IEC 61753-131-03

Edition 1.0 2021-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Performance standard –
Part 131-03: Single-mode mechanical fibre splice for category OP – Outdoor protected environment

Dispositifs d'interconnexion et composants passifs fibroniques – Norme de performance –
Partie 131-03: Épissure mécanique de fibres unimodales pour catégorie OP – Environnement extérieur protégé

IEC 61753-131-03:2021-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 131-03: Single-mode mechanical fibre splice for category OP – Outdoor protected environment

FOREWORD

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IEC 61753-131-03 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 61753-131-3 first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) addition of definitions;
b) addition of IEC 60068-2-10 mould growth test and test severities for materials;
c) replacement of the IEC 61753-1:2007 category U tests and test severities by the IEC 61753-1:2018 category OP tests;

d) addition of the requirement that dimensions are in accordance with IEC 61756-1;

e) addition of the bending moment test;

f) change of low temperature in cold test and change of temperature test to −25°C. If 40°C is required, the user can refer to category OP+.

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

Draft	Report on voting
86B/4500/FDIS	86B/4524/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 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 in the data related to the specific document. At this date, the document will be

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- withdrawn,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

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – PERFORMANCE STANDARD –

Part 131-03: Single-mode mechanical fibre splice for category OP – Outdoor protected environment

1 Scope

This part of IEC 61753 contains the minimum tests, test severities and measurement requirements which a mechanical fibre splice need to satisfy in order to be categorised as meeting the requirements of single-mode fibre splice for use in category OP (Outdoor protected) environments, as defined in IEC 61753-1.

This document 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.

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 60068-2-10, *Environmental testing – Part 2-10: Tests – Test J and guidance: Mould growth*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

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 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

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 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 61300-2-7, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-7: Tests – Bending moment*

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*

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 mechanical splices, fibre management systems and closures*

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

IEC 61300-3-3, *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 61300-3-7, *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 61753-1, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1: General and guidance*

IEC 61756-1, *Fibre optic interconnecting devices and passive components – Interface standard for fibre management systems – Part 1: General and guidance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61073-1 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

4 General requirements

4.1 General

A product that has been shown to meet all the requirements of this performance standard can be declared as conforming to 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 to 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 document, 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 is maintained using a recognised quality assurance programme whilst the reliability of product is evaluated using the procedures recommended in IEC 62005 series.

Tests and measurements are selected from IEC 61300 (all parts).

4.2 Storage, transportation and packaging

The classes of environmental conditions and their severities to which the mechanical splice can be exposed during transportation are defined in IEC 60721-3-1 and 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 and after installation meet the requirements as specified in Table 1 and Table 2.

4.3 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 product and 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.

4.4 Materials

For all applicable materials, a material safety data sheet shall be made available upon request.

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

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. Exposure to these solvents shall not adversely affect the product's performance.

Polymeric materials shall not support mould growth causing mechanical degradation of the materials. Mould growth shall be tested according to IEC 60068-2-10 Test Variant 1, Severity 1. The effect of mould growth shall be determined first by a visual rating based on examination per IEC 60068-2-10. When a rating 0 is obtained, the material is considered fungus resistant and no further testing is required. When a rating 1 or 2 is obtained, the effect of mould growth shall be evaluated by measuring a suitable property (e.g. tensile strength at yield and elongation at yield for thermoplastic polymers, a compression set, a Shore A hardness for elastic materials, or any other test which checks a relevant property) both before and after exposure of the material slabs. The average change in mechanical characteristics of the tested material slabs shall be less than 20 %. A rating of more than 2 is not allowed.

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.

5 Test

5.1 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 sample to a number of mechanical and environmental conditions and measuring any optical performance deviations at prescribed intervals during and after completion of each test.

5.2 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 buffered), a number of test samples will be prepared as defined in Table B.1.

5.3 Test and measurement methods

All tests and measurements shall be selected from IEC 61300 (all parts).

All changes in attenuation values refer to the ± deviation from the original value of the transmitted power at the start of the test.

No deviation from the specified test method is allowed.

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

5.4 Acceptance criteria

A product will have met the requirements of this document provided no failures occur in any test. The pass/fail criteria for mechanical splices are specified in Table 1.

Consecutive testing on the same sample is allowed. In the event of a failure occurring, the test shall be repeated using a sample size double that of the original and the failed test shall be re-done. When the samples fail again the test shall be reported as a failure.

5.5 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.

6 Performance tests, test severities and pass/fail requirements

6.1 Sample size, sequencing and grouping

The sample size to be used for the tests are defined in Table B.1 in Annex B. All samples shall be subjected to criterion test 1 and criterion test 2 at the start and at the end of each test. Samples for tests 2 to 14 are randomly selected from the samples of the installation test 1 meeting the optical performance criteria of criterion test 1 and criterion test 2 in Table 1. There is no defined sequence in which tests 2 to 14 in Table 2 are carried out.

6.2 Dimensions

Dimensions shall meet the interface requirements for mechanical splices as defined in IEC 61756-1.

6.3 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 on site. Therefore, a small percentage of the installed splices might not meet the expected performance level (see test 1 in Table 2).

6.4 Pass/fail criteria

The pass/fail criteria and requirements are given in Table 1.

Table 1 – Pass/fail requirements

No.	Examinations and measurements	Requirement	Details	
Criterion 1	Attenuation	Attenuation per splice: ≤ 0,25 dB max. Grade B ≤ 0,50 dB max. Grade C	Method: Launch conditions: Wavelengths: Source stability: Detector linearity:	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. 1 310 nm ± 30 nm 1 550 nm ± 30 nm 1 625 nm ± 30 nm less than ± 0,01 dB over the measuring period or at least 1 h Within ± 0,01 dB over the dynamic range to be measured.
Criterion 2	Return loss	Return loss per splice: ≥ 60 dB Grade 1 ≥ 45 dB Grade 2 ≥ 35 dB Grade 3	Method: Launch conditions: Source type: Wavelengths: Source stability: Detector linearity:	IEC 61300-3-6, method 1 Launch fibre length ≥ 2 m. Only the fundamental mode shall propagate at the mechanical splice and at the detector. LD 1 310 nm ± 30 nm 1 550 nm ± 30 nm 1 625 nm ± 30 nm less than± 0,05 dB over the measuring period or at least 1 h. Within ± 0,05 dB over the dynamic range to be measured.
Criterion 3	Active monitoring of change in attenuation[a] and return loss	During the test the change in attenuation shall be ≤ 0,2 dB[a]. During the test the return loss shall meet the relevant return loss grade listed in test 2.	Method: Launch conditions: Wavelengths: Source stability: Detector linearity:	IEC 61300-3-3, method 1 Launch fibre length ≥ 2 m. Only the fundamental mode shall propagate at the mechanical splice and at the detector 1 310 nm ± 30 nm 1 550 nm ± 30 nm 1 625 nm ± 30 nm Within ± 0,05 dB over the measuring period Within ± 0,05 dB over the dynamic range to be measured
Criterion 4	Transient loss[a]	During the test the change in attenuation shall be ≤ 0,5 dB[a].	Method: Launch condition: Wavelength: Source stability: Detector linearity:	IEC 61300-3-28 Launch fibre length ≥ 2 m. Only the fundamental mode shall propagate at the mechanical splice and at the detector 1 550 nm ± 30 nm Within ± 0,05 dB over the measuring period Within ± 0,05 dB over the dynamic range to be measured

[a] The change in attenuation values refer to the ± deviation from the original value of the transmitted power at the start of the test.