IEC 60794-2-30

Edition 3.0 2019-03

INTERNATIONAL STANDARD

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Optical fibre cables –
Part 2-30: Indoor cables – Family specification for optical fibre ribbon cables for use in terminated cable assemblies

Câbles à fibres optiques –
Partie 2-30: Câbles intérieurs – Spécification de famille pour les câbles à rubans de fibres optiques utilisés dans les assemblages de câbles connectorisés

IEC 60794-2-30:2019-03(en-fr)

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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ICS 33.180.10

ISBN 978-2-8322-6507-9

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CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 Construction 7
4.1 General 7
4.2 Optical fibres and primary coating 7
4.3 Buffer 8
4.4 Ruggedized fibre 8
4.5 Slotted core 8
4.6 Tube 8
4.7 Stranded loose tube 8
4.8 Ribbon structure 8
4.9 Strength and anti-buckling members 8
4.10 Ripcord 8
4.11 Sheath 8
4.12 Sheath marking 8
4.13 Identification 8
4.14 Example of cable construction 9
5 Dimensions 9
5.1 Optical fibres and primary coating 9
5.2 Ribbon structural geometry 9
5.3 Optical fibre ribbon cable 9
6 Tests 10
6.1 General 10
6.2 Dimensions 10
6.3 Mechanical requirements 10
6.3.1 Cable tensile performance 10
6.3.2 Cable crush 11
6.3.3 Cable impact 11
6.3.4 Cable bending 11
6.3.5 Cable repeated bending 11
6.3.6 Cable bending under tension 11
6.3.7 Cable bending at low temperature 11
6.3.8 Cable flexing 12
6.3.9 Cable torsion 12
6.3.10 Cable kink 12
6.4 Environmental requirements – Temperature cycling 12
6.5 Transmission requirements 13
6.5.1 General 13
6.5.2 Single mode optical fibres 13
6.5.3 Single-mode dispersion unshifted optical fibre (B1.1) 13
6.5.4 Single-mode dispersion unshifted optical fibre (B1.2) 13
6.5.5 Single-mode dispersion unshifted optical fibre (B1.3) 14
6.5.6 Single-mode dispersion shifted optical fibre (B2) 14

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6.5.7 Single-mode non-zero dispersion optical fibre (B4) 14
6.5.8 Single-mode wide band non-zero dispersion optical fibre (B5) 14
6.5.9 Single-mode bending loss insensitive optical fibre (B6) 15
6.5.10 Multimode fibres 15
6.6 Fire performance 15
Annex A (informative) Example of cable construction 16
Annex B (informative) Family specification indoor cables – Optical fibre ribbon cables 17
B.1 Blank detail specification 17
B.1.1 Cable description 17
B.1.2 Cable element 18
B.1.3 Cable construction 18
B.1.4 Installation and operating conditions 18
B.1.5 Mechanical, environmental and fire performance tests 19
B.2 Cables subject to the MICE environmental classification (ISO 11801-3 and related standards) 19
Bibliography 21

Figure 1 – Example of identification by means of colour coding and positioning 9
Figure A.1 – Example of cross-section of a four-fibre ribbon cable 16

Table 1 – Dimensions of optical fibre ribbon cables 10
Table 2 – Temperature cycling conditions 12
Table 3 – Common single-mode fibre requirements 13
Table 4 – Cabled attenuation requirements for B1.1 optical fibre 13
Table 5 – Cabled attenuation requirements for B1.2 optical fibre 13
Table 6 – Cabled attenuation requirements for B1.3 optical fibre 14
Table 7 – Cabled attenuation requirements for B2 optical fibre 14
Table 8 – Cabled attenuation requirements for B4 optical fibre 14
Table 9 – Cabled attenuation requirements for B5 optical fibre 14
Table 10 – Cabled attenuation requirements for B6 optical fibre 15
Table 11 – Requirements for multimode optical fibre (A1a and A1b) 15
Table B.1 – Cable description 17
Table B.2 – Cable element 18
Table B.3 – Cable construction 18
Table B.4 – Installation and operating conditions 19
Table B.5 – Tests applicable 19

Documents
Document Sharing Hub

Full document details: IEC 60794-2-30 2019

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OPTICAL FIBRE CABLES –

Part 2-30: Indoor cables – Family specification for optical fibre ribbon cables for use in terminated cable assemblies

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International Standard IEC 60794-2-30 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. This edition constitutes a technical revision.

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

a) removal of Annex C;
b) reference to the most recent fibre standards;
c) reference to IEC 60794-1-21, IEC 60794-1-22, IEC 60794-1-23 and IEC 60794-1-24.

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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 International Standard is based on the following documents:

CDV	Report on voting
86A/1704/CDV	86A/1808/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 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 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 FIBRE CABLES –

Part 2-30: Indoor cables – Family specification for optical fibre ribbon cables for use in terminated cable assemblies

1 Scope

This part of IEC 60794 is a family specification which covers indoor optical fibre ribbon cables for use in terminated cable assemblies. The requirements of the sectional specification IEC 60794-2 are applicable to cables covered by this document.

The requirements of this document are written to define flat ribbon cables. This document can be applicable to other cable constructions. Parts of IEC 60794-3 which are applicable for ribbon tests are the subject of IEC 60794-1-31.

Annex B contains requirements that supersede the normal requirements in case the cables are intended to be used in installation governed by the MICE table of ISO 11801-3 [4][1].

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.

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

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

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

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

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 specification – Sectional specification for class B single-mode fibres*

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

[1] Numbers in square brackets refer to the Bibliography.

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

IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical test methods*

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 60794-2:2017, *Optical fibre cables – Part 2: Indoor cables – Sectional specification*

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

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*

3 Terms and definitions

No terms and definitions are listed in this document.

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

4 Construction

4.1 General

In addition to the constructional requirements in IEC 60794-2, the following considerations apply to ribbon cables for use in terminated cable assemblies.

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

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

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

4.2 Optical fibres and primary coating

Category A1 multimode fibres which meet the requirements of IEC 60793-2-10 or categories B1.1, B1.2, B1.3, B2, B4, B5 and B6 single-mode optical fibres which meet the requirements

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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 the customer and the supplier.

4.3 Buffer

None.

4.4 Ruggedized fibre

None.

4.5 Slotted core

None.

4.6 Tube

None.

4.7 Stranded loose tube

None.

4.8 Ribbon structure

The ribbon structure shall be in accordance with IEC 60794-3.

4.9 Strength and anti-buckling members

The optical fibre ribbon cable may incorporate a tensile strength member. The strength member may be a layer of suitable material, longitudinally or helically applied, and/or may be embedded in the overall sheath.

4.10 Ripcord

None.

4.11 Sheath

The optical fibre ribbon shall be uniformly covered with a protective sheath generally as shown in Figure A.1.

4.12 Sheath marking

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

4.13 Identification

The coated fibre shall be distinguishable by means of colour coding and positioning. For example (see Figure 1):

a) a fibre ribbon has an identification coloured fibre on one side and a sub-identification coloured one on the other side;

b) the identification and the sub-identification coloured fibres are the first and the last in the fibre ribbon, respectively;

c) any colour of the identification colours group is different from that of the sub-identification colours group;

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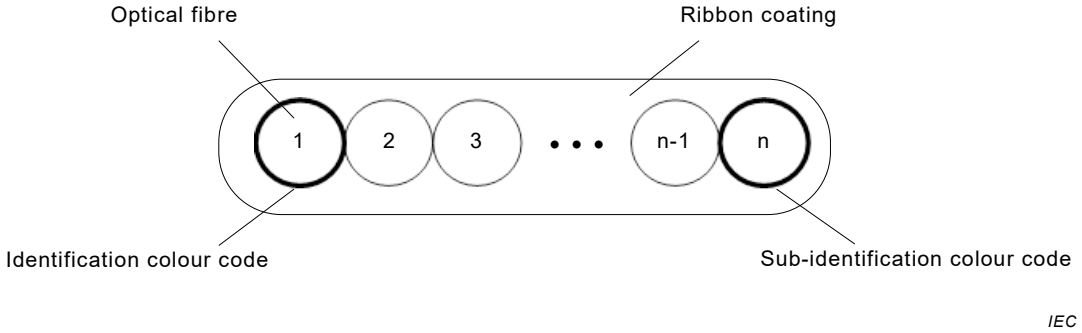
d) the colour types and the order used for identification and sub-identification should be agreed between the customer and the supplier. The colours of the other fibres shall be agreed by the customer and/or the supplier;

e) the colour range used is similar to the first 12 colours described in Table 1 of IEC 60794-2:2002, i.e., blue, yellow, red, white, green, violet, orange, grey, turquoise, black, brown and pink.



NOTE 1 The identification colour enables each fibre ribbon to be identified individually within a group of ribbons.

NOTE 2 The sub-identification colour shows the ribbon group.

NOTE 3 The identification and the sub-identification colour in a ribbon enables each fibre to be identified individually within the ribbon.

Figure 1 – Example of identification by means of colour coding and positioning

Other methods of identification are under consideration.

4.14 Example of cable construction

An example of a ribbon cable construction is shown in Figure A.1. Other configurations are not precluded if they meet the mechanical, environmental and transmission requirements given in this document.

5 Dimensions

5.1 Optical fibres and primary coating

The dimensions of the individual primary coated fibres in the finished product shall be in accordance with IEC 60793-2.

5.2 Ribbon structural geometry

The ribbon geometry shall be in accordance with IEC 60794-3.

5.3 Optical fibre ribbon cable

The structural geometry of the optical fibre ribbon cables shall be designed so as to comply with the mechanical, environmental and transmission requirements as defined in this document. For instance, either rectangular or circular structure can be chosen.

In the case of a rectangular structure, the dimensions and the structural geometry of optical fibre ribbon cables shall be as shown in Table 1.

Other structures can be applied if agreed between the supplier and the customer.

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Table 1 – Dimensions of optical fibre ribbon cables

Number of fibres	Optical fibre ribbon cables			
	Width mm		Height mm	
	Nominal	Maximum tolerance	Nominal	Maximum tolerance
2	3,0 to 3,5	± 0,4	2,3 to 2,7	± 0,3
4	3,0 to 3,5	± 0,4	2,3 to 2,7	± 0,3
6	3,5 to 4,0	± 0,4	2,3 to 2,7	± 0,3
8	2,5 to 4,5	± 0,4	0,9 to 3,0	± 0,3
12	3,5 to 5,5	± 0,4	0,9 to 3,0	± 0,3
NOTE These dimensions apply to the ribbon cable including the sheath and any strength members.				

6 Tests

6.1 General

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

Some of the following tests can be performed on a short sample length of optical fibre ribbon cable which is still an integral part of a longer length. For testing, the force shall be applied on the flat sides of the cable. Thus, it becomes possible to detect permanent changes in attenuation. The wavelength and maximum increase in attenuation change can be agreed between the customer and the supplier.

6.2 Dimensions

The dimensions and structural geometry of optical fibre ribbon can be verified with a type test described in IEC 60794-3 to establish and ensure proper control of the ribbon manufacturing process. Once the process is established, and in order to ensure functional performance, the dimensions of ribbons may be controlled and verified, for final inspection purposes, with a dial gauge as described in Method G4 of IEC 60794-1-23. The size of the optical fibre ribbon cable, width and height shall be measured in accordance with the methods of IEC 60811-203.

6.3 Mechanical requirements

6.3.1 Cable tensile performance

Method:	IEC 60794-1-21, E1
Diameter of chuck drums and transfer devices:	not lower than the minimum dynamic bending diameter specified for the cable
Velocity of transfer device:	either 100 mm/min or 100 N/min
Load:	200 N applied for 5 min
Length of sample:	sufficient to achieve the desired accuracy of measurement of attenuation and shall be agreed between the customer and the supplier.
Requirement:	no change in attenuation after the test, and there shall be no damage to the cable elements.

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6.3.2 Cable crush

Method:	IEC 60794-1-21, E3
Force:	500 N
Duration:	1 min
Length between test locations:	500 mm
Requirement:	no change in attenuation after the test, and there shall be no damage to the cable elements.

NOTE The force is applied on the flat sides of the cable.

6.3.3 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 by at least 500 mm
Requirement:	no fibre breakage

NOTE The force is applied on the flat sides of the cable.

6.3.4 Cable bending

Method:	IEC 60794-1-21, E11A
Mandrel diameter:	50 mm
Number of turns per helix:	6
Number of cycles:	10
Requirements:	no fibre breakage

NOTE The bending is applied in the vertical direction to the flat sides of the cable.

6.3.5 Cable repeated bending

Method:	IEC 60794-1-21, E6
Bending radius:	100 mm
Number of cycles:	300
Mass of weights:	2 kg
Requirement:	no fibre breakage

NOTE The bending is applied in the vertical direction to the flat sides of the cable.

6.3.6 Cable bending under tension

None.

6.3.7 Cable bending at low temperature

Method:	IEC 60794-1-21, E11A (see also IEC 60811-504)
Bending radius:	10 times cable diameter for flat cables; diameter is the minimum dimension. For cables with preferential bend, the diameter is perpendicular to the plane of bending.
Number of cycles:	2

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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
Requirements:	in addition to the requirement of IEC 60811-504, no fibre shall break during the test.

6.3.8 Cable flexing

Method:	IEC 60794-1-21, E8
Number of cycles:	300
Pulley diameter:	100 mm
Mass of weight:	2 kg
Requirement:	no fibre breakage

NOTE The bending is applied in the vertical direction to the flat sides of the cable.

6.3.9 Cable torsion

Method:	IEC 60794-1-21, E7
Number of cycles:	20
Distance between fixed and rotation clamp:	250 mm
Tension load:	20 N
Requirement:	no fibre breakage

6.3.10 Cable kink

None.

6.4 Environmental requirements – Temperature cycling

Method:	IEC 60794-1-22, F1
Number of cycles:	2
Length of sample:	sufficient to achieve the desired accuracy of measurement of attenuation
Temperature:	see Table 2
Requirement:	the wavelength and maximum increase in attenuation shall be agreed between the customer and the supplier

Table 2 – Temperature cycling conditions

	Temperature T_A	Temperature T_B
a)	0 °C	50 °C
b)	–5 °C	50 °C
c)	–20 °C	60 °C
d)	–45 °C	60 °C
Condition a), b), c) or d) shall be selected depending on application and customer requirements; for example, condition c) is for appropriate implementation of ISO/IEC 11801 [3].		

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6.5 Transmission requirements

6.5.1 General

The transmission requirements shall be verified in accordance with IEC 60793-2-10 or IEC 60793-2-50 and shall be agreed between the customer and the supplier. Maximum cable attenuation shall comply with IEC 60794-1-1. See Tables 3 to 11.

6.5.2 Single mode optical fibres

Table 3 – Common single-mode fibre requirements

Characteristics	IEC 60794-2:2017 subclause	Family requirements	Test methods	Remarks
Uncabled optical fibre	4.1	IEC 60793-2		
Cabled fibre cut-off wavelength	4.2	$\lambda_{cc} < \lambda$ operational	IEC 60793-1-44	
Fibre colouring	4.1	IEC 60304	Visual inspection	
Outer diameter including colouring	4.1	As IEC 60793-2	IEC 60793-1-20	
Attenuation discontinuities at 1 550 nm	4.2	≤ 0,10 dB	IEC 60793-1-40	

6.5.3 Single-mode dispersion unshifted optical fibre (B1.1)

Table 4 – Cabled attenuation requirements for B1.1 optical fibre

Characteristics	IEC 60794-2:2017 subclause	Family requirements	Test methods	Remarks
Attenuation coefficient (cabled fibres)	4.2	According to detail specification	IEC 60793-1-40	
at 1 310 nm at 1 550 nm at 1 625 nm		≤ 0,40 dB/km ≤ 0,30 dB/km ≤ 0,30 dB/km		

6.5.4 Single-mode dispersion unshifted optical fibre (B1.2)

Table 5 – Cabled attenuation requirements for B1.2 optical fibre

Characteristics	IEC 60794-2:2017 subclause	Family requirements	Test methods	Remarks
Attenuation coefficient (cabled fibres)	4.2	According to detail specification	IEC 60793-1-40	
at 1 550 nm at 1 625 nm		≤ 0,25 dB/km ≤ 0,40 dB/km		

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