SLOVENSKI STANDARD
oSIST prEN IEC 60793-1-22:2023

01-oktober-2023

Optična vlakna - 1-22. del: Merilne metode in postopki preskušanja - Merjenje dolžine

Optical fibres - Part 1-22: Measurement methods and test procedures - Length measurement

Lichtwellenleiter - Teil 1-22: Messmethoden und Prüfverfahren - Längenmessung

Fibres optiques - Partie 1-22: Méthodes de mesure et procédures d'essai - Mesure de la longueur

Ta slovenski standard je istoveten z: **prEN IEC 60793-1-22:2023**

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33.180.10	(Optična) vlakna in kabli	Fibres and cables

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COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:	
IEC 60793-1-22 ED2	
DATE OF CIRCULATION:	CLOSING DATE FOR VOTING:
2023-08-04	**2023-10-27**
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IEC SC 86A : FIBRES AND CABLES	
SECRETARIAT: France	SECRETARY: Mr Laurent Gasca
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any relevant "In Some Countries" clauses to be included should this proposal proceed. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (SEE AC/22/2007 OR NEW GUIDANCE DOC).

TITLE:

Optical fibres - Part 1-22: Measurement methods and test procedures - Length measurement

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRES –

Part 1-22: Measurement methods and test procedures – Length measurement

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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International Standard IEC 60793-1-22 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

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 category C single mode fibres in Table 1

b) Inclusion of a new informative Annex F on Brillouin frequency shift test method

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

FDIS	Report on voting
86A/687/FDIS	86A/726/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.

Annexes A, B, C, D and E form an integral part of this standard.

IEC 60793-1-2X consists of the following parts, under the general title: Optical fibres:

- Part 1-20: Measurement methods and test procedures – Fibre geometry
- Part 1-21: Measurement methods and test procedures – Coating geometry
- Part 1-22: Measurement methods and test procedures – Length measurement

The committee has decided that the contents of this publication will remain unchanged until XXXX. At this date, the publication will be

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

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:

- 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.

OPTICAL FIBRES –

Part 1-22: Measurement methods and test procedures – Length measurement

1 Scope

This part of IEC 60793 establishes uniform requirements for measuring the length and elongation of optical fibre (typically within cable).

The length of an optical fibre is one of the most fundamental values and shall be known for the evaluation of transmission characteristics such as losses and bandwidths.

In addition, informative Annex F has been added to determine the tensile strain applied to a fibre. It uses Brillouin reflectometry (BOTDR) or so-called Brillouin analysis (BOTDA), which are single-sided and double-sided methods respectively.

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

IEC 60793-1-42, *Optical fibres – Part 1-42: Measurement methods and test procedures – Chromatic dispersion*

IEC 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 Overview of method

This standard gives five methods for measuring length, which are presented in the following table 1.

Table 1 – Measurement methods

Method	Characteristics covered	Fibre category(ies) covered
A Delay measuring	Length	All A1, B, and C
B Backscattering	Length	All A1, B, and C
C Fibre elongation [a]	Fibre elongation [c]	A1, B1 [b], and C
D Mechanical	Length	All
E Phase shift	Length	All A1, B, and C

[a] The measurement of fibre elongation, method C, is part of several measurement methods for fibres and fibre optic cables, such as those in IEC 60794-1-1.

[b] This measurement is applicable unreservedly to type B single-mode fibres. For type A1 multimode fibres, take particular care when interpreting the results because the results of this measurement may be influenced by interfering modal effects, for example, due to the occurrence of non-longitudinal stresses on the fibre. Application of the measurement to A2 to A4 multimode fibres is under consideration.

[c] In addition, informative Annex F has been added to determine the tensile strain applied to a fibre. It uses Brillouin reflectometry (BOTDR) or so-called Brillouin analysis (BOTDA), which are single-sided and double-sided methods respectively.

Information common to all measurements is contained in clauses 2 to 8. Information on specific application appears in annexes A, B, C, D, and E for methods A, B, C, D and E, respectively.

4.1 Method A – Delay measuring

The delay measuring method applies to measurements of the fibre length by the measurement of the propagation time of an optical pulse or a pulse train on the basis of a known value of the group index of the fibre.

Alternatively, this method is suitable for measuring the group index of a fibre of known length. Therefore, in practice this fibre length measurement method is calibrated against a known length of fibre of the same type.

4.2 Method B – Backscattering

The backscattering method, which is a single-sided measurement, uses an optical time domain reflectometer (OTDR), and measures the optical power backscattered from different points in the fibre to the beginning of the fibre.

4.3 Method C – Fibre elongation

This measurement method describes a procedure for determining the fibre elongation. It does not measure absolute strain, but instead measures the changes in strain from one loading condition to another.

4.4 Method D – Mechanical length

This measurement method describes a procedure for determining the fibre length by winding a fibre around a fixed diameter calibrated wheel that rotates. The length is determined by the number of revolutions of the wheel.

4.5 Method E – Phase shift

The phase shift method describes a procedure for determining the fibre length. The length is determined from the phase shift that occurs when a predetermined modulation frequency f_{max} is applied.

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4.6 Reference test method

The reference test method (RTM), which shall be the one used to settle disputes, varies depending on whether the fibre is cabled or not, such as

– uncabled fibre: method D;
– length of fibre within cable: method B;
– elongation of fibre within cable: method C;
– elongation of uncabled fibre: method C;

5 Apparatus

Annexes A, B, C, D, and E include layout drawings and other equipment requirements for each of the methods A, B, C, D and E, respectively.

6 Sampling and specimens

See the appropriate annex A, B, C, D or E for specific requirements. General requirements follow.

Prepare a flat end face, perpendicular to the fibre axis, at the input and output ends of each specimen for measurements based on optical delay measurements.

7 Procedure

See the appropriate annex A, B, C, D or E for specific requirements.

8 Calculations

See the appropriate annex A, B, C, D or E for specific requirements.

9 Results

The following information shall be provided with each measurement:

– date and title of measurement;
– identification and description of specimen, including whether fibre or cable;
– specimen length, or elongation;
– measurement method used: A, B, C, D or E;
– other results, as required by the appropriate annex, A, B, C, D or E.

The following information shall be available upon request:

- description of measurement apparatus arrangement;
- type and wavelength of measurement source;
- launch conditions;
- details of computation technique;
- date of latest calibration of equipment.

See annexes A, B, C, D and E for any additional information that shall be available upon request.

10 Specification information

The detail specification shall specify the following information:

- type of fibre (or cable) to be measured;
- failure or acceptance criteria;
- information to be reported;
- deviations to the procedure that apply.

Annex A
(normative)

Requirements specific to method A – Delay measuring

A.1 General

Use this method to measure the length of optical fibre by itself, or installed in cable. If the specimen is a fibre in a cable, determine the value of group index N under conditions applicable to the specimen under measurement (for example, tension, temperature). This is done by inverting equation (A.1) and the measurements on a specimen with a known length.

A.2 Principle

An optical pulse travelling through an optical fibre with length L and average group index N experiences a travelling/delay time, Δt:

$$\Delta t = \frac{NL}{C} \quad \text{(A.1)}$$

where

Δt is the time delay;

N is the average group index;

C is the velocity of light in vacuum.

If N is known, the measurement of Δt gives L. On the other hand, the measurement of Δt gives the value of N when L is known.

A.3 Apparatus

A.3.1 Two techniques

There are two techniques for measuring the propagation time of an optical pulse:

– time measurement of the transmitted pulse (Δt measured);

– time measurement of the reflected pulse ($2\Delta t$ measured).

See figures A.1 and A.2 for two different arrangements corresponding to the two techniques applying a sampling oscilloscope.

Instead of the sampling oscilloscope, backscattering equipment, or a counter with separate start/stop gate and averaging capability (for example, at least 10^4 counts), can be used.