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REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Optical fibres –
Part 2-50: Product specifications – Sectional specification for class B single-mode fibres

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FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60793-2-50 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

The sixth edition cancels and replaces the fifth edition published in 2015. This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

a) Introduction of a revised naming convention which better matches with those found in ITU-T Recommendations G.652, G.653, G.654, G.655, G.656, and G.657. These changes are outlined in the scope of this document along with a cross reference table for the new names. Annexes have been rearranged to improve clarity based on the new naming;
b) Further details on the requirements for 200 micron coated single-mode fibre;
c) Harmonization with the following ITU-T Recommendations published in November 2016: G.652, G.654, G.657 including revised chromatic dispersion specifications, new categories and new application spaces for these fibre categories;
d) Descriptions of fibre types have been added to the titles of Annexes A to F.

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

FDIS	Report on voting
86A/1884/FDIS	86A/1898/RVD

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- withdrawn,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.

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OPTICAL FIBRES –

Part 2-50: Product specifications – Sectional specification for class B single-mode fibres

1 Scope

This part of IEC 60793 is applicable to optical fibre categories ~~B1.1, B1.2, B1.3, B2, B4, B5 and B6~~ B-652, B-653, B-654, B-655, B-656 and B-657. A map illustrating the connection of IEC designations to ITU-T designations is shown in ~~Annex I~~ Table 1. These fibres are used or can be incorporated in information transmission equipment and optical fibre cables.

Three types of requirements apply to these fibres:

- general requirements, as defined in IEC 60793-2;
- specific requirements common to the class B single-mode fibres covered in this document and which are given in Clause 5;
- particular requirements applicable to individual fibre categories or specific applications, which are defined in Annexes A to ~~G~~ F.

For some fibre categories (shown in the relevant family specifications), there are sub-categories that are distinguished on the basis of difference in transmission attribute specifications. The designations for these sub-categories are documented in the individual family specifications.

Table 1 shows a map from the IEC designations to the ITU-T recommendations. The table also provides the normative annex in this document that contains the detailed specification as well as the name used to describe this fibre type in IEC 60793-2-50:2015. The ITU-T recommendations as well as the IEC categories/sub-categories within each recommendation are given. In some cases, as for Recommendation G.652, a given IEC designation maps to multiple categories in the ITU-T because the ITU-T categories are distinguished by cabled fibre attribute (PMD_Q) performance which are not distinguished in the IEC fibre specifications.

Table 1 – Map of IEC designation to ITU-T Recommendations and IEC 60793-2-50:2015 designation

Annex	Category	Sub Category	Description	IEC 60793-2-50:2015	ITU-T Rec
	B-652		Dispersion unshifted fibre		G.652
A		B-652.B		B1.1	G.652.B
A		B-652.D		B1.3	G.652.D
	B-653		Dispersion shifted fibre		G.653
B		B-653.A		B2_a	G.653.A
B		B-653.B		B2_b	G.653.B
	B-654		Cut-off shifted fibre		G.654
C		B-654.A		B1.2_a	G.654.A
C		B-654.B		B1.2_b	G.654.B
C		B-654.C		B1.2_c	G.654.C
C		B-654.D		N/A	G.654.D
C		B-654.E		N/A	G.654.E
C	B-655		Non-zero dispersion shifted fibre	B4	G.655
D		B-655.C		B4_c	G.655.C
D		B-655.D		B4_d	G.655.D
D		B-655.E		B4_e	G.655.E
E	B-656		Wideband non-zero dispersion shifted fibre	B5	G.656
F	B-657		Bending loss insensitive fibre	B6	G.657
F		B-657.A1		B6_a1	G.657.A1
F		B-657.A2		B6_a2	G.657.A2
F		B-657.B2		B6_b2	G.657.B2
F		B-657.B3		B6_b3	G.657.B3

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 (all parts), *Optical fibres ~~– Measurement methods and test procedures~~*

~~IEC 60793-1-1, *Optical fibres – Measurement methods and test procedures – Part 1-1: General and guidance*~~

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

IEC 60793-1-21, *Optical fibres – Part 1-21: Measurement methods and test procedures – Coating geometry*

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

IEC 60793-1-30, *Optical fibres – Part 1-30: Measurement methods and test procedures – Fibre proof test*

IEC 60793-1-31, *Optical fibres – Part 1-31: Measurement methods and test procedures – Tensile strength*

IEC 60793-1-32, *Optical fibres – Part 1-32: Measurement methods and test procedures – Coating strippability*

IEC 60793-1-33, *Optical fibres – Part 1-33: Measurement methods and test procedures – Stress corrosion susceptibility*

IEC 60793-1-34, *Optical fibres – Part 1-34: Measurement methods and test procedures – Fibre curl*

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

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

IEC 60793-1-44, *Optical fibres – Part 1-44: Measurement methods and test procedures – Cut-off wavelength*

IEC 60793-1-45, *Optical fibres – Part 1-45: Measurement methods and test procedures – Mode field diameter*

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 60793-1-48, *Optical fibres – Part 1-48: Measurement methods and test procedures – Polarization mode dispersion*

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*

IEC 60793-1-53, *Optical fibres – Part 1-53: Measurement methods and test procedures – Water immersion tests*

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

IEC 60794-2, *Optical fibre cables – Part 2: Indoor cables – Sectional specification*

~~IEC 60794-3, *Optical fibre cables – Part 3: Outdoor cables – Sectional specification*~~

~~IEC TR 62316, *Guidance for the interpretation of OTDR backscattering traces*~~

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60793-2 and the IEC 60793-1 series apply.

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

NOTE General definitions for fibres are provided in IEC 60793-2. The definitions of the specified attributes are contained in the relevant test methods standard of the IEC 60793-1 series, while general definitions for testing are provided in IEC 60793-1-1.

4 Abbreviated terms and symbols

For the purposes of this document, the following abbreviated terms and symbols apply:

F_{avg}	Average strip force
F_{peak}	Peak strip force
λ_0	Zero dispersion wavelength
λ_c	Fibre cut-off wavelength
λ_{cc}	Cable cut-off wavelength
MFD	Mode field diameter
n_d	Stress corrosion parameter – dynamic
PMD	Polarization mode dispersion
PMD_Q	PMD link design value

5 Specifications

5.1 General

The fibre shall consist of a glass core and glass cladding in accordance with the construction of optical fibre class B – single-mode fibre – as given in IEC 60793-2.

The term “glass” usually refers to material consisting of non-metallic oxides. The composition of some fibres may be all glass, or glass and glass/hard polymeric composites.

5.2 Dimensional requirements

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

Requirements common to all categories of class B single-mode fibres are given in Table 3.

Cladding diameter, cladding non-circularity, and core – cladding concentricity error shall be specified in the family specifications

Table 2 – Dimensional attributes and measurement methods

Attribute	Measurement method
Cladding diameter	IEC 60793-1-20
Cladding non-circularity	IEC 60793-1-20
Core – cladding concentricity error	IEC 60793-1-20
Primary coating diameter	IEC 60793-1-21
Primary coating non-circularity	IEC 60793-1-21
Primary coating-cladding concentricity error	IEC 60793-1-21
Fibre length	IEC 60793-1-22

Table 3 – Dimensional requirements common to all category B fibres

Attribute	Unit	Limit
Primary coating diameter – uncoloured	µm	235 to 255 [a]
Primary coating diameter – coloured	µm	235 to 265 [a]
Primary coating-cladding concentricity error	µm	≤ 12,5
Fibre length	km	[b]

[a] The above limits on primary coating diameter are most commonly used in telecommunications cables. There are other applications, such as fibre for use within optical sub-systems, pigtails, or specialty applications such as for submarines cables or for compact FTTH cables, which use other primary coating diameters, several of which are listed below.

~~Alternative nominal primary coating diameters and ranges:~~

~~200 µm ± 10 µm (uncoloured; 190 µm to 220 µm coloured)~~

~~400 µm ± 40 µm~~

~~500 µm ± 30 µm~~

~~700 µm ± 100 µm~~

~~900 µm ± 100 µm~~

~~The primary coating cladding concentricity error should be limited to a maximum 10 µm for 200 µm.~~

180 µm to 210 µm uncoloured; 180 µm to 220 µm coloured

400 µm ± 40 µm

500 µm ± 50 µm

700 µm ± 70 µm

900 µm ± 90 µm

Alternative coating diameters may impact fibre connectivity such as ribbons, multi-fibre connectors, mechanical splices, and fusion splice protectors; they may also need adjustments to connectivity tools and/or tighter coating tolerances.

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

5.3 Mechanical requirements

Relevant mechanical attributes and test methods are given in Table 4. The relationship between some of these attributes and mechanical reliability are described in IEC TR 62048 and ITU-T G.Sup.59.

Requirements common to all categories of class B single-mode fibres are given in Table 5.

Table 4 – Mechanical attributes and test methods

Attribute	Test method
Proof test	IEC 60793-1-30
Tensile strength	IEC 60793-1-31
Coating strippability	IEC 60793-1-32
Stress corrosion susceptibility	IEC 60793-1-33
Fibre curl	IEC 60793-1-34

Table 5 – Mechanical requirements common to all class B fibres

Attribute	Unit	Limit
Proof stress level	GPa	≥ 0,69 [a]
Coating strip force (average) [b, c]	N	$1,0 \leq F_{ave} \leq 5,0$
Coating strip force (peak) [b, c]	N	$1,0 \leq F_{peak} \leq 8,9$
Fibre curl radius	m	≥ 2 [d]
Tensile strength (median) for 0,5 m specimen length	GPa	≥ 3,8
Stress corrosion susceptibility parameter, n_d	–	≥ 18

[a] The proof test value of 0,69 GPa equals about 1 % strain or about 8,8 N force. For the relation between these different units, see IEC TR 62048:2014, ~~7.4~~ clause 8.4.

[b] Either average strip force or peak strip force, which are defined in the test procedure, may be specified with agreement between supplier and customer.

[c] In case of alternative nominal primary coating diameters (see Table 2), associated alternative coating strip force values need to be agreed between supplier and customer or provided in the detailed specifications provided in Annexes of this document.

[d] Depending on splicing methods, a minimum of 4 m may be specified for fibre intended to be used in some cable constructions – such as ribbon cable.

5.4 Transmission requirements

Relevant transmission attributes and measurement methods are given in Table 6.

Requirements common to all categories of class B single-mode fibres are shown in Table 7.

Requirements that shall be specified in the family specifications are listed in Table 8.