



BSI Standards Publication

# Optical fibres

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

### National foreword

This British Standard is the UK implementation of EN 60793-2-50:2013. It is identical to IEC 60793-2-50:2012. It supersedes BS EN 60793-2-50:2008 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/1, Optical fibres and cables.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2013

ISBN 978 0 580 72471 8

ICS 33.180.10

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2013.

### Amendments/corrigenda issued since publication

| Date | Text affected |
|------|---------------|
|------|---------------|

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

# EN 60793-2-50

July 2013

ICS 33.180.10

Supersedes EN 60793-2-50:2008

English version

**Optical fibres -  
Part 2-50: Product specifications -  
Sectional specification for class B single-mode fibres  
(IEC 60793-2-50:2012)**

Fibres optiques -  
Partie 2-50: Spécifications de produits -  
Spécification intermédiaire pour les fibres  
unimodales de classe B  
(CEI 60793-2-50:2012)

Lichtwellenleiter -  
Teil 2-50: Produktspezifikationen -  
Rahmenspezifikation für Einmodenfasern  
der Kategorie B  
(IEC 60793-2-50:2012)

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Ref. No. EN 60793-2-50:2013 E

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## Foreword

The text of document 86A/1481/FDIS, future edition 4 of IEC 60793-2-50, prepared by SC 86A "Fibres and cables" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60793-2-50:2013.

The following dates are fixed:

- latest date by which the document has to be (dop) 2014-01-05  
implemented at national level by  
publication of an identical national  
standard or by endorsement
- latest date by which the national (dow) 2016-01-17  
standards conflicting with the  
document have to be withdrawn

This document supersedes EN 60793-2-50:2008.

EN 60793-2-50:2013 includes the following significant technical changes with respect to EN 60793-2-50:2008:

- aligns the requirements with the relevant ITU-T Recommendations;
- adds another option to the list of alternative primary coating diameter constructions in Table 2 and subsequent family specifications; related modification of coating strip force in Tables 4 and 11;
- removes the jumper cut-off wavelength in Table 5;
- modifies B6 sub-categories;
- aligns B6-b MFD on B1.3 MFD.

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## Endorsement notice

The text of the International Standard IEC 60793-2-50:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

|             |      |                           |
|-------------|------|---------------------------|
| IEC 60794-2 | NOTE | Harmonised as EN 60794-2. |
| IEC 60794-3 | NOTE | Harmonised as EN 60794-3. |

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| <u>Publication</u> | <u>Year</u> | <u>Title</u>                                                                                             | <u>EN/HD</u>  | <u>Year</u> |
|--------------------|-------------|----------------------------------------------------------------------------------------------------------|---------------|-------------|
| IEC 60793-1        | Series      | Optical fibres -<br>Part 1: Measurement methods and test procedures                                      | EN 60793-1    | Series      |
| IEC 60793-1-1      | -           | Optical fibres -<br>Part 1-1: Measurement methods and test procedures - General and guidance             | EN 60793-1-1  | -           |
| IEC 60793-1-20     | -           | Optical fibres -<br>Part 1-20: Measurement methods and test procedures - Fibre geometry                  | EN 60793-1-20 | -           |
| IEC 60793-1-21     | -           | Optical fibres -<br>Part 1-21: Measurement methods and test procedures - Coating geometry                | EN 60793-1-21 | -           |
| IEC 60793-1-22     | -           | Optical fibres -<br>Part 1-22: Measurement methods and test procedures - Length measurement              | EN 60793-1-22 | -           |
| IEC 60793-1-30     | -           | Optical fibres -<br>Part 1-30: Measurement methods and test procedures - Fibre proof test                | EN 60793-1-30 | -           |
| IEC 60793-1-31     | -           | Optical fibres -<br>Part 1-31: Measurement methods and test procedures - Tensile strength                | EN 60793-1-31 | -           |
| IEC 60793-1-32     | -           | Optical fibres -<br>Part 1-32: Measurement methods and test procedures - Coating strippability           | EN 60793-1-32 | -           |
| IEC 60793-1-33     | -           | Optical fibres -<br>Part 1-33: Measurement methods and test procedures - Stress corrosion susceptibility | EN 60793-1-33 | -           |
| IEC 60793-1-34     | -           | Optical fibres -<br>Part 1-34: Measurement methods and test procedures - Fibre curl                      | EN 60793-1-34 | -           |
| IEC 60793-1-40     | -           | Optical fibres -<br>Part 1-40: Measurement methods and test procedures - Attenuation                     | EN 60793-1-40 | -           |
| IEC 60793-1-42     | -           | Optical fibres -<br>Part 1-42: Measurement methods and test procedures - Chromatic dispersion            | EN 60793-1-42 | -           |
| IEC 60793-1-44     | -           | Optical fibres -<br>Part 1-44: Measurement methods and test procedures - Cut-off wavelength              | EN 60793-1-44 | -           |

| <u>Publication</u> | <u>Year</u> | <u>Title</u>                                                                                                                  | <u>EN/HD</u>  | <u>Year</u> |
|--------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|
| IEC 60793-1-45     | -           | Optical fibres -<br>Part 1-45: Measurement methods and test<br>procedures - Mode field diameter                               | EN 60793-1-45 | -           |
| IEC 60793-1-46     | -           | Optical fibres -<br>Part 1-46: Measurement methods and test<br>procedures - Monitoring of changes in optical<br>transmittance | EN 60793-1-46 | -           |
| IEC 60793-1-47     | -           | Optical fibres -<br>Part 1-47: Measurement methods and test<br>procedures - Macrobending loss                                 | EN 60793-1-47 | -           |
| IEC 60793-1-48     | -           | Optical fibres -<br>Part 1-48: Measurement methods and test<br>procedures - Polarization mode dispersion                      | EN 60793-1-48 | -           |
| IEC 60793-1-50     | -           | Optical fibres -<br>Part 1-50: Measurement methods and test<br>procedures - Damp heat (steady state)                          | EN 60793-1-50 | -           |
| IEC 60793-1-51     | -           | Optical fibres -<br>Part 1-51: Measurement methods and test<br>procedures - Dry heat                                          | EN 60793-1-51 | -           |
| IEC 60793-1-52     | -           | Optical fibres -<br>Part 1-52: Measurement methods and test<br>procedures - Change of temperature                             | EN 60793-1-52 | -           |
| IEC 60793-1-53     | -           | Optical fibres -<br>Part 1-53: Measurement methods and test<br>procedures - Water immersion                                   | EN 60793-1-53 | -           |
| IEC 60793-2        | -           | Optical fibres -<br>Part 2: Product specifications - General                                                                  | EN 60793-2    | -           |

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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. A map illustrating the connection of IEC designations to ITU-T designations is shown in Annex I. 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 standard and which are given in Clause 3;
- particular requirements applicable to individual fibre categories or specific applications, which are defined in Annexes A to G.

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.

#### 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 60793-1 (all Parts 1), *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 60793-1-40:2011, *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)*

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

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

### **3 Terms and definitions**

For the purposes of this document, a number of definitions apply. 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 Abbreviations and symbols**

The following abbreviations and symbols apply:

|                   |                                      |
|-------------------|--------------------------------------|
| $\lambda_0$       | zero dispersion wavelength           |
| $F_{\text{avg}}$  | average strip force                  |
| $F_{\text{peak}}$ | peak strip force                     |
| 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 category 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 1.

Requirements common to all categories of class B single-mode fibres are given in Table 2.

**Table 1 – Dimensional attributes and measurement methods**

| Attributes                                   | Measurement methods |
|----------------------------------------------|---------------------|
| 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 2 – Requirements common to all category B fibres**

| Attributes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Unit | Limits                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------------------|
| Primary coating diameter – uncoloured                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | µm   | 235 to 255 <sup>a</sup> |
| Primary coating diameter – coloured                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | µm   | 235 to 265 <sup>a</sup> |
| Primary coating-cladding concentricity error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | µm   | ≤ 12,5                  |
| Fibre length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | km   | <sup>b</sup>            |
| NOTE 1 The primary coating cladding concentricity error should be limited to a maximum 10 µm for 200 µm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |                         |
| NOTE 2 Alternate coating diameters may impact fibre connectivity such as ribbons, multi-fibre connectors, mechanical splices, and fusion splice protectors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                         |
| NOTE 3 Alternate coating diameters may need adjustments to connectivity tools.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |                         |
| <sup>a</sup> 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.<br><br>Alternative nominal primary coating diameters and ranges:<br>200 µm ± 10 µm (uncoloured; 190 to 220 µm coloured)<br>400 µm ± 40 µm<br>500 µm ± 30 µm<br>700 µm ± 100 µm<br>900 µm ± 100 µm<br><br><sup>b</sup> 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 3. The relationship of these attributes and requirements to mechanical reliability are described in IEC/TR 62048.

Requirements common to all categories of class B single-mode fibres are given in Table 4.

**Table 3 – Mechanical attributes and test methods**

| Attributes                      | Test methods   |
|---------------------------------|----------------|
| 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 4 – Requirements common to all category B fibres**

| Attributes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Unit | Limits                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------|
| Proof stress level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | GPa  | $\geq 0,69^a$                |
| Coating strip force (average) <sup>b, c</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | N    | $1,0 \leq F_{ave} \leq 5,0$  |
| Coating strip force (peak) <sup>b, c</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | N    | $1,0 \leq F_{peak} \leq 8,9$ |
| Fibre curl radius                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | m    | $\geq 2^d$                   |
| Tensile strength (median) for 0,5 m specimen length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GPa  | $\geq 3,8$                   |
| Stress corrosion susceptibility parameter, $n_d$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | –    | $\geq 18$                    |
| <sup>a</sup> 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 Clause 4 of IEC/TR 62048.<br><sup>b</sup> Either average strip force or peak strip force, which are defined in the test procedure, may be specified with agreement between supplier and customer.<br><sup>c</sup> 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.<br><sup>d</sup> 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 5.

Requirements common to all categories of class B single-mode fibres are shown in Table 6.

Requirements that shall be specified in the family specifications are listed in Table 7.

**Table 5 – Transmission attributes and measurement methods**

| Attributes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Measurement methods         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Attenuation coefficient                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | IEC 60793-1-40 <sup>a</sup> |
| Chromatic dispersion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | IEC 60793-1-42              |
| Cut-off wavelength <sup>b</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | IEC 60793-1-44              |
| Mode field diameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | IEC 60793-1-45              |
| Change of optical transmission                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | IEC 60793-1-46              |
| Macrobending loss                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | IEC 60793-1-47              |
| Polarization mode dispersion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | IEC 60793-1-48              |
| NOTE The indicated maximum attenuation values apply to uncabled optical fibres; for the maximum cabled attenuation values, reference is made to IEC 60794-2, which can be used in conjunction with this standard.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |
| <sup>a</sup> The attenuation coefficient at various wavelengths can be calculated using the measured values at a few wavelengths using a spectral model such as that given in IEC 60793-1-40. For example, the attenuation at 1 480 nm can be calculated and used for design of systems that employ remote pumping of optical amplifiers. When using Method C, OTDR, additional guidance information in IEC/TR 62316 should be taken into account.<br><sup>b</sup> There are two ways to measure cut-off wavelength, leading to: fibre cut-off wavelength $\lambda_c$ and to cable cut-off wavelength $\lambda_{cc}$ , respectively. The correlation of the measured values of $\lambda_c$ and $\lambda_{cc}$ depends on the specific fibre and cable design and the test conditions. While in general $\lambda_{cc} < \lambda_c$ a general quantitative relationship cannot be easily established, the importance of ensuring single-mode transmission in the minimum cable length between joints at the minimum operating wavelength is paramount. This may be performed by recommending the maximum cable cut-off wavelength $\lambda_{cc}$ of a cabled single-mode fibre to be 1 260 nm or for worst case length and bends by recommending a maximum fibre cut-off wavelength $\lambda_c$ to be 1 250 nm. |                             |