

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Performance standard –

Part 043-02: Simplex patch-cord style single-mode fibre wavelength selective devices with cylindrical ferrule connectors for category C – Controlled environment

[IEC 61753-043-02:2022](https://standards.iteh.ai/catalog/standards/sist/ef76bb83-7f82-449d-9f01-2354b0c9c147/iec-61753-043-02:2022)

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Dispositifs d'interconnexion et composants passifs fibroniques – Norme de performance –

Partie 043-02: Dispositifs sélectifs en longueur d'onde à fibres unimodales de type cordon simplex de brassage avec des connecteurs à férules cylindriques pour la catégorie C – Environnement contrôlé



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Partie 043-02: Dispositifs sélectifs en longueur d'onde à fibres unimodales de type cordon simplex de brassage avec des connecteurs à férules cylindriques pour la catégorie C – Environnement contrôlé

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES AND
PASSIVE COMPONENTS – PERFORMANCE STANDARD –****Part 043-02: Simplex patch-cord style single-mode fibre wavelength
selective devices with cylindrical ferrule connectors for category C –
Controlled environment**

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IEC 61753-043-02 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics. It is an International Standard.

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

| Draft | Report on voting |
|---------------|------------------|
| 86B/4635/FDIS | 86B/4654/RVD |

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

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INTRODUCTION

Wavelength selective cords combine features and functions from cords as described in the IEC 61753-12x series and from filters as described in IEC 61977. Additional information about functional principle and application can be found in Annex D and Annex E.

The cords consist of simplex fibre optic cable terminated at each end of the cable with single-mode fibre optic connector plugs with cylindrical ferrules. The operating wavelength range is between 1 260 nm and 1 660 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 IEC 61754 (all parts). The relevant requirements for the optical interface of single-mode fibre optical connector sets are covered by IEC 61755 (all parts). The relevant requirements for performance of connector sets are covered by IEC 61753-1:2018. The relevant requirements for single-mode fibres are covered by IEC 60793-2-50. The relevant requirements for cables for cords are covered by IEC 60794-2-50.

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 043-02: Simplex patch-cord style single-mode fibre wavelength selective devices with cylindrical ferrule connectors for category C – Controlled environment

1 Scope

This part of IEC 61753 specifies the test requirements for wavelength selective cords used in a controlled environment (category C) according to IEC 61753-1:2018, where the connectors already comply with the category C requirements of IEC 61753-1:2018. The tests selected are a subset of the connector tests from IEC 61753-1:2018 appropriate for requalification with additional requirements relevant to cords and the connector/cable interface.

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

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

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

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

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

IEC 61300-2-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-6: Tests – Tensile strength of coupling mechanism*

IEC 61300-2-12, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-12: Tests – Impact*

IEC 61300-2-17, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-17: Tests – Cold*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

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 61300-3-6, *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 61753-043-02:2022

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 61300-3-34, *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 61753-1:2018, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1: General and guidance*

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 61977, *Fibre optic interconnecting devices and passive components – Fibre optic fixed filters – Generic specification*

IEC TR 61931, *Fibre optic – Terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61753-021-2, IEC 61977 and 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

pass wavelength range

wavelength range or wavelength ranges which intend to pass the wavelength selective cord from the connector at the input side to the connector at the output side

Note 1 to entry: According to IEC 61977, "passband" is frequently used.

Note 2 to entry: There are two or more pass wavelength ranges possible.

3.2

isolation wavelength range

wavelength range or wavelength ranges which are nominally suppressed by the wavelength selective cord from the connector at the input side to the connector at the output side

Note 1 to entry: "Blocked wavelength" range is frequently used.

Note 2 to entry: There are two or more isolation wavelength ranges possible.

3.3

wavelength selective cord

cord combining features and functions from cord as described in the IEC 61753-12x series and from filter as described in IEC 61977

Note 1 to entry: Additional information is included in Annex E.

4 Description

4.1 General

Wavelength selective 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 may be of any cable length between 2 m and 5 m.

4.2 Optical fibres

Optical fibres meeting the requirements of IEC 60793-2-50 category B-652.B or B-652.D single-mode fibres shall be used. Once these cords are qualified, cords with the same construction using B-657.A1 or B-657.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.

4.4 Optical connectors

4.4.1 Mechanical connectivity

The dimensional interface requirements in the IEC 61754 series 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 the IEC 61755 series. Considered attenuation grades R1 and R2 are defined in IEC 61755-2-4 and IEC 61755-2-5, and grades B, C and D are defined in IEC 61755-1. Considered return loss grades 1, 2 and 3 are defined in IEC 61755-1.

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. Cable bend should meet requirements of IEC 60794-2-50.

5 Tests

5.1 General

All tests and measurements have been selected from IEC 61300 series. Additional requirements to the change of temperature test 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 | | |
|-------------|-------------------------|-------|-------|
| | 1 310 | 1 550 | 1 625 |
| Single-mode | | | |

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 the IEC 61754 series at all ends of the cord.

The sample size requirements are defined in Annex A.

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

Unless otherwise specified, all tests shall be carried out at standard atmospheric conditions 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 after 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: IEC 61300-3-1 Examination: 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 series | Method: IEC 61300-3-47 IEC 61300-3-25 IEC 61300-3-26 |
| 3 | Fibre optic connector end face visual inspection | IEC 61755 series | Method: IEC 61300-3-35 Examination: Scratches, defects, debris |
| 4 | Ferrule compression force ^a | IEC 61754 series: for the connectorised buffered fibre IEC 60794-2-50: additional requirements for the ruggedised fibre cable | Method: IEC 61300-3-22 Examination: 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 Table 4. These requirements are related to connections between the same fibre types.

Table 4 – Optical performance requirements

| No. | Test | Requirement | Details |
|-----|------------------------------|---|---|
| 5 | Insertion loss (attenuation) | Grade B: $\leq 0,12$ dB mean $\leq 0,25$ dB for 97 % Grade C: $\leq 0,25$ dB mean $\leq 0,5$ dB for 97 % Grade D: $\leq 0,5$ dB mean $\leq 1,0$ dB for 97 % | Method: IEC 61300-3-34, method 2 Source type: Light emitting diode (LED) or laser diode (LD) Wavelength: At minimum, one wavelength for each pass wavelength range Source stability: $\pm 0,01$ dB from the initial value over 1 h Detector linearity: $\pm 0,01$ 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 Preconditioning procedure: Clean plug and adaptor according to manufacturer's instructions NOTE The difference to standard patchcords according to IEC 61753-121-2 is explained in Annex D. The parameter attenuation is only valid for wavelength ranges which are allowed to pass the wavelength selective device. For these wavelengths ranges, the attenuation is the same as for a standard patchcord of the specified grade. |
| 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 \pm 30) nm (1 550 \pm 30) nm (1 625 \pm 30) nm Additional at minimum one wavelength for each pass wavelength range. Additional at minimum one wavelength for each isolation wavelength range. Source stability: $\pm 0,01$ dB over 1 h Detector linearity: $\pm 0,1$ dB over the dynamic range to be measured NOTE The difference to standard patchcords according to IEC 61753-121-2 is explained in Annex D. For blocked wavelength ranges, the return loss is the valid parameter. For these devices, it is the lowest value of the return loss from the wavelength selective device and both connectors. For these devices, isolation and return loss are functionally identical. Therefore, there is no requirement e.g. to specify isolation. |

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 | Cold | <p>Change in attenuation during the test:</p> <p>If pass wavelength range $\leq 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 0,40\text{ dB}$</p> <p>If pass wavelength range $> 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 1,0\text{ dB}$</p> <p>Change in attenuation before and after the test:</p> <p>If pass wavelength range $\leq 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 0,20\text{ dB}$</p> <p>If pass wavelength range $> 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 0,40\text{ dB}$</p> <p>Initial and final attenuation shall be less than or equal to specified for the grade</p> <p>Initial and final return loss shall satisfy the requirements for the specified grade</p> | <p>Method: IEC 61300-2-17</p> <p>Temperature: $-10\text{ °C} \pm 2\text{ °C}$</p> <p>Duration of the exposure: 96 h</p> <p>Maximum sampling interval during the test: 1 h</p> <p>DUT optically functioning: Yes</p> <p>Measurements required: Attenuation measurements before, during and after the test. Return loss measurements before and after the test.</p> <p>Preconditioning procedure: $\geq 2\text{ h}$ at normal ambient conditions. Clean connector plugs and adaptor according to manufacturer's instructions</p> <p>Recovery procedure: $\geq 2\text{ h}$ at normal ambient conditions. Connection shall not be demated.</p> | |
| 8 | Dry heat – High temperature endurance | <p>Change in attenuation during the test:</p> <p>If pass wavelength range $\leq 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 0,40\text{ dB}$</p> <p>If pass wavelength range $> 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 1,0\text{ dB}$</p> <p>Change in attenuation before and after the test:</p> <p>If pass wavelength range $\leq 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 0,20\text{ dB}$</p> <p>If pass wavelength range $> 1\,595\text{ nm}$: at one wavelength for each pass wavelength range $\leq 0,40\text{ dB}$</p> <p>Initial and final attenuation shall be less than or equal to specified for the grade</p> <p>Initial and final return loss shall satisfy the requirements for the specified grade</p> | <p>Method: IEC 61300-2-18</p> <p>Temperature: $+60\text{ °C} \pm 2\text{ °C}$</p> <p>Duration of the exposure: 96 h</p> <p>Maximum sampling interval during the test: 1 h</p> <p>DUT optically functioning: Yes</p> <p>Measurements required: Attenuation measurements before, during and after the test. Return loss measurements before and after the test.</p> <p>Preconditioning procedure: $\geq 2\text{ h}$ at normal ambient conditions. Clean connector plugs and adaptor according to manufacturer's instructions</p> <p>Recovery procedure: $\geq 2\text{ h}$ at normal ambient conditions. Connection shall not be demated.</p> | |