IEC 60794-2-20

Edition 3.0 2013-11

INTERNATIONAL STANDARD

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colour inside

Optical fibre cables –
Part 2-20: Indoor cables – Family specification for multi-fibre optical cables

Câbles à fibres optiques –
Partie 2-20: Câbles intérieurs – Spécification de famille pour les câbles optiques multifibres

IEC 60794-2-20:2013

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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.
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International Standard IEC 60794-2-20 has been prepared by sub-committee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2008 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

– removal of Annex C;
– reference to the most recent fibre standards;
– reference to the new series IEC 60794-1-2X.

This standard is to be used in conjunction with IEC 60794-1-1, IEC 60794-1-2 and IEC 60794-2.

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

FDIS	Report on voting
86A/1513/FDIS	86A/1549/RVD

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 IEC 60794 series, published under the general title *Optical fibre cables*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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,
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- replaced by a revised edition, or
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OPTICAL FIBRE CABLES –

Part 2-20: Indoor cables – Family specification for multi-fibre optical cables

1 Scope

This part of IEC 60794 is a family specification covering multi-fibre optical cables for indoor use. The requirements of the sectional specification IEC 60794-2 are applicable to cables covered by this standard. Annex B contains a Blank Detail Specification and general guidance in case the cables are intended to be used in installation governed by the MICE table of ISO/IEC 24702 (Industrial premises) [11][1].

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.

NOTE These reference complete the normative references already listed in the generic specification (IEC 60794-1-1 and IEC 60794-1-2).

IEC 60189-1, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60304, *Standard colours for insulation for low-frequency cables and wires*

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 60793-2-10, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

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

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

IEC 60794-1-20, *Optical fibre cables – Part 1-20: Generic specification – Basic optical cable test procedures – General and definitions*[2]

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1 Figures in square brackets refer to the Bibliography.

2 To be published.

IEC 60794-1-22, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods*

IEC 60794-1-23, *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable element test methods*

IEC 60794-2:2002, *Optical fibre cables – Part 2: Indoor cables – Sectional specification*

IEC 60794-3:2001, *Optical fibre cables – Part 3: Sectional specification – Outdoor cables*

IEC 60811-202, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath*

IEC 60811-203, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions.*

IEC 60811-504, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 504: Mechanical tests – Bending tests at low temperature for insulation and sheaths*

IEC/TR 62222, *Fire performance of communication cables installed in buildings*

3 Construction

3.1 General

In addition to the constructional requirements in IEC 60794-2, the following considerations apply to multi-fibre indoor cables.

The cable shall be designed and manufactured for an expected operating lifetime of at least 15 years. In this context, the attenuation at the operational wavelength(s) of the optical fibres contained in the installed cable shall not exceed values agreed between customer and supplier. The materials in the cable shall not present a health or environmental hazard within its intended use.

There shall be no fibre splice in a delivery length unless otherwise agreed by customer and supplier.

It shall be possible to identify each individual fibre throughout the length of the cable.

3.2 Optical fibres

Class A1 multimode fibres which meet the requirements of IEC 60793-2-10 or class B sub-categories B1.1, B1.3, B6_a, and B6_b single-mode optical fibres which meet the requirements of IEC 60793-2-50 shall be used. The linear coefficient of optical fibre attenuation and attenuation point discontinuity may be affected by the cable manufacturing process. Maximum values for these optical characteristics shall be agreed between customer and supplier.

3.3 Buffer

If a tight or semi-tight (loosely applied) buffer is required, it shall consist of one or more layers of inert material. The buffer shall be easily removable. For tight buffers, the buffer and fibre primary coating shall be removable in one operation over a length of 15 mm to 25 mm, depending on customer requirements. For semi-tight buffers, the buffer shall be easily removable over a length of 0,3 m to 2,0 m.

Buffer dimensions are shown in Table 1.

Table 1 – Dimensions of buffered fibres

Buffer type	Nominal diameter mm	Tolerances mm
Semi-tight buffer	0,3 to 1,4	± 0,05
Tight buffer	0,3 to 1,0	± 0,05

3.4 Ruggedized fibre

Further protection can be provided to tight or semi-tight buffered fibres by surrounding them with non-metallic strength members within a sheath of suitable material.

3.5 Slotted core

The slotted core is obtained by extruding a suitable material with a defined number of slots, providing helical or SZ (reverse-oscillating lay) configuration along the core. One or more primary coated fibres or optical elements such as ribbons or fibre bundles are located in each slot.

3.6 Tube

One or more primary coated or buffered fibres or ribbons are packaged (loosely or not) in a tube construction which may be filled. The tube may be reinforced with a composite wall.

3.7 Stranded tube

Multiple tubes, containing one or more primary coated or buffered fibres or ribbons, are stranded around a central member. For the sake of preserving cable geometry, some tubes may be "filler" or "empty" elements not containing optical fibres.

3.8 Ribbon structure

Ribbon structures shall conform to 6.5 and 8.2.3 of IEC 60794-3:2001. Fibres shall be arranged to be parallel and formed into ribbons so that the fibres remain parallel and do not cross over. Unless otherwise specified, each ribbon shall be uniquely identified with a printed legend or by uniquely colouring the reference fibre and/or by colouring the matrix material of the ribbon.

3.9 Strength and anti-buckling members

The cable shall be designed with sufficient strength members to meet installation and service conditions so that the fibres are not subjected to strain in excess of limits agreed between customer and supplier.

The strength and/or anti-buckling members may be either metallic or non-metallic and may be located in the cable core and/or under the sheath and/or in the sheath.

3.10 Ripcord

If required, a ripcord may be provided beneath the sheath.

3.11 Sheath

The cable shall have an overall protective sheath. The cable diameter shall be specified in the relevant blank detail specification (or product) specification.

3.12 Sheath marking

If required, the cable shall be marked as agreed between customer and supplier.

3.13 Identification

Optical fibres, buffers and sub-unit sheaths shall be easily and uniquely identifiable through the use of a suitable colour code (i.e. IEC 60304) and/or an easily visible numbering scheme to be agreed between customer and supplier.

3.14 Examples of cable constructions

Examples of some main types of cable construction are shown in Annex A. Other configurations (e.g. multi-layer constructions) are not precluded if they meet the mechanical, environmental and transmission requirements given in this specification.

4 Tests

4.1 General

Compliance with relevant detail specification requirements shall be verified by carrying out tests selected from the following subclauses. It is not intended that all tests be carried out; the frequency of testing shall be agreed between customer and supplier.

Unless otherwise specified, all tests shall be carried out at room temperature: (23 ± 5) °C.

Attenuation measurements shall be conducted at the highest specified wavelength.

Some of the following tests can be performed on a short sample length of cable which is still an integral part of a longer length. Thus it becomes possible to detect permanent changes in attenuation within the measurement uncertainty of the equipment used (see 4.8.2, Assessment of uncertainties in IEC 60794-1-20:201X). The wavelength and maximum value of this attenuation change shall be agreed between customer and supplier.

4.2 Dimensions

The fibre dimensions and tolerances shall be verified in accordance with test method C of IEC 60793-1-20 or IEC 60793-1-21. The diameter of the buffer and of the cable, as well as the thickness of the sheath, shall be measured in accordance with the methods of IEC 60189-1.

4.3 Mechanical requirements

4.3.1 Cable tensile performance

Method:	IEC 60794-1-21-E1A and/or E1B [4]
Diameter of chuck drums and transfer devices:	not smaller than the minimum bending diameter specified for the cable under load
Velocity of transfer device:	either 100 mm/min or 100 N/min
Load and duration:	400 N or the weight of 1 km of cable, whichever is greater, and for a minimum period of 5 min
Length of sample:	sufficient to achieve the desired accuracy of measurement of attenuation change (typically 300 m) and shall be agreed between customer and supplier
Requirements:	for E1A there shall be no change in attenuation after the test

	for E1B allowed fibre strain to be agreed between supplier and customer
	There shall be no visible damage to the cable elements

Fibre strain above 60 % of the proof test of the all-glass fibre while under test load is not recommended.

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different load and duration values may be agreed between customer and supplier.

4.3.2 Cable crush

Method:	IEC 60794-1-21-E3
Force during installation:	500 N
Duration during installation:	1 min
Force during operation:	300 N
Duration during operation:	15 min
Length between test locations:	500 mm
Requirements:	no change in attenuation during the operational test and after the installation test. There shall be no visible damage to the cable elements

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different force values may be agreed between customer and supplier.

4.3.3 Cable impact

Method:	IEC 60794-1-21-E4
Radius of striking surface:	12,5 mm
Impact energy:	1,0 J
Number of impacts:	at least 3, each separated at least 500 mm
Requirements:	no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, impact energy values may be agreed between customer and supplier.

4.3.4 Cable bending

Method:	IEC 60794-1-21-E11A
Mandrel diameter:	20 times cable diameter
Number of turns per helix:	6
Number of cycles:	10
Requirements:	no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different mandrel diameter values may be agreed between customer and supplier.

4.3.5 Cable repeated bending

Method:	IEC 60794-1-21-E6
Bending radius:	20 times cable diameter
Number of cycles:	25
Mass of weights:	4 kg
Requirements:	under visual examination without magnification there shall be no damage to the sheath and to the cable elements

4.3.6 Cable bending under tension

Method:	IEC 60794-1-21-E18

Bending radius:	20 times cable diameter
Load:	400 N or weight of 1 km of cable, whichever is greater
Requirements:	no change in attenuation after the test, and there shall be no visible damage to the cable elements

4.3.7 Cable bending at low temperature

Method:	IEC 60794-1-21-E11A (see IEC 60811-504)
Bending radius:	10 times cable diameter
Test temperature:	0 °C, –10 °C or –15 °C depending on application and customer requirements.
Number of turns per helix:	according to IEC 60811-504
Number of cycles:	2
Requirements:	in addition to the requirements of IEC 60811-504, no fibre shall break during the test

4.3.8 Cable flexing

Method:	IEC 60794-1-21-E8
Number of cycles:	100
Pulley diameter:	20 times cable diameter
Mass of weights:	2 kg (minimum)
Requirements:	no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different pulley diameter values may be agreed between customer and supplier.

4.3.9 Cable torsion

Method:	IEC 60794-1-21-E7
Number of cycles:	10
Distance between fixed and rotation clamp:	125 times cable diameter but not more than 2,0 m
Tension load:	20 N
Requirements:	no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different values for the number of cycles may be agreed between customer and supplier.

4.3.10 Cable kink

Method:	IEC 60794-1-21-E10
Minimum loop diameter:	20 times cable diameter
Requirement:	no kink shall occur

4.4 Environmental requirements – Temperature cycling

Method:	IEC 60794-1-22-F1