

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components performance standard –

Part 021-6: Grade B/2 single-mode fibre optic connectors for category O –
Uncontrolled environment

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Norme de qualité de fonctionnement des dispositifs d'interconnexion et
composants passifs à fibres optiques –

Partie 021-6: Connecteurs à fibres optiques unimodales de classe B/2 pour la
catégorie O – Environnement non contrôlé



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 021-6: Grade B/2 single-mode fibre
optic connectors for category O –
Uncontrolled environment**

FOREWORD

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International Standard IEC 61753-021-6 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

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

FDIS	Report on voting
86B/2592/FDIS	86B/2616/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.

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

A list of all parts of the 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 maintenance result 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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INTRODUCTION

Performance standards define the requirements for standard optical performance under a set of specified conditions. Each standard contains a series or a set of tests and measurements with clearly stated conditions, severities and pass/fail criteria. The series of tests, commonly referred to as an operating service environment or performance category, is intended to be run on a 'one-off' basis to prove the product's ability to satisfy the requirements of a specific application, market sector or user group.

The subsequent parts of this document define those sets of tests which form each operating service environment or performance category and which have been standardized for international use. A product that has been shown to meet all the requirements of a performance standard may be declared as complying with that performance standard.

Products having the same classification from one manufacturer that satisfy a performance standard will operate within the boundaries set by the performance standard. Intermateability or interchangeability of products from different suppliers (having the same classification and conforming to the same performance standard) can only be guaranteed when these products also meet the interface standards. Only in this condition will an equivalent level of performance be provided when they are used together (for example, in the case of optical connectors).

Conformance to a performance standard is not a guarantee of lifetime assured performance or reliability.

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Reliability testing must be the subject of a separate test schedule, where the tests and severities selected are truly representative of the requirements of this reliability test programme. Consistency of manufacture should be maintained using a recognized Quality Assurance programme whilst the reliability of the product should be evaluated using the procedures recommended in IEC 62005.

Tests and measurements should be selected from the IEC 61300 series. Where this is not possible, the required test method should be attached as an annex to the performance standard.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS PERFORMANCE STANDARD –

Part 021-6: Grade B/2 single-mode fibre optic connectors for category O – Uncontrolled environment

1 Scope

This part of IEC 61753 defines B/2 performance levels which a singlemode connector/cable assembly must satisfy in order to be categorised as meeting the IEC standard, Category O – Uncontrolled environment, as defined in Table A.4b of IEC 61753-1.

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

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

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

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 61300-2-26, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-26: Tests – Salt mist*

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 61300-2-48, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-48: Tests – Temperature-humidity cycling*

IEC 61300-2-49, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-49: Tests – Connector installation test*

IEC 61300-2-50, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-50: Tests – Fibre optic connector proof test with static load – Singlemode and multimode*

IEC 61300-2-51 *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-51: Tests – Fibre optic connector test for transmission with applied tensile load – singlemode and multimode*

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 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

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

IEC 61753-1:2007, *Fibre optic interconnecting devices and passive components performance standard – Part 1: General and guidance for performance*

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IEC 61754 (all parts), *Fibre optic connector interfaces*

IEC 61755 (all parts), *Fibre optic connector optical interfaces*

IEC 61755-3 (all parts), *Fibre optic connector optical interfaces – Part 3: Optical interface*

3 Terms and definitions

For the purposes of this document, the following definitions apply.

3.1

small form factor (SFF) connector

optical fibre connector with a ferrule with an outside diameter of less than 2,0 mm or a connector designed to accommodate two or more optical fibres with at least the same mounting density as the RJ-45 connector. SFF connectors have a smaller cross-sectional area, about one-half that of traditional connectors

3.2

change in attenuation

peak-to-peak variation

3.3

sample

the complete set of connector components required to provide demountable coupling between one or more pairs of optical fibres

3.4 pigtail assembly

two connector plugs mated with an adapter with unterminated leads as shown in Figure 1

NOTE Each of the unterminated leads should be at least 3 m long so that the splices may be located outside of the environmental test chamber.

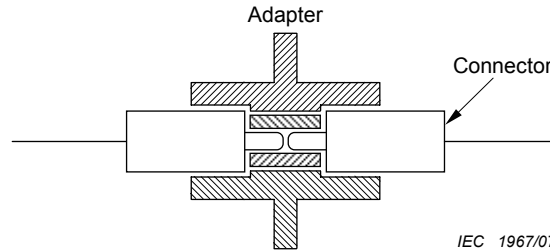


Figure 1 – Pigtail assembly

3.5 jumper cable assembly

jumper cable terminated with plugs on each end, connected with adapters to two additional connector plugs with unterminated leads on either end, as shown in Figure 2.

NOTE 1 The jumper cable should be $(5 \pm 0,5)$ m. Each of the unterminated leads should be long enough so that the splices may be located outside of the environmental test chamber.

NOTE 2 The complete jumper cable assembly including the cable and both adaptors are located inside the environmental test chamber

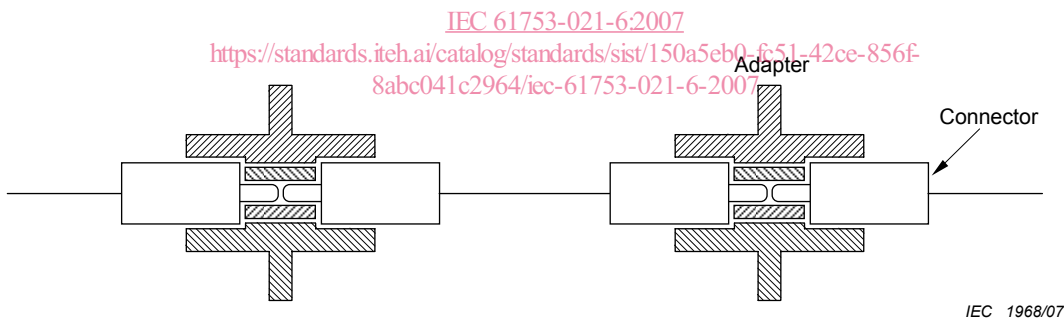


Figure 2 – Jumper cable assembly

4 Test

All test methods are in accordance with a specific IEC 61300 series standard as defined in 7.4 and 7.5.

The connectors under test shall be terminated onto singlemode fibre per IEC 60793-2-50, type B1.1 or B1.3, in either secondary coated or cable format. The connector interface standard shall meet the dimensions of IEC 61754 and the connector optical interface standard shall meet the relevant requirements of IEC 61755.

Each test defines the number of samples to be evaluated. The sample set used for the first test is to be composed of randomly selected and previously unstressed new samples. The remaining tests are to be performed sequentially as per Tables 1 and 2 in 7.4 and 7.5 respectively, using the same samples.

The optical criteria for each test shall be as defined in 7.4.

5 Test report

Fully documented test reports and supporting evidence shall be prepared and available for inspection as evidence that the tests have been carried out and the results are satisfactory.

6 Reference components

No reference components are required to perform the tests in this standard.

7 Performance requirements

7.1 Dimensions

Dimensions shall comply with the appropriate IEC interface standard as defined in IEC 61754.

7.2 Sample size, test sequencing and grouping

For the purposes of this standard, a sample is composed of pigtail assemblies and jumper cable assemblies (see Clause 3). The sample sizes, test sequence, and grouping to be used for the tests shall be as defined in Annex A. Samples for the first test (attenuation) are to be randomly selected and randomly mated new products. Samples for the second test (return loss) are the same plugs selected and mated for the first test. All subsequent tests are sourced from the mated plugs from the first and second test. After randomly selecting and randomly mating the plugs for the first test, the plugs shall not be uncoupled or cleaned anytime during the tests, except during impact and mating durability.

7.3 Endface geometry

The connector endface shall comply with the endface geometry requirements of the applicable IEC optical interface standard as defined in IEC 61755-3. Compliance to the appropriate optical interface standard shall be confirmed on all samples before the start of testing and after all of the tests have been completed. Non-compliance with the endface geometry requirements of the applicable optical interface standard on any connector tested results in a failure of this performance standard.

7.4 Performance levels

The performance levels shall meet the requirements of Grade B/2 as defined in Table A.12 of IEC 61753-1.

Table 1 – Performance levels

Performance level	Test name	Initial	During and after test
B/2	Attenuation, IEC 61300-3-34	$\leq 0,12$ dB mean $\leq 0,25$ dB max. for $\geq 97\%$ of samples	
	Return loss, IEC 61300-3-6	≥ 45 dB	Return loss ≥ 45 dB during and after test
	Monitoring change in attenuation and in return loss (multiple path IEC 61300-3-3)		Maximum variation $\leq 0,2$ dB during and after test for pigtail assemblies Maximum variation $\leq 0,5$ dB during and $\leq 0,4$ dB after test for jumper cable assemblies

7.5 Performance details

Performance details are specified in Table 2.

Table 2 – Performance details

No	Test	Requirements	Details
1	Attenuation (Method 2)	Grade B performance level: Mean $\leq 0,12$ dB Maximum = $0,25$ dB for $\geq 97\%$ of samples Test wavelengths: $1\ 310\ \text{nm} \pm 30\ \text{nm}$ and $1\ 550\ \text{nm} \pm 30\ \text{nm}$ (launch condition S4 and S5)	IEC 61300-3-34 DUT type 5, insertion method (2) Launch mode conditions: only the fundamental mode shall propagate at the connector interface and at the detector. Source characteristics: reference to IEC 61300-3-4 (attenuation) Specimen shall be optically functioning. Preconditioning procedure: clean plug and adapter according to manufacturer's instructions.
2	Return loss	Grade 2 performance level: Minimum > 45 dB Test wavelengths: $1\ 310\ \text{nm} \pm 20\ \text{nm}$ and $1\ 550\ \text{nm} \pm 20\ \text{nm}$	IEC 61300-3-6, method branching devices Launch fibre length: $L > 2$ m Source stability: $\pm 0,20$ dB over the measuring period or at least 1 h Detector linearity: within 5% of the power levels to be measured Directivity: >65 dB Specimen shall be optically functioning. Preconditioning procedure: clean plug and adapter according to manufacturer's instructions. Alternative method: IEC 61300-3-6 Method OTDR Launch fibre length: $L1 \geq 500$ m, $L2 \geq 6$ m, $L3 \geq 6$ m Pulse duration: ≤ 10 ns Specimen shall be optically functioning. Preconditioning procedure: clean plug and adapter according to manufacturer's instructions.

Table 2 (continued)

No	Test	Requirements	Details
3	Dry heat - High temperature endurance	<p>Attenuation: All attenuation measurements shall meet the criteria specified in 7.4.</p> <p>Return loss: All return loss measurements shall meet the criteria specified in 7.4.</p> <p>Test wavelengths: 1 310 nm \pm 20 nm and 1 550 nm \pm 20 nm</p> <p>NOTE Attenuation and return loss decrease is the difference between any measurement and the initial measurement made at room temperature, and applies to all measurements. Maximum and mean attenuation and return loss criteria apply to all measurements</p>	<p>IEC 61300-2-18</p> <p>Temperature:</p> <p>Test condition A: +85 °C \pm 2 °C for 168 h</p> <p>Test condition B: +75 °C \pm 2 °C for 336 h</p> <p>Test condition B shall be used for products with LSZH cables with temperature limitation of 75 °C; the longer duration ensures the same aging as in test condition A.</p> <p>Length of the cable on each side of the connector inside the chamber: 1,5 m minimum</p> <p>Sampling rate: initially at room ambient, at least every 6 h during the test and at the end of the test at room ambient.</p> <p>Preconditioning procedure: before test, specimens shall be maintained in room temperature condition for 2 h. Clean plug and adapter according to manufacturer's instructions.</p> <p>Recovery procedure: after test, specimens shall be maintained in room temperature condition for 2 h.</p> <p>The connector samples shall not be uncoupled or cleaned at anytime before, during, or after the test.</p>
4	Change of temperature	<p>Attenuation: All attenuation measurements shall meet the criteria specified in 7.4.</p> <p>Return loss: All return loss measurements shall meet the criteria specified in 7.4.</p> <p>Test wavelengths: 1 310 nm \pm 20 nm and 1 550 nm \pm 20 nm</p> <p>NOTE The maximum attenuation and return loss variation is the difference between any measurement and the initial measurement made at room temperature, and applies to all measurements. Maximum and mean attenuation and return loss criteria apply to all measurements</p>	<p>IEC 61300-2-22, Test Nb</p> <p>High temperature dwell: +75 °C \pm 2 °C</p> <p>Room ambient dwell: +23 °C \pm 2 °C</p> <p>Low temperature dwell: -40 °C \pm 2 °C</p> <p>Duration at each dwell temperature: 1 h</p> <p>Ramp time = 1 h</p> <p>Number of cycles: 21</p> <p>Length of the cable on each side of the connector inside the chamber: 1,5 m minimum for pigtailed and 3 m minimum for patchcords</p> <p>Specimen shall be optically functioning.</p> <p>Sampling rate: initially at room ambient, after 1/2 h during each dwell (measurements to be completed during dwell) and at the end of the test at room ambient.</p> <p>Preconditioning procedure: before test, specimens shall be maintained in room temperature condition for 2 h.</p> <p>Recovery procedure: after test, specimens shall be maintained in room temperature condition for 2 h.</p> <p>The connector samples shall not be uncoupled or cleaned anytime before, during or after the test.</p>