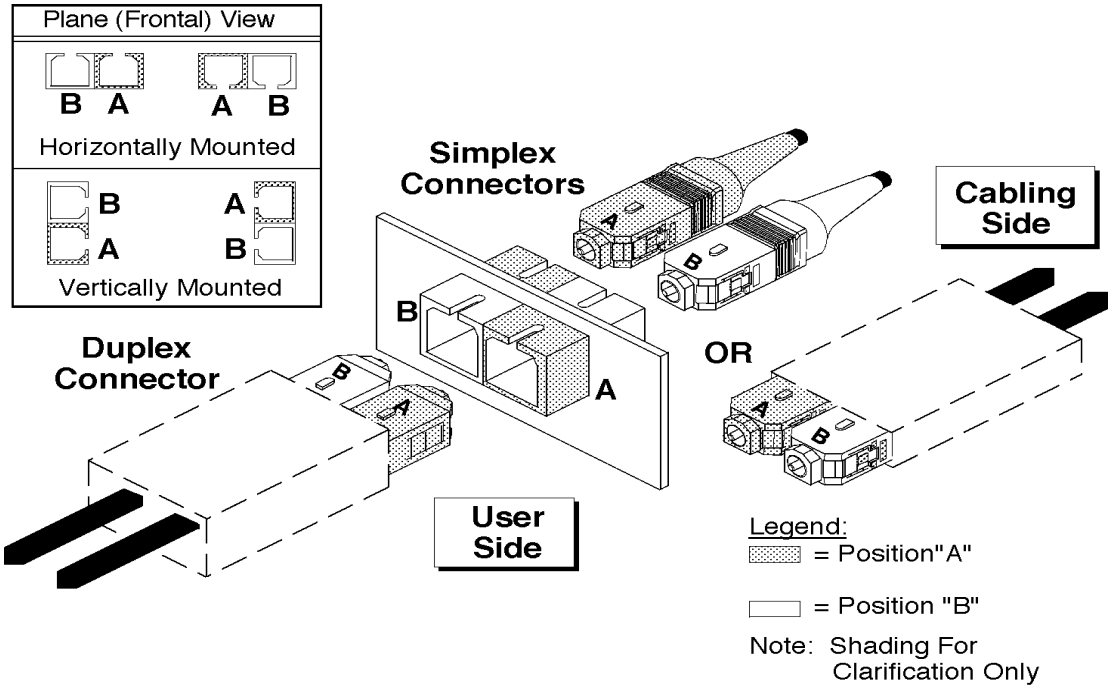

Figure 1 – Position A and B configuration of a 568SC

5.2.4.2 Other duplex connectors

Alternate connector designs shall employ similar labeling and identification schemes. Position A and Position B on alternate duplex connector designs shall be in the same position as the 568SC in figure 1. For alternate connector designs utilizing latches, the latch defines the positioning in the same manner as the key and keyways.

5.3 Telecommunications outlet box

As a minimum, the telecommunications outlet box shall be capable of housing two terminated optical fibers. The outlet box shall have the ability to secure the optical fiber cable and provide for a minimum fiber bend radius of 25 mm (1 in).

5.4 Patch panels

5.4.1 Mounting

Optical fiber cable connecting hardware should be designed to provide flexibility for mounting on walls, in racks, or on other types of distribution frames and standard mounting hardware.

5.4.2 Mechanical termination density

Optical fiber cable connecting hardware should incorporate high-density termination to conserve space and provide for ease of optical fiber cable and patch cord management upon installation.

5.4.3 Design

The optical fiber patch panel shall be designed to provide a:

a) means to cross-connect cabling with patch cords;

b) means to interconnect premises equipment to the optical fiber cabling;

c) means to identify cabling for administration in accordance with ANSI/TIA/EIA-606;

d) means to use standard colors to functionally identify termination groups per ANSI/TIA/EIA-606;

e) means of handling optical fiber cables and patch cords, and to promote orderly management;

f) means of access to monitor or test optical fiber cabling and premises equipment; and,

g) means of adequate protection for connectors and adapters on the cabling side from accidental contact with foreign objects that may temporarily or permanently degrade the optical performance.

5.5 Connecting hardware for centralized cabling

The optical fiber connecting hardware used to join horizontal cables to intrabuilding backbone cables in a centralized cabling configuration shall be designed to:

a) provide a means of joining the fibers between the backbone and horizontal cables by using either re-mateable connectors or splices. It is recommended that only one method be used at a facility;

   1) Re-mateable connectors shall meet the requirements of subclause 5.2.

   2) Splices may be either fusion or mechanical. Splices shall meet the requirements of subclause 5.6.

b) provide joining technology which allows fibers to be joined as single fibers or as fiber pairs, but organizes and manages the fiber by pairs;

c) provide a means to uniquely identify each joining position;

d) allow for removal of existing horizontal connections, and the addition of new horizontal connections;

e) provide a means to store and identify non-connected fibers from either the backbone or the horizontal cables;

f) provide a means to accommodate the addition of backbone cables, or horizontal cables, or both;

g) provide a means for migration from an interconnection or splice to a cross-connection;

h) provide a means of access to test optical fiber cabling; and,

i) provide adequate protection for the connections against accidental contact with foreign objects that may disturb optical continuity.

The manufacturer shall provide installation and design instructions and recommendations to accomplish the above requirements.

5.6 Optical fiber splice

Optical fiber splices, fusion or mechanical, shall not exceed a maximum optical attenuation of 0.3 dB when measured in accordance with ANSI/EIA/TIA-455-34, Method A (factory testing) or ANSI/EIA/TIA-455-59 (field testing).

Optical fiber splices, fusion or mechanical, shall have a minimum return loss of 20 dB for multimode, 26 dB for singlemode, when measured in accordance with ANSI/EIA/TIA-455-107. The minimum singlemode return loss for broadband analog video (CATV) applications is 55 dB.

6. PATCH CORDS

6.1 General

This clause contains the performance specifications for the optical fiber patch cords recognized in premises cabling standards. These patch cords are used to connect optical fiber links at cross-connects and as equipment or work area cords used to connect telecommunications equipment to horizontal or backbone cabling.

NOTE - The requirements for special application cable assemblies are outside the scope of this Standard.

6.2 Patch cord cable

The optical fiber patch cord shall be a two-fiber cable, of the same fiber type as the optical fiber cabling, of an indoor construction, and shall meet the requirements of subclauses 4.2 and 4.3.1.

6.3 Patch cord connectors

The patch cord connector shall meet the requirements of subclause 5.2.

6.4 Termination configuration

Optical fiber patch cords, whether they are used for cross-connection or interconnection to equipment, shall be of an orientation such that Position A goes to Position B on one fiber, and Position B goes to Position A on the other fiber of the fiber pair (figure 2). Each end of the optical fiber patch cord shall be identified to indicate Position A and Position B if the connector can be separated into its simplex components. For alternate connector designs utilizing latches, the latch defines the positioning in the same manner as the keys.

For simplex connectors, the connector that plugs into the receiver shall be considered Position A, and the connector that plugs into the transmitter shall be considered Position B.

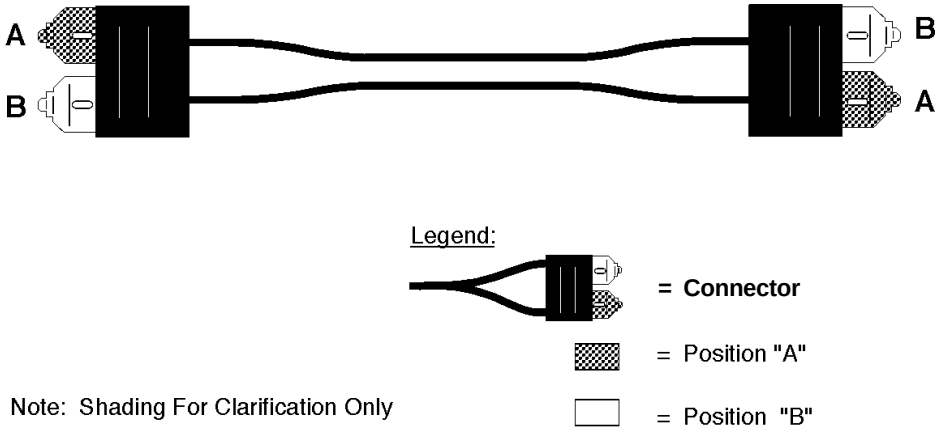

Figure 2 – Optical fiber patch cord

7. FIELD TEST INSTRUMENTS

7.1 Multimode

Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.1) with a Category 1 light source.

7.2 Singlemode

Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

ANNEX A (normative) OPTICAL FIBER CONNECTOR PERFORMANCE SPECIFICATIONS

This annex is normative and is considered part of this Standard.

A.1 Introduction

This annex contains the minimum performance requirements (optical, mechanical and environmental) for optical fiber connectors, adapters and cable assemblies recognized in premises cabling standards.

A.2 Intermateability requirements

All connectors, adapters and cable assemblies shall comply with the dimensional requirements of the corresponding Fiber Optic Connector Intermateability Standard (FOCIS).

A.3 Performance requirements

All multimode connectors, adapters and cable assemblies shall meet the requirements of this clause at both 850 nm and 1300 nm ± 30 nm wavelengths. All singlemode connectors, adapters and cable assemblies shall meet the requirements of this clause at both 1310 nm and 1550 nm ± 30 nm wavelengths. Qualification testing shall be conducted in accordance with the specified TIA Fiber Optic Test Procedure (FOTP) and in accordance with the details specified within this clause. Performance testing does not require any particular test sequence or that the same samples must be used in any series of tests.

A.3.1 Visual and mechanical inspections: FOTP-13

Sample Size: 24 mated connector pairs

Details

- Size measurement methods: per applicable FOCIS
- Deviations: None

A.3.2 Attenuation: FOTP-171 Methods A1 or D1, or FOTP-34 Method A2 for multimode FOTP-171 Methods A3 or D3, or FOTP-34 Method B for singlemode

Sample Size: 24 mated connector pairs

Details

- Deviations: For FOTP 171 Methods D1 and D3, a reference quality launch is not used. The launch loss is included with the pair under test.
- Requirement: maximum insertion loss of 0.75 dB

A.3.3 Return loss: FOTP-107 or FOTP-8

Sample Size: 24 mated connector pairs

Details

- Deviations: None
- Requirement: 20 dB minimum for multimode fiber, 26 dB minimum for singlemode fiber
- For all annex A requirements, the minimum singlemode return loss for broadband analog video (CATV) applications is 55 dB.

A.3.4 Low temperature: FOTP-188

Sample Size: 8 mated connector pairs

Details

- Specimen mated
- Temperature: 0ºC (32 ºF), preconditioned 24 hours
- Test time condition: 4 days
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - maximum change in insertion loss of 0.3 dB
- Final measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.5 Temperature life: FOTP-4

Sample Size: 8 mated connector pairs

Details

- Test condition: 60ºC (140 ºF)
- Test time condition: 4 days
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.6 Humidity: FOTP-5

Sample Size: 8 mated connector pairs

Details

- Specimen mated
- Test Method A: Steady state
- Test condition A: 96 hours (4 days) of 90 - 95% at 40 ± 2ºC (104 ± 3.6ºF)
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertions loss of 0.75 dB
- Measurements and performance requirements during test:
  - maximum change in insertion loss of 0.4 dB
- Final measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.7 Impact: FOTP-2

Sample Size: 8 mated connector pairs

Details

- Light service class method B: 8 drops from 1.8 m (70.9 in)
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertions loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.8 Strength of coupling mechanism: FOTP-185

Sample Size: 8 mated connector pairs

Details

- Specimen mated
- Tensile force: 33 N (7.4 lbf) at 0-degree pull angle
- Load application rate: 25.4 mm (1 in) per minute
- Duration: 5 seconds minimum
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final Measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.9 Durability: FOTP-21

Sample Size: 8 mated connector pairs

Details

- Number of cycles: 500
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.10 Cable retention: FOTP-6

Test 1: 0-degrees
Sample Size: 8 mated connector pairs
Details

- Specimen Mated
- Deviations: None
- Tensile load (for cables with strength members terminated on connector): 50 N (11.24 lbf) at 0-degree pull angle per terminated cable sheath
- Tensile load (for cables without strength members terminated on connector): 2.2 N (0.5 lbf) at 0-degrees pull angle per terminated buffered or coated fiber
  - Load application rate: 25.4 mm (1 inch) per minute minimum
  - Duration: 5 seconds minimum
- Initial measurements and performance requirements:
  - Maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final measurements and performance requirements:
  - maximum attenuation increase 0.5 dB
  - maximum insertions loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

Test 2: 90-degrees
Sample Size: 8 mated connector pairs
Details

- Specimen mated
- Deviations: None
- Tensile load (for cables with strength members terminated on connector): 19.4 N (4.4 lbf) at 90-degrees pull angle per terminated cable sheath
- Tensile load (for cables without strength members terminated on connector): 2.2 N (0.5 lbf) at 90-degrees pull angle per terminated buffered or coated fiber
  - Load application rate: 25.4 mm (1 inch) per minute minimum
  - Duration: 5 seconds minimum
- Initial measurements and performance requirements:
  - Maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final measurements and performance requirements:
  - maximum attenuation increase 0.5 dB
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.11 Flex: FOTP-1

Sample Size: 8 mated connector pairs

Details

- Applied weight: 0.5 kg (1.1 lb) per terminated cable sheath, 224 g (0.5 lb) per buffered or coated fiber
- Test fixture: per figure 2.
- Test fixture rotation cycle: 0-degrees, +90-degrees, 0-degrees, -90-degrees, 0-degrees for 100 cycles
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

A.3.12 Twist: FOTP-36

Sample Size: 8 mated connector pairs

Details:

- Specimen mated
- Tensile load: 15 N (3.4 lbf) at 0-degrees pull angle per terminated cable sheath.
  2.2 N (0.5 lbf) at 0-degrees pull angle per buffered or coated fiber.
  Load applied 220 - 280 mm (8.6 – 11 in) from connector under test.
- Details: Rotate through the following cycle:
  2.5 revolutions in one direction, reverse for 5 revolutions, and reverse for 2.5 revolutions to initial position. Repeat 9 times
- Deviations: None
- Initial measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
- Measurements and performance requirements during test:
  - None
- Final measurements and performance requirements:
  - maximum insertion loss of 0.75 dB
  - minimum return loss of 20 dB for multimode, and 26 dB for singlemode

ANNEX B (informative) BIBLIOGRAPHY AND REFERENCES

This annex is informative only and is not part of this Standard.

This annex contains information on the documents that are related to or have been referenced in this document. Many of the documents are in print and are distributed and maintained by national or international standards organizations. These documents can be obtained through contact with the associated standards body or designated representatives. The applicable electrical code in the United States is the National Electrical Code® (NEC®).

- ANSI/EIA/TIA-492AAAB, Detail Specification for 50 μm Core Diameter/125 μm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibers
- ANSI/EIA/TIA-455-A-1991, Standard Test Procedures for Fiber Optic Fibers, Cables and Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components
- ANSI/ICEA S-83-596-1994, Fiber Optic Premises Distribution Cable
- ANSI/ICEA S-87-640-2000, Fiber Optic Outside Plant Communications Cable
- ANSI/IEEE C2-1997, National Electrical Safety Code®
- ANSI/NFPA 70-1999, National Electrical Code®
- ANSI/TIA/EIA-492AAAA-A-1998, Detail Specification for 62.5 μm Core Diameter/125 μm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers
- ANSI/TIA/EIA-492CAAA-1998, Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Fibers
- ANSI/TIA/EIA-526-7-1998, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant-OFSTP-7
- ANSI/TIA/EIA-526-14-A-1998, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant OFSTP-14A
- ANSI/TIA/EIA-604-3-1997, FOCIS 3 Fiber Optic Interconnector Intermateability Standard
- ANSI/TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard: Part 1, General Requirements

  NOTE: -- The Commercial Building Telecommunications Cabling Standard: Part 1, General Requirements was under development at the time of this Standard being approved and is expected to be published as ANSI/TIA/EIA-568-B-1.

- ANSI/TIA/EIA-569-A-1998, Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-570-A-1999, Residential Telecommunications Cabling Standard
- ANSI/TIA/EIA-598-A-1995, Optical Fiber Cable Color Coding

- ANSI/TIA/EIA-606-1993, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/TIA/EIA-607-1994, Commercial Building Grounding and Bonding Requirements for Telecommunications
- ANSI/TIA/EIA-758-1999, Customer-owned Outside Plant Telecommunications Cabling Standard
- ANSI X3.166-1995, ANSI Standard for Token Ring FDDI Physical Layer Medium Dependent (PMD)
- ANSI Z136.2, 1997, American Standard for the Safe Operation of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources
- BICSI Telecommunications Distribution Methods Manual
- BICSI Cabling Installation Manual
- BICSI Customer-owned Outside Plant Methods Manual
- Federal Communications Commission (FCC) Washington D.C., "The Code of Federal Regulations, FCC 47 CFR 68 (1982 issue or latest revision)
- Federal Telecommunications Recommendation 1090-1997, Commercial Building Telecommunications Cabling Standard
- IEEE 802.3-1998 (also known as ANSI/IEEE Std 802.3-1990 or ISO 8802-3: 1990 (E), Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
- IEEE 802.4-1995 Standard for Local Area Network Token Passing Bus Access Method, Physical Layer Specification
- IEEE 802.5-1998 (also known as ANSI/IEEE Std 802.5-1992), Token Ring Access Method and Physical Layer Specifications
- IEEE 802.7-1989 (R1997) IEEE Recommended Practices for Broadband Local Area Networks (ANSI)

The organizations listed below can be contacted to obtain reference information.

ANSI
American National Standards Institute (ANSI)
11 W 42 St.
New York, NY 10032
USA
(212) 642-4900
www.ansi.org

ASTM
American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
USA
(610) 832-9500
www.astm.org

BICSI

Building Industry Consulting Service International
8610 Hidden River Parkway
Tampa, FL 33637-1000
USA
(800) 242-7405
www.bicsi.org

CSA
Canadian Standards Association International (CSA)
178 Rexdale Blvd.
Etobicoke, (Toronto), Ontario
Canada M9W 1R3
(416) 747-4000
www.csa-international.org

EIA/TIA
Electronic Industries Alliance (EIA)
2500 Wilson Blvd., Suite 400
Arlington, VA 22201-3836
USA
(703) 907-7500
www.eia.org

Telecommunications Industry Association (TIA)
2500 Wilson Blvd., Suite 300
Arlington, VA 22201-3836
USA
(703) 907-7700
www.tiaonline.org

FCC
Federal Communications Commission (FCC)
Washington, DC 20554
USA
(301) 725-1585
www.fcc.org

Federal and Military Specifications
National Communications System (NCS)
Technology and Standards Division
701 South Court House Road Arlington, VA 22204-2198
USA
(703) 607-6200
www.ncs.gov

ICEA
Insulated Cable Engineers Association, Inc. (ICEA)
PO Box 440
South Yarmouth, MA 02664
USA
(508) 394-4424
www.icea.net

IEC
International Electrotechnical Commission (IEC)
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PO Box 131
3 rue de Varembe
1211 Geneva 20
Switzerland
+41 22 919 02 11
www.iec.ch

IEEE
The Institute of Electrical and Electronic Engineers, Inc (IEEE)
IEEE Service Center
445 Hoes Ln., PO Box 1331
Piscataway, NJ 08855-1331
USA
(732) 981-0060
www.ieee.org

IPC
The Institute for Interconnecting and Packaging Electronic Circuits
2215 Sanders Rd.
Northbrook, IL 60062-6135
USA
(847) 509-9700
www.ipc.org

ISO
International Organization for Standardization (ISO)
1, Rue de Varembe
Case Postale 56
CH-1211 Geneva 20
Switzerland
+41 22 74 901 11
www.iso.ch

NEMA
National Electrical Manufacturers Association (NEMA)
1300 N. 17th Street, Suite 1847
Rosslyn, VA 22209
USA
(703) 841-3200
www.nema.org

NFPA
National Fire Protection Association
Batterymarch Park
Quincy, MA 02269-9101
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(617) 770-3000
www.nfpa.org

SCTE
Society of Cable Telecommunications Engineers
140 Philips Rd.
Exton, PA 19341-1318
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(800) 542-5040
www.scte.org

Telcordia Technologies (formerly; Bellcore)
Telcordia Technologies Customer Service
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