



IEC 60793-2-40

Edition 3.0 2009-04

INTERNATIONAL STANDARD

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE



ICS 33.180.10

ISBN 2-8318-1037-2

CONTENTS

FOREWORD.....	4
1 Scope and object.....	6
2 Normative references	7
3 Specifications	7
3.1 Dimensional requirements	7
3.2 Mechanical requirements.....	8
3.2.1 Tensile load test	9
3.3 Transmission requirements	10
3.4 Environmental requirements	11
3.4.1 Mechanical environmental requirement.....	12
3.4.2 Transmission environmental requirements	12
Annex A (normative) Family specifications for A4a multimode fibres	14
Annex B (normative) Family specifications for A4b multimode fibres	16
Annex C (normative) Family specifications for A4c multimode fibres	18
Annex D (normative) Family specifications for A4d multimode fibres.....	20
Annex E (normative) Family specifications for A4e multimode fibres	22
Annex F (normative) Family specifications for A4f multimode fibres	24
Annex G (normative) Family specifications for A4g multimode fibres.....	26
Annex H (normative) Family specifications for A4h multimode fibres.....	28
Annex I (normative) Mode Scramblers for A4a to A4d Fibres (based on IEC 794-1-1, 1999).....	30
Annex J (informative) Additional transmission requirements for A4a multimode fibres for wavelengths below 650 nm	31
Figure 1 – Tensile Load versus Elongation for a plastic optical fibre.	10
Figure I.1 – Mode Scrambler for A4 fibre	30
Table 1 – Characteristics and applications of category A4 Fibres.....	6
Table 2 – Dimensional attributes and measurement methods.....	8
Table 3 – Requirements common to all category A4 fibres	8
Table 4 – Additional attributes required in A4a through A4e family specifications	8
Table 5 – Additional attributes required in A4f through A4h family specifications.....	8
Table 6 – Mechanical attributes and test methods.....	9
Table 7 – Requirements common to category A4 fibres.....	9
Table 8 – Additional attributes required in family specification for categories A4a through A4e fibres	9
Table 9 – Additional attributes required in family specification for categories A4f through A4h fibres	9
Table 10 – Transmission attributes and measurement methods	11
Table 11 – Attributes required in family specifications.....	11
Table 12 – Environmental exposure tests.....	11
Table 13 – Attributes measured	12
Table 14 – Requirement for tensile strength.....	12

Table 15 – Requirement for change in attenuation for A4a through A4e fibre	12
Table 16 – 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	15
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

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 third edition cancels and replaces the second edition published in 2006 and constitutes a technical revision which defines an enhanced A4a fibre named A4a.2 while the existing A4a fibre has been renamed A4a.1.

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

CDV	Report on voting
86A/1237/CDV	86A/1264/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 of 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 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
- amended.

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

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 optical fibre 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 optical fibre cables. Table 1 summarizes some of the salient characteristics and applications of these fibres.

Table 1 – Characteristics and applications of category A4 Fibres

	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)	1000	750	500	1000	750	490	490	245
Numerical aperture	0,50 ^t	0,50 ^t	0,50 ^t	0,30 ^t	0,25 ^t	0,190 ^e	0,190 ^e	0,190 ^e
Operating wavelength(s) (nm)	650 See Note 2	650	650	650	650	650, 850, 1300	650, 850, 1300	850, 1300
Applications	Digital audio interface, automobile, industrial and sensor Data transmission	industrial and sensor	sensor	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 15µm to 35 µm smaller than the cladding diameter.								
NOTE 2 Other potential wavelengths for A4a fibre are described in Annex J.								
^t Theoretical.								
^e Measured effective.								

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 that are given in Clause 3;
- particular requirements applicable to individual fibre types or specific applications and that are defined in this standard in the normative family specification annexes.

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

IEC 60793-1 (all parts), *Optical fibres – Part 1: Measurement methods and test procedures*

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

IEC 60793-1-22:2001, *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 60793-1-41:2001, *Optical fibres – Part 1-41: Measurement methods and test procedures – Bandwidth*

IEC 60793-1-42:2007, *Optical fibres – Part 1-42: Measurement methods and test procedures – Chromatic dispersion*

IEC 60793-1-43:2001, *Optical fibres – Part 1-43: Measurement methods and test procedures – Numerical aperture*

IEC 60793-1-46:2001, *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 60793-1-50:2001, *Optical fibres – Part 1-50: Measurement methods and test procedures – Damp heat (steady state)*

IEC 60793-1-51:2001, *Optical fibres – Part 1-51: Measurement methods and test procedures – Dry heat*

IEC 60793-1-52:2001, *Optical fibres – Part 1-52: Measurement methods and test procedures – Change of temperature*

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

IEC 60794-2-41, *Optical fibre cables – Part 2-41: Product specification for simplex and duplex buffered A4 fibres.*