IEC 60794-2-22

Edition 2.0 2023-03
REDLINE VERSION

INTERNATIONAL STANDARD

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Optical fibre cables –
Part 2-22: Indoor cables – Detail specification for multi-simplex breakout optical cables ~~to be terminated with connectors~~ for use in terminated breakout cable assemblies

IEC 60794-2-22:2023-03 RLV(en)

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OPTICAL FIBRE CABLES –

Part 2-22: Indoor cables – Detail specification for multi-simplex breakout optical cables ~~to be terminated with connectors~~ for use in terminated breakout cable assemblies

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60794-2-22:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60794-2-22 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

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

a) changed partly the wording in the title and the scope to align with IEC 60794-2-50, IEC 60794-2-23 and IEC 60794-2-24;
b) added IEC 60793-1-40, IEC 60793-1-46 and IEC 60794-1-2 to the normative references;
c) deleted reference to IEC 60794-2-51;
d) added the definition of terminated breakout cable assembly;
e) changed the number of bend cycles from 10 to 3 to harmonise with IEC 60794-2-50;
f) changed test parameters for temperature cycling to harmonise with IEC 60794-2-50;
g) added maximum attenuation requirements after temperature cycling;
h) replaced the text for the fire performance with an improved description.

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

Draft	Report on voting
86A/2285/FDIS	86A/2317/RVD

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The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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OPTICAL FIBRE CABLES –

Part 2-22: Indoor cables – Detail specification for multi-simplex breakout optical cables ~~to be terminated with connectors~~ for use in terminated breakout cable assemblies

1 Scope

This part of IEC 60794 is a detail specification and specifies breakout optical cables with multiple simplex optical fibre cables for ~~termination with connectors~~ use in terminated breakout cable assemblies.

~~The requirements of the sectional specification IEC 60794-2 are applicable to cables covered by this document.~~

~~The requirements of the family specification IEC 60794-2-20 are applicable to breakout cables to be installed without terminated connectors.~~

~~Fan-out kits used for cable systems are not covered by this document.~~

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 60793-1-46, *Optical fibres – Part 1-46: Measurement methods and test procedures – Monitoring of changes in optical transmittance*

~~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 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 – General guidance*

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

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

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

IEC 60794-2-20, *Optical fibre cables – Part 2-20: Indoor cables – Family specification for multi-fibre optical cables*

IEC 60794-2-50, *Optical fibre cables – Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies*

~~IEC 60794-2-51, *optical fibre cables – Part 2-51: Indoor cables – Detail specification for simplex and duplex cables for use in cords for controlled environment*~~

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60794-1-1 and the following apply.

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

3.1.1
multi-simplex breakout cable
cable consisting of multiple simplex optical fibre cables, stranded together under a common sheath, which may be stranded in one layer or multi-layers or bundled to subunits around a central member as necessary

3.1.2
simplex optical fibre cable
cable including a primary or secondary coated fibre that is surrounded with either metallic or non-metallic strength members within a sheath of suitable material

3.1.3
terminated breakout cable assembly
breakout cable terminated with connectors

4 General

The requirements of the sectional specification IEC 60794-2 are applicable to cables covered by this document.

The requirements of the family specification IEC 60794-2-20 are applicable to breakout cables to be installed without terminated connectors.

Fan-out kits used for cable systems are not covered by this document.

5 Construction

5.1 General

In addition to the constructional requirements in IEC 60794-2 and IEC 60794-2-20, the considerations in Clause 5 apply to multi-simplex breakout cables for use in terminated breakout cable assemblies.

It is not the intention of this document to specify the finished terminated breakout cable assembly complete with terminations.

There shall be no fibre splice in any delivery length. It shall be possible to identify each individual fibre throughout the length of the cable.

5.2 Optical fibres

~~Multi-mode or single-mode optical fibres meeting the requirements of IEC 60793-2-10 sub-categories A1a and A1b and IEC 60793-2-50 class B shall be used. Other fibre types may be used if agreed upon between the customer and the supplier. In this case, the mechanical and environmental requirements shall be agreed upon between the customer and the supplier.~~

Multimode or single-mode optical fibres shall meet the requirements of IEC 60793-2-10 sub-categories A1-OM1 or A1-OM2 to A1-OM5 or IEC 60793-2-50 class B.

5.3 Simplex optical fibre cables

~~The simplex cables shall meet the requirements of the family specification IEC 60794-2-50 and the detail specification IEC 60794-2-51.~~

The simplex optical fibre cables shall meet the requirements of the family specification IEC 60794-2-50. The buffer type, the buffer diameter and simplex optical fibre cable diameter shall be according to the relevant specification or agreed between customer and supplier.

5.4 Strength and anti-buckling members

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

The cable shall be designed with sufficient strength members to meet the requirements of this document.

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.

5.5 Ripcord

If required, a ripcord may be provided beneath the cable sheath. The functionality of the ripcord shall be tested according to IEC 60794-1-21, method E25.

5.6 Cable sheath

The cable shall have an overall protective sheath. The cable diameter shall be ~~specified in the relevant detail specification (or product specification)~~ agreed between customer and supplier.

5.7 Sheath marking

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

5.8 Examples of cable constructions

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

6 Tests

6.1 General

Compliance with the specification requirements shall be verified by carrying out tests selected from Clause 6. It is not intended that all tests be carried out in all cases. The tests to be applied and the frequency of testing ~~shall~~ need to be agreed upon between the customer and the supplier.

As a general requirement for the tests specified in this document, the spirit is to keep "no change in attenuation" criteria at the end of each evaluation, although the parameters specified in this document may be affected by measurement uncertainty arising either from measurement errors or calibration errors. The optical total uncertainty of measurement for this document shall be ±0,05 dB for single-mode fibres and ±0,2 dB for multimode fibres. Any measured value within this range shall be considered as "no change in attenuation".

Single-mode cables shall be measured at 1 550 nm and multimode cables at 1 300 nm. Measurement at other wavelengths may be agreed between the customer and the supplier. Measurements of attenuation shall be carried out according to IEC 60793-1-40. Change in attenuation measurements shall be carried out according to IEC 60793-1-46. The maximum change in attenuation refers to the ± deviation from the original value at ambient temperature before the test.

NOTE The optimized wavelength for multimode fibres A1-OM3 and A1-OM4 is 850 nm and for A1-OM5 fibre, the targeted operational wavelength range is in the vicinity of 850 nm to 950 nm.

If cable loops are used within a test to fix the ends of a cable, the loop diameter shall be equal or greater than the specified minimum cable bend diameter to avoid cable damage and excessive mode filtering in multimode fibre.

Unless otherwise specified, all tests shall be carried out at ~~ambient temperature, as described in IEC 60793-1-1~~ expanded test conditions as specified in IEC 60794-1-2.

~~The following tests can be performed on a short sample length of cable which is still a part of a longer length. Thus, it becomes possible to detect permanent changes in attenuation. The measuring wavelength and maximum value of the attenuation change for longer lengths shall be agreed upon between the customer and the supplier.~~

6.2 Dimensions

The fibre dimensions and tolerances shall be verified in accordance with IEC 60793-1-20 or IEC 60793-1-21. The diameter of the buffer, simplex optical fibre cable and of the cable, as well as the thickness of the sheath, shall be measured in accordance with the methods of IEC 60811-202 and IEC 60811-203.

6.3 Mechanical requirements

6.3.1 General

The cable shall fulfil the mechanical requirements of tensile, crush, impact and repeated bending according to IEC 60794-2-20. ~~The exceptions to IEC 60794-2-20 are defined in the following clauses.~~ The specific requirements for this cable type are defined in 6.3.

6.3.2 ~~Cable~~ Bend

Method:	IEC 60794-1-21, E11A ~~(helix method)~~
Mandrel diameter:	20 times cable diameter
Number of turns ~~per helix~~:	6
Number of cycles:	~~10~~ 3
Cable sample:	See Annex A for details.
Prior to bending:	At both ends of the sample, all the components of each simplex optical fibre cable shall be fixed together, for example with ~~loops~~ clamps or glue. The simplex optical fibre cables shall not be fixed to the cable sheath and to each other. See Annex A.
Bend location:	The section in the middle of the breakout cable length shall be bent.
Requirements for cabled single-mode fibres:	Maximum attenuation change of 0,20 dB during the test ~~≤ 0,20 dB~~. No change in attenuation after the test.
Requirements for cabled multimode fibres:	Maximum attenuation change of 0,4 dB during the test ~~≤ 0,4 dB~~. No change in attenuation after the test.

6.4 Environmental requirements – Temperature cycling

~~Method:~~ ~~IEC 60794-1-22, F12~~

~~**Table 1 – Temperatures**~~

~~Category [a]~~	~~Low temperature T_A~~	~~High temperature T_B~~
	~~°C~~	~~°C~~
~~C~~	~~-10~~	~~+60~~
~~U~~	~~-25~~	~~+70~~
~~O~~	~~-40~~	~~+75~~

~~[a] The acronyms for the categories are according to IEC 61753-1. A suitable category should be selected according to the application. Category C, for example, is for the appropriate implementation of ISO/IEC 11801.~~

~~Soak time:~~ ~~IEC 60794-1-22, F1~~

~~Number of cycles:~~ ~~6~~

~~Cable sample:~~ ~~See Annex A for details~~

~~Prior to temperature cycling:~~ ~~At both ends of the sample, all the components of each simplex cable shall be fixed together e.g. with loops or glue. The simplex cables shall not be fixed to the cable sheath and to each other. See Annex A.~~

~~Requirements for cabled single-mode fibres:~~ ~~Maximum attenuation change ≤ 0,50 dB~~

~~Requirements for cabled multi-mode fibres:~~ ~~Maximum attenuation change ≤ 0,5 dB~~

~~The maximum increase in attenuation refers to the change of attenuation at the low and high temperature in relation to the ambient temperature before the test. Other attenuation requirements may be agreed upon between the customer and the supplier.~~

Method:	IEC 60794-1-22, F12
Cable sample:	The cable sample shall be prepared as shown in Annex A.
Prior to temperature cycling:	At both ends of the length of the cable sample, all components of each simplex optical fibre cable shall be fixed together, for example with clamps or glue. The simplex optical fibre cables shall not be fixed to the cable sheath and to each other. See Annex A.
Temperatures:	For indoor breakout cables, –10 °C and +60 °C are the recommended low and high temperatures. Specific operating temperatures can be agreed between customer and supplier. Table 1 gives the preferred operating temperatures.

Table 1 – Preferred low and high temperatures

Low temperature T_A °C	High temperature T_B °C	Sources of temperatures (informative)		Remark
		Performance categories of connectors, components and protective housings [a]	Environmental classification of customer premises cabling [b]	
–10	+60	C	$M_xI_xC_1E_x$	Recommended
–10	+70	C^{HD}	-	
–25	+70	OP	$M_xI_xC_2E_x$	
–25	+85	OP^{HD}	-	

A suitable operating service environment (performance category) or environmental classification should be selected according to the application. A complete list of operating service environments can be found in IEC 60794-1-1.

[a] Included in IEC 61753-1. The abbreviations represent:

C: indoor controlled environment;

OP: outdoor protected environment;

HD: necessary extended upper temperature due to additional dissipation by active electronics.

[b] Included in ISO/IEC 11801-1. For an introduction to the MICE environmental classification system, use ISO/IEC TR 29106. The abbreviation MICE represents: mechanical, ingress, climatic, electromagnetic.

Soak time t_1:	1 h
Number of cycles:	5

Requirements for cabled single-mode fibres:	Maximum attenuation change of 0,50 dB during the test. No change in attenuation after test.
Requirements for cabled multimode fibres:	Maximum attenuation change of 0,5 dB dB during the test. No change in attenuation after test.

7 Transmission requirements

The transmission requirements shall be in accordance with IEC 60793-2-10 or IEC 60793-2-50 and shall be agreed upon between the customer and the supplier. The maximum cable attenuation shall comply with IEC 60794-1-1.

8 Fire performance

All cables according to this document shall pass fire performance specifications. The requirements may differ in different regions (e.g. North America, EU). But they also can differ from country to country.

NOTE 1 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. Account is also taken of applicable legislation and regulation.

IEC TR 62222 references several IEC fire performance test methods and also other test methods that ~~may~~ can be required by local or national legislation and regulation. ~~The tests to be applied, and the requirements, shall be agreed upon between the customer and the supplier, taking into account the fire hazard presented by the end use application of the terminated assembly in which the cable is intended to be used.~~ It is important that the tests to be applied fulfil the national legislation and regulation and the specific requirements by its intended use.

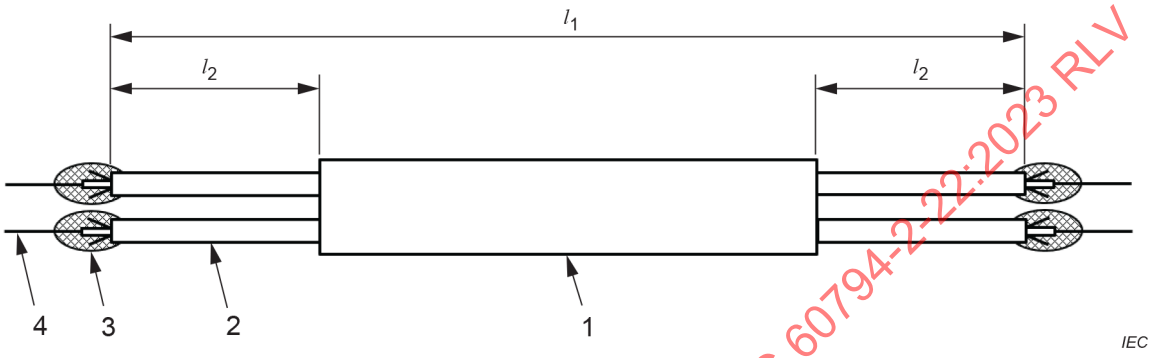
Products placed on the EU or UK market should determine whether harmonised EN 50575 is applicable after checking with local regulations.

Annex A
(normative)

Cable sample preparation for bend and temperature cycling test

The cable sample shall be prepared as shown in Figure A.1. Components of the cable shall be fixed together at the illustrated positions, for example with clamps or glue.

Dimensions in metres



l_1	l_2
10,0	1,00

Key

1 breakout cable
2 simplex optical fibre cable
3 component fixing location at simplex optical fibre cable
4 primary coated optical fibre

Figure A.1 – Cable sample preparation and lengths

Annex B
(informative)

Examples of cable constructions

Figure B.1 and Figure B.2 show examples of cable constructions.

~~B.1 Breakout cable with simplex cables~~

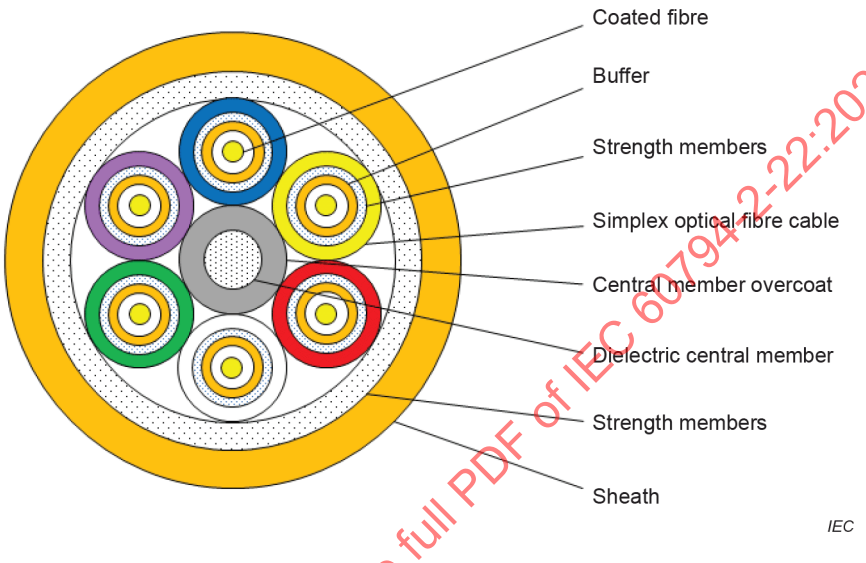


Figure B.1 – Example of a cross-section of a six-fibre breakout cable

~~B.2 Breakout cable with subunit containing simplex cables~~

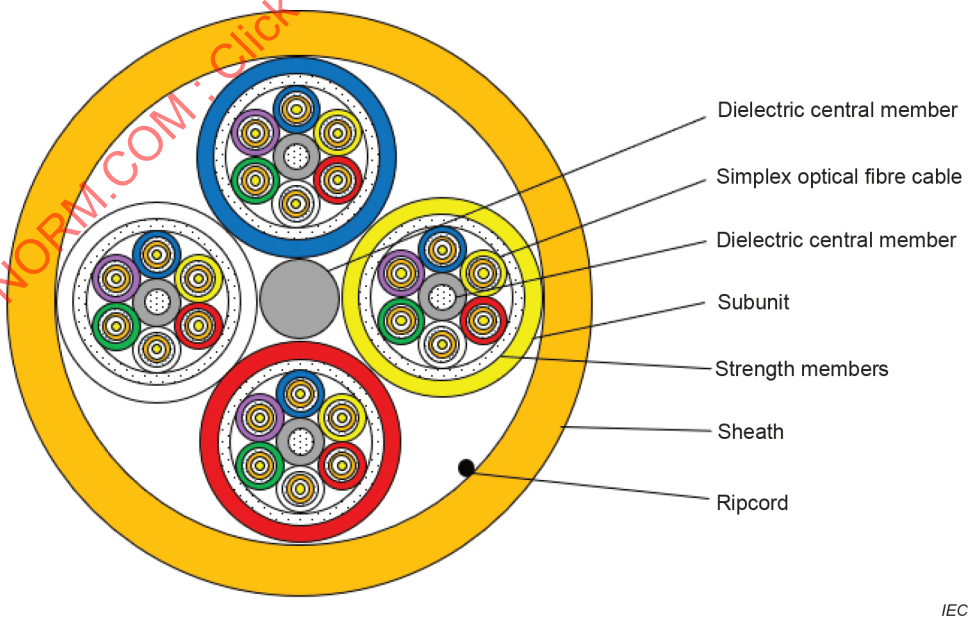


Figure B.2 – Example of a cross-section of a 24-fibre breakout cable

Bibliography

IEC 60794-2-23, *Optical fibre cables – Part 2-23: Indoor cables – Detail specification for multi-fibre cables for use in MPO connector terminated cable assemblies*[1]

IEC 60794-2-24, *Optical fibre cables – Part 2-24: Indoor cables – Detail specification for multiple multi-fibre unit cables for use in MPO connector terminated breakout cable assemblies*[2]

IEC 60794-2-51, *Optical fibre cables – Part 2-51: Indoor cables – Detail specification for simplex and duplex cables for use in cords for controlled environment*[3]

IEC 61753-1, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1: General and guidance ~~for performance standards~~*

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

IEC TR 62959, *Optical fibre cables – Shrinkage effects on cable and cable element end termination – Guidance*

ISO/IEC 11801-1, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

ISO/IEC TR 29106, *Information technology – Generic cabling – Introduction to the MICE environmental classification*

EN 50575, *Power, control and communication cables – Cables for general applications in construction works subject to reaction to fire requirements*

1 Under preparation. Stage at the time of publication: IEC/CDV 60794-2-23.

2 Under preparation. Stage at the time of publication: IEC/CDV 60794-2-24.

3 This publication has been withdrawn.

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Optical fibre cables –
Part 2-22: Indoor cables – Detail specification for multi-simplex breakout optical cables for use in terminated breakout cable assemblies

Câbles à fibres optiques –
Partie 2-22: Câbles intérieurs – Spécification particulière pour les câbles optiques épanouis simplex multiples destinés à être utilisés comme câbles assemblés épanouis équipés

IEC 60794-2-22:2023-04(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

OPTICAL FIBRE CABLES –

Part 2-22: Indoor cables – Detail specification for multi-simplex breakout optical cables for use in terminated breakout cable assemblies

1 Scope

This part of IEC 60794 is a detail specification and specifies breakout optical cables with multiple simplex optical fibre cables for use in terminated breakout cable assemblies.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60793-1-20, *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 60793-1-40, *Optical fibres – Part 1-40: Attenuation measurement methods*

IEC 60793-1-46, *Optical fibres – Part 1-46: Measurement methods and test procedures – Monitoring of changes in optical transmittance*

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 – General guidance*

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

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

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

IEC 60794-2-20, *Optical fibre cables – Part 2-20: Indoor cables – Family specification for multi-fibre optical cables*

IEC 60794-2-50, *Optical fibre cables – Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies*

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60794-1-1 and the following apply.

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

3.1.1
multi-simplex breakout cable
cable consisting of multiple simplex optical fibre cables stranded together under a common sheath, which may be stranded in one layer or multi-layers or bundled to subunits around a central member as necessary

3.1.2
simplex optical fibre cable
cable including a primary or secondary coated fibre that is surrounded with either metallic or non-metallic strength members within a sheath of suitable material

3.1.3
terminated breakout cable assembly
breakout cable terminated with connectors

4 General

The requirements of the sectional specification IEC 60794-2 are applicable to cables covered by this document.

The requirements of the family specification IEC 60794-2-20 are applicable to breakout cables to be installed without terminated connectors.

Fan-out kits used for cable systems are not covered by this document.

5 Construction

5.1 General

In addition to the constructional requirements in IEC 60794-2 and IEC 60794-2-20, the considerations in Clause 5 apply to multi-simplex breakout cables for use in terminated breakout cable assemblies.

It is not the intention of this document to specify the finished terminated breakout cable assembly complete with terminations.

There shall be no fibre splice in any delivery length. It shall be possible to identify each individual fibre throughout the length of the cable.

5.2 Optical fibres

Multimode or single-mode optical fibres shall meet the requirements of IEC 60793-2-10 sub-categories A1-OM1 or A1-OM2 to A1-OM5 or IEC 60793-2-50 class B.

5.3 Simplex optical fibre cables

The simplex optical fibre cables shall meet the requirements of the family specification IEC 60794-2-50. The buffer type, the buffer diameter and simplex optical fibre cable diameter shall be according to the relevant specification or agreed between customer and supplier.

5.4 Strength and anti-buckling members

The cable shall be designed with sufficient strength members to meet the requirements of this document.

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.

5.5 Ripcord

If required, a ripcord may be provided beneath the cable sheath. The functionality of the ripcord shall be tested according to IEC 60794-1-21, method E25.

5.6 Cable sheath

The cable shall have an overall protective sheath. The cable diameter shall be agreed between customer and supplier.

5.7 Sheath marking

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

5.8 Examples of cable constructions

Examples of typical cable constructions are shown in Annex B. Other configurations (e.g. multi-layer constructions) are not precluded if they meet the mechanical, environmental and transmission requirements given in this document.

6 Tests

6.1 General

Compliance with the specification requirements shall be verified by carrying out tests selected from Clause 6. It is not intended that all tests be carried out in all cases. The tests to be applied and the frequency of testing need to be agreed upon between the customer and the supplier.

As a general requirement for the tests specified in this document, the spirit is to keep "no change in attenuation" criteria at the end of each evaluation, although the parameters specified in this document may be affected by measurement uncertainty arising either from measurement errors or calibration errors. The optical total uncertainty of measurement for this document shall be ±0,05 dB for single-mode fibres and ±0,2 dB for multimode fibres. Any measured value within this range shall be considered as "no change in attenuation".

Single-mode cables shall be measured at 1 550 nm and multimode cables at 1 300 nm. Measurement at other wavelengths may be agreed between the customer and the supplier. Measurements of attenuation shall be carried out according to IEC 60793-1-40. Change in attenuation measurements shall be carried out according to IEC 60793-1-46. The maximum change in attenuation refers to the ± deviation from the original value at ambient temperature before the test.

NOTE The optimized wavelength for multimode fibres A1-OM3 and A1-OM4 is 850 nm and for A1-OM5 fibre, the targeted operational wavelength range is in the vicinity of 850 nm to 950 nm.

If cable loops are used within a test to fix the ends of a cable, the loop diameter shall be equal or greater than the specified minimum cable bend diameter to avoid cable damage and excessive mode filtering in multimode fibre.

Unless otherwise specified, all tests shall be carried out at expanded test conditions as specified in IEC 60794-1-2.

6.2 Dimensions

The fibre dimensions and tolerances shall be verified in accordance with IEC 60793-1-20 or IEC 60793-1-21. The diameter of the buffer, simplex optical fibre cable and of the cable, as well as the thickness of the sheath, shall be measured in accordance with the methods of IEC 60811-202 and IEC 60811-203.

6.3 Mechanical requirements

6.3.1 General

The cable shall fulfil the mechanical requirements of tensile, crush, impact and repeated bending according to IEC 60794-2-20. The specific requirements for this cable type are defined in 6.3.

6.3.2 Bend

Method:	IEC 60794-1-21, E11A
Mandrel diameter:	20 times cable diameter
Number of turns:	6
Number of cycles:	3
Cable sample:	See Annex A for details.
Prior to bending:	At both ends of the sample, all the components of each simplex optical fibre cable shall be fixed together, for example with clamps or glue. The simplex optical fibre cables shall not be fixed to the cable sheath and to each other. See Annex A.
Bend location:	The section in the middle of the breakout cable length shall be bent.
Requirements for cabled single-mode fibres:	Maximum attenuation change of 0,20 dB during the test. No change in attenuation after the test.
Requirements for cabled multimode fibres:	Maximum attenuation change of 0,4 dB during the test. No change in attenuation after the test.

6.4 Environmental requirements – Temperature cycling

Method:	IEC 60794-1-22, F12
Cable sample:	The cable sample shall be prepared as shown in Annex A.
Prior to temperature cycling:	At both ends of the length of the cable sample, all components of each simplex optical fibre cable shall be fixed together, for example with clamps or glue. The simplex optical fibre cables shall not be fixed to the cable sheath and to each other. See Annex A.
Temperatures:	For indoor breakout cables, –10 °C and +60 °C are the recommended low and high temperatures. Specific operating temperatures can be agreed between customer and supplier. Table 1 gives the preferred operating temperatures.

Table 1 – Preferred low and high temperatures

Low temperature T_A °C	**High temperature** T_B °C	**Sources of temperatures** (informative)		**Remark**
		Performance categories of connectors, components and protective housings [a]	**Environmental classification of customer premises cabling** [b]	
–10	+60	C	$M_xI_xC_1E_x$	Recommended
–10	+70	C^{HD}	-	
–25	+70	OP	$M_xI_xC_2E_x$	
–25	+85	OP^{HD}	-	

A suitable operating service environment (performance category) or environmental classification should be selected according to the application. A complete list of operating service environments can be found in IEC 60794-1-1.

[a] Included in IEC 61753-1. The abbreviations represent:

C: indoor controlled environment;

OP: outdoor protected environment;

HD: necessary extended upper temperature due to additional dissipation by active electronics.

[b] Included in ISO/IEC 11801-1. For an introduction to the MICE environmental classification system, use ISO/IEC TR 29106. The abbreviation MICE represents: mechanical, ingress, climatic, electromagnetic.

Soak time t_1:	1 h
Number of cycles:	5
Requirements for cabled single-mode fibres:	Maximum attenuation change of 0,50 dB during the test. No change in attenuation after test.
Requirements for cabled multimode fibres:	Maximum attenuation change of 0,5 dB dB during the test. No change in attenuation after test.

7 Transmission requirements

The transmission requirements shall be in accordance with IEC 60793-2-10 or IEC 60793-2-50 and shall be agreed upon between the customer and the supplier. The maximum cable attenuation shall comply with IEC 60794-1-1.

8 Fire performance

All cables according to this document shall pass fire performance specifications. The requirements may differ in different regions (e.g. North America, EU). But they also can differ from country to country.

NOTE 1 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. Account is also taken of applicable legislation and regulation.

IEC TR 62222 references several IEC fire performance test methods and also other test methods that can be required by local or national legislation and regulation. It is important that the tests to be applied fulfil the national legislation and regulation and the specific requirements by its intended use.

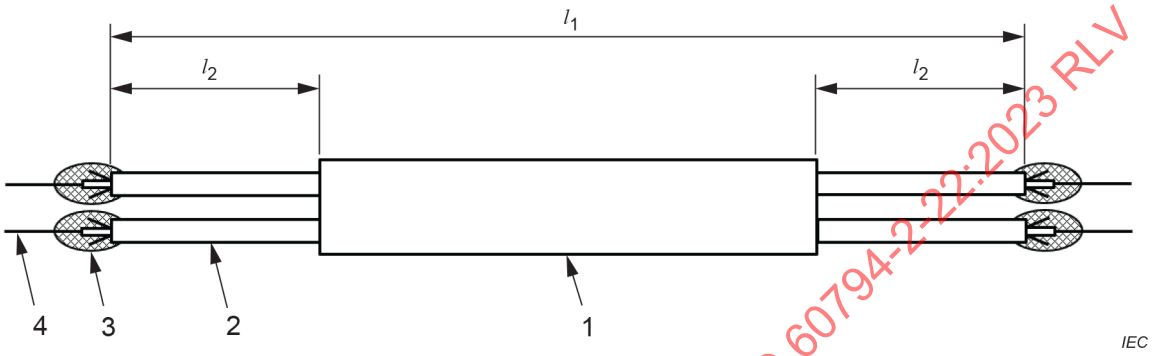
Products placed on the EU or UK market should determine whether harmonised EN 50575 is applicable after checking with local regulations.

Annex A
(normative)

Cable sample preparation for bend and temperature cycling test

The cable sample shall be prepared as shown in Figure A.1. Components of the cable shall be fixed together at the illustrated positions, for example with clamps or glue.

Dimensions in metres



l_1	l_2
10,0	1,00

Key

1 breakout cable
2 simplex optical fibre cable
3 component fixing location at simplex optical fibre cable
4 primary coated optical fibre

Figure A.1 – Cable sample preparation and lengths

Annex B
(informative)

Examples of cable constructions

Figure B.1 and Figure B.2 show examples of cable constructions.

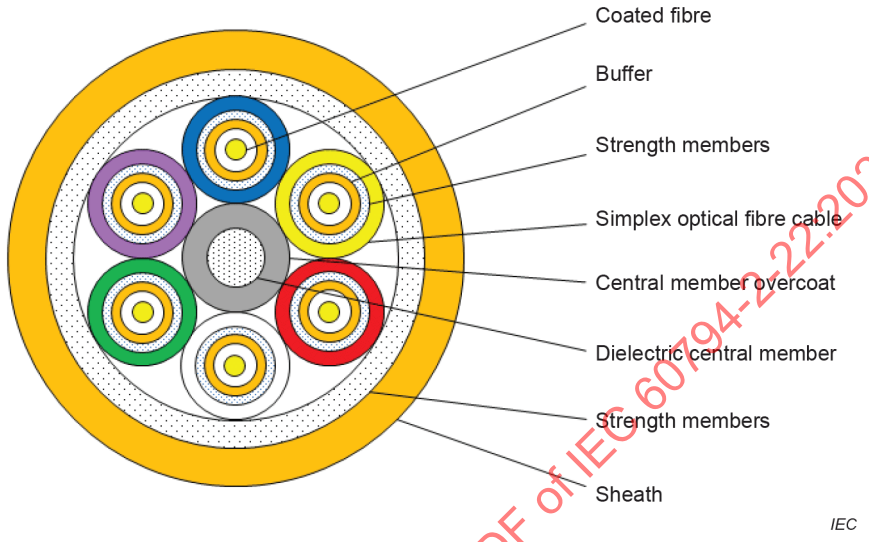


Figure B.1 – Example of a cross-section of a six-fibre breakout cable

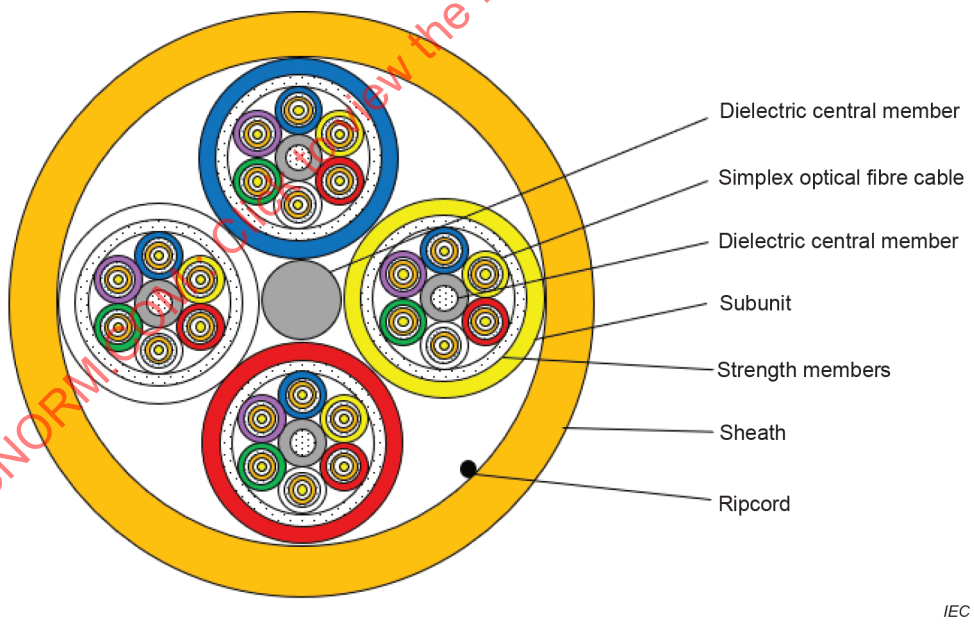


Figure B.2 – Example of a cross-section of a 24-fibre breakout cable

Bibliography

IEC 60794-2-23, *Optical fibre cables – Part 2-23: Indoor cables – Detail specification for multi-fibre cables for use in MPO connector terminated cable assemblies*[1]

IEC 60794-2-24, *Optical fibre cables – Part 2-24: Indoor cables – Detail specification for multiple multi-fibre unit cables for use in MPO connector terminated breakout cable assemblies*[2]

IEC 60794-2-51, *Optical fibre cables – Part 2-51: Indoor cables – Detail specification for simplex and duplex cables for use in cords for controlled environment*[3]

IEC 61753-1, *Fibre optic interconnecting devices and passive components – Performance standard – Part 1: General and guidance*

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

IEC TR 62959, *Optical fibre cables – Shrinkage effects on cable and cable element end termination – Guidance*

ISO/IEC 11801-1, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

ISO/IEC TR 29106, *Information technology – Generic cabling – Introduction to the MICE environmental classification*

EN 50575, *Power, control and communication cables – Cables for general applications in construction works subject to reaction to fire requirements*

1 Under preparation. Stage at the time of publication: IEC/CDV 60794-2-23.

2 Under preparation. Stage at the time of publication: IEC/CDV 60794-2-24.

3 This publication has been withdrawn.

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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CÂBLES À FIBRES OPTIQUES –

Partie 2-22: Câbles intérieurs – Spécification particulière pour les câbles optiques épanouis simplex multiples destinés à être utilisés comme câbles assemblés épanouis équipés

AVANT-PROPOS

1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
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4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
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7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
9) L'attention est attirée sur le fait que certains des éléments du présent document de l'IEC peuvent faire l'objet de droits de brevet. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

L'IEC 60794-2-22 a été établie par le sous-comité 86A: Fibres et câbles, du comité d'études 86 de l'IEC: Fibres optiques. Il s'agit d'une Norme internationale.

Cette deuxième édition annule et remplace la première édition parue en 2016. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) modification partielle de la formulation du titre et du domaine d'application à des fins d'harmonisation avec l'IEC 60794-2-50, l'IEC 60794-2-23 et l'IEC 60794-2-24;

b) ajout de l'IEC 60793-1-40, l'IEC 60793-1-46 et l'IEC 60794-1-2 aux références normatives;

c) suppression de la référence à l'IEC 60794-2-51;

d) ajout de la définition des câbles assemblés épanouis équipés;

e) modification du nombre de cycles en courbure de 10 à 3 aux fins d'harmonisation avec l'IEC 60794-2-50;

f) modification des paramètres de l'essai des cycles de températures aux fins d'harmonisation avec l'IEC 60794-2-50;

g) ajout des exigences d'affaiblissement maximal après les cycles de températures;

h) remplacement du texte relatif au comportement au feu par une description améliorée.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
86A/2285/FDIS	86A/2317/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications.

Une liste de toutes les parties de la série IEC 60794, publiées sous le titre général *Câbles à fibres optiques*, se trouve sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

IMPORTANT – Le logo 'colour inside' qui se trouve sur la page de couverture de cette publication indique qu'elle contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer ce document en utilisant une imprimante couleur.

CÂBLES À FIBRES OPTIQUES –

Partie 2-22: Câbles intérieurs – Spécification particulière pour les câbles optiques épanouis simplex multiples destinés à être utilisés comme câbles assemblés épanouis équipés

1 Domaine d'application

La présente partie de l'IEC 60794 est une spécification particulière pour câbles optiques épanouis comprenant des câbles à fibres optiques simplex multiples destinés à être utilisés comme câbles assemblés épanouis équipés.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60793-1-20, *Fibres optiques – Partie 1-20: Méthodes de mesure et procédures d'essai – Géométrie de la fibre*

IEC 60793-1-21, *Fibres optiques – Partie 1-21: Méthodes de mesure et procédures d'essai – Géométrie du revêtement*

IEC 60793-1-40, *Fibres optiques – Partie 1-40: Méthodes de mesure et procédures d'essai - Affaiblissement*

IEC 60793-1-46, *Fibres optiques – Partie 1-46: Méthodes de mesure et procédures d'essai – Contrôle des variations du facteur de transmission optique*

IEC 60793-2-10, *Fibres optiques – Partie 2-10: Spécifications de produits – Spécification intermédiaire pour les fibres multimodales de catégorie A1*

IEC 60793-2-50, *Fibres optiques – Partie 2-50: Spécifications de produits – Spécification intermédiaire pour les fibres unimodales de classe B*

IEC 60794-1-1, *Câbles à fibres optiques – Partie 1-1: Spécification générique – Généralités*

IEC 60794-1-2, *Câbles à fibres optiques – Partie 1-2: Spécification générique – Procédures fondamentales d'essais des câbles optiques – Recommandations générales*

IEC 60794-1-21, *Câbles à fibres optiques – Partie 1-21: Spécification générique – Procédures fondamentales d'essais des câbles optiques – Méthodes d'essai mécanique*

IEC 60794-1-22, *Câbles à fibres optiques – Partie 1-22: Spécification générique – Modes opératoires de base applicables aux essais des câbles optiques – Méthodes d'essais d'environnement*

IEC 60794-2, *Câbles à fibres optiques – Partie 2: Câbles intérieurs – Spécification intermédiaire*

IEC 60794-2-20, *Câbles à fibres optiques – Partie 2-20: Câbles intérieurs – Spécification de famille pour les câbles optiques multifibres*

IEC 60794-2-50, *Câbles à fibres optiques – Partie 2-50: Câbles intérieurs – Spécification de famille pour les câbles simplex et duplex utilisés dans les ensembles de câbles équipés*

IEC 60811-202, *Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux non métalliques – Partie 202: Essais généraux – Mesure de l'épaisseur des gaines non métalliques*

IEC 60811-203, *Câbles électriques et à fibres optiques – Méthodes d'essai pour les matériaux non métalliques – Partie 203: Essais généraux – Mesure des dimensions extérieures*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 60794-1-1, ainsi que les suivants, s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1.1
câble épanoui simplex multiple
câble constitué de plusieurs câbles à fibres optiques simplex, toronnés dans une gaine commune, qui peuvent être toronnés en une ou plusieurs couches ou être mis en faisceaux pour constituer des unités secondaires autour d'un élément central si nécessaire

3.1.2
câble à fibres optiques simplex
câble comportant une fibre sous revêtement primaire ou secondaire entourée d'éléments de renfort métalliques ou non métalliques à l'intérieur d'une gaine constituée d'un matériau approprié

3.1.3
câble assemblé épanoui équipé
câble épanoui équipé d'un connecteur

4 Généralités

Les exigences de la spécification intermédiaire IEC 60794-2 sont applicables aux câbles couverts par le présent document.

Les exigences de la spécification de famille IEC 60794-2-20 sont applicables aux câbles épanouis destinés à être installés sans connecteurs d'extrémité.

Les kits d'éclatement utilisés dans les systèmes de câbles ne relèvent pas du présent document.

5 Construction

5.1 Généralités

Outre les exigences de construction de l'IEC 60794-2 et de l'IEC 60794-2-20, les considérations décrites dans l'Article 5 s'appliquent aux câbles épanouis simplex multiples destinés à être utilisés comme câbles assemblés épanouis équipés.

L'objet du présent document n'est pas de spécifier les câbles assemblés épanouis, équipés de leurs connecteurs.

Aucune longueur de livraison ne doit comporter d'épissure de fibre. Il doit être possible d'identifier chaque fibre individuellement sur toute la longueur du câble.

5.2 Fibres optiques

Les fibres optiques multimodales ou unimodales utilisées doivent être conformes aux exigences des sous-catégories A1-OM1 ou A1-OM2 à A1-OM5 de l'IEC 60793-2-10 ou de la catégorie B de l'IEC 60793-2-50.

5.3 Câbles à fibres optiques simplex

Les câbles à fibres optiques simplex doivent être conformes aux exigences de la spécification de famille IEC 60794-2-50. Le type et le diamètre du revêtement protecteur ainsi que le diamètre du câble à fibres optiques simplex doivent être conformes à la spécification applicable ou faire l'objet d'un accord entre le client et le fournisseur.

5.4 Éléments de renfort et d'antidéformation

La conception des câbles doit comprendre suffisamment d'éléments de renfort pour satisfaire aux exigences du présent document.

Les éléments de renfort et/ou d'antidéformation peuvent être métalliques ou non métalliques, et peuvent être situés dans le cœur du câble et/ou sous la gaine et/ou à l'intérieur de la gaine.

5.5 Filin de déchirement

Si cela est exigé, un filin de déchirement peut être placé sous la gaine du câble. La fonctionnalité du filin de déchirement doit être soumise à l'essai conformément à la méthode E25 de l'IEC 60794-1-21.

5.6 Gaine du câble

Le câble doit posséder une gaine de protection intégrale. Le diamètre du câble doit faire l'objet d'un accord entre le client et le fournisseur.

5.7 Marquage de la gaine

Si cela est exigé, le câble doit comporter le marquage conforme à l'accord passé entre le client et le fournisseur.

5.8 Exemples de constructions de câbles

Des exemples de constructions de câbles typiques sont donnés à l'Annexe B. D'autres configurations (par exemple, des constructions multicouches) ne sont pas exclues si elles satisfont aux exigences mécaniques, environnementales et de transmission qui figurent dans le présent document.