

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Fibre optic interconnecting devices and passive components – Performance standard –  
Part 051-3: Single-mode fibre, plug style fixed attenuators for category U –  
Uncontrolled environment**

[IEC 61753-051-3:2013](#)

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**Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme  
de performance –  
Partie 051-3: Affaiblisseurs fixes de type fiche pour fibres unimodales en  
catégorie U – Environnement non-contrôlé**



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**FIBRE OPTIC INTERCONNECTING  
DEVICES AND PASSIVE COMPONENTS –  
PERFORMANCE STANDARD –****Part 051-3: Single-mode fibre, plug style fixed  
attenuators for category U –  
Uncontrolled environment**

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International Standard IEC 61753-051-3 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 2001 and constitutes a technical revision. The specific technical changes from the previous edition are to reconsider test details and requirement and the constitution of the standard.

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

FDIS	Report on voting
86B/3543/FDIS	86B/3580/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 the 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 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 051-3: Single-mode fibre, plug style fixed attenuators for category U – Uncontrolled environment

### 1 Scope

This part of IEC 61753 contains the minimum initial test and measurement requirements and severities which a fibre optic attenuator satisfies in order to be categorized as meeting the requirements of single-mode fibre, plug-style fixed attenuator devices used in uncontrolled environments. Optical performances specified in this standard relate to plug-style configurations optical attenuators only.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*<sup>1</sup>  
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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: 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*

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<sup>1</sup> A fourth edition is due to be published shortly.

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 61300-2-22, *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 61300-2-27, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-27: Tests – Dust – Laminar flow*

IEC 61300-2-46, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-46: Tests – Damp heat, cyclic*

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 measurement – 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<sup>2</sup>*

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

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IEC 61300-3-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-7: Examinations and measurements – Wavelength dependence of attenuation and return loss of single mode components*

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

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

IEC/TR 62627-02:2010, *Fibre optic interconnecting devices and passive components – Part 02: Report of round robin test results on SC plug style fixed attenuators*

### 3 Test

All test methods are in accordance with the IEC 61300 series.

All tests shall be carried out to validate performance over the required operating wavelength and power range.

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<sup>2</sup> A third edition is due to be published shortly..



## 4 Test report

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

## 5 Performance requirements

### 5.1 Sample size, sequencing and grouping

The sample size to be used for the tests shall be as defined in Annex B. Test groups shall be performed as shown in Annex B.

### 5.2 Dimensions

Dimensions of mechanical interface for mating, plug and receptacle size shall comply with both the IEC 61754 series and the IEC 61755 series. Other dimensions shall comply with those given in appropriate manufacturer's drawings.

When implementing this standard be aware that there have been problems when using a rigid interface component with SC plug style adaptors and plugs. See Clause 6 of IEC/TR 62627-02:2010

### 5.3 Test details and requirements

Table 1 defines the performance requirements and test details for plug style fixed attenuators.

**Table 1 – Test details and requirements (1 of 7)**

No.	Tests	Requirements	Details
1	Insertion loss	<p>Passband: 1 260 nm – 1 360 nm and/or 1 460 nm – 1 625 nm</p> <p>For nominal values <math>\leq 5</math> dB the tolerance shall be <math>\leq \pm 0.75</math> dB around the nominal insertion loss value</p> <p>For nominal values <math>&gt; 5</math> dB the tolerance shall be <math>\leq \pm 15</math> % around the nominal insertion loss value</p>	<p>Method: IEC 61300-3-4, test sample configuration according to IEC 61300-3-4 substitution method.</p> <p>Launch patchcord length: <math>\geq 2</math> m. Only the fundamental mode shall propagate at the attenuator interface and at the detector.</p> <p>Other requirements: This test shall be performed against a reference plug and reference adaptor<sup>a, b</sup>. This test shall be performed twice, reversing the sample.</p> <p>Launch conditions: The wavelength of the source shall be longer than cut-off wavelength of the fibre.</p> <p>Optical source wavelength: 1 310 nm <math>\pm</math> 10 nm, 1 550 nm <math>\pm</math> 10 nm and 1 625 nm <math>\pm</math> 10 nm. Test every sample with the three wavelengths.</p> <p>Source power stability: Within <math>\pm 0,05</math> dB over the measuring period or at least 1 h.</p> <p>Total uncertainty: <math>\leq \pm 0,1</math> dB</p>

**Table 1 (2 of 7)**

No.	Tests	Requirements	Details	
2	Return loss	≥ 35 dB for attenuator Grade T ≥ 40 dB for attenuator Grade R ≥ 50 dB for attenuator Grade U ≥ 60 dB for attenuator Grade V mated ≥ 55 dB for attenuator Grade V unmated	Method:  Optical source wavelength:  Other requirements:  Total uncertainty:	IEC 61300-3-6 measurement method 1, OCWR (performed against a reference plug and reference adaptor <sup>a,b</sup> ) measurement with a branching device.  1 310 nm ± 10 nm, 1 550 nm ± 10 nm and 1 625 nm ± 10 nm. Test every sample with the three wavelengths.  This test shall be performed twice, reversing the sample. Both measurements shall be within the specified limits.  ≤ ± 0,5 dB
3	Polarization dependent loss	≤ 0,3 dB at 1 550 nm. The samples shall be terminated onto single-mode fibres as per IEC 60793-2-50, Type B1.1, in either coated fibres (primary and secondary) or reinforced cable format	Method:  Optical source wavelength:  Total uncertainty:	IEC 61300-3-2, all polarization method  1 310 nm ± 10 nm 1 550 nm ± 10 nm 1 625 nm ± 10 nm Test every sample with one wavelength,  ≤ ± 0,05 dB over the dynamic range to be measured
4	Polarization mode dispersion	≤ 0,2 ps Over the specified operating wavelength range	Method: Optical source Wavelength:  Total uncertainty:	IEC 61300-3-32, MPS method  1 310 nm ± 10 nm 1 550 nm ± 10 nm 1 625 nm ± 10 nm Test every sample with one wavelength, changing wavelength for each sample  ≤ ± 0,05 dB over the dynamic range to be measured
5	High optical power	Before and after the test the insertion loss shall meet the requirements of test 1.  Before and after the test the return loss shall meet the requirements of test 2.  During the test insertion loss and return loss shall be monitored	Method:  Test temperature:  Optical source Wavelength:  Test duration:  Power increments:	IEC 61300-2-14  25 °C ± 2 °C  1 310 nm ± 10 nm 1 550 nm ± 10 nm 1 625 nm ± 10 nm  Test every sample with one wavelength, changing wavelength for each sample.  1 h at each power level  For nominal insertion loss ≤ 5 dB: 100 mW power increments.  For nominal insertion loss > 5 dB: 10 mW continuous power increments  The above increments are applied up to the maximum allowed power input of:  - 10 dBm for 1,25 mm ferrule; - 20 dBm for 2,5 mm ferrule

Table 1 (3 of 7)

No.	Tests	Requirements	Details	
6	Vibration	<p>Before and after the test the insertion loss shall meet the requirements of test 1 .</p> <p>Before and after the test the return loss shall meet the requirements of test 2.</p> <p>The insertion loss change during the test shall be within <math>\pm 0,5</math> dB of the initial value.</p>	<p>Method:</p> <p>Frequency range:</p> <p>Constant vibration amplitude:</p> <p>Number of cycles:</p> <p>Number of axes:</p> <p>Sweep rate:</p> <p>Optical source Wavelength:</p> <p>Specimen optically functioning:</p>	<p>IEC 61300-2-1</p> <p>During the test the change in insertion loss shall be measured by transient loss test method IEC 61300-3-28.</p> <p>10 Hz to 55 Hz</p> <p>0,75 mm</p> <p>15</p> <p>3 orthogonal</p> <p>1 oct/min</p> <p>1 310 nm <math>\pm</math> 10 nm 1 550 nm <math>\pm</math> 10 nm 1 625 nm <math>\pm</math> 10 nm</p> <p>Test every sample with one wavelength, changing wavelength for each sample</p> <p>Yes</p>
7	Strength of coupling mechanism	<p>Before and after the test the insertion loss shall meet the requirements of test 1 .</p> <p>Before and after the test the return loss shall meet the requirements of test 2.</p> <p>The insertion loss change during the test shall be within <math>\pm 0,5</math> dB of the initial value.</p>	<p>Method:</p> <p>Magnitude of the load:</p> <p>Load application point:</p> <p>Duration of the load:</p> <p>Optical source wavelength:</p> <p>Specimen optically functioning:</p>	<p>IEC 61300-2-6</p> <p>40 N, at a rate of 2 N/s</p> <p>0,2 m from the optical interface point:</p> <p>120 s</p> <p>1 310 nm <math>\pm</math> 10 nm 1 550 nm <math>\pm</math> 10 nm 1 625 nm <math>\pm</math> 10 nm</p> <p>Test every sample with one wavelength, changing wavelength for each sample.</p> <p>Yes</p>

**Table 1 (4 of 7)**

No.	Tests	Requirements	Details	
8	Mating durability	<p>Before and after the test the insertion loss shall meet the requirements of test 1</p> <p>Before and after the test the return loss shall meet the requirements of test 2</p> <p>The insertion loss change during the test shall be within <math>\pm 0,5</math> dB of the initial value</p>	<p>Method:</p> <p>Number of mating cycles:</p> <p>Optical source wavelength:</p> <p>Specimen optically functioning:</p> <p>Other specifications:</p>	<p>IEC 61300-2-2</p> <p>500, all parts (connector-attenuator-adaptor-connector) shall be demated and mated</p> <p>1 310 nm <math>\pm</math> 10 nm 1 550 nm <math>\pm</math> 10 nm 1 625 nm <math>\pm</math> 10 nm</p> <p>Test every sample with one wavelength, changing wavelength for each sample</p> <p>Yes</p> <p>Preconditioning procedure: clean plug and adaptor according to manufacturer's instructions.</p> <p>In situ conditioning procedure: clean the mechanical and optical alignment parts of the moving connector according to the manufacturer instructions after cycle 24, 74, 124, and 174. Clean both the moving and stationary connectors and adaptor according to the manufacturer instructions after cycle 49, 99, 149, and 199. No additional cleaning or re-cleaning is allowed.</p> <p>Recovery procedure: the mechanical and optical alignment parts of the specimen may be cleaned according to manufacturer instructions up to 2 times after the final mating cycle</p>
9	Impact	<p>Before and after the test the insertion loss shall meet the requirements of test 1.</p> <p>Before and after the test the return loss shall meet the requirements of test 2.</p> <p>Specimen shall be unmated during the test, dust covers in place</p>	<p>Method:</p> <p>Drop height:</p> <p>Specimen optically functioning:</p>	<p>IEC 61300-2-12, Method A</p> <p>5</p> <p>1,5 m</p> <p>No</p>
10	Cold	<p>During the test the maximum allowed change in insertion loss is: <math>\leq 0,5</math> dB for attenuator <math>\leq 5</math> dB <math>\leq 10\%</math> for attenuators <math>&gt; 5</math> dB</p> <p>Before and after the test the insertion loss requirements of test No 1 shall be met.</p> <p>Before and after the test the return loss requirement of test No 2 shall be met.</p>	<p>Method:</p> <p>Temperature:</p> <p>Duration of the exposure:</p> <p>Optical source wavelength:</p> <p>Maximum sampling interval during the test:</p> <p>Specimen optically functioning:</p>	<p>IEC 61300-2-17: During the test the change in insertion loss shall be measured by test method IEC 61300-3-3</p> <p><math>-25</math> °C <math>\pm</math> 2 °C</p> <p>96 h</p> <p>1 310 nm <math>\pm</math> 10 nm 1 550 nm <math>\pm</math> 10 nm 1 625 nm <math>\pm</math> 10 nm</p> <p>Test every sample with one wavelength, changing wavelength for each sample</p> <p>1 h</p> <p>Yes</p>

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