IEC 60794-2-24

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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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

Câbles à fibres optiques –
Partie 2-24: Câbles intérieurs – Spécification particulière pour les câbles à plusieurs unités multifibres utilisés dans les câbles assemblés épanouis équipés de connecteurs MPO

IEC 60794-2-24:2024-01 (en-fr)

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

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

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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

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IEC 60794-2-24 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

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

Draft	Report on voting
86A/2391/FDIS	86A/2413/RVD

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

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

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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

1 Scope

This part of IEC 60794 is a detail specification and specifies indoor multiple multi-fibre unit cables for use in MPO (multi-fibre push on) connector 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 60794-1-31, *Optical fibre cables – Part 1-31: Generic specification – Optical cable elements – Optical fibre ribbon*

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

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

IEC 60794-2-23, *Optical fibre cables – Part 2-23: Indoor cables – Detailed specification for multi-fibre cables for use in MPO connector 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 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
multi-fibre unit
cable element in cable core that contains and packages multiple coated fibres

Note 1 to entry: A multi-fibre unit might be

- a sheath/tube construction, loosely or not,
- a fibre bundle with tie yarn,
- a ribbon structure, in accordance with IEC 60794-1-31, or
- other possible constructions.

4 Construction

4.1 General

In addition to the constructional requirements in IEC 60794-2 and IEC 60794-2-20, the following considerations apply to multiple multi-fibre unit cables for use in MPO connector terminated breakout cable assemblies.

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

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

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

4.2 Optical fibres

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.

NOTE The linear coefficient of optical fibre attenuation and attenuation point discontinuity might be affected by the cable manufacturing process. Maximum values for these optical characteristics can be agreed between the customer and the supplier.

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4.3 Multi-fibre unit

A multi-fibre unit contains a number of primary coated fibres and can be used as a breakout branch directly or with some further protections. The fibre number in a multi-fibre unit shall be in accordance with fibre number of the connector which the unit is to be terminated with.

A multiple multi-fibre unit cable can contain several multi-fibre units. The multi-fibre units in the cable core shall be identifiable by appropriate means (e.g., numbers, rings, colour, etc.).

If the multi-fibre units are to be directly used as breakout branches, the dimensions of the multi-fibre units and tolerance values shall be specified in relevant specification. The multi-fibre units shall meet the requirements of cables for cords in IEC 60794-2-23.

4.4 Stranded core

The multi-fibre units can be stranded together with or without a central member. For the sake of preserving cable geometry, some units may be "filler" or "empty" elements not containing optical fibres.

4.5 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 between the customer and the supplier.

The strength and/or anti-buckling members may be either metallic or non-metallic and may be located in the cable core and/or under the sheath and/or in the sheath. A multi-fibre unit which has a sheath/tube and to be used directly as a breakout branch should contain enough strength members.

4.6 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.

4.7 Cable sheath

The cable shall have an overall protective sheath. The outer dimensions, sheath thickness of the cable and tolerance values shall be specified in relevant specification.

4.8 Sheath marking

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

4.9 Examples of cable constructions

Examples of cable constructions are shown in Annex B. Other configurations are not precluded if they meet the mechanical, environmental and transmission requirements given in this document.

5 Tests

5.1 General

Compliance with the specification requirements shall be verified by carrying out tests selected from 5.2 to 5.4. 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 between the customer and the supplier.

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As a general requirement for the tests specified in this document, unless otherwise specified, 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 multi-mode fibres. Any measured value within this range shall be considered as "no change in attenuation".

Single-mode fibre cables are measured at 1 550 nm or 1 625 nm and the measuring wavelength shall be agreed between the customer and supplier. Multimode fibre cables are measured at 850 nm or 1 300 nm and the measuring wavelength shall be agreed between the customer and supplier. Measurements of attenuation shall be carried out according to IEC 60793-1-40. Measurements of changes in attenuation shall be carried out according to IEC 60793-1-46.

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 multi-mode fibre.

Unless otherwise specified, all tests shall be carried out at expanded test conditions, as described 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 between the customer and the supplier.

5.2 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 tube, the outer dimensions of the cable, as well as the thickness of the sheaths/tubes of the multi-fibre units and the cable sheath, shall be measured in accordance with the methods of IEC 60811-202 and IEC 60811-203.

5.3 Mechanical requirements

5.3.1 General

The cable shall fulfil the mechanical requirements of tensile and crush according to IEC 60794-2-20. Other mechanical requirements are defined in 5.3.2 to 5.3.6.

5.3.2 Impact

Method:	IEC 60794-1-21, E4
Radius of striking surface:	300 mm, minimum
Impact energy:	0,5 J for cables with diameter ≤ 2,0 mm;
	1,0 J for cables with diameter > 2,0 mm
Number of impacts:	3, each one impact per test location
Length between test locations:	500 mm
Requirements:	no change in attenuation after the test. There shall be no visible damage to the cable elements. Any flattening of cable elements is not considered as damage.

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5.3.3 Bending

Method:	IEC 60794-1-21, E11A
Mandrel diameter:	20 times cable diameter, but not less than 60 mm
Number of turns:	6
Number of cycles:	10
Cable sample:	See Annex A for details
Prior to bending:	at both ends of the sample, elements of the cable shall be fixed together at certain positions, e.g. with clamps or glue. See Annex A.
Bend location:	the section in the middle of the cable length shall be bent.
Requirements for cabled single-mode fibres:	maximum attenuation change during the test ≤ 0,20 dB. No change in attenuation after the test.
Requirements for cabled multi-mode fibres:	maximum attenuation change during the test ≤ 0,4 dB. No change in attenuation after the test.
Requirements for cable:	there shall be no damage to the cable elements. Any flattening of cable elements is not considered as damage.

5.3.4 Repeated bending

Method:	IEC 60794-1-21, E6
Bending radius:	20 times cable diameter, but not less than 30 mm
Number of cycles:	25
Mass of weights:	sufficient to contour the apparatus, e.g., 40 N
Requirements:	no change in attenuation after the test. There shall be no damage to the cable elements. Any flattening of cable elements is not considered as damage.

5.3.5 Torsion

Method:	IEC 60794-1-21, E7
Number of cycles:	10
Distance between fixed and rotation clamp:	125 times cable diameter but not less than 0,3 m and not greater than 2,0 m
Tension load:	sufficient to keep the sample straight, e.g.,40 N
Requirements for cabled single-mode fibres:	maximum attenuation change during the test ≤ 0,20 dB, No change in attenuation after the test
Requirements for cabled multi-mode fibres:	maximum attenuation change during the test ≤ 0,4 dB, No change in attenuation after the test.
Requirements for cable:	there shall be no damage to the cable elements.

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