

**Optična vlakna – 1-40. del: Metode merjenja in preskusni postopki – Dušenje  
(IEC 60793-1-40:2001, prirejen)\***

Optical fibres - Part 1-40: Measurement methods and test procedures - Attenuation  
(IEC 60793-1-40:2001, modified)

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EUROPEAN STANDARD

**EN 60793-1-40**

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2003

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Partly supersedes EN 188000:1992

English version

**Optical fibres**  
**Part 1-40: Measurement methods and test procedures –**  
**Attenuation**  
(IEC 60793-1-40:2001, modified)

Fibres optiques  
Partie 1-40: Méthodes de mesure  
et procédures d'essai –  
Affaiblissement  
(CEI 60793-1-40:2001, modifiée)

Lichtwellenleiter  
Teil 1-40: Messmethoden und  
Prüfverfahren –  
Dämpfung  
(IEC 60793-1-40:2001, modifiziert)

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This European Standard was approved by CENELEC on 2003-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 86A/669/FDIS, future edition 1 of IEC 60793-1-40, prepared by SC 86A, Fibres and cables, of IEC TC 86, Fibre optics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60793-1-40 on 2001-10-01.

A draft amendment, prepared by the Technical Committee CENELEC TC 86A, Optical fibres and optical fibre cables, was submitted to the Unique Acceptance Procedure and was approved by CENELEC for inclusion into EN 60793-1-40 on 2003-11-01.

This European Standard supersedes subclause 4.5 (test method 301), subclause 4.6 (test method 302) and subclause 4.7 (test method 303) of EN 188000:1992.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-11-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-11-01

Annexes designated "normative" are part of the body of the standard.  
In this standard, Annexes A, B, C, D and ZA are normative.  
Annex ZA has been added by CENELEC.

Compared to IEC 60793-1:1989 and IEC 60793-2:1992, IEC/SC 86A has adopted a revised structure of the new IEC 60793 series: The individual measurement methods and test procedures for optical fibres are published as "Part 1-XX"; the product standards are published as "Part 2-XX".

The general relationship between the new series of EN 60793 and the superseded European Standards of the EN 188000 series is as follows:

EN	Title	supersedes
EN 60793-1-XX	Optical fibres -- Part 1-XX: Measurement methods and test procedures	Individual subclauses of EN 188000:1992
EN 60793-2-XX	Optical fibres -- Part 2-XX: Product specifications	EN 188100:1995 EN 188101:1995 EN 188102:1995 EN 188200:1995 EN 188201:1995 EN 188202:1995

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

- 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 optical transmittance
- 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

## Endorsement notice

The text of the International Standard IEC 60793-1-40:2001 was approved by CENELEC as a European Standard with agreed common modifications as given below.

### COMMON MODIFICATIONS

#### Annex C

#### C.3 Procedure

**C.3.6.2 Add** at the end of the third sentence (...of the fibre or cable attenuation):

"... (C.3) or the measurement of the fibre longitudinal attenuation uniformity (C.4)".

**Insert** the following new title and text for C.4 and **renumber** the existing clauses C.4 and C.5 to become C.5 Calculations and C.6 Results.

#### C.4 Measurement of fibre longitudinal attenuation uniformity using an OTDR

This procedure describes the use of an OTDR to measure the longitudinal attenuation uniformity of single-mode fibres in a bi-directional way. The use for multimode fibres is still under consideration.

Longitudinal attenuation uniformity is the deviation in attenuation coefficient of segments of the fibre under test, compared with its average attenuation coefficient determined over the entire fibre length.

In case an OTDR instrument is not able to calculate the longitudinal attenuation uniformity, an additional computer is needed to analyze the measured OTDR traces.

**C.4.1** The fibre under test should be measured in both directions using an OTDR at the relevant wavelength (See C.3 for start-up details).

**C.4.2** For both bi-directional measurements the OTDR traces are fitted using a least-squares fit over the entire length of the fibre (excluding the dead-zone and reflecting pulse areas). The attenuation coefficient of the entire fibre length is calculated as the mean of the slopes of both bi-directional traces (comparable to C.3.5.2 and C.5.5).

**C.4.3** Divide both bi-directional traces in segments with a length of about 2 km. These segments should have the same orientation for the measurements in both directions. Each segment may have an overlap with adjacent segments: the length of this overlap (e.g. 1 km) is to be determined between the customer and the manufacturer.

**C.4.4** For each segment, the slopes of the corresponding traces in both directions are determined, using a least-squares fit.

**C.4.4** The attenuation coefficient of each fibre segment is calculated as the mean of the slopes of both bi-directional traces for the corresponding segment

**C.4.6** The longitudinal attenuation (non-) uniformity parameter X (in dB/km) is the maximum difference between the segment attenuation coefficient (result of C.4.5) and the attenuation coefficient determined for the entire fibre length (result of C.4.2).

NOTE 1 The use of this longitudinal attenuation (non-)uniformity parameter is a matter of common agreement between the customer and the manufacturer.

NOTE 2 The minimum fibre length for this test should be 4 km.

NOTE 3 The use of this longitudinal attenuation (non-) uniformity parameter should be treated with great care, because the determination of the segment attenuation coefficients may be less accurate compared with the attenuation coefficient of the entire fibre length.

**C.5 Calculations** (renumbered from C.4)

**C.5.3** Replace "in 6.4.2" by "in 6.5.2".

**C.5.4** Replace "in C.4.1 to .4.2" by "in C.5.1 to 6.5.2".

**C.5.5** Replace "in C.4.2" by "in C.5.2".

**C.5.6** Replace "C.4.1 through C.4.5" by "C.5.1 through C.5.5".

**C.6 Results** (renumbered from C.5)

**C.6.1** Add at the end:

Report the following information when measuring fibre longitudinal uniformity:

- the longitudinal attenuation non-uniformity parameter X (in dB/km) at the specified wavelength.

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**Annex ZA**  
(normative)

**Normative references to international publications  
with their corresponding European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60793-1-22	2001	Optical fibres Part 1-22: Measurement methods and test procedures - Length measurement	EN 60793-1-22	2002
IEC 60793-1-43	2001	Optical fibres Part 1-43: Measurement methods and test procedures - Numerical aperture	EN 60793-1-43	2002

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**Fibres optiques –**

**Partie 1-40:  
Méthodes de mesure et procédures d'essai –  
Affaiblissement**

**iTech STANDARD PREVIEW**

**Optical fibres –**

**Part 1-40:  
Measurement methods and test procedures –  
Attenuation**

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International Electrotechnical Commission  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## OPTICAL FIBRES –

**Part 1-40: Measurement methods and test procedures –  
Attenuation**

## 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.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60793-1-40 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This standard, together with the other standards in the IEC 60793-1-4X series, replaces the second edition of IEC 60793-1-4, of which it constitutes a technical revision.

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

FDIS	Report on voting
86A/669/FDIS	86A/693/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 3.

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

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