IEC 60793-1-46

Edition 2.0 2024-06
COMMENTED VERSION

INTERNATIONAL STANDARD

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Optical fibres –
Part 1-46: Measurement methods and test procedures – Monitoring of changes in attenuation

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

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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OPTICAL FIBRES –

Part 1-46: Measurement methods and test procedures – Monitoring of changes in ~~optical transmittance~~ attenuation

FOREWORD

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This commented version (CMV) of the official standard IEC 60793-1-46:2024 edition 2.0 allows the user to identify the changes made to the previous IEC 60793-1-46:2001 edition 1.0. Furthermore, comments from IEC SC 86A experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 60793-1-46 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

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

a) inclusion of class C single mode intraconnection fibre;

b) replacement of 'optical transmittance' by 'attenuation'.

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

Draft	Report on voting
86A/2442/FDIS	86A/2475/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/publications.

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IEC 60793-1-1 and IEC 60793-1-2 cover generic specifications.

IEC 60793-1-4X consists of the following parts, under the general title: *Optical fibres*:

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– *Part 1-40: Measurement methods and test procedures – Attenuation*
– *Part 1-41: Measurement methods and test procedures – Bandwidth*
– *Part 1-42: Measurement methods and test procedures – Chromatic dispersion*
– *Part 1-43: Measurement methods and test procedures – Numerical aperture*
– *Part 1-44: Measurement methods and test procedures – Cut-off wavelength*
– *Part 1-45: Measurement methods and test procedures – Mode field diameter*
– *Part 1-46: Measurement methods and test procedures – Monitoring of changes in attenuation*
– *Part 1-47: Measurement methods and test procedures – Macrobending loss*
– *Part 1-48: Measurement methods and test procedures – Polarization mode dispersion*
– *Part 1-49: Measurement methods and test procedures – Differential mode delay*

A list of all parts in the IEC 60793 series, published under the general title *Optical fibres*, 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, or
- revised.

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INTRODUCTION

Publications in the IEC 60793-1 series concern measurement methods and test procedures as they apply to optical fibres.

Within the same series several different areas are grouped, as follows:

- ~~parts 1-10 to 1-19: General~~
- IEC 60793-1-20 to IEC 60793-1-29: *Measurement methods and test procedures for dimensions*
- IEC 60793-1-30 to IEC 60793-1-39: *Measurement methods and test procedures for mechanical characteristics*
- IEC 60793-1-40 to IEC 60793-1-49: *Measurement methods and test procedures for transmission and optical characteristics*
- IEC 60793-1-50 to IEC 60793-1-59: *Measurement methods and test procedures for environmental characteristics*
- IEC 60793-1-60 to IEC 60793-1-69: *Measurement methods and test procedures for polarization-maintaining fibres*

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OPTICAL FIBRES –

Part 1-46: Measurement methods and test procedures – Monitoring of changes in ~~optical transmittance~~ attenuation 1

1 Scope

This part of IEC 60793 establishes uniform requirements for the monitoring of changes in ~~optical transmittance~~ attenuation, thereby assisting in the inspection of fibres and cables for commercial purposes.

This document gives two methods for monitoring the changes in ~~optical transmittance~~ attenuation of optical fibres and cables that occur during mechanical or environmental testing, or both. It provides a monitor in the change of ~~optical transmission~~ attenuation characteristics arising from optical discontinuity, physical defects and modifications of the attenuation slope:

– method A: change in ~~transmittance~~ attenuation by transmitted power;
– method B: change in ~~transmittance~~ attenuation by backscattering.

Methods A and B apply to the monitoring of all categories of the following fibres:

– class A: multimode fibres;
– class B: single-mode fibres;
– class C: single-mode intraconnection fibres. 2

Information common to both measurements is contained in Clause 1 to Clause 10, and information pertaining to each individual method appears in Annex A, and Annex B respectively.

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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 60793-1-40, *Optical fibres – Part 1-40: ~~Measurement methods and test procedures –~~ Attenuation measurement methods*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 Reference test method

~~Under consideration.~~

There are no reference test methods indicated in this document. 3

5 Apparatus

Annex A and Annex B include layout drawings and other equipment requirements that individually apply for each of the methods, respectively.

6 Sampling ~~and specimens~~ 4

6.1 ~~Specimen~~ Sample length

The minimum length of the ~~specimen~~ sample shall be such that the changes in attenuation are compatible with the resolution of the applicable test method (method A or method B), measurement apparatus, and the non-linearities at the beginning and end of it shall not affect the results.

6.2 ~~Specimen~~ Sample end face

Prepare a flat end face, orthogonal to the fibre axis, at the input and output ends of each ~~specimen~~ sample.

6.3 ~~Specimen~~ Sample preparation

Prepare the ~~specimen~~ sample as described in the appropriate mechanical, environmental, or other test method specified.

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6.4 Reference ~~specimen~~ sample

In methods where a reference ~~specimen~~ sample is used, it shall comprise an identical kind of optical fibre or cable to the ~~specimen~~ sample and shall be linked between the optical divider and detector, as shown in Figure A.1. It ~~may~~ can be a short length of fibre. The condition of the reference ~~specimen~~ sample shall be constant during the whole test.

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7 Procedure

For individual procedures, see appropriate annex: Annex A and Annex B, respectively.

8 Calculations

For calculation procedures, see the appropriate annex: Annex A and Annex B, respectively.

9 Results

9.1 Information to be provided with each measurement

Report the following information with each measurement:

– date and title of measurement;
– identification of ~~specimen~~ sample;
– optical source wavelength, λ;
– ~~specimen~~ sample length;
– conditions of the environment and measurement equipment;

– changes in ~~optical transmittance, D_n~~ attenuation, A_n; n = 1,2,3, … preferably plotted in a graph versus test parameters.

9.2 Information available upon request

The following information shall be available upon request:

– measurement method used: A or B;
– type of optical source used and its spectral width (FWHM);
– launching technique used;
– description of all key equipment;
– details of computation technique;
– date of latest calibration of measurement equipment.

10 Specification information

The detail specification shall specify the following information:

– type of fibre to be measured;
– failure or acceptance criteria;
– information to be reported;
– any deviations from the procedure that apply.

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Annex A
(normative)

Requirements specific to method A – Change in ~~transmittance~~ attenuation by transmitted power

A.1 Apparatus

A.1.1 General

The arrangement shall provide a monitoring for ~~optical transmittance~~ attenuation with high resolution and good stability over the time and temperature changes given in the relevant product specification.

Figure A.1 is an example of a typical arrangement suitable for use when carrying out mechanical or environmental tests in a laboratory or factory. By comparison with a reference sample, it provides a measurement of the change in ~~optical transmittance~~ attenuation, corrected for any changes that might occur in the optical source. Connections shall have stable coupling conditions.

Figure A.2 is an example of a typical arrangement suitable for use in the field, laboratory, or factory where long-term tests are required, in cases where it is possible to stabilize the optical source by optical feedback. If the stability of the optical source is compatible with the accuracy necessary for the measurement, then the insertion loss measurement method (method B of IEC 60793-1-40) ~~may~~ can be used.

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A.1.2 Optical source

Use a suitable source such as a laser or light-emitting diode, emitting at wavelengths compatible with the optical fibres under test. It is customary to modulate the optical source and wavelength selective optical filters ~~may~~ can be used.

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A.1.3 Optical divider

The optical divider shall have a splitting ratio that remains constant during the test. The splitting ratio and temperature stability shall be as shown in the relevant detail specification. Commercially available or custom-built devices ~~may~~ can be used.

A.1.4 Optical detector

The optical detector shall be of sufficient area to intercept all of the radiated power in the output cone and shall be sufficiently linear over the optical powers encountered.