This is a free page sample. Access the full version online.

NSAI Standards

Irish Standard
I.S. EN IEC 60793-1-45:2018

Optical fibres - Part 1-45: Measurement methods and test procedures - Mode field diameter

© CENELEC 2018 No copying without NSAI permission except as permitted by copyright law.

This is a free page sample. Access the full version online.

I.S. EN IEC 60793-1-45:2018

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:	*Published:*
EN IEC 60793-1-45:2018	2018-02-09

This document was published under the authority of the NSAI and comes into effect on:	ICS number:
2018-02-27	33.180.10
	NOTE: If blank see CEN/CENELEC cover page

NSAI	T +353 1 807 3800	Sales:
1 Swift Square,	F +353 1 807 3838	T +353 1 857 6730
Northwood, Santry	E standards@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.ie	W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

This is a free page sample. Access the full version online.

National Foreword

I.S. EN IEC 60793-1-45:2018 is the adopted Irish version of the European Document EN IEC 60793-1-45:2018, Optical fibres - Part 1-45: Measurement methods and test procedures - Mode field diameter

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This is a free page sample. Access the full version online.

This page is intentionally left blank

This is a free page sample. Access the full version online.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 60793-1-45

February 2018

ICS 33.180.10

Supersedes EN 60793-1-45:2003

English Version

Optical fibres - Part 1-45: Measurement methods and test procedures - Mode field diameter (IEC 60793-1-45:2017)

Fibre optiques - Partie 1-45: Méthodes de mesure et procédures d'essai - Diamètre du champ de mode (IEC 60793-1-45:2017)

Lichtwellenleiter - Teil 1-45: Messmethoden - Messung des Modenfelddurchmessers (IEC 60793-1-45:2017)

This European Standard was approved by CENELEC on 2017-12-14. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2018 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN IEC 60793-1-45:2018 E

This is a free page sample. Access the full version online.

European foreword

The text of document 86A/1758/CDV, future edition 2 of IEC 60793-1-45, prepared by IEC/SC 86A: "Fibres and cables", of IEC/TC 86: "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60793-1-45:2018.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2018-09-14
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-12-14

This document supersedes EN 60793-1-45:2003.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60793-1-45:2017 was approved by CENELEC as a European Standard without any modification.

This is a free page sample. Access the full version online.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60793-1-40 (mod)	2001	Optical fibres -- Part 1-40: Measurement methods and test procedures - Attenuation	EN 60793-1-40	2003
IEC 60793-2	-	Optical fibres -- Part 2: Product specifications.	-	-

This is a free page sample. Access the full version online.

This page is intentionally left blank

This is a free page sample. Access the full version online.

IEC 60793-1-45

Edition 2.0 2017-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Fibres optiques –
Partie 1-45: Méthodes de mesure et procédures d'essai – Diamètre du champ de mode

IEC 60793-1-45:2017-11(en-fr)

This is a free page sample. Access the full version online.

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

This is a free page sample. Access the full version online.

IEC 60793-1-45

Edition 2.0 2017-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Fibres optiques –
Partie 1-45: Méthodes de mesure et procédures d'essai – Diamètre du champ de mode

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.180.10

ISBN 978-2-8322-4979-6

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

This is a free page sample. Access the full version online.

CONTENTS

FOREWORD 5
1 Scope 7
2 Normative references 7
3 Terms and definitions 7
4 General consideration about mode field diameter 7
5 Reference test method 8
6 Apparatus 8
6.1 General 8
6.2 Light source 8
6.3 Input optics 9
6.4 Input positioner 9
6.5 Cladding mode stripper 9
6.6 High-order mode filter 9
6.7 Output positioner 9
6.8 Output optics 9
6.9 Detector 9
6.10 Computer 9
7 Sampling and specimens 10
7.1 Specimen length 10
7.2 Specimen end face 10
8 Procedure 10
9 Calculations 10
9.1 Basic equations 10
9.2 Method A – Direct far-field scan 10
9.3 Method B – Variable aperture in the far field 11
9.4 Method C – Near-field scan 11
10 Results 12
10.1 Information available with each measurement 12
10.2 Information available upon request 12
11 Specification information 12
Annex A (normative) Requirements specific to method A – Mode field diameter by direct far-field scan 14
A.1 Apparatus 14
A.1.1 General 14
A.1.2 Scanning detector assembly – Signal detection electronics 14
A.1.3 Computer 14
A.2 Procedure 15
A.3 Calculations 15
A.3.1 Determine folded power curve 15
A.3.2 Compute the top (T) and bottom (B) integrals of Equation (1) 15
A.3.3 Complete the calculation 15
A.4 Sample data 16
Annex B (normative) Requirements specific to method B – Mode field diameter by variable aperture in the far field 17
B.1 Apparatus 17

This is a free page sample. Access the full version online.

B.1.1 General ... 17
B.1.2 Output variable aperture assembly ... 17
B.1.3 Output optics system ... 18
B.1.4 Detector assembly and signal detection electronics ... 18
B.2 Procedure ... 18
B.3 Calculations ... 18
B.3.1 Determine complementary aperture function ... 18
B.3.2 Complete the integration ... 19
B.3.3 Complete the calculation ... 19
B.4 Sample data ... 19
Annex C (normative) Requirements specific to method C – Mode field diameter by near-field scan ... 20
C.1 Apparatus ... 20
C.1.1 General ... 20
C.1.2 Magnifying output optics ... 20
C.1.3 Scanning detector ... 20
C.1.4 Detection electronics ... 21
C.2 Procedure ... 21
C.3 Calculations ... 21
C.3.1 Calculate the centroid ... 21
C.3.2 Fold the intensity profile ... 22
C.3.3 Compute the integrals ... 22
C.3.4 Complete the calculation ... 22
C.4 Sample data ... 23
Annex D (normative) Requirements specific to method D – Mode field diameter by optical time domain reflectometer (OTDR) ... 24
D.1 General ... 24
D.2 Apparatus ... 24
D.2.1 OTDR ... 24
D.2.2 Optional auxiliary switches ... 24
D.2.3 Optional computer ... 25
D.2.4 Test sample ... 25
D.2.5 Reference sample ... 25
D.3 Procedure ... 25
D.3.1 Orientation and notation ... 25
D.4 Calculations ... 26
D.4.1 Reference fibre mode field diameter ... 26
D.4.2 Computation of the specimen mode field diameter ... 27
D.4.3 Validation ... 27
Annex E (informative) Sample data sets and calculated values ... 29
E.1 General ... 29
E.2 Method A – Mode field diameter by direct far-field scan ... 29
E.3 Method B – Mode field diameter by variable aperture in the far field ... 30
E.4 Method C – Mode field diameter by near-field scan ... 30

Figure 1 – Transform relationships between measurement results ... 8
Figure A.1 – Far-field measurement set ... 14
Figure B.1 – Variable aperture by far-field measurement set ... 17

This is a free page sample. Access the full version online.

Figure C.1 – Near-field measurement set-ups 20
Figure D.1 – Optical switch arrangement 25
Figure D.2 – View from reference fibre A 26
Figure D.3 – View from reference fibre B 26
Figure D.4 – Validation example – Comparison of methods 27

Table E.1 – Sample data, method A – Mode field diameter by direct far-field scan 29
Table E.2 – Sample data set, method B – Mode field diameter by variable aperture in the far field 30
Table E.3 – Sample data set, method C – Mode field diameter by near-field scan 30

This is a free page sample. Access the full version online.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRES –
Part 1-45: Measurement methods and test procedures – Mode field diameter

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.
2) The formal decisions or agreements of 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 IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60793-1-45 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) improvement of the description of measurement details for B6 fibre;
b) correction of Equations (1), (2),(5) and (6);
c) correction of Table E.1, Table E.2 and Table E.3.

This is a free page sample. Access the full version online.

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

CDV	Report on voting
86A/1758/CDV	86A/1802/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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

This is a free page sample. Access the full version online.

OPTICAL FIBRES –

Part 1-45: Measurement methods and test procedures – Mode field diameter

1 Scope

This part of IEC 60793 establishes uniform requirements for measuring the mode field diameter (MFD) of single-mode optical fibre, thereby assisting in the inspection of fibres and cables for commercial purposes.

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

IEC 60793-2, *Optical fibres – Part 2: Product specifications – General*

3 Terms and definitions

No terms and definitions are listed in this document.

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 General consideration about mode field diameter

The mode field diameter measurement represents a measure of the transverse extent of the electromagnetic field intensity of the guided mode in a fibre cross section, and it is defined from the far-field intensity distribution as a ratio of integrals known as the Petermann II definition. See Equation (1).

The definitions of mode field diameter are strictly related to the measurement configurations. The mathematical equivalence of these definitions results from transform relationships between measurement results obtained by different implementations summarized in Figure 1 as follows.

SAI GLOBAL

This is a free preview. Purchase the entire publication at the link below:

Product Page

Looking for additional Standards? Visit Intertek Inform Infostore

Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation