

INTERNATIONAL STANDARD



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



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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.

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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 $\pm 0,05$ dB for single-mode fibres and $\pm 0,2$ 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 $\pm$ 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 60793-1-4~~ 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 $\leq 0,50$ dB~~

~~Requirements for cabled multi-mode fibres:~~ ~~Maximum attenuation change $\leq 0,5$ 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, $-10\text{ }^{\circ}\text{C}$ and $+60\text{ }^{\circ}\text{C}$ 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 $^{\circ}\text{C}$	High temperature T_B $^{\circ}\text{C}$	Sources of temperatures (informative)		Remark
		Performance categories of connectors, components and protective housings ^a	Environmental classification of customer premises cabling ^b	
-10	+60	C	$M_x I_x C_1 E_x$	Recommended
-10	+70	C^{HD}	-	
-25	+70	OP	$M_x I_x C_2 E_x$	
-25	+85	OP^{HD}	-	
<p>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.</p> <p>^a Included in IEC 61753-1. The abbreviations represent:</p> <p>C: indoor controlled environment;</p> <p>OP: outdoor protected environment;</p> <p>HD: necessary extended upper temperature due to additional dissipation by active electronics.</p> <p>^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.</p>				

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.

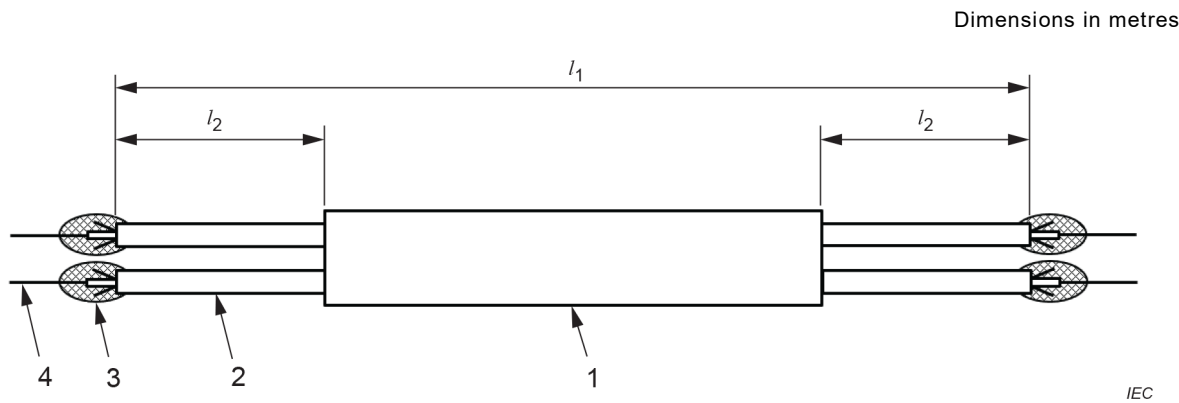
IEC TR 62222 references several IEC fire performance test methods and also other test methods that ~~may~~ can be required by local or national legislation and regulation. ~~The tests to be applied, and the requirements, shall be agreed upon between the customer and the supplier, taking into account 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.



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