SLOVENSKI STANDARD

SIST EN 60793-1-49:2004

september 2004

Optična vlakna – 1-49. del: Metode merjenja in preskusni postopki - Razlika v trajanju (IEC 60793-1-49:2003)*

Optical fibres - Part 1-49: Measurement methods and test procedures - Differential mode delay (IEC 60793-1-49:2003)

ICS 33.180.10

Referenčna številka
SIST EN 60793-1-49:2004(en)

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60793-1-49

November 2003

ICS 33.180.10

English version

Optical fibres
Part 1-49: Measurement methods and test procedures – Differential mode delay
(IEC 60793-1-49:2003)

Fibres optiques
Partie 1-49: Méthodes de mesure et procédures d'essai – Retard différentiel de mode
(CEI 60793-1-49:2003)

Lichtwellenleiter
Teil 1-49: Messmethoden und Prüfverfahren – Gruppenlaufzeitdifferenz
(IEC 60793-1-49:2003)

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

Ref. No. EN 60793-1-49:2003 E

Foreword

The text of document 86A/842/FDIS, future edition 1 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 2003-11-01.

This European Standard is to be read in conjunction with EN 60793-1-1:2003.

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) 2004-08-01
- 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.
Annexes designated "informative" are given for information only.
In this standard, annexes B and ZA are normative and annexes A and C are informative.
Annex ZA has been added by CENELEC.

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 60793-1-49:2003 was approved by CENELEC as a European Standard without any modification.

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.

Publication	Year	Title	EN/HD	Year
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)]	Part 1-22: Measurement methods and test procedures - Length measurement	EN 60793-1-22	2002 [2)]
IEC 60793-1-42	- [1)]	Part 1-42: Measurement methods and test procedures - Chromatic dispersion	EN 60793-1-42	2002 [2)]
IEC 60793-1-45 (mod)	- [1)]	Part 1-45: Measurement methods and test procedures - Mode field diameter	EN 60793-1-45	2003 [2)]

1) Undated reference.

2) Valid edition at date of issue.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC
60793-1-49

Première édition
First edition
2003-03

Fibres optiques –

Partie 1-49:
Méthodes de mesure et procédures d'essai –
Retard différentiel de mode

Optical fibres –

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

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE Q

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

FOREWORD 5
1 Scope 9
2 Normative references 9
3 Definitions 9
4 Apparatus 9
4.1 Optical source 11
4.2 Stability 11
4.3 Launch system 11
4.4 Detection system 13
4.5 Computational equipment 15
5 Sampling and specimens 15
5.1 Test sample 15
5.2 Specimen endfaces 15
5.3 Specimen length 15
5.4 Specimen packaging 15
5.5 Specimen positioning 15
6 Procedure 15
6.1 Adjust and measure system response 15
6.2 Adjust detection system 17
6.3 Measure the test sample 17
7 Calculations and interpretation of results 19
7.1 Differential Mode Delay (DMD) 19
7.2 Length normalization 19
8 Documentation 19
8.1 Report the following information for each test 19
8.2 Information to be available upon request 21
9 Specification information 21

Annex A (informative) Comparison between this Standard and ITU recommendations 23
Annex B (normative) Source spectral width limitation 25
Annex C (informative) Discussion of measurement details 31

Bibliography 35

Figure C.1 – Idealized DMD data 31

Table B.1 – Highest expected dispersion for commercially available category A.1 fibres 29

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRES –

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

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 60793-1-49 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre Optics.

This standard cancels and replaces IEC/PAS 60793-1-49 published in 2002. This first edition constitutes a technical revision.

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

FDIS	Report on voting
86A/842/FDIS	86A/854/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.

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 [1)]

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 2008. At this date, the publication will be

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

1) To be published.

OPTICAL FIBRES –

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

1 Scope

This part of IEC 60793 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 when used with laser sources.

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. The difference in optical pulse delay time between the fastest and slowest modes of the fibre under test is 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.

This standard 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.

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: Generic specification – Section 1: General*

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

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*

3 Terms and definitions

For the purposes of this part of IEC 60793, the following definitions apply.

3.1
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