

Optical fibres —

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

The European Standard EN 60793-2-40:2006 has the status of a British Standard

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National foreword

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A list of organizations represented on GEL/86/1 can be obtained on request to its secretary.

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Part 2-40: Product specifications -
Sectional specification for category A4 multimode fibres
(IEC 60793-2-40:2006)**

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Partie 2-40: Spécifications de produits -
Spécification intermédiaire pour les fibres
multimodales de la catégorie A4
(CEI 60793-2-40:2006)

Lichtwellenleiter -
Teil 2-40: Produktspezifikationen -
Rahmenspezifikation für
Mehrmodenfasern der Kategorie A4
(IEC 60793-2-40:2006)

This European Standard was approved by CENELEC on 2006-04-01. 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.

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Foreword

The text of document 86A/1050/FDIS, future edition 2 of IEC 60793-2-40, 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 60793-2-40 on 2006-04-01.

This European Standard supersedes EN 60793-2-40:2002. Main change is addition of Annexes E, F, G and H that describe new fibres with lower attenuation reflecting the current state of the art.

The following dates were fixed:

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with the EN have to be withdrawn (dow) 2009-04-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60793-2-40:2006 was approved by CENELEC as a European Standard without any modification.

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OPTICAL FIBRES -

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

1 Scope and object

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

Characteristics and applications	Types of category A4 fibres							
	A4a	A4b	A4c	A4d	A4e	A4f	A4g	A4h
Core diameter μm	a	a	a	a	≥ 500	200	120	62,5
Cladding diameter μm	1 000	750	500	1 000	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	650	650	650	650	650, 850, 1 300	650, 850, 1 300	850, 1 300
Applications	Digital audio interface, automobile, industrial and sensor	Industrial and sensor	Sensor	Digital audio/visual interface and data transmission	Digital audio/visual interface and data transmission	Industrial and mobile; compatible with A3 transmission equipment	Data transmission	Data transmission; primarily used in ribbon structures
NOTE ^t = theoretical; ^e = measured effective								
^a Typically 15 to 35 μm smaller than the cladding diameter								

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.

Informative Annex J shows typical characteristics and requirements for some buffered A4 fibres. The actual requirements are specified in the buffered fibre document IEC 60794-2-41.

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, *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, *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*

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

IEC 60793-1-47, *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)*

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

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

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

IEC 60794-1-1: *Optical fibre cables – Part 1-1: Generic specification - General*

IEC 60794-2-41, *Optical fibre cables – Part 2-41: Product specification for simplex and duplex buffered A4 fibres*¹

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.

Tables 4 and 5 list additional attributes that shall be specified by each family specification.

Table 2 – Dimensional attributes and measurement methods

Attributes	Measurement methods
Cladding diameter	IEC 60793-1-20
Cladding non-circularity	IEC 60793-1-20
Core diameter	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

Table 3 – Requirements common to all category A4 fibres

Attributes	Unit	Limits
Cladding non-circularity	%	≤ 6 ^a
Core diameter	μm	b
Fibre length	km	c
^a Unless otherwise specified in the family specification. ^b 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. ^c Length requirements vary and should be agreed between supplier and customer.		

Table 4 – Additional attributes required in A4a though A4e family specifications

Attributes
Cladding diameter

¹ Under preparation.

Table 5 – Additional attributes required in A4f through A4h family specifications

Attributes
Cladding diameter
Core non-circularity
Core-cladding concentricity error

3.2 Mechanical requirements

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

Relevant mechanical attributes and test methods are given in Table 6.

Requirements common to all category A4 fibres are indicated in Table 7.

Additional attributes that shall be specified in the family specifications for categories A4a through A4e are given in Table 8.

Additional attributes that shall be specified in the family specifications for categories A4f through A4h are given in Table 9.

Table 6 – Mechanical attributes and test methods

Attributes	Test methods
Tensile performance	3.2.1

Table 7 – Requirements common to category A4 fibres

Attribute	Unit	Limit
Elongation at yield peak	%	≥ 4,0

Table 8 – Additional attributes required in family specification for categories A4a through A4e fibres

Attributes
Tensile load at yield peak

Table 9 – Additional attributes required in family specification for categories A4f through A4h fibres

Attributes
Tensile load at yield peak
Tensile load to induce 4 % elongation

3.2.1 Tensile load test

3.2.1.1 Object

The purpose of this test is to characterize the ability of the fibre to support a load during handling. Its purpose is to obtain values of the fibre's tensile strength.

The fibre samples are subjected to a mechanical environment as specified below. The test shall be carried out at the standard test conditions in compliance with IEC 60068-1.

3.2.1.2 Definition of yield peak

Figure 1 shows a typical load vs. elongation curve for a plastic optical fibre. The curve exhibits an initial monotonic increase in tensile load with applied elongation that goes through a load peak. The peak is followed by a decrease in load as the sample begins to undergo a ductile, irreversible elongation. Localized necking and drawing of the sample may accompany the process. This phenomenon is known as yielding and the peak is termed a yield peak.

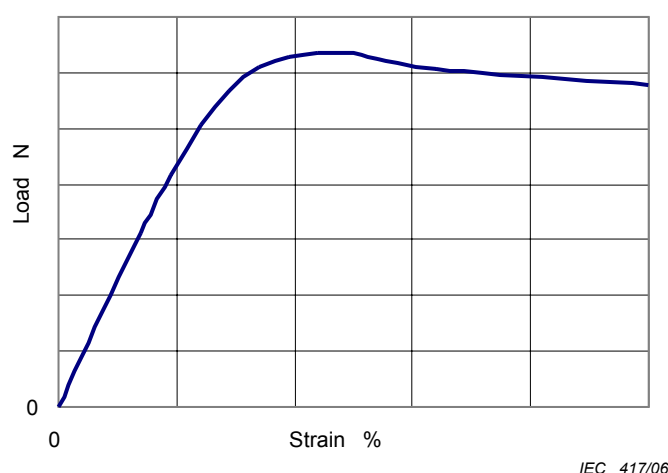


Figure 1– Tensile load versus elongation for a plastic optical fibre

3.2.1.3 Test apparatus

The length of the sample between two clamping devices shall be between 100 mm and 200 mm.

The tensile strength measuring apparatus shall be a device, for example a vertical tensile tester, that provides relative motion to the test fibre. The apparatus shall be capable of imparting constant motion without jerking the fibre under test. The apparatus shall have the ability to simultaneously measure and record the resulting tensile force or load. To prevent fibre breakage, the means used to secure the fibre ends at the clamping points shall not stress the fibre excessively.

3.2.1.4 Procedure

The tensile speed shall be 100 mm/min ($\pm 10\%$). Yield strength and yield elongation are obtained from the load-elongation curve described in 3.2.1.2. Unless otherwise specified, tensile load at the yield peak and tensile load to induce 4 % elongation shall be recorded.

NOTE Elongation to breaking point is not applicable to A4 fibres.

3.2.1.5 Requirements

The requirements are stated in the family specifications in the normative annexes. If the fibre sample breaks at a clamping point, the test shall be regarded as invalid and another test shall be carried out. The number of samples tested shall be sufficient to allow for a statistical analysis.

3.3 Transmission requirements

Relevant transmission attributes and measurement methods are given in Table 10.

Additional attributes required in the family specifications are indicated in Table 11.

Table 10 – Transmission attributes and measurement methods

Attributes	Measurement methods
Attenuation ^a	IEC 60793-1-40
Modal bandwidth ^a	IEC 60793-1-41
Theoretical numerical aperture	IEC 60793-1-20
Numerical aperture	IEC 60793-1-43
Chromatic dispersion	IEC 60793-1-42
Macrobending loss	IEC 60793-1-47 Method B
^a When measuring attenuation and modal bandwidth, the appropriate launching conditions should be applied as specified in IEC 60793-1-40 and IEC 60793-1-41 or as stated in the family specification. Bandwidth is not necessarily linear with regard to length. The value of bandwidth is referenced to 100 m of fibre.	

Table 11 – Attributes required in family specifications

Attributes
Attenuation
Modal bandwidth
Theoretical numerical aperture or measured numerical aperture
Chromatic dispersion
Macrobending loss