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Optical fibres – **iTeh STANDARD PREVIEW**
Part 2-70: Product specifications – Sectional specification for polarization-
maintaining fibres **(standards.iteh.ai)**

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Fibres optiques – **IEC 60793-2-70:2017**
Partie 2-70: Spécifications de produits – Spécification intermédiaire pour
les fibres à maintien de polarisation





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OPTICAL FIBRES –

**Part 2-70: Product specifications –
Sectional specification for polarization-maintaining fibres**

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International Standard IEC 60793-2-70 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

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

CDV	Report on voting
86A/1741/CDV	86A/1780/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

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OPTICAL FIBRES –

Part 2-70: Product specifications – Sectional specification for polarization-maintaining fibres

1 Scope

This part of IEC 60793 is applicable to optical fibre types D1, D2, D3, as described in Table 1. These fibres are polarization-maintaining fibre types, and are used or can be incorporated in information transmission equipment and optical fibre cable. These fibres are available for use in optical transport networks. Three types of requirements apply to these fibres:

- general requirements defined in IEC 60793-2;
- specific requirements common to the category D polarization-maintaining fibres covered in this document and which are given in Clause 4;
- particular requirements applicable to individual fibre types or specific applications, which are defined in Annexes A to C.

Table 1 – Categories of glass core/glass clad polarization-maintaining fibres

Category	Type	Description
D1	Polarization-maintaining fibre suitable for use at 980 nm	This category of polarization-maintaining fibre is optimised for polarization-maintaining ability in the 980 nm region. This fibre is used for erbium-doped fibre amplifier.
D2	Polarization-maintaining fibre suitable for use at 1 310 nm	This category of polarization-maintaining fibre is optimised for polarization-maintaining ability and connection property of category B fibres in the 1 310 nm region.
D3	Polarization-maintaining fibre suitable for use at 1 550 nm	This category of polarization-maintaining fibre is optimised for polarization-maintaining ability and connection property of category B fibres in the 1 550 nm region.

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 60793-1-20:2014, *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 60793-1-40, *Optical fibres – Part 1-40: Measurement methods and test procedures – Attenuation*

IEC 60793-1-44:2011, *Optical fibres – Part 1-44: Measurement methods and test procedures – Cut-off wavelength*

IEC 60793-1-45:2001, *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 60793-1-52, *Optical fibres – Part 1-52: Measurement methods and test procedures – Change of temperature tests*

IEC 60793-1-60¹, *Optical fibres – Part 1-60: Measurement methods and test procedures – Beat length*

IEC 60793-1-61², *Optical fibres – Part 1-61: Measurement methods and test procedures – Polarization crosstalk*

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

3 Terms and definitions

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No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:
<http://terminology.iso.org/terminology> and <http://www.iso.org/standard/732e330d7037/iec-60793-2-70-2017>

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Specifications

4.1 General

The fibre shall consist of a glass core and glass cladding in accordance with the construction of optical fibre category D – polarization-maintaining fibre – as given in IEC 60793-2.

The term "glass" usually refers to material consisting of non-metallic oxides.

4.2 Dimensional requirements

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

¹ Under preparation. Stage at the time of publication: IEC 60793-1-60:2017.

² Under preparation. Stage at the time of publication: IEC 60793-1-61:2017.

Table 2 – Dimensional attributes and measurement methods

Attributes	Measurement methods
Cladding diameter ^a	IEC 60793-1-20
Cladding non-circularity ^a	IEC 60793-1-20
Core-cladding concentricity error ^a	IEC 60793-1-20
Primary coating diameter	IEC 60793-1-21
Primary coating-cladding concentricity error	IEC 60793-1-21
Fibre length	IEC 60793-1-22
<p>^a The dimensional characteristics of polarization-maintaining (PM) fibre can be measured by method A: refracted near-field or method B: transmitted near-field. Information pertaining to each individual method appears respectively in Annexes A and B of IEC 60793-1-20:2014.</p> <p>For a general optical fibre, a circle-fitting is used to determine the core centre. However, as for the PM fibre, in particular the elliptical core PM fibre, the core centre cannot be determined if an ellipse-fitting is not used, because the fibre has an oval core. Method C is the reference test method (RTM), which shall be the one used to settle disputes.</p>	

4.3 Mechanical requirement

The relevant mechanical attribute and test method are given in Table 3.

Table 3 – Mechanical attribute and test method

Attribute	Test method
Proof test	IEC 60793-1-30

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4.4 Transmission requirements

The relevant transmission attributes and measurement methods are given in Table 4.

Table 4 – Transmission attributes and measurement methods

Attributes	Measurement methods
Attenuation coefficient	IEC 60793-1-40 ^a
Mode field diameter (MFD)	IEC 60793-1-45 ^b
Beat length	IEC 60793-1-60 ^c
Polarization crosstalk	IEC 60793-1-61 ^d
Cut-off wavelength	IEC 60793-1-44 ^e
<p>^a When measuring attenuation, the appropriate launching conditions should be applied. These may differ from those prescribed in the measurement methods to which reference is made.</p> <p>^b MFD of PM fibre can be measured by method A: direct far-field scan, method B: variable aperture in the far field or method C: near-field scan of IEC 60793-1-45. Information pertaining to each individual method appears respectively in Annexes A, B and C of IEC 60793-1-45:2001. Only information for PM fibre is shown in Annex D.</p> <p>^c Beat length of PM fibre is basically defined and measured by the phase beat length measurement methods shown in IEC 60793-1-60. The phase beat length and group beat length are based on different definitions, and will give different results depending on the type of PM fibre. If the correlation between both methods is confirmed in advance, the group beat length measurement with the appropriate correlation factor can be used as an alternative easy-to-use measurement method. Each definition (phase or group beat length) and measurement method is not excluded if supplier and customer agree in advance.</p> <p>^d Polarization crosstalk of PM fibre is basically defined and measured by method A of IEC 60793-1-61. The crosstalk measured by method A is defined as an "averaged" crosstalk value over a measured wavelength range. The crosstalk value obtained from method B of IEC 60793-1-61 shows the "worst case" crosstalk value. Each definition (averaged or the worst case crosstalk) and measurement method (method A or B) is not excluded if supplier and customer agree in advance, however, they will give different results.</p> <p>^e As shown in Annex E, the cut-off wavelength of the PM fibre should be measured paying attention to excite an LP₁₁ mode sufficiently and not to impose an extra, small bending more carefully than the cut-off wavelength measurement of a single-mode (SM) optical fibre. The recommended deployment configuration of the sample fibre shall follow the same condition as defined for fibre cut-off wavelength in IEC 60793-1-44.</p>	

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4.5 Environmental requirements

Environmental exposure tests and measurement methods are documented in two forms:

- relevant environmental attributes and test methods are given in Table 5;
- measurements of particular transmission attributes that may change on the application of the environment are listed in Table 6.

Table 5 – Environmental exposure tests

Attributes	Test methods
Change of temperature tests	IEC 60793-1-52

Table 6 – Attributes measured

Attributes	Test methods
Change in optical transmission	IEC 60793-1-46
Attenuation	IEC 60793-1-40
Polarization crosstalk	IEC 60793-1-61

These tests are normally conducted periodically as type tests for a fibre and coating design. Unless otherwise indicated, the recovery period allowed between the completion of the environmental exposure and the measurements of the attribute shall be as stated in the particular environmental test method.

Annex A
(normative)

**Family specification for category D1
polarization-maintaining fibres**

A.1 General

Category D1 polarization-maintaining fibres is suitable for 980 nm transmissions.

The following clauses and tables contain particular requirements applicable to D1 fibres. Common requirements, repeated here for ease of reference from this document, are noted by an entry in the "Reference" column.

A.2 Dimensional requirements

Table A.1 contains dimensional requirements specific to D1 fibres.

Table A.1 – Dimensional requirements specific to D1 fibres

Attributes	Unit	Limits	Reference
Cladding diameter	µm	125 ± 3	4.2
Cladding non-circularity	%	≤ 2,0	4.2
Core concentricity error	µm	≤ 0,8	4.2
Primary coating diameter – uncoloured	µm	245 ± 15 ^a	4.2
Primary coating-cladding concentricity error	µm	≤ 12,5	4.2
Fibre length	km	b	4.2
^a These limits are most commonly used in telecommunications cables. There are other applications, which use other primary coating diameter, several of which are listed below. Alternative nominal primary coating diameter and ranges (µm): 300 ± 20 400 ± 15			
^b Length requirements vary and should be agreed between supplier and customer.			

A.3 Mechanical requirement

Table A.2 contains the mechanical requirement specific to D1 fibres.

Table A.2 – Mechanical requirement specific to D1 fibres

Attribute	Unit	Limit	Reference
Proof test level	GPa	≥ 0,69 ^a	4.3
^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, Clause 4.			

A.4 Transmission requirements

Table A.3 contains transmission requirements specific to D1 fibres.

Table A.3 – Transmission requirements specific to D1 fibres

Attributes	Unit	Limits	Reference
Attenuation coefficient at 980 nm	dB/km	$\leq 3,0$	4.4
Nominal MFD range at 980 nm	μm	6,6	4.4
MFD tolerance	μm	$\pm 1,0$	4.4
Beat length at 980 nm	mm	$\leq 3,3$	4.4
Polarization crosstalk at 980 nm	dB/100 m	$\leq -25^{\text{a}}$	4.4
Cut-off wavelength	nm	≤ 970	4.4
^a The fibre configuration when measuring polarization crosstalk may be specified by agreement between supplier and customer.			

A.5 Environmental requirements

Table A.4 contains environmental requirements specific to D1 fibres.

Table A.4 – Environmental requirements specific to D1 fibres

Environment	Attributes	Unit	Limits	Reference
Change of temperature	Attenuation at 980 nm	dB/km	a	4.5
Change of temperature	Polarization crosstalk at 980 nm	dB/100 m	a	4.5
^a These requirements should be agreed between supplier and customer.				

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