IEC 61753-121-2

Edition 2.0 2017-05

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

IEC 61753-121-2:2017-05(en-fr)

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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 second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) merge an optical performance requirement of a reference cord;
b) delete Annexes D and E due to updated relevant standard document;

c) modify the whole document structure according to the latest ISO/IEC Directives.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
86B/4076/FDIS	86B/4084/RVD

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

This document 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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 cords including reference cords used in a controlled (Category C) environment according to IEC 61753-1, where the connectors already comply with the Category C requirements of IEC 61753-1. The tests selected are a subset of the connector tests from IEC 61753-1 appropriate for requalification with additional requirements relevant to cords and the connector/cable interface.

The cords consist of simplex or duplex fibre optic cable terminated at each end of the cable with single-mode fibre optic connector plugs with cylindrical ferrules. The operational wavelength range is between 1 260 nm and 1 625 nm. Short length cords are used as test samples as the attenuation of the cord and the temperature cycling performance will be affected by longer lengths of cable. It is important that any qualification of a cord whose length is greater than 5 m takes these factors into account.

The relevant requirements for the mechanical interface of connector sets are covered by the IEC 61754 all parts. The relevant requirements for the optical interface of connector sets are covered by IEC 61755 (all parts). The relevant requirements for performance of connector sets are covered by IEC 61753 (all parts). The relevant requirements for fibres are covered by IEC 60793-2-50. The relevant requirements for cables for cords are covered by IEC 60794-2-50.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60794-2-50, *Optical fibre cables – Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies*

IEC 60794-2-51, *Optical fibre cables – Part 2-51: Indoor cables – Detail specification for simplex and duplex cables for use in cords for controlled environment*

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 61300-2-22, *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 strain relief*

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

IEC 61300-3-25, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-25: Examinations and measurements – Concentricity of non-angled ferrules and non-angled ferrules with fibre installed*

IEC 61300-3-26, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-26: Examinations and measurements – Measurement of the angular misalignment between fibre and ferrule axes*

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 procedures – Part 3-35: Examinations and measurements – Visual inspection of fibre optic connectors and fibre-stub transceivers*

IEC 61300-3-47, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-47: Examinations and measurements – End face geometry of PC/APC spherically polished ferrules using interferometry*

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 (all parts), *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces*

IEC 61755 (all parts), *Fibre optic interconnecting devices and passive components – Connector optical interfaces*

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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
terminated cable assembly
fibre optic cable terminated with any passive fibre optic component on each end

3.2
cord
cable terminated with fibre optic connectors at each end

EXAMPLE Equipment cord, work area cord or patchcord.

Note 1 to entry: Cord is also referred to as "terminated cable assembly".

[SOURCE: IEC 60794-2-51:2014, 3.2, modify – The definition has been rephrased, and an example and note to entry have been added.]

3.3
connector set
complete assembly of components (plug-adaptor-plug) required to provide demountable coupling between two or more optical fibres

3.4
reference cord
cord terminated with reference connector plugs

3.5
reference connector plug
connector plug manufactured with restricted tolerances for dimensions relevant to lateral and angular offset

Note 1 to entry: See IEC 61755-2-4 and IEC 61755-2-5.

3.6
change in attenuation
peak-to-peak variation

[SOURCE: IEC 61753-021-2:2007, 3.1]

4 Description

4.1 General

Patchcords, work area cords, equipment cords and reference cords (called "cords" in subsequent text) defined according to this document are terminated cable assemblies with optical connector plugs at each end.

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

Cords, except reference cords, can be of any cable length. Reference cords have a length between 2 m and 5 m.

4.2 Optical fibres

Optical fibres meeting the requirements of IEC 60793-2-50 category B1.1 and B1.3 single-mode fibres shall be used. Once these cords are qualified, cords with the same construction using B6_a1 and B6_a2 fibre types according to IEC 60793-2-50 are qualified as well.

4.3 Cable design and construction

Cable used for the cords shall conform to the requirements of IEC 60794-2-50 and IEC 60794-2-51.

4.4 Optical connectors

4.4.1 Mechanical connectivity

The dimensional interface requirements in IEC 61754 (all parts) shall be met.

4.4.2 Optical performance requirements

The functionality of the connections according to this document is based upon physical contact. All the connector plugs shall conform to the standard performance grade as defined in IEC 61755 (all parts). Considered attenuation grades are R1 and R2 defined in IEC 61755-2-4 and IEC 61755-2-5, and B, C and D defined in IEC 61755-2-1 and IEC 61755-2-2. Considered return loss grades are 1, 2 and 3 defined in IEC 61755-2-1 and IEC 61755-2-2.

4.4.3 Connector set performance requirements

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

4.5 Cable bend radius

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

5 Tests

5.1 General

All tests and measurements have been selected from IEC 61300 (all parts) for connectors and from the cable test procedure outlined in IEC 60794-1-2. Additional requirements to certain tests are given in Annex C.

5.2 Measurement 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	Centre wavelength nm		
Single-mode	1 310	1 550	1 625

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

5.3 Device under test

For this document, a device under test (DUT) is defined as a terminated cable assembly with optical connector plugs according to IEC 61754 (all parts) at all ends of the cord.

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

The length of the DUT shall be 3,0 m to 5,0 m.

5.4 Test report

A fully documented test report and supporting data shall be prepared and shall be available for inspection as evidence that the tests described in this document have been carried out accordingly.

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 DUTs before and after all mechanical and environmental 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 connector plugs	Method: Examination:	IEC 61300-3-1 Product shall be visually checked without magnification

6.3 Fibre optic connector plug end face

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

Table 3 – End face requirements

No.	Test	Requirement	Details	
2	End face geometry	IEC 61755-3 (all parts)	Method:	IEC 61300-3-47, End face geometry IEC 61300-3-25, Concentricity IEC 61300-3-26, Angular misalignment
3	Fibre optic connector end face visual inspection	IEC 61300-3-35	Method: Examination:	IEC 61300-3-35 Scratches, defects, debris
4	Ferrule compression force[a]	IEC 61754 (all parts): for the connectorised buffered fibre IEC 60794-2-50: additional requirements for the ruggedised fibre cable	Method: Examination:	IEC 61300-3-22 Movement length, compression force
[a] This test is applicable to connector plugs with spring loaded ferrules.				

6.4 Optical performance requirements

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

Table 4 – Optical performance requirements

No.	Test	Requirement	Details	
5	Attenuation	R1 (reference grade): ≤ 0,1 dB R2 (reference grade): ≤ 0,2 dB Grade B: ≤ 0,12 dB mean ≤ 0,25 dB for 97 % Grade C: ≤ 0,25 dB mean ≤ 0,5 dB for 97 % Grade D: ≤ 0,5 dB mean ≤ 1,0 dB for 97 %	Method: Source type: Wavelength: Source stability: Detector linearity: Launch fibre length: Pre-conditioning procedure:	IEC 61300-3-34, Method 2 LED/LD (1 310 ± 30) nm (1 550 ± 30) nm (1 625 ± 30) nm ±0,01 dB over 1 h ±0,01 dB over the dynamic range to be measured > 2 m. Only the fundamental mode shall propagate at the connector interface to be tested and at the detector 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: Wavelengths: Source stability: Detector linearity:	IEC 61300-3-6, Method 1 (1 310 ± 30) nm (1 550 ± 30) nm (1 625 ± 30) nm ±0,01 dB over 1 h ±0,1 dB over the dynamic range to be measured

6.5 Environmental performance requirements

Environmental performance requirements are given in the following Table 5.

Table 5 – Environmental performance requirements

No.	Test	Requirement	Details	
7	Change of temperature	Change in attenuation during the test at (1 310 ± 30) nm ≤ 0,40 dB at (1 625 ± 30) nm ≤ 1,0 dB Change in attenuation before and after the test at (1 310 ± 30) nm ≤ 0,20 dB at (1 625 ± 30) nm ≤ 0,40 dB Initial and final attenuation shall be ≤ specified for the grade Return loss shall satisfy the requirements for the specified grade Final visual examination: see Annex B	Method:	IEC 61300-2-22, see Annex C
			Low temperature:	–10 °C
			High temperature:	60 °C
			Duration at temperature extreme:	1 h
			Rate of change of temperature:	1 °C/min
			Number of cycles:	5
			DUT optically functioning:	Yes
			Measurements required:	Measuring procedure: IEC 61300-3-3. Measurements before, during and after the test
			Sampling rate:	Max. interval 10 min
			Attenuation:	According to Table 4
			Return loss:	According to Table 4
			Pre-conditioning procedure:	2 h at normal ambient conditions. Clean connector plugs and adaptor according to manufacturer's instructions
			Recovery procedure:	2 h at normal ambient conditions. Connection shall not be demated