

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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

**Part 051-02: Plug-receptacle style single-mode fibre fixed optical attenuators for category C – Controlled environments**

[IEC 61753-051-02:2022](#)

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

[7b25ae9ba07b/iec-61753-051-02-2022](#)

**Partie 051-02: Affaiblisseurs optiques fixes à fibres unimodales de type fiche-embase pour la catégorie C – Environnements contrôlés**





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IEC Secretariat  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

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**FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE  
COMPONENTS – PERFORMANCE STANDARD –****Part 051-02: Plug-receptacle style single-mode fibre fixed optical  
attenuators for category C – Controlled environments**

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IEC 61753-051-02 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.

This first edition cancels and replaces IEC 61753-051-3 published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 61753-051-3:2013:

- a) change the category from U to C and the test items and their conditions according to IEC 61753-1;
- b) change the requirements reflecting the survey results.

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

Draft	Report on voting
86B/4531/CDV	86B/4588A/RVC

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

A list of all parts in 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 document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

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## INTRODUCTION

The performance standard of single-mode plug style optical attenuators has been published in 2001 as IEC 61753-051-3 [1]<sup>1</sup>. After publication of the corrigendum in 2004, the second edition, in which test details and requirements were reconsidered, has been published in 2013. In 2019, the market survey of five Japanese suppliers, two Chinese ones and one Swiss has been carried out. As a result of the survey, it was revealed that some suppliers could not comply to the category U requirements. It was decided to withdraw IEC 61753-051-3 and establish this document for category C reflecting the survey result.

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<sup>1</sup> Figures in square brackets refer to the Bibliography.

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

### **Part 051-02: Plug-receptacle style single-mode fibre fixed optical attenuators for category C – Controlled environments**

#### **1 Scope**

This part of IEC 61753 contains the minimum initial test and measurement requirements and severities which plug-receptacle style single-mode fibre fixed optical attenuators need to satisfy in order to be categorized as meeting the requirements of category C – Controlled environments, as defined in IEC 61753-1:2018, Annex A.

#### **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 60869-1, *Fibre optic interconnecting devices and passive components – Fibre optic passive power control devices – Part 1: Generic specification*

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

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

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

IEC 61300-2-14, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-14: Tests – High optical power*

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 61300-3-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-2: Examination and measurements – Polarization dependent loss in a single-mode fibre optic device*

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

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

IEC 61754 (all parts), *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces*

IEC 61755-2-4, *Fibre optic interconnecting devices and passive components – Connector optical interfaces – Part 2-4: Connection parameters of non-dispersion shifted single-mode physically contacting fibres – Non-angled for reference connection applications*

IEC 61755-2-5, *Fibre optic interconnecting devices and passive components – Connector optical interfaces – Part 2-5: Connection parameters of non-dispersion shifted single-mode physically contacting fibres – Angled for reference connection applications*

IEC TS 62627-09, *Fibre optic interconnecting devices and passive components – Vocabulary for passive optical devices*

### 3 Terms and definitions

For the purposes of this document, terms and definitions given in IEC 60869-1, IEC TS 62627-09 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

##### **plug-receptacle style single-mode fibre fixed optical attenuator**

single-mode fibre fixed optical attenuator which has an optical connector plug interface and an optical receptacle interface

#### 3.2

##### **attenuation tolerance**

allowable attenuation differences from the nominal attenuation for fixed optical attenuators

Note 1 to entry: The attenuation tolerance is expressed in  $\pm x$  dB.

## 4 Test conditions

Unless otherwise specified, all test methods are in accordance with the IEC 61300 series. Plug-receptacle style single-mode fibre fixed optical attenuators used for each test are intended to be previously unstressed new samples but may also be selected from previously used samples if desired. All measurements shall be carried out under standard atmospheric conditions, unless otherwise stated. Before the connection with optical connector plugs and adaptors for the test and the measurements of the optical performances, all optical connector plug end-faces shall be cleaned.

NOTE IEC 61300-3-35 [2] defines the visual inspection of the end-face for optical connector plugs. IEC TR 62627-01 [3] describes the cleaning method of optical connectors.

Table 1 is intended to provide guidance on the wavelength ranges of the various spectral bands. It is not intended to serve as a specification. Values of operating wavelength used in performance verification shall be specified between the customer and the supplier or shall be as defined in the manufacturer's specification.

**Table 1 – Single-mode spectral bands**

Band	Descriptor	Range nm
O-band	Original	1 260 to 1 360
E-band	Extended	1 360 to 1 460
S-band	Short wavelength	1 460 to 1 530
C-band	Conventional	1 530 to 1 565
L-band	Long wavelength	1 565 to 1 625
U-band	Ultralong wavelength	1 625 to 1 675
NOTE This table is based on ITU-T G. Supplement 39 [4].		

## 5 Test report

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

## 6 Performance requirements

### 6.1 Dimensions

Dimensions of interfaces of an optical connector plug and an optical receptacle shall comply with the IEC 61754 series as well as those given in appropriate manufacturers' drawings. When implementing this document, be aware that there have been problems when using a rigid interface component (without spring loaded ferrule) with SC plug style adaptors and plugs. See IEC TR 62627-02:2010, Clause 6 [5].

### 6.2 Sample size

Sample sizes shall be accordance with Annex A. Number of samples for each test is described in Table A.1.

### 6.3 Test details and requirements

The requirements are given only for plug-receptacle style single-mode fibre fixed optical attenuators. The test details and requirements for category C are shown in Table 2.

**Table 2 – Test details and requirements for category C**

No	Tests	Requirements	Details	
1	Attenuation tolerance IEC 61300-3-4, insertion method	Deviation of attenuation from the nominal attenuation shall be: –0,75 dB ≤ deviation of attenuation from the nominal attenuation ≤ +0,75 dB for the nominal attenuation: ≤ 0 dB and ≤ 5 dB. –15 % dB of the nominal attenuation ≤ deviation of attenuation from the nominal attenuation ≤ +15 % dB of the nominal attenuation for the nominal attenuation: > 5 dB and ≤ 20 dB.	Launch fibre length  Source wavelength  Measurement uncertainty  Optical connector plugs for measurement	≤ 2,0 m  1 310 nm and 1 550 nm  ≤ 0,2 dB  Fibre shall comply with IEC 60793-2-50, B-652.  Optical connector plugs shall be the reference grade defined in IEC 61755-2-4 (physical contact; PC) or IEC 61755-2-5 (angled PC; APC).
2	Return loss IEC 61300-3-6, OCWR method	≤ 60 dB (mated) and ≤ 55 dB (unmated) for grade 1 (APC); ≤ 45 dB (mated) for grade 2 (PC); ≤ 35 dB (mated) for grade 3 (PC); ≤ 26 dB (mated) for grade 4 (PC).	Source wavelength  Measurement uncertainty  Optical connector plugs for measurement	1 310 nm and 1 550 nm  ≤ 1,0 dB  Fibre shall comply with IEC 60793-2-50, B-652.
3	Polarization dependent loss (PDL) IEC 61300-3-2, all polarization method	≤ 0,3 dB for PC and APC	Launch fibre length  Source wavelength  Measurement uncertainty	≤ 2,0 m  1 310 nm and 1 550 nm  ≤ 0,1 dB

No	Tests	Requirements	Details	
4	High optical power IEC 61300-2-14	<p>Before and after the test, the attenuation tolerance in test no.1 and return loss in test no.2 shall be met.</p> <p>During the test, the attenuation change shall be monitored. During the test, the attenuation change from that at the starting to input high optical power of the test shall be <sup>a</sup>:</p> <p>–0,3 dB ≤ attenuation change ≤ +0,3 dB for the nominal attenuation of 1 dB;</p> <p>–0,5 dB ≤ attenuation change ≤ +0,5 dB for the nominal attenuation: &gt; 1 dB and ≤ 2 dB;</p> <p>–1,0 dB ≤ attenuation change ≤ +1,0 dB for the nominal attenuation: &gt; 2 dB and ≤ 10 dB;</p> <p>–2,0 dB ≤ attenuation change ≤ +2,0 dB for the nominal attenuation: &gt; 10 dB and ≤ 20 dB.</p> <p>After the test, the attenuation change from the initial value shall be:</p> <p>–0,3 dB ≤ attenuation change ≤ +0,3 dB for the nominal attenuation of 1 dB;</p> <p>–0,5 dB ≤ attenuation change ≤ +0,5 dB for the nominal attenuation: &gt; 1 dB and ≤ 2 dB;</p> <p>–1,0 dB ≤ attenuation change ≤ +1,0 dB for the nominal attenuation: &gt; 2 dB and ≤ 10 dB;</p> <p>–2,0 dB ≤ attenuation change ≤ +2,0 dB for the nominal attenuation: &gt; 10 dB and ≤ 20 dB.</p> <p>During the test, the return loss shall be monitored. During the test, the return loss in test no.2 shall be met.</p> <p>During the test, the attenuation and the return loss shall be monitored by IEC 61300-3-3.</p>	<p>Input power</p> <p>Source wavelength</p> <p>Duration</p> <p>Test temperature</p> <p>Relative humidity</p> <p>NOTE</p>	<p>100 mW for the nominal attenuation: ≤ 4,0 dB;</p> <p>200 mW for the nominal attenuation: 3,0 dB</p> <p>300 mW for the nominal attenuation: 2,0 dB</p> <p>500 mW for the nominal attenuation: 1,0 dB</p> <p>1 310 nm and/or 1 550 nm</p> <p>30 min</p> <p>60 °C ± 2 °C</p> <p>93 % <math>\pm \frac{2}{3}</math> % RH</p> <p>The internal temperature can increase when high optical power is inserted. See IEC TR 62627-03-03 [6].</p>
5	Mating durability IEC 61300-2-2	<p>Before and after the test, the attenuation tolerance in test no.1 and return loss in test no.2 shall be met.</p> <p>During the test, the maximum allowed change in attenuation shall be:</p> <p>–0,5 dB ≤ attenuators change ≤ +0,5 dB for nominal attenuation: ≤ 5 dB;</p> <p>–10 % dB of the nominal attenuation ≤ attenuation change ≤ +10 % dB of the nominal attenuation for nominal attenuation: &gt; 5 dB and ≤ 20 dB.</p>	<p>Mating times</p> <p>Source wavelength</p>	<p>200 times each for plug side and receptacle side</p> <p>1 310 nm and/or 1 550 nm</p>