IEC 60793-2-40

Edition 4.0 2015-11

INTERNATIONAL STANDARD

colour inside

Withdrawn

Optical fibres –
Part 2-40: Product specifications – Sectional specification for category A4 multimode fibres

IEC 60793-2-40:2015-11(en)

Documents
Document Sharing Hub

Full document details: IEC 60793-2-40 2015

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 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.

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 It also gives information on projects, replaced and withdrawn publications.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 more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 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.

Withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60793-2-40 2015

IEC 60793-2-40

Edition 4.0 2015-11

INTERNATIONAL STANDARD

colour inside

withdrawn

Optical fibres –
Part 2-40: Product specifications – Sectional specification for category A4 multimode fibres

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.10

ISBN 978-2-8322-3022-0

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

Documents
Document Sharing Hub

Full document details: IEC 60793-2-40 2015

CONTENTS

FOREWORD 5
1 Scope 7
2 Normative references 8
3 Specifications 8
3.1 Dimensional requirements 8
3.2 Mechanical requirements 9
3.2.1 General 9
3.2.2 Tensile load test 10
3.3 Transmission requirements 11
3.4 Environmental requirements 12
3.4.1 General 12
3.4.2 Mechanical environmental requirements 13
3.4.3 Transmission environmental requirements 13
Annex A (normative) Family specifications for sub-category A4a multimode fibres 14
A.1 General 14
A.2 Dimensional requirements 14
A.3 Mechanical requirements 14
A.4 Transmission requirements 14
A.5 Environmental requirements 15
Annex B (normative) Family specifications for sub-category A4b multimode fibres 16
B.1 General 16
B.2 Dimensional requirements 16
B.3 Mechanical requirements 16
B.4 Transmission requirements 16
B.5 Environmental requirements 17
Annex C (normative) Family specifications for sub-category A4c multimode fibres 18
C.1 General 18
C.2 Dimensional requirements 18
C.3 Mechanical requirements 18
C.4 Transmission requirements 18
C.5 Environmental requirements 19
Annex D (normative) Family specifications for sub-category A4d multimode fibres 20
D.1 General 20
D.2 Dimensional requirements 20
D.3 Mechanical requirements 20
D.4 Transmission requirements 20
D.5 Environmental requirements 21
Annex E (normative) Family specifications for sub-category A4e multimode fibres 22
E.1 General 22
E.2 Dimensional requirements 22
E.3 Mechanical requirements 22
E.4 Transmission requirements 22
E.5 Environmental requirements 23
Annex F (normative) Family specifications for sub-category A4f multimode fibres 24
F.1 General 24

Withdrawn

AVA Documents
Document Sharing Hub

Full document details: IEC 60793-2-40 2015

F.2 Dimensional requirements 24
F.3 Mechanical requirements 24
F.4 Transmission requirements 24
F.5 Environmental requirements 25
Annex G (normative) Family specifications for sub-category A4g multimode fibres 26
G.1 General 26
G.2 Dimensional requirements 26
G.3 Mechanical requirements 26
G.4 Transmission requirements 26
G.5 Environmental requirements 27
Annex H (normative) Family specifications for sub-category A4h multimode fibres 28
H.1 General 28
H.2 Dimensional requirements 28
H.3 Mechanical requirements 28
H.4 Transmission requirements 28
H.5 Environmental requirements 29
Annex I (normative) Mode scramblers for sub-category A4a to A4d fibres 30
I.1 General 30
I.2 Specification for mode scramblers 30
Annex J (informative) Additional transmission requirements for sub-category A4a multimode fibres for wavelengths below 650 nm 31
J.1 General 31
J.2 Transmission requirements 31
Bibliography 32

Figure 1 – Tensile load versus elongation for a plastic optical fibre 10
Figure I.1 – Mode scrambler for category A4 fibre 30

Table 1 – Characteristics and applications of category A4 fibres 7
Table 2 – Dimensional attributes and measurement methods 9
Table 3 – Requirements common to all category A4 fibres 9
Table 4 – Additional attributes required in A4f through A4h family specifications 9
Table 5 – Mechanical attributes and test methods 10
Table 6 – Requirements common to category A4 fibres 10
Table 7 – Additional attributes required in family specification for sub-category A4f through A4h fibres 10
Table 8 – Transmission attributes and measurement methods 11
Table 9 – Attributes required in family specifications 12
Table 10 – Environmental exposure tests 12
Table 11 – Attributes measured 12
Table 12 – Requirement for tensile strength 13
Table 13 – Requirement for change in attenuation for A4a through A4e fibre 13
Table 14 – Requirement for change in attenuation for A4f through A4h fibre 13
Table A.1 – Dimensional requirements specific to A4a fibres 14
Table A.2 – Mechanical requirements specific to A4a fibres 14
Table A.3 – Transmission requirements specific to A4a fibres 14

Withdrawn

AVA Documents
Document Sharing Hub

Table B.1 – Dimensional requirements specific to A4b fibres 16
Table B.2 – Mechanical requirements specific to A4b fibres 16
Table B.3 – Transmission requirements specific to A4b fibres 17
Table C.1 – Dimensional requirements specific to A4c fibres 18
Table C.2 – Mechanical requirements specific to A4c fibres 18
Table C.3 – Transmission requirements specific to A4c fibres 19
Table D.1 – Dimensional requirements specific to A4d fibres 20
Table D.2 – Mechanical requirements specific to A4d fibres 20
Table D.3 – Transmission requirements specific to A4d fibres 21
Table E.1 – Dimensional requirements specific to A4e fibres 22
Table E.2 – Mechanical requirements specific to A4e fibres 22
Table E.3 – Transmission requirements specific to A4e fibres 23
Table F.1 – Dimensional requirements specific to A4f fibres 24
Table F.2 – Mechanical requirements specific to A4f fibres 24
Table F.3 – Transmission requirements specific to A4f fibres 25
Table G.1 – Dimensional requirements specific to A4g fibres 26
Table G.2 – Mechanical requirements specific to A4g fibres 26
Table G.3 – Transmission requirements specific to A4g fibres 27
Table H.1 – Dimensional requirements specific to A4h fibres 28
Table H.2 – Mechanical requirements specific to A4h fibres 28
Table H.3 – Transmission requirements specific to A4h fibres 29
Table I.1 – Mode Scrambler parameters 30
Table J.1 – Transmission requirements specific to A4a.2 fibre 31

Withdrawn

Documents
Document Sharing Hub
Full document details: IEC 60793-2-40 2015

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRES –

Part 2-40: Product specifications – Sectional specification for category A4 multimode fibres

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 60793-2-40 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This fourth edition cancels and replaces the third edition published in 2009. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) harmonization of terminology within the IEC 60793-2 series;

b) added measurement parameters for numerical aperture and fibre geometry.

Withdrawn

AVA Documents Document Sharing Hub

Full document details: IEC 60793-2-40 2015

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

CDV	Report on voting
86A/1587/CDV	86A/1618/RVC

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.

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 publication will remain unchanged until the stability 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
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

Withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60793-2-40 2015

OPTICAL FIBRES –

Part 2-40: Product specifications – Sectional specification for category A4 multimode fibres

1 Scope

This part of IEC 60793-2 is applicable to category A4 optical multimode fibres and the related sub-categories A4a, A4b, A4c, A4d, A4e, A4f, A4g and A4h. These fibres have a plastic core and plastic cladding and may have step-index, multi-step index or graded-index profiles. The fibres are used in information transmission equipment and other applications employing similar light transmitting techniques, and finally in fibre optic cables. Table 1 summarizes some of the salient characteristics and applications of these fibres.

Table 1 – Characteristics and applications of category A4 fibres

Sub-category	A4a	A4b	A4c	A4d	A4e	A4f	A4g	A4h
Core diameter (μm)	See Note 1	See Note 1	See Note 1	See Note 1	≥ 500	200	120	62,5
Cladding diameter (μm)	1 000	750	500	1 000	750	490	490	245
Numerical aperture Na_{ff}	0,50	0,50	0,50	0,30	0,25	0,190	0,190	0,190
Operating wave-length (s) (nm)	650 See Note 2	650	650	650	650	650 850 1 300	650 850 1 300	850 1 300
Applica-tions	Digital audio interface, automobile, industrial, sensor and data transmis-sion	Indus-trial and sen-sor	Sen-sor	Digital audiovisual interface and data transmission	Digital audiovisual interface and data transmission	Industrial and mobile; compatible with A3 transmission equipment	Data transmission	Data transmission; primarily used in ribbon structures

NOTE 1 Typically 15 μm to 35 μm smaller than the cladding diameter.

NOTE 2 Other potential wavelengths for A4a fibre are described in Annex J.

In addition to the applications shown in Table 1, other applications for A4 fibres include, but are not restricted to, the following: support for short reach, high bit-rate systems in telephony, distribution and local networks, carrying data, voice and/or video services and on-premises intrabuilding and interbuilding fibre installations, including LANs, PBXs, video, various multiplexing uses and miscellaneous related uses, such as consumer electronics and industrial and mobile networks.

Three types of requirements apply to A4 fibres:

- general requirements, as defined in IEC 60793-2;
- specific requirements common to category A4 multimode fibres covered in this standard and which are given in Clause 3;

Withdrawn
AVA Documents Document Sharing Hub
Full document details: IEC 60793-2-40 2015

- particular requirements applicable to individual fibre sub-categories and implementations or specific applications which are defined in this standard, in the normative family specification annexes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60793-1-20:2001, *Optical fibres – Part 1-20: Measurement methods and test procedures – Fibre geometry*

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

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

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 60793-1-43, *Optical fibres – Part 1-43: Measurement methods and test procedures – Numerical aperture measurement*

IEC 60793-1-46, *Optical fibres – Part 1-46:Measurement methods and test procedures – Monitoring of changes in optical transmittance*

IEC 60793-1-47:2009, *Optical fibres – Part 1-47: Measurement methods and test procedures – Macrobending loss*

IEC 60793-1-50, *Optical fibres – Part 1-50: Measurement methods and test procedures – Damp heat (steady state) tests*

IEC 60793-1-51, *Optical fibres – Part 1-51: Measurement methods and test procedures – Dry heat (steady state) tests*

IEC 60793-1-52, *Optical fibres – Part 1-52: Measurement methods and test procedures – Change of temperature tests*

3 Specifications

3.1 Dimensional requirements

Relevant dimensional attributes and measurement methods are given in Table 2.

Requirements common to all category A4 fibres are indicated in Table 3.

Additional attributes that shall be specified in the family specifications for sub-categories A4f through A4h are given in Table 4.

Withdrawn

AVA Documents Document Sharing Hub

Full document details: IEC 60793-2-40 2015

Table 2 – Dimensional attributes and measurement methods

Attribute	Measurement method
Cladding diameter	IEC 60793-1-20 [a]
Cladding non-circularity	IEC 60793-1-20 [a]
Core diameter [b]	IEC 60793-1-20
Fibre length	IEC 60793-1-22
Core-cladding concentricity error	IEC 60793-1-20
Core non-circularity	IEC 60793-1-20

[a] Mechanical methods are also applicable to cladding diameter and cladding non-circularity measurements if they provide the same measurement uncertainty.

[b] Core diameter is specified at (650 ± 10) nm with a test specimen length of 2,0 m ± 0,2 m and a threshold value k_{CORE} of 2,5 % (IEC 60793-1-20:2001, Method B) for A4 fibres.

Table 3 – Requirements common to all category A4 fibres

Attribute	Unit	Limit
Cladding diameter	µm	[a]
Cladding non-circularity	%	≤ 6 [b]
Core diameter	µm	[c]
Fibre length	km	[d]

[a] The cladding diameter varies and is listed in the family specification.

[b] Unless otherwise specified in the family specification.

[c] For A4a, A4b, A4c and A4d fibre, the core diameter is typically 15 µm to 35 µm smaller than the cladding diameter. For A4e, A4f, A4g and A4h fibre, the core diameter varies and is listed in the family specification.

[d] Length requirements vary and should be agreed between supplier and customer.

Table 4 – Additional attributes required in A4f through A4h family specifications

Attribute
Core non-circularity
Core-cladding concentricity error

3.2 Mechanical requirements

3.2.1 General

Mechanical attributes, test methods, and requirements for buffered fibres can be found in IEC 60794-2-41.

Relevant mechanical attributes and test methods are given in Table 5.

Requirements common to all category A4 fibres are indicated in Table 6.

Additional attributes that shall be specified in the family specifications for sub-categories A4f through A4h are given in Table 7.

Withdrawn

AVA Documents Document Sharing Hub

Full document details: IEC 60793-2-40 2015