

SLOVENSKI STANDARD
SIST EN 60793-1-49:2007
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Optical fibres -- Part 1-49: Measurement methods and test procedures - Differential mode delay (IEC 60793-1-49:2006)

Optische Schnittstellen von Lichtwellenleiter-Steckverbindern -- Teil 2-1: Optische Schnittstelle von nicht abgeschragten Einmodenfasern mit physikalischem Kontakt (IEC 60793-1-49:2006)

Interfaces optiques de connecteurs pour fibres optiques -- Partie 2-1: Interfaces optiques pour fibres unimodales en contact physique sans angles (IEC 60793-1-49:2006)

Ta slovenski standard je istoveten z: EN 60793-1-49:2006

ICS:

33.180.10 (U] cã } aD|a } aš Á aã|ã Fibres and cables

SIST EN 60793-1-49:2007 **en,fr,de**

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SIST EN 60793-1-49:2007

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English version

Optical fibres
Part 1-49: Measurement methods and test procedures -
Differential mode delay
(IEC 60793-1-49:2006)

Fibres optiques
Partie 1-49: Méthodes de mesure et
procédures d'essai -
Retard différentiel de mode
(CEI 60793-1-49:2006)

Lichtwellenleiter
Teil 1-49: Messmethoden und
Prüfverfahren -
Gruppenlaufzeitdifferenz
(IEC 60793-1-49:2006)

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This European Standard was approved by CENELEC on 2006-07-01. 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, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the 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/1061/FDIS, future edition 2 of IEC 60793-1-49, 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 60793-1-49 on 2006-07-01.

This European Standard supersedes EN 60793-1-49:2003.

It adds minimum calculated effective modal bandwidth (EMBc) to the test procedures, supporting EN 60793-2-10.

This standard is to be read in conjunction with EN 60793-1-1 and EN 60793-2-10.

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) 2007-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-07-01

Annex ZA has been added by CENELEC.

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Endorsement notice

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The text of the International Standard IEC 60793-1-49:2006 was approved by CENELEC as a European Standard without any modification.

[SIST EN 60793-1-49:2007](http://standards.iteh.ai/catalog/standards/sist-en-60793-1-49-2007)

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

- <http://standards.iteh.ai/catalog/standards/sist-en-60793-1-49-2007>
- | | | |
|-------------|------|---|
| IEC 60825-1 | NOTE | Harmonized as EN 60825-1:1994 (not modified). |
| IEC 60825-2 | NOTE | Harmonized as EN 60825-2:2004 (not modified). |
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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

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 60793-1-1	- ¹⁾	Optical fibres Part 1-1: Measurement methods and test procedures - General and guidance	EN 60793-1-1	2003 ²⁾
IEC 60793-1-22	- ¹⁾	Optical fibres Part 1-22: Measurement methods and test procedures - Length measurement	EN 60793-1-22	2002 ²⁾
IEC 60793-1-41	- ¹⁾	Optical fibres Part 1-41: Measurement methods and test procedures - Bandwidth	EN 60793-1-41	2003 ²⁾
IEC 60793-1-42	- ¹⁾	Optical fibres Part 1-42: Measurement methods and test procedures - Chromatic dispersion	EN 60793-1-42	2002 ²⁾
IEC 60793-1-45 (mod)	- ¹⁾	Optical fibres Part 1-45: Measurement methods and test procedures - Mode field diameter	EN 60793-1-45 + corr. April	2003 ²⁾ 2004
IEC 60793-2-10	- ¹⁾	Optical fibres Part 2-10: Product specifications - Sectional specification for category A1 multimode fibres	EN 60793-2-10	2004 ²⁾
IEC 61280-1-4	- ¹⁾	Fibre optic communication subsystem test procedures Part 1-4: General communication subsystems - Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters	EN 61280-1-4	2003 ²⁾

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

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NORME
INTERNATIONALE
INTERNATIONAL
STANDARD

CEI
IEC

60793-1-49

Deuxième édition
Second edition
2006-06

Fibres optiques –

Partie 1-49:

**Méthodes de mesure et procédures d'essai –
Retard différentiel de mode**

iTeh STANDARD PREVIEW

Optical fibres –

Part 1-49:

**Measurement methods and test procedures –
Differential mode delay**

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRES –

**Part 1-49: Measurement methods and test procedures –
Differential mode delay**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 60793-1-49 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 2003, of which it constitutes a technical revision. This edition adds minimum calculated effective modal bandwidth (EMBc) to the test procedures, supporting IEC 60793-2-10.

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

FDIS	Report on voting
86A/1061/FDIS	86A/1077/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.

This standard is to be read in conjunction with IEC 60793-1-1 and IEC 60793-2-10.

IEC 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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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 [SIST EN 60793-1-49:2007](https://standards.iteh.ai/catalog/standards/sist/c802d154-488e-4e50-b2ea-9f1bd44343ba/sist-en-60793-1-49-2007)
- amended. <https://standards.iteh.ai/catalog/standards/sist/c802d154-488e-4e50-b2ea-9f1bd44343ba/sist-en-60793-1-49-2007>

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OPTICAL FIBRES –

Part 1-49: Measurement methods and test procedures – Differential mode delay

1 Scope

This part of IEC 60793 applies only to multimode, graded-index glass-core (category A1) fibres. The test method is commonly used in production and research facilities, but is not easily accomplished in the field.

This standard describes a method for characterizing the modal structure of a graded-index multimode fibre. This information is useful for assessing the bandwidth performance of a fibre especially when the fibre is intended to support a variety of launch conditions such as those produced by standardized laser transmitters.

With this method, the output from a fibre that is single-mode at the test wavelength excites the multimode fibre under test. The probe spot is scanned across the endface of the fibre under test, and the optical pulse delay is determined at specified offset positions.

Two results can be produced from the same data. First, the difference in optical pulse delay time between the fastest and slowest mode groups of the fibre under test can be determined. The user specifies the upper and lower limits of radial offset positions over which the probe fibre is scanned in order to specify desired limits of modal structure. The DMD data is then compared to DMD specifications that have been determined by modeling and experimentation to correspond to a minimum EMB for a range of transmitters. Second, the optical pulse shapes can be combined using specific weights to determine a calculated effective modal bandwidth (EMBc), and by calculating a sequence of EMBc values with different sets of weights, a minimum EMBc can be calculated, corresponding to a range of transmitters.

The test quantifies the effects of interactions of the fibre modal structure and the source modal characteristics excluding the source spectral interactions with fibre chromatic dispersion. Adding the effects of chromatic dispersion and source spectral width will reduce the overall transmission bandwidth, but this is a separate calculation in most transmission models. In this test, the effects of non-zero spectral width are minimized but any residual effects will tend to increase the DMD value and decrease the EMBc value.

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 60793-1-1: *Optical fibres – Part 1: Measurement methods and test procedures – General and guidance*

IEC 60793-1-22: *Optical fibres – Part 1-22: Measurement methods and test procedures – Length measurement*

IEC 60793-1-41: *Optical fibres – Part 1-41: Measurement methods and test procedures – Bandwidth.*

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

IEC 60793-1-45: *Optical fibres – Part 1-45: Measurement methods and test procedures – Mode field diameter*

IEC 60793-2-10: *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 61280-1-4: *Fibre optic communication subsystem test procedures – Part 1-4: General communication subsystems – Collection and reduction of two-dimensional nearfield data for multimode fibre laser transmitters*

3 Terms and definitions

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For the purposes of this document, the following terms and definitions apply.

NOTE The user of this standard specifies either the maximum DMD for the outer (R_{OUTER}) and inner (R_{INNER}) limits of radial offset position over which the probe spot is scanned, or the minimum EMBC among the EMBC values calculated from a sequence of DMD weightings.

3.1 differential mode delay DMD

the estimated difference in optical pulse delay time between the fastest and slowest modes excited for all radial offset positions between and including R_{INNER} and R_{OUTER}

3.2 effective modal bandwidth

bandwidth associated with the transfer function, $H(f)$, of a particular laser/fibre combination

3.3 inner limit

R_{INNER}
outer limit

R_{OUTER}

limits of radial offset positions on the endface of the fibre under test over which the probe spot is scanned