

INTERNATIONAL STANDARD

**Optical fibre cables –
Part 2-42: Indoor optical fibre cables – Product specification for simplex and
duplex cables with A4 fibres**



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

**Part 2-42: Indoor optical fibre cables –
Product specification for simplex and duplex cables with A4 fibres**

FOREWORD

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International Standard IEC 60794-2-42 has been prepared by sub-committee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

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:

CDV	Report on voting
86A/1126/CDV	86A/1155/RVC

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 blank detail specification is provided in Annex B.

A list of all parts of 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 publication will remain unchanged until the maintenance result 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;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

OPTICAL FIBRE CABLES –

Part 2-42: Indoor optical fibre cables – Product specification for simplex and duplex cables with A4 fibres

1 Scope

This part of IEC 60794 covers simplex and duplex optical fibre cables containing A4 fibres for indoor use. The requirements of the sectional specification IEC 60794-2 are applicable to cables covered by this standard.

2 Normative references

The following referenced documents are indispensable for the application 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 60189-1: *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60654-4, *Operating conditions for industrial-process measurement and control equipment – Part 4: Corrosive and erosive influences*

IEC 60721-1, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC 60721-3-3, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weather protected locations*

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 60793-2-40, *Optical fibres – Part 2-40: Product specifications – Sectional specification for category A4 multimode 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 60794-2: *Optical fibre cables – Part 2: Indoor cables – Sectional specification*

IEC 60811-1-1, *Common test methods for insulating and sheathing materials of electric cables and optical cables – Part 1-1: Methods for general application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section 4: Tests at low temperature*

IEC 61000-2-5, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 5: Classification of electromagnetic environments – Basic EMC publication*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61326 (all parts), *Electrical equipment for measurement, control and laboratory use – EMC*

ISO/IEC 11801: *Information technology – Generic cabling for customer premises*

ISO/IEC 24702: *Information technology – Generic cabling – Industrial premises*

3 Construction

3.1 General

In addition to the constructional requirements in IEC 60794-2, the following considerations apply to simplex and duplex indoor cables.

The cable shall be designed and manufactured for an expected 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 customer and 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 customer and supplier.

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

3.2 Optical fibres

Multimode category A4a through A4g optical fibres shall be used that meet the requirements of IEC 60793-2-40.

3.3 Buffer

The buffer, if any, shall consist of one or more layers of inert material. For tight buffer, the buffer shall be easily 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 0,2 m to 2,0 m.

3.4 Ruggedized fibre

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

3.5 Tube

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

If required, the suitability of the tube shall be determined by an evaluation of its kink resistance in accordance with IEC 60794-1-2, Method G7.

3.6 Strength and anti-buckling members

The cable shall be designed with sufficient strength members to meet installation and service conditions thus enabling fibres not to be subjected to strain in excess of limits in 4.2.1.

The strength and/or anti-buckling member may be located in the cable core and/or under the sheath and/or in the sheath.

3.7 Sheath

The cable shall have an overall protective sheath. The cable diameter shall be specified by agreement between customer and supplier.

3.8 Sheath marking

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

3.9 Examples of cable constructions

Examples of some main types of cable construction are shown in Figures A.1 to A.8. Other configurations are not excluded if they meet the mechanical, environmental and transmission requirements given in this specification.

4 Tests

4.1 General

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

Unless otherwise specified, all tests shall be carried out at ambient temperature.

4.2 Dimensions

The fibre dimensions and tolerances shall be checked in accordance with test method 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 General

Some of the following tests can be performed on a short sample length of cable that is still an integral part of a longer length. Thus it becomes possible to detect permanent changes in attenuation. Launch conditions to measure changes in attenuation shall be in conformity with IEC 60793-2-40.

4.3.2 Tensile performance

Method IEC 60794-1-2-E1A

Diameter of chuck drums and transfer devices: approximately 250 mm.

Rate of transfer device: either 100 mm/min or 100 N/min.

Load: 100 N applied for 5 min for simplex cables, 200 N for 5 min for duplex cables.

Length of sample: sufficient to achieve the desired accuracy of measurement of attenuation change and shall be agreed between customer and supplier.

Requirements: change in attenuation less than 0,2 dB after the test and there shall be no damage to the cable elements.

4.3.3 Crush

Method: IEC 60794-1-2-E3.

Force: 1 000 N.

Duration: 1 min.

Number of test locations: 3, at least 500 mm apart.

Requirements: change in attenuation shall not exceed 0,2 dB after the test. Under visual examination, there shall be no damage to the cable elements.

NOTE In the case of flat cables the force should be applied on the flat sides of the cable.

4.3.4 Impact

Method: IEC 60794-1-2-E4.

Radius of striking surface: 12,5 mm.

Impact energy: 1J.

Number of impacts: at least 3, each separated at least 500 mm.

Requirements: change in attenuation shall not exceed 0,2 dB after the test. Under visual examination without magnification there shall be no damage to the sheath and to the cable elements. The imprint of the striking surface on the sheath is not considered mechanical damage.

NOTE In the case of flat cables the force should be applied on the flat sides of the cable.

4.3.5 Bend

Method: IEC 60794-1-2-E11A

Mandrel diameter: 10 times cable diameter (for flat cables, the diameter is the minor dimension).

Number of turns per helix: 6.

Number of cycles: 10.

Requirements: change in attenuation should be less than 0,2 dB after test. Under visual examination, there shall be no damage to the sheath or cable element.

NOTE In the case of flat cables the force should be applied on the flat sides of the cable.

4.3.6 Repeated bending

Method: IEC 60794-1-2-E6.

Bending radius: 5 times cable diameter (for flat cables, the diameter is the minor dimension).

Number of cycles: 300.

Mass of weights: 2 kg.

Requirements: change in attenuation shall not exceed 0,2 dB after the test. Under visual examination without magnification there shall be no damage to the sheath and to the cable elements.

NOTE In the case of flat cables, the sample should be fixed to the apparatus so that bending is perpendicular to the flat surface of the cable.

4.3.7 Bend at low temperature

Method: IEC 60794-1-2-E11A (see IEC 60811-1-4, Clause 8).

Bending radius: 10 times cable diameter (for flat cables, the diameter is the minor dimension).

Number of cycles: 2.

Test temperature: 0 °C, –10 °C or –15 °C depending on application and customer requirements.

Number of turns per helix: according to Clause 8 of IEC 60811-1-4.

Requirements: in addition to the requirement of Clause 8 of IEC 60811-1-4, no fibre shall break during the test.

4.3.8 Flexing

Method: IEC 60794-1-2-E8.

Number of cycles: 300.

Pulley diameter: 100 mm.

Mass of weights: 2 kg.

Requirement: no fibre breakage.

NOTE In the case of flat cables the force shall be applied on the flat sides of the cable.

4.3.9 Torsion

Method: IEC 60794-1-2-E7.

Number of cycles: 20.

Distance between fixed and rotating clamp: 250 mm.

Tension load: 20 N.

Requirements: no fibre breakage.

4.3.10 Kink

Method: IEC 60794-1-2-E10.

Minimum loop diameter: 20 times cable diameter (for flat cables, the diameter is the minor dimension).

Requirement: no kink shall occur and no fibre breakage.

4.4 Environmental requirements – Temperature cycling

Method: IEC 60794-1-2-F1.

Table 1 – Temperature cycling

Condition	Low temperature T_A	High temperature T_B
a)	0 °C	+50 °C
b)	–5 °C	+50 °C
c)	–20 °C	+60 °C
d)	–40 °C	+60 °C
Condition a), b), c) or d) shall be selected depending on application and user requirements, for example condition c) is appropriate for applications supported by ISO/IEC 11801.		

Period: t_1 sufficient that the cable has reached, and stabilized to, the specified temperature.

Number of cycles: 2.

Length of sample: sufficient to achieve the desired accuracy of measurement of attenuation.

Requirements: maximum increase in attenuation to be agreed between customer and supplier.

4.5 Transmission requirements

The transmission requirements shall be in accordance with IEC 60793-2-40. Values for bandwidth and attenuation requirements shall be as agreed between customer and supplier.

4.6 Fire performance

IEC/TR 62222 provides guidance and recommendations for the requirements and test methods for the fire performance of communication cables when installed in buildings. The recommendations relate to typical applications and installation practices, and an assessment of the fire hazards presented. Applicable legislation and regulation are also taken into account.

IEC/TR 62222 references several IEC fire performance test methods and also other test methods that may be required by local or National legislation and regulation. The tests to be applied, and the requirements, shall be agreed between the customer and supplier taking into account the fire hazard presented by the end use application in which the cable is intended to be used.

Annex A (informative)

Examples of cable constructions

NOTE The main dimensions should be agreed between customer and supplier.

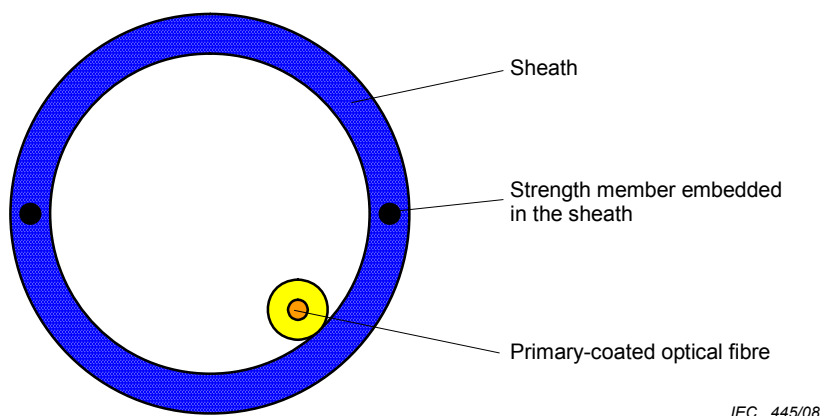


Figure A.1 – Simplex loose non-buffered fibre cable

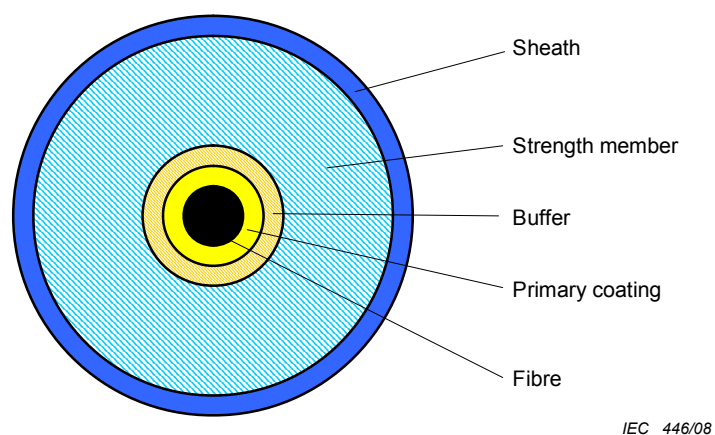


Figure A.2 – Simplex ruggedized fibre cable

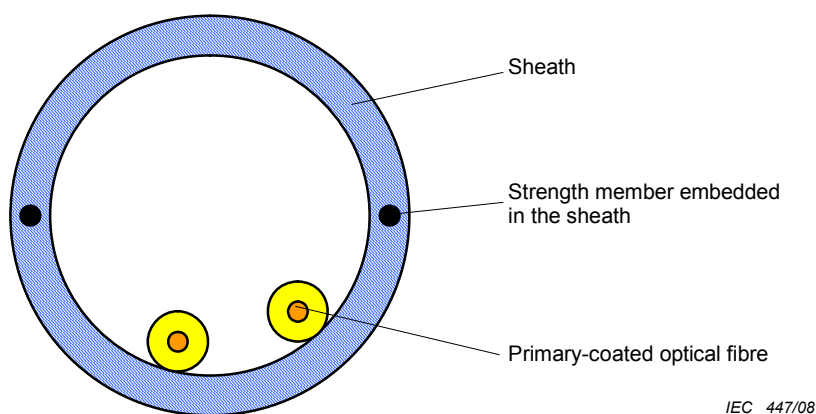
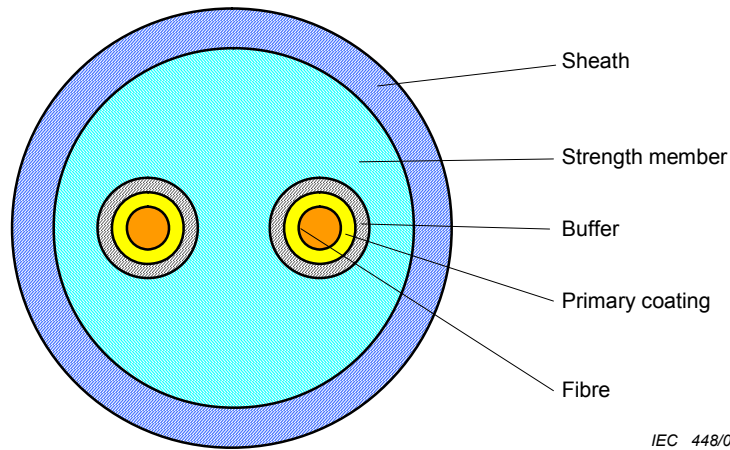
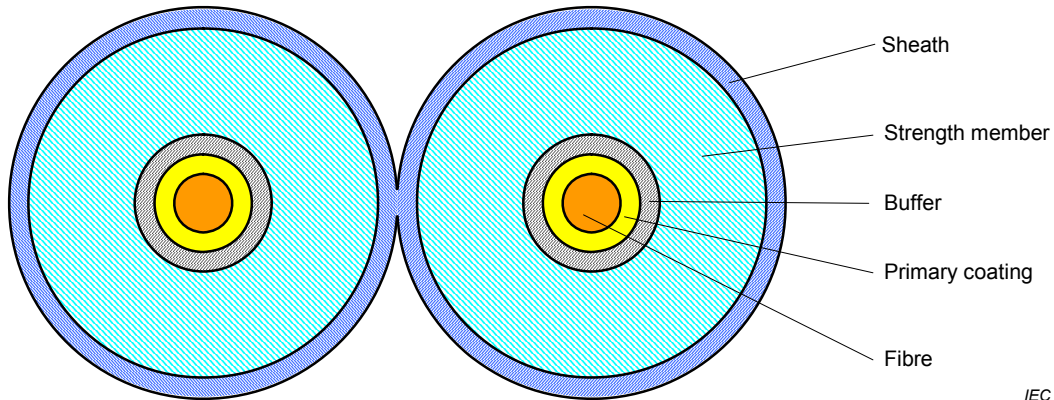


Figure A.3 – Duplex loose non-buffered fibre cable



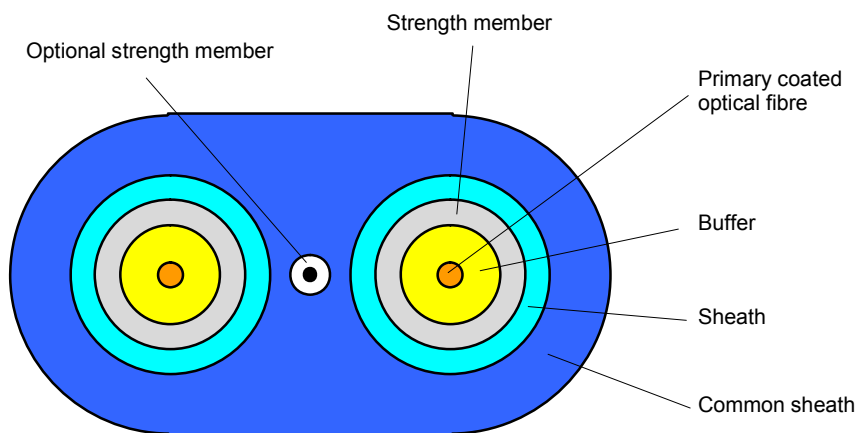
IEC 448/08

Figure A.4 – Duplex ruggedized fibre cable



IEC 449/08

Figure A.5 – Duplex ruggedized fibre zip cord



IEC 450/08

Figure A.6 – Duplex flat cable

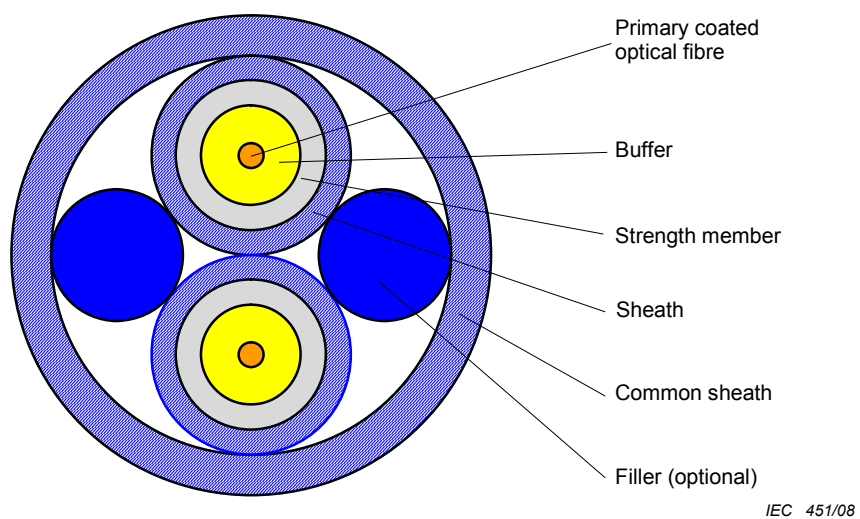


Figure A.7 – Duplex round cable

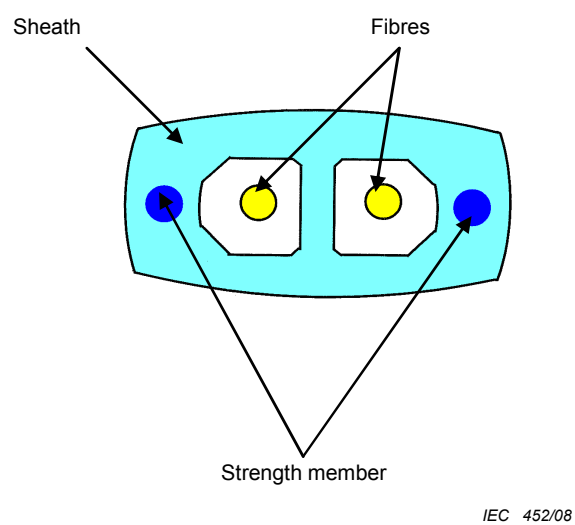


Figure A.8 – Duplex flat cable

Annex B (informative)

Blank detail specification (BDS)

B.1 Cable description

(1) Prepared by		(2) Document No : Issue : Date :
(3) Available from :	(4) Generic specification : IEC 60794-1 Sectional specification : IEC 60794-2	
(5) Additional references : ISO/IEC 24702 if required		
(6) Cable description :		
(7) Cable construction :		
Optical fibres :		
Range of fibre count :		
Modularity		
<u>Construction</u> - Single coloured fibre - Tube - filled - Tube - unfilled - Slotted core - filled - Slotted core - unfilled - Tight or semi-tight secondary coating - Ribbon in slotted core - Ribbon in tube - Strength elements - non metallic - Strength elements - metallic		Additional remarks
<u>Lay-up</u> - Stranding (helical or reverse oscillating/SZ) - Single unit - Hybrid configuration - Other		
Insulated copper conductors - AWG Solid/stranded Insulation material		
<u>Inner sheath</u> - Material - Minimum wall thickness		
<u>Peripheral strength member</u> - Metallic - Non-metallic		
Outer sheath - Material - Minimum wall thickness		
<u>Additional armouring</u> - Non-metallic armouring - Metallic armouring		
<u>Marking identification</u> - Customer requirement - Identification of manufacturer		

(8) Application information :	
Application	
Maximum outer diameter (<i>d</i>)	mm
Rated maximum tensile load	N
Minimum bending radius for operation	mm or nxd
Minimum bending radius under load	mm or nxd
Temperature range :	
- Transport and storage	°C
- Installation	°C
- Operation	°C
Manufacturing cable length	
- Typical	m
- Nominal/tolerances :	+1 % 0

B.2 Category A4a through A4c multimode optical fibres

(9) Characteristics	(10) IEC 60794-2-40 Subclause	(11) Requirements	(12) Test methods	(13) Remarks
Uncabled optical fibre	3.2	IEC 60793-2-40 Category A4a, b, or c		
Attenuation coefficient (cabled fibres) at 650 nm	5.4	IEC 60793-2-40 Category A4a, b, or c ≤ 40 dB/100 m (overfilled launch) ≤ 30 dB/100 m (equilibrium launch)	IEC 60793-1-40	
Minimal modal bandwidth (uncabled fibres) at 650 nm	5.4	IEC 60793-2-40 Category A4a, b, or c 10 MHz over 100 m	IEC 60793-1-41	
Fibre identification		IEC 60794-2-42, subclause 3.1	Visual inspection	
Cladding diameter		A4a : 1 000 µm A4b : 750 µm A4c : 500 µm	IEC 60793-1-20 and IEC 60793-1-21	
<u>Environmental exposure</u>		Select test condition A or B from 3.4 in IEC 60793-2-40	IEC 60793-1-50 IEC 60793-1-51 IEC 60793-1-52	

B.3 Category A4d multimode optical fibre

(9) Characteristics	(10) IEC 60794-2-40 Subclause	(11) Requirements	(12) Test methods	(13) Remarks
Uncabled optical fibre	3.2	IEC 60793-2-40 Category A4d		
Attenuation coefficient (cabled fibres) at 650 nm	5.4	IEC 60793-2-40 Category A4d ≤ 40 dB/100 m (overfilled launch) ≤ 18 dB/100 m (NA=0,3 launch)	IEC 60793-1-40	
Minimal modal bandwidth (uncabled fibres) at 650 nm	5.4	IEC 60793-2-40 Category A4d 100 MHz over 100 m	IEC 60793-1-41	
Fibre identification		IEC 60794-2-42, subclause 3.1	Visual inspection	
Cladding diameter		1000 µm	IEC 60793-1-20 and IEC 60793-1-21	
<u>Environmental exposure</u>		Select test condition A or B from 3.4 in IEC 60793-2-40	IEC 60793-1-50 IEC 60793-1-51 IEC 60793-1-52	

B.4 Category A4e multimode optical fibre

(9) Characteristics	(10) IEC 60794-2-40 subclause	(11) Requirements	(12) Test methods	(13) Remarks
Uncabled optical fibre	3.2	IEC 60793-2-40 Category A4e		
Attenuation coefficient (cabled fibres) at 650 nm	5.4	IEC 60793-2-40 Category A4e ≤ 18 dB/100 m (NA=0,3 launch)	IEC 60793-1-40	
Minimal modal bandwidth (uncabled fibres) at 650 nm	5.4	IEC 60793-2-40 Category A4e ≥ 200 MHz over 100 m (NA=0,3 launch)	IEC 60793-1-41	
Fibre identification		IEC 60794-2-42, subclause 3.1	Visual inspection	
Cladding diameter		750 µm	IEC 60793-1-20 and IEC 60793-1-21	
<u>Environmental exposure</u>		Select test condition A or B from 3.4 in IEC 60793-2-40	IEC 60793-1-50 IEC 60793-1-51 IEC 60793-1-52	

B.5 Category A4f multimode optical fibre

(9) Characteristics	(10) IEC 60794-2-40 subclause	(11) Requirements	(12) Test methods	(13) Remarks
Uncabled optical fibre	3.2	IEC 60793-2-40 Category A4f		
Attenuation coefficient (cabled fibres) at 650 nm at 850 nm at 1 300 nm	5.4	IEC 60793-2-40 Category A4f ≤ 10 dB/100 m ≤ 4 dB/100 m ≤ 4 dB/100 m	IEC 60793-1-40	
Minimal modal bandwidth (uncabled fibres) at 650 nm at 850 nm at 1 300 nm	5.4	IEC 60793-2-40 Category A4f 800 MHz over 100 m 1 500 MHz to 4 000 MHz over 100 m 1 500 MHz to 4 000 MHz over 100 m	IEC 60793-1-41	
Fibre identification		IEC 60794-2-42, Clause 3.1	Visual inspection	
Cladding diameter		490 μm	IEC 60793-1-20 and IEC 60793-1-21	
<u>Environmental exposure</u>		Select test condition A or B from 3.4 in IEC 60793-2-40	IEC 60793-1-50 IEC 60793-1-51 IEC 60793-1-52	

B.6 Category A4g multimode optical fibre

(9) Characteristics	(10) IEC 60794-2-40 subclause	(11) Requirements	(12) Test methods	(13) Remarks
Uncabled optical fibre	3.2	IEC 60793-2-40 Category A4g		
Attenuation coefficient (cabled fibres) at 650 nm at 850 nm at 1 300 nm	5.4	IEC 60793-2-40 Category A4g ≤ 10 dB/100 m ≤ 3,3 dB/100 m ≤ 3,3 dB/100 m	IEC 60793-1-40	
Minimal modal bandwidth (uncabled fibres) at 650 nm at 850 nm at 1 300 nm	5.4	IEC 60793-2-40 Category A4g 800 MHz over 100 m 1 880 MHz to 5 000 MHz over 100 m 1880 MHz to 5 000 MHz over 100 m	IEC 60793-1-41	
Fibre identification		IEC 60794-2-42, subclause 3.1	Visual inspection	
Cladding diameter		490 µm	IEC 60793-1-20 and IEC 60793-1-21	
<u>Environmental exposure</u>		Select test condition A or B from 3.4 in IEC 60793-2-40	IEC 60793-1-50 IEC 60793-1-51 IEC 60793-1-52	

B.7 Category A4h multimode optical fibre

(9) Characteristics	(10) IEC 60794-2-40 subclause	(11) Requirements	(12) Test methods	(13) Remarks
Uncabled optical fibre	3.2	IEC 60793-2-40 Category A4h		
Attenuation coefficient (cabled fibres) at 850 nm at 1 300 nm	5.4	IEC 60793-2-40 Category A4h ≤ 3,3 dB/100 m ≤ 3,3 dB/100 m	IEC 60793-1-40	
Minimal modal bandwidth (uncabled fibres) at 850 nm at 1 300 nm	5.4	IEC 60793-2-40 Category A4h 1 880 MHz to 5 000 MHz over 100 m 1 880 MHz to 5 000 MHz over 100 m	IEC 60793-1-41	
Fibre identification		IEC 60794-2-42, subclause 3.1	Visual inspection	
Cladding diameter		245 µm	IEC 60793-1-20/ IEC 60793-1-21	
<u>Environmental exposure</u>		Select test condition A or B from 3.4 in IEC 60793-2-40	IEC 60793-1-50 IEC 60793-1-51 IEC 60793-1-52	

B.8 Cable element

(14) Characteristics	(15) IEC 60794-2-40 Subclause	(16) Requirements	(17) Test methods	(18) Remarks
<u>Cable element</u>				
<u>Tight/semi-tight buffer</u>		IEC 60794-2-42, subclause 3.3		
<u>Slotted core</u>				
<u>Tube</u>				
Compound flow and evaporation				
Outer diameter				
<u>Ribbon</u>				
<u>Filler</u>				
<u>Insulated copper conductor</u>				
<u>Central strength member</u>				

B.9 Cable construction

(19) Characteristics	(20) IEC 60794-2 subclause	(21) Family requirements	(22) Test methods	(23) Remarks
<u>Lay-up</u>	6.2	According to detail specification	Visual inspection	
<u>Cable core</u>	6.3	According to detail specification		
<u>Strength member</u> - central - peripheral	6.4	According to detail specification	Visual inspection	
<u>Outer cable sheath</u> Material Minimum sheath thickness Outer diameter Optional protection	6.6	IEC 60794-2 subclause 6.6.3 According to detail specification According to detail specification According to detail specification	IEC 60811-1-1 IEC 60811-1-1	
<u>Sheath marking</u> Configuration, dimensions Abrasion resistance	6.7	According to detail specification According to detail specification	Visual inspection IEC 60794-1-2- E2A Or IEC 60794-1-2- E2B	Steel needle diameter d = 1,0 mm load : 4 N
<u>Sheath abrasion</u>	8.10	According to detail specification	IEC 60794-1-2- E2A	
Cable length				

B.10 Installation and operating conditions

(24) Characteristics	(25) IEC 60794-2 subclause	(26) Requirements	(27) Test methods	(28) Remarks
General requirements Bend of cable element Tube kinking Ribbons : - dimensions - separability of individual fibres from ribbon - ribbon stripping - torsion			IEC 60794-1-2-G1 IEC 60794-1-2-G7 IEC 60794-2 subclause 7.2.3.1 IEC 60794-1-2-G5 or acc. DS IEC 60794-1-2-G6	

B.11 Mechanical and environmental tests – Tests applicable

(29) Characteristics	(30) IEC 60794-2-40 subclause	(31) Family requirements	(32) Test methods	(33) Remarks
<u>Tensile performance</u>			IEC 60794-1-2-E1A	See 4.2.1
<u>Installation capability</u> (selection from the following) - bend at low temperature - repeated bending - impact - kink - torsion - flexing			IEC 60794-1-2-E11 IEC 60794-1-2-E6 IEC 60794-1-2-E4 IEC 60794-1-2-E10 IEC 60794-1-2-E7 IEC 60794-1-2-E8	See 4.2.6 See 4.2.5 See 4.2.3 See 4.2.9 See 4.2.8 See 4.2.7
Cable bend			IEC 60794-1-2-E11A	See 4.2.4
<u>Crush</u>			IEC 60794-1-2-E3	See 4.2.2
<u>Temperature cycling</u>		According to detail specification	IEC 60794-1-2-F1	See 4.3.1
<u>Ageing</u> - coating adhesion stability - finished cable			IEC 60794-1-2-E5	

B.12 Additional requirements for industrial premises

Cables intended for industrial premises installations as defined in ISO/IEC 24702 and related standards may require the specification of additional tests to ensure their suitability in the applicable environments defined by the mechanical, ingress, climatic and chemical and electromagnetic (MICE) classification. For supplemental guidance see the future IEC/TR 62362. Required tests may be selected from the following table.

Characteristics	MICE classification of ISO/IEC 24702 and related standards ^{a, b}			Test method
	M₁	M₂	M₃	
MECHANICAL				
Shock/bump ^a				
Peak acceleration	40 m/s ²	100 m/s ²	250 m/s ²	IEC 60721-3-3
Vibration ^a				
Displacement amplitude (2 Hz to 9 Hz)	1,5 mm	7,0 mm	15,0 mm	IEC 60721
Acceleration amplitude (9 Hz to 500 Hz)	5 m/s ²	20 m/s ²	50 m/s ²	IEC 60721
Tensile force (see Note 1)	As required	As required	As required	IEC 60794-1-2 Method E.1
Crush	45 N/ 25 mm	1 100 N/ 150 mm	2 200 N/ 150 mm	IEC 60794-1-2 Method E.3
Impact	1 J	10 J	30 J	IEC 60794-1-2 Method E.4
Bending (see Note 1)	As required	As required	As required	IEC 60794-1-2 Method E.6
Flexing (see Note 1)	As required	As required	As required	IEC 60794-1-2 Method E.8
Torsion (see Note 1)	As required	As required	As required	IEC 60794-1-2 Method E.7
INGRESS	I₁	I₂	I₃	
Immersion ^b	N/A	Intermittent liquid jet ≤12,5 l/min ≥ 6,3 mm/jet > 2,5 m distance	Intermittent liquid jet ≤12,5 l/min ≥ 6,3 mm/jet > 2,5 m distance and immersion ≤ 1m for ≤ 30 min	IEC 60794-1-2 Method F.3
CLIMATIC AND CHEMICAL	C₁	C₂	C₃	
Temperature cycling (ambient and rate of change)	-10°C to +60°C	-25°C to +70°C	-40°C to +70°C	IEC 60794-1-2 Method F.1
Solar radiation ^b	700 W/m ²	1 120 W/m ²	1 120 W/m ²	IEC 60721-1
Humidity ^b	5 % to 85 % (non- condensing)	5 % to 95 % (condensing)	5 % to 95 % (condensing)	IEC 60721-3-3
Liquid pollution contaminants (see Note 2)	Concentration ×10 ⁻⁶	Concentration ×10 ⁻⁶	Concentration ×10 ⁻⁶	
Sodium chloride (salt/sea water) ^b	0	< 0,3	< 0,3	IEC 60721-1

Characteristics	MICE classification of ISO/IEC 24702 and related standards ^{a, b}			Test method
Oil (dry-air concentration) ^b (for oil types see Note 1)	0	< 0,005	< 0,5	
Sodium stearate (soap) ^a	None	> 5 × 10 ⁴ aqueous non-gelling	> 5 × 10 ⁴ aqueous gelling	ISO/IEC 24702
Gaseous pollution contaminants (see Note 2)	Mean/Peak concentration × 10 ⁻⁶	Mean/peak concentration × 10 ⁻⁶	Mean/peak concentration × 10 ⁻⁶	
Hydrogen sulphide ^a	<0,003/<0,01	<0,05/<0,5	<10/<50	IEC 60654-4
Sulphur dioxide ^a	<0,01/<0,03	<0, 1/<0,3	<5/<15	IEC 60654-4
Sulphur trioxide ^a (ffs)	<0,01/<0,03	<0, 1/<0,3	<5/<15	IEC 60654-4
Chlorine wet (>50 % humidity) ^b	<0,0005 /<0,001	<0,005/<0,03	<0,05/<0,3	IEC 60654-4
Chlorine dry (<50 % humidity) ^b	<0,002/<0,01	<0,02/<0,1	<0,2/<1,0	IEC 60654-4
Hydrogen chloride ^b	0/<0,06	<0,06/<0,3	<0,6/<3,0	IEC 60654-4
Hydrogen fluoride ^b	<0,001/<0,005	<0,01/<0,05	<0,1/<1,0	IEC 60654-4
Ammonia ^b	<1,0/<5,0	<10,0/<50,0	<50/<250	IEC 60654-4
Oxides of nitrogen ^b	<0,05/<0,1	<0,5/<1,0	<5/<10	IEC 60654-4
Ozone ^b	<0,002/<0,005	<0,025/<0,05	<0,1/<1	IEC 60654-4
ELECTRO-MAGNETIC (for cables containing electrically conductive elements)				
	E₁	E₂	E₃	
Electrostatic discharge – Contact (0,667 µC) ^a	4 kV	4 kV	4 kV	IEC 61326
Electrostatic discharge – Air (0,132 µC) ^a	8 kV	8 kV	8 kV	IEC 61326
Radiated RF – AM ^a	3 V/m @ (80 to 1 000) MHz 3 V/m @ (1 400 to 2 000) MHz 1 V/m @ (2 000 to 2 700) MHz	3 V/m @ (80 to 1 000) MHz 3 V/m @ (1 400 to 2 000) MHz 1 V/m @ (2 000 to 2 700) MHz	10 V/m @ (80 to 1 000) MHz 3 V/m @ (1 400 to 2 000) MHz 1 V/m @ (2 000 to 2 700) MHz	IEC 61000-2-5
Conducted RF ^a	3 V@ 150 kHz to 80 MHz	3 V@ 150 kHz to 80 MHz	10 V@ 150 kHz to 80 MHz	IEC 61000-6-2
EFT/B (comms) ^b	500 V	1 000 V	1 000 V	IEC 61326
Surge (transient ground potential difference) - signal, line to earth ^b	500 V	1 000 V	1 000 V	IEC 61000-6-2

Characteristics	MICE classification of ISO/IEC 24702 and related standards ^{a, b}			Test method
Magnetic field (50/60 Hz) ^b	1 A/m	3 A/m	30 A/m	IEC 61326
<p>NOTE 1 This aspect of environmental classification is installation-specific and should be considered in association with IEC 61918 and the appropriate component specification.</p> <p>NOTE 2 A single dimensional characteristic, i.e. Concentration $\times 10^{-6}$, was chosen to unify limits from different standards.</p>				
<p>^a Subclause 6.2.2 of ISO/IEC 24702 provides the basis for the requirement.</p> <p>^b Annex F of ISO/IEC 24702 explains the background to classification boundaries.</p>				

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IEC 60794-2-40:2003, *Optical fibre cables – Part 2-40: Indoor cables – Family specification for simplex and duplex cables with buffered A4 fibres*

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

IEC/TR 62362, *Guide on the selection of optical fibre cable specifications relative to mechanical, ingress, climatic or electromagnetic characteristics*¹

¹ Under consideration.

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
P.O. Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch