IEC 61753-131-3

Edition 1.0 2010-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Performance standard –
Part 131-3: Single-mode mechanical fibre splice for category U – Uncontrolled environment

Dispositifs d'interconnexion et composants passifs à fibres optiques – Norme de performance –
Partie 131-3: Epissure mécanique de fibres unimodales pour catégorie U – Environnement non contrôlé

IEC 61753-131-3:2010

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 131-3: Single-mode mechanical fibre splice for category U – Uncontrolled environment

FOREWORD

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International Standard IEC 61753-131-3 had been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components of IEC technical committee 86: Fibre optics.

This bilingual version (2010-07) replaces the English version.

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

FDIS	Report on voting
86B/2945/FDIS	86B/2983/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.

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The French version of this standard has not been voted upon.

This publication 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.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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

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- withdrawn,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

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INTRODUCTION

This part of IEC 61753 for mechanical splices defines the requirements for standard optical performance under a set of specified conditions. The 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 a basis to prove the product's ability to satisfy the requirements of a specific application, market sector or user group.

A product that has been shown to meet all the requirements of this performance standard may be declared as complying with this performance standard. Products having the same classification from one manufacturer that satisfy this performance standard, will operate within the boundaries set by the performance standard. There is no guarantee that products from different manufacturers, having the same classification and which conform to the same performance standard, will provide an equivalent level of performance when they are used together.

Conformance with IEC environmental policy according to IEC Guide 109 and concerning the need to reduce the impact on the natural environment of fibre management system products during all phases of their life – from acquiring materials to manufacturing, distribution, use, and end-of-life treatment (i.e. re-use, recycling (recovery and disposal)) are not part of this standard, but will be covered in the generic specification.

Conformance to a performance standard demonstrates that a product has passed a design verification test. It is not a guarantee of lifetime assured performance or reliability. Reliability testing are the subject of a separate test schedule, where the tests and severities selected are such that they are truly representative of the requirements of this reliability test programme. Consistency of manufacture should be maintained using a recognised Quality Assurance programme whilst the reliability of product should be evaluated using the procedures recommended in IEC 62005 series.

Tests and measurements are selected from the IEC 61300 series.

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 131-3: Single-mode mechanical fibre splice for category U – Uncontrolled environment

1 Scope

This part of IEC 61753 contains the minimum initial test and measurement requirements and severities which a mechanical fibre splice will satisfy in order to be categorised as meeting the requirements of single-mode fibre splice for use in uncontrolled environments.

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 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 61073-1, *Fibre optic interconnecting devices and passive components – Mechanical splices and fusion splice protectors for optical fibres and cables – Part 1: Generic specification*

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

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

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

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 – 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*

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

IEC 61300-2-33, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-33: Tests – Assembly and disassembly of fibre optic closures*

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 2-26: Tests – Salt mist*

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 61300-3-7, *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 3-8: Examinations and measurements – Transient loss*

3 General requirements

3.1 Storage, transportation and packaging

The classes of environmental conditions and their severities to which the mechanical splice may be exposed during transportation are defined in IEC 60721-3-2. Normal transportation time is considered to be 30 days or less.

The product, in its original packaging, shall be suitable for normal public or commercial transportation and storage in weather protected non-temperature controlled storage environments.

3.2 Marking and identification

Marking of the packaging of the mechanical splice shall be according to IEC 61073-1.

Product marking and identification shall survive the storage and transportation.

Each test sample should contain the following information at the minimum:

– manufacturer's identification mark or logo;
– product designation, model or type;
– one of the following: lot number, batch number, date (at least month and year) of production or serial number;
– expiry date (at least year) if the product contains components with a limited shelf life.

3.3 Materials

For all applicable materials, a Material Safety Data Sheet must be made available upon request.

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The materials of the mechanical splice shall be compatible with the other materials or solvents that are likely to come into contact with them, for example cable filling compounds and degreasing agents.

All materials that are likely to come in contact with personnel shall meet appropriate health and safety regulations.

Polymeric materials shall not support mould growth.

Metallic elements shall be corrosion resistant. Dissimilar metals shall not be used in contact with each other unless they are suitably finished to prevent electrolytic corrosion.

Materials which are not specified or which are not specifically described are left to the discretion of the manufacturer.

3.4 Test report

Conformance to a performance standard shall be supported by a test report. The test report shall clearly demonstrate that the tests were carried out in accordance with the requirements of the performance standard and provide full details of the tests together with a pass/fail declaration. An analysis of the cause of the failure shall be undertaken and any corrective actions taken shall be described.

If design changes are made, an assessment should be carried out to determine whether full or partial requalification should be done.

4 Test

4.1 General

The mechanical and environmental performance of a fibre splice is vital to the optical cabling system. The purpose of testing is to demonstrate that the mechanical splice remains functional under defined environmental conditions, without irreversible or reversible failures.

Optical performance testing is accomplished by subjecting the test specimen to a number of mechanical and environmental conditions and measuring any optical performance deviations at prescribed intervals during and after completion of each test.

4.2 Test sample preparation

The test samples are prepared by making a mechanical splice between identical fibres. Optical test samples shall be installed according to the manufacturer's installation instructions. The fibres for the optical test samples are single-mode fibres as described in Annex A. The length of the fibres shall be at least 2 m on both sides of the mechanical splice. For each fibre construction (primary and secondary coated) a number of test samples will be prepared as defined in Table B.1.

4.3 Test and measurement methods

All tests and measurements have been selected from the IEC 61300 series.

Unless otherwise stated in the individual test details, all attenuation measurements shall be performed at 1 310 nm ± 25 nm, 1 550 nm ± 25 nm and 1 625 nm ± 25 nm for the environmental optical tests, and at 1 550 nm ± 25 nm for the mechanical optical tests.

All optical losses indicated are referenced to the initial attenuation at the start of the test.

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No deviation from the specified test method is allowed.

Unless otherwise specified, tests should be carried out under standard atmospheric conditions according to IEC 61300-1.

4.4 Pass/fail criteria

A product will have met the requirements of this standard provided no failures occur in any test.

5 Performance requirements

5.1 Sample size, sequencing and grouping

The sample size to be used for the tests shall be as defined in Table B.1. All samples shall be subjected to Tests 1 to 2 at the start and at the end of the environmental or mechanical tests. Samples for Tests 4 to 15 are randomly selected from the samples of Test 3. There is no defined sequence in which Tests 4 to 15 are carried out.

5.2 Dimensions

No requirements on dimensions are available.

5.3 Installation yield requirement

The success rate or yield of installation of mechanical splices depends on many variables (e.g. installer skills, ambient conditions, condition of tools). Typically no feedback is given on the optical performance when a mechanical splice is made. Therefore, a small percentage of the installed splices might not meet the expected performance level.

Ninety-seven per cent (97 %) of the splices shall meet the maximum attenuation and minimum return loss requirements as specified by Tests 1 and 2 in Table 1 when 100 splices are made.

5.4 Test details and requirements

Table 1 – Test details and requirements

No.	Test	Requirement	Details	
1	Attenuation	Attenuation per splice : ≤ 0,25 dB max. Grade B ≤ 0,50 dB max. Grade C	Method:	IEC 61300-3-4, insertion method.
			Launch fibre length:	≥ 2 m. Only the fundamental mode shall propagate at the mechanical splice and at the detector.
			Source type:	LD
			Launch conditions:	The wavelength of the source shall be longer than cut-off wavelength of the fibre.
			Source stability:	Better than ± 0,01 dB over the measuring period or at least 1 h.
			Detector linearity:	± 0,01 dB over the dynamic range to be measured.
			LD source central wavelengths:	1 310 nm ± 25 nm, 1 550 nm ± 25 nm and 1 625 nm ± 25 nm

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Table 1 *(Continued)*

No.	Test	Requirement	Details	
2	Return loss	Return loss per splice: ≥ 60 dB Grade 1 ≥ 45 dB Grade 2 ≥ 35 dB Grade 3	Method: Launch fibre length: Source type: Launch conditions: Source stability: Detector linearity: LD source central wavelengths:	IEC 61300-3-6, method 1 ≥ 2 m. Only the fundamental mode shall propagate at the mechanical splice and at the detector. LD The wavelength of the source shall be longer than cut-off wavelength of the fibre. Better than ± 0,01 dB over the measuring period or at least 1 h. ± 0,01 dB over the dynamic range to be measured. 1 310 nm ± 25 nm, 1 550 nm ± 25 nm and 1 625 nm ± 25 nm
3	Installation yield	100 splices will be made. A minimum of 97 % shall meet the maximum attenuation requirement of Test 1 and return loss requirement of Test 2	Method: Launch fibre length: Source type: Launch conditions: Source stability: Detector linearity: LD source central wavelengths:	IEC 61300-3-4, insertion method IEC 61300-3-6, method 1. ≥ 2 m. Only the fundamental mode shall propagate at the mechanical splice and at the detector. LD. The wavelength of the source shall be longer than cut-off wavelength of the fibre. Better than ± 0,01 dB over the measuring period or at least 1 h. ± 0,01 dB over the dynamic range to be measured. 1 310 nm ± 25 nm, 1 550 nm ± 25 nm and 1 625 nm ± 25 nm
4	Wavelength dependence of attenuation	Pass band: 1 260 nm-1 625 nm Attenuation per splice on random selected fibres: Grade B: ≤ 0,25 dB maximum Grade C: ≤ 0,50 dB maximum	Method: Launch fibre length: Source type: Launch conditions: Source stability: Wavelength range Detector linearity:	IEC 61300-3-7, test sample configuration according to IEC 61300-3-4 cut-back method or insertion method. ≥ 2 m. Only the fundamental mode shall propagate at the mechanical splice and at the detector. Unpolarized broadband light source with spectral power >-35 dBm/nm. The wavelength of the source shall be longer than the cut-off wavelength of the fibre. Better than ± 0,05 dB over the measuring period or at least 1 h. 1 260 nm-1 625 nm ± 0,05 dB over the dynamic range to be measured.

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Table 1 *(Continued)*

No.	Test	Requirement	Details	
5	Vibration (Sinusoidal)	Before and after the test, the attenuation shall meet the requirements of Test 1. Before and after the test, the return loss shall meet the requirements of Test 2. During test, the change in attenuation shall be ≤ ± 0,2 dB	Method: Frequency range: Constant vibration amplitude: Number of cycles (10-55-10 Hz): Number of axis: Duration per axis: Specimen optically functioning :	IEC 61300-2-1 10 Hz - 55 Hz 0,75 mm 15 The three main axes, perpendicular one to each other. 0,5 h. Yes
			Measurements required:	Attenuation and return loss shall be measured before, and after the test. During the test, the change in attenuation shall be measured by transient loss test method IEC 61300-3-28 (Transient loss) at 1 550 nm ± 25 nm
6	Shock	Before and after the test, the attenuation shall meet the requirements of Test 1. Before and after the test, the return loss shall meet the requirements of Test 2 .	Method: Acceleration force: Duration shock: Number of axes: Number of shocks: Specimen optically functioning: Measurements required:	IEC 61300-2-9 Components: 500 g_n 1 ms half sine pulse. 3 main axes, perpendicular to each other. 2 per axis (one in each direction). No Before and after each axis.
7	Torsion	Before and after the test, the attenuation shall meet the requirements of Test 1. Before and after the test, the return loss shall meet the requirements of Test 2 .	Method: Magnitude of the load: Rate of load application: Load application point: Number of cycles: Specimen optically functioning : Measurements required:	IEC 61300-2-5 2,0 N ± 0,5 N for primary and secondary coated fibres. 0,1 N/s 0,2 m from end of device. 10 cycles at +/- 180° Yes Attenuation and return loss shall be measured before and after the test

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Table 1 *(Continued)*

No.	Test	Requirement	Details	
8	Fibre/cable retention	Before and after the test, the attenuation shall meet the requirements of Test 1. Before and after the test, the return loss shall meet the requirements of Test 2	Method: Magnitude of the load: Load application point: Load rate: Duration of the load: Specimen optically functioning : Measurements required:	IEC 61300-2-4 5,0 N ± 0,5 N for secondary coated fibres. 2,0 N ± 0,5 N for primary coated fibres. 0,3 m from the end of device. 0,5 N/s for primary and secondary coated fibre. 60 s Yes Attenuation and return loss shall be measured before and after the test
9	Assembly and disassembly of splices (only for re-usable mechanical splices)	Only for re-usable mechanical splices. Before and after the test, the attenuation shall meet the requirements of Test 1. Before and after the test, the return loss shall meet the requirements of Test 2	Method: Conditioning between each installation Number of re-entries: Measurements required:	IEC 61300-2-33 (test method under consideration) After each re-entry of the mechanical splice, the splice shall age by 1 temperature cycle (–40 °C to +70 °C) as specified in Test 13. 5 Attenuation and return loss shall be measured before and after each ageing cycle.
10	Cold	During the test, the maximum allowed change in attenuation is ≤ ± 0,2 dB. Before and after the test, the spectral loss attenuation requirements of Test 1 shall be met. Before, during and after the test, the return loss requirement of Test 2 shall be met	Method: Pre-conditioning procedure: Specimen optically functioning: Temperature: Duration of the exposure: Operating wavelength: Measurements required: Maximum sampling interval during the test: Recovery procedure:	IEC 61300-2-17 Standard atmospheric conditions for 2 h. Yes –40 °C ± 2 °C 96 h 1 310 nm ± 25 nm, 1 550 nm ± 25 nm and 1 625 nm ± 25 nm Attenuation and return loss shall be measured before, and after the test. During the test, the change in attenuation and return loss shall be measured by test method IEC 61300-3-3. 1 h Allow specimen to recover at room temperature during 2 h

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