

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Fibre optic interconnecting devices and passive components – Performance standard –**

**Part 121-2: Simplex and duplex cords with single-mode fibre and cylindrical ferrule connectors for category C – Controlled environment**

**Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –**

**Partie 121-2: Cordons simplex et duplex avec fibres unimodales, munis de connecteurs à ferrule cylindrique pour catégorie C – Environnement contrôlé**



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## CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	8
4 Description .....	9
4.1 General .....	9
4.2 Optical fibres .....	9
4.3 Cable design and construction.....	9
4.4 Optical connectors .....	9
4.4.1 Mechanical connectivity.....	9
4.4.2 Optical performance requirements .....	9
4.4.3 Connector set performance requirements .....	9
4.5 Cable bend radius .....	9
4.6 Identification.....	9
5 Tests.....	9
5.1 General .....	9
5.2 Measuring wavelengths .....	9
5.3 Test specimen .....	10
6 Test procedure .....	10
6.1 General.....	10
6.2 Visual examination .....	10
6.3 Fibre optic connector end face .....	10
6.4 Optical performance requirements.....	11
6.5 Climatic performance requirements .....	12
6.6 Mechanical performance requirements .....	13
7 Test report.....	15
Annex A (normative) Sample size requirements .....	16
Annex B (normative) Visual examination of outer cable sheath movement .....	17
Annex C (normative) Change of teperature .....	18
Annex D (normative) Static side load .....	19
Annex E (normative) Flexing strain relief of fibre optic devices .....	20
Bibliography.....	21
Figure B.1 – Initial marking of the cable sheath.....	17
Figure B.2 – Final visual examination .....	17
Figure C.1 – Change of temperature test configuration .....	18
Figure D.1 – Test apparatus for transmission with applied side load .....	19
Figure E.1 – Flexing test apparatus .....	20
Table 1 – Wavelengths for attenuation and return loss measurements .....	10
Table 2 – Visual examination requirements.....	10
Table 3 – End face requirements .....	10
Table 4 – Optical performance requirements.....	11
Table 5 – Climatic performance requirements .....	12

Table 6 – Mechanical performance requirements ..... 13  
Table A.1 – Sample size requirements ..... 16

Withhold

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING  
DEVICES AND PASSIVE COMPONENTS –  
PERFORMANCE STANDARD –**

**Part 121-2: Simplex and duplex cords with single-mode  
fibre and cylindrical ferrule connectors for category C –  
Controlled environment**

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International Standard IEC 61753-121-2 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This bilingual version, published in 2011-05, corresponds to the English version.

The text of this standard is based on the following documents:

FDIS	Report on voting
86B/2988/FDIS	86B/3024/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 61753 series, published under the general title *Fibre optic interconnecting devices and passive components – Performance standard*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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# FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

## Part 121-2: Simplex and duplex cords with single-mode fibre and cylindrical ferrule connectors for category C – Controlled environment

### 1 Scope

This part of IEC 61753 specifies the test requirements for finished cable assemblies for use as patchcords, work area cords and equipment cords for applications in a controlled (C) environment according to IEC 61753-1, where the connectors already comply, with the Category C requirements of IEC 61753-1. The assemblies consist of simplex or duplex fibre optic cable terminated at each end of the cable with non-angled (PC) or angled (APC) polished single-mode fibre optic connectors with cylindrical ferrules. The wavelength of operation is between 1 260 nm<sup>1</sup> and 1 625 nm.

The relevant requirements for mechanical and optical connectivity systems are covered by mechanical and optical interface standards IEC 61754 series and IEC 61755 series respectively. The relevant requirements for connector sets are covered by IEC 61753 series. The relevant requirements for cable are covered by IEC 60794-2-50.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

IEC 60794-2-50, *Optical fibre cables – Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies*

IEC 61300 series, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-5, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion*

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<sup>1</sup> Low wavelength limit depends on maximum cabled fibre cut-off wavelength specification.



IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-42: Tests – Static side load for connectors*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

IEC 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61300-3-15, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-15: Examinations and measurements – Dome eccentricity of a convex polished ferrule endface*

IEC 61300-3-16, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-16: Examinations and measurements – Endface radius of spherically polished ferrules*

IEC 61300-3-17, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-17: Examinations and measurements – Endface angle of angle-polished ferrules*

IEC 61300-3-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-22: Examinations and measurements – Ferrule compression force*

IEC 61300-3-23, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-23: Examination and measurements – Fibre position relative to ferrule endface*

IEC 61300-3-28, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-28: Examinations and measurements – Transient loss*

IEC 61300-3-34, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-34: Examinations and measurements – Attenuation of random mated connectors*

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedure – Part 3-35: Examinations and measurements – Fibre optic connector endface visual and automated inspection*

IEC 61753 series, *Fibre optic interconnecting devices and passive components – Performance standard*

IEC 61753-1, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1: General and guidance for performance standards*

IEC 61753-021-2, *Fibre optic interconnecting devices and passive components – Performance standard – Part 021-2: Grade C/3 single-mode fibre optic connectors for category C – Controlled environment*

IEC 61754 series, *Fibre optic connector interfaces*

IEC 61755 series, *Fibre optic connector optical interfaces*

IEC 61755-2-1, *Fibre optic connector optical interfaces – Part 2-1: Optical interface standard single mode non-angled physically contacting fibres*

IEC 61755-2-2, *Fibre optic connector optical interfaces – Part 2-2: Optical interface standard single mode angled physically contacting fibres*

IEC/TR 61931, *Fibre optic – Terminology*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC/TR 61931 and the following apply.

**3.1 change in attenuation**  
defined as peak to peak variation

**3.2 connector set**  
complete assembly of components (plug-adaptor-plug) required to provide demountable coupling between two or more optical fibres

**3.3 cord**  
general term for terminated cable assembly, whatever the expected use is

Example: equipment cord, work area cord or patchcord.

**3.4 equipment cord**  
cord connecting equipment to a distributor

**3.5 patchcord**  
cord used within cross-connect implementations at distributors

**3.6 terminated cable assembly**  
product defined as a fibre optic cable terminated with any passive fibre optic component on both ends

**3.7 work area cord**  
cord connecting the telecommunications outlet to the terminal equipment

## 4 Description

### 4.1 General

Patchcords, work area cords and equipment cords (called cords in subsequent text) defined according to this specification are terminated cable assemblies with optical connectors. The cord comprises cable and terminated fibre optic connectors on each end.

The length, unless otherwise specified, is defined as being between the end faces of the connectors.

### 4.2 Optical fibres

Optical fibres meeting the requirements of IEC 60793-2-50 for single-mode fibres (SM) B1.1, B1.3 and B6\_a shall be used.

### 4.3 Cable design and construction

Cable used for the cords shall conform to the requirements of IEC 60794-2-50.

### 4.4 Optical connectors

#### 4.4.1 Mechanical connectivity

The dimensional interface requirements in IEC 61754 series shall be met.

#### 4.4.2 Optical performance requirements

The functionality of the connections according to this specification is based upon physical contact. All the connectors shall conform to the standard performance grade as defined in IEC 61755 series. Considered attenuation grades are B, C and D. Considered return loss grades are 1, 2 and 3.

#### 4.4.3 Connector set performance requirements

Connector set shall conform to the requirements described in IEC 61753-021-2.

### 4.5 Cable bend radius

Care shall be taken to observe the minimum bend radius of the cable.

### 4.6 Identification

The connectors shall be identifiable as to type of fibre, type of connector, connector end face (PC or angled-PC), polarity (for duplex cords), connection grade or other type of identification required for administration.

## 5 Tests

### 5.1 General

All tests and measurements have been selected from the IEC 61300 series for connectors and from the cable test procedure outlined in IEC 60794-1-2. Additional requirements to certain tests are given in Annexes C, D and E.

### 5.2 Measuring wavelengths

Unless otherwise specified in the individual test details, all attenuation measurements are made at the wavelengths given in Table 1.

**Table 1 – Wavelengths for attenuation and return loss measurements**

Fibre type	Single-mode		
Centre wavelength (nm)	1 310	1 550	1 625

Return loss measurements shall be performed at the wavelengths specified in the individual tests.

### 5.3 Test specimen

For this specification, a specimen is defined as a terminated cable assembly with optical connectors according to the IEC 61754 series at all ends of the cord. All specimens shall be marked according to identification requirements.

The sample size and product sourcing requirements are defined in Annex A.

The length of the test specimen shall be 3,0 m to 5,0 m with a tolerance of  $\pm 0,5$  m.

## 6 Test procedure

### 6.1 General

No deviation from the specified test method is allowed.

Unless otherwise specified, all tests shall be carried out at ambient temperature as specified in IEC 61300-1.

### 6.2 Visual examination

A visual examination shall be carried out on all specimens before and after all mechanical and climatic tests (see Table 2). The outer cable sheath shall be marked at the end of the connector boot during the initial visual examination (see Annex B).

**Table 2 – Visual examination requirements**

No.	Test	Requirement	Details	
1	Visual examination	No visible defects of cable or connectors	Method: Examination:	IEC 61300-3-1 Product shall be visually checked without magnification

### 6.3 Fibre optic connector end face

The performance of the fibre optic connection depends on characteristics of the end faces of both connectors (see Table 3).

**Table 3 – End face requirements**

No.	Test	Requirement	Details	
2	End face geometry	IEC 61755 series	Method:	IEC 61300-3-15, Apex offset IEC 61300-3-16, Polishing radius IEC 61300-3-17, Endface angle of angle-polished ferrules IEC 61300-3-23, Fibre position
3	Fibre optic cylindrical connector end face visual	IEC 61755-2-1	Method:	IEC 61300-3-35

No.	Test	Requirement	Details
	inspection	IEC 61755-2-2	Examination: Scratches, defects, debris
4	Ferrule compression force  NOTE This test is applicable to the connectors with spring loaded ferrule.	IEC 61754 series: for the connectorized buffered fibre IEC 60794-2-50: additional requirements for the ruggedized fibre	Method: IEC 61300-3-22  Examination: Movement length, compression force

#### 6.4 Optical performance requirements

Optical performance requirements for attenuation and return loss are given in the following Table 4. These requirements in the Table 4 are related to connections between the same fibre types.

**Table 4 – Optical performance requirements**

No.	Test	Requirement	Details
5	Attenuation	Grade D: ≤ 0,5 dB mean ≤ 1,0 dB for 97 % Grade C: ≤ 0,25 dB mean ≤ 0,5 dB for 97 % Grade B: ≤ 0,12 dB mean ≤ 0,25 dB for 97 %	Method: IEC 61300-3-34, Method 2  Source type: LED/LD Peak wavelength: (1 310 ± 30) nm (1 550 ± 30) nm (1 625 ± 30) nm Source stability: ± 0,01 dB over 1 h Detector linearity: Within ± 0,01 dB over the dynamic range to be measured Launch fibre length: > 2 m. Only the fundamental mode shall propagate at the connector interface to be tested and at the detector Pre-conditioning procedure: Clean plug and adaptor according to manufacturer's instructions
6	Return loss	Grade 1: ≥ 60 dB Grade 2: ≥ 45 dB Grade 3: ≥ 35 dB	Method: IEC 61300-3-6, Method 1  Wavelengths: (1 310 ± 30) nm (1 550 ± 30) nm (1 625 ± 30) nm Source stability: ± 0,01 dB over 1 h Detector linearity: ± 0,1 dB over the dynamic range to be measured
NOTE 1 Patchcord attenuation corresponds to the loss of two connections.			
NOTE 2 The requirements for return loss are valid only for one connection.			