

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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

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



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies

FOREWORD

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International Standard IEC 60794-2-50 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

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

- a) update of the normative references;
- b) review and update of parameters and requirements for mechanical tests and environmental tests;
- c) Annex B has been removed and test method for sheath pull-off force evaluation refers to IEC 60794-1-21, method E21;
- d) Annex C has been removed and test method for sheath shrinkage evaluation refers to IEC 60794-1-22, method F11;

- e) Annex D has been removed and test method for buffered fibre movement under compression refers to IEC 60794-1-21, method E22;
- f) Annex E has been removed and test method for temperature cycling evaluation refers to IEC 60794-1-22, method F12;
- g) fibre type designations have been updated and the new wideband MM fibre is included as an option.

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

FDIS	Report on voting
86A/1972/FDIS	86A/1978/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 61340 series, published under the general title *Optical fibre cables*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
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OPTICAL FIBRE CABLES –

Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies

1 Scope

This part of IEC 60794 is a family specification that specifies requirements for simplex and duplex optical fibre cables for use in terminated cable assemblies or for termination with optical fibre passive components.

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 60793-1-32, *Optical fibres – Part 1-32: Measurement methods and test procedures – Coating strippability*

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

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 tests methods*

IEC 60794-1-23, *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable element test methods*

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

IEC 60811-202, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath*

IEC 60811-203, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions*

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

terminated cable assembly

short length of cable provisioned with a connector at both ends

Note 1 to entry: Examples from ISO/IEC 11801 (all parts) are fibre optic cords used to establish connections on patch panels, equipment and at work areas or to connect outlets to the terminal equipment.

4 Construction

4.1 General

In addition to the constructional requirements in IEC 60794-2, the following considerations apply to simplex and duplex indoor cables for use in terminated 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 a delivery length. It shall be possible to identify each individual fibre throughout the length of the cable.

4.2 Optical fibres and primary coating

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

4.3 Buffer

If a tight or semi-tight (loosely applied) buffer is required, it shall consist of one or more layers of inert material. Semi-tight tubes may be filled. Unless otherwise specified, the tight buffer shall be removable in one operation together with fibre coating over a specified length. For semi-tight and loose buffer, the buffer material is stripped off for a specified length leaving the primary coating of the fibre intact.

Specified buffer strippability lengths:

- tight: 15 mm;
- semi tight: 300 mm;
- loose: 1,0 m minimum.

Strip force shall comply to the values stated in the relevant specification and the evaluation shall be carried out according IEC 60793-1-32.

Buffer dimensions are shown in Table 1.

Table 1 – Dimensions of buffered fibres

Nominal diameter mm	Tolerances mm
0,3 to 0,9	±0,05

Lower tolerance levels can be a requirement for buffered fibres having a low nominal diameter within the specified range. In such cases, tolerance values shall be agreed between supplier and customer.

4.4 Tube

One or two primary coated or buffered fibres are 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 60794-1-23, method G7.

4.5 Strength and anti-buckling members

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

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The strength and/or anti-buckling member 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.

4.6 Sheath

The cable shall have a uniform overall protective sheath. The cable diameter shall be specified in the relevant detail specification (or product specification). Sheath removal is an important feature of these cables. Sheath pull-off force shall be determined in accordance with IEC 60794-1-21, method E21.

4.7 Sheath marking

If required, the cable shall be marked as agreed between the customer and supplier. The marking shall be resistant to abrasion, which shall be verified in accordance with IEC 60794-1-21, method E2B, method 2.

4.8 Examples of cable constructions

Examples of some main types of cable construction are shown in Annex A.

Other configurations are not excluded if they meet the mechanical, environmental, transmission and termination requirements given in this document.

5 Tests

5.1 General

Compliance with the specification requirements shall be verified by carrying out tests selected from Clause 5. It is not intended that all tests be carried out in all cases, and Annex B provides guidance on the selection of tests. The tests to be applied and the frequency of testing shall be agreed between the customer and supplier.

Some of the following tests can be performed on a short sample length of cable which is still an integral part of a longer length, thus making it possible to detect permanent changes in attenuation. 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 singlemode fibres and $\pm 0,2$ dB for multimode fibres. Any measured value within this range shall be considered as "no change in attenuation".

Cabled single-mode fibres are measured at 1 550 nm or 1 625 nm and shall be agreed between the customer and supplier. Cabled multimode fibres are measured at 850 nm or 1 300 nm and shall be agreed between the customer and supplier. Measurements shall be carried out according to IEC 60793-1-40.

NOTE The optimized wavelength for multimode fibres A1-OM3 and A1-OM4 is 850 nm and for A1-OM5 fibre, the targeted operational wavelength(s) is between 850 nm and 950 nm.

If 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.

5.2 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 60811-202 and IEC 60811-203.

The cable diameter tolerance shall be $\pm 0,2$ mm.

The deviation of the average sheath thickness shall be within the tolerance of $\pm 0,1$ mm for 100 % of the cable length.

5.3 Mechanical requirements

5.3.1 Tensile performance

Method: IEC 60794-1-21, E1

Diameter of chuck drums and transfer devices: not less than the minimum loaded bending diameter specified for the cable, at least 250 mm diameter.

Load for 5 min:

- simplex cables $d < 1,2$ mm at 50 N; simplex cables $1,2 \text{ mm} \leq d \leq 2,0$ mm at 70 N; simplex cables $d > 2,0$ mm at 100 N;
- duplex round cables at 100 N;

- zipcord cables $d \leq 2,0$ mm at 140 N; zipcord cables $d > 2,0$ mm at 200 N.

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

Requirements:

- in all cases, fibre strain shall be less than 0,6 %;
- the maximum allowable increase in attenuation during the test shall be specified in the product specification; there shall be no change in attenuation after the test;
- there shall be no damage to the cable elements.

5.3.2 Crush

Method: IEC 60794-1-21, E3A

Force short term:

- 300 N for simplex/duplex cables with diameter $\leq 2,0$ mm;
- 500 N for simplex/duplex cables with diameter $> 2,0$ mm.

Duration short term: 1 min

Number of crushes short term: 1

Force long term:

- 100 N for simplex/duplex cables with diameter $\leq 2,0$ mm;
- 200 N for simplex/duplex cables with diameter $> 2,0$ mm.

Duration long term: 10 min

Number of crushes long term: 1, separated at least 500 mm to any other loaded position.

Requirements:

- the maximum increase in attenuation during the test with a long term force shall be specified in the product specification; there shall be no change in attenuation after the test with short term and long term force;
- there shall be no damage to the cable elements.

For cables having a non-circular cross section, the force shall be applied in the direction of the minor axis (perpendicular to the major axis).

5.3.3 Impact

Method: IEC 60794-1-21, E4

- impact energy: 0,5 J for simplex/duplex cables with diameter $\leq 2,0$ mm; 1,0 J for simplex/duplex cables with diameter $> 2,0$ mm;
- number of impacts: at least 3, each separated at least 500 mm.

Requirements:

- there shall be no change in attenuation after the test; there shall be no damage to the cable elements;
- any imprint of the striking surface on the cable sheath is not considered mechanical damage.

For cables having a non-circular cross section, the force shall be applied in the direction of the minor axis (perpendicular to the major axis).

5.3.4 Repeated bending

Method: IEC 60794-1-21, E6

Bending diameter:

- 60 mm for simplex and non-circular duplex cables (consider the cable diameter is the minor dimension);
- 40 times cable diameter for circular duplex cables but not less than 60 mm.

Number of cycles: 200

Mass of weights: sufficient to contour the apparatus, for example 1 kg to 2 kg.

Requirements:

- the maximum increase in attenuation during the test shall be specified in the product specification;
- there shall be no change in attenuation after the test, and there shall be no damage to the cable elements.

NOTE For cables having a non-circular cross section, the bend requirements are determined using the minor axis as the cable diameter with bending in the direction of the preferential bend.

5.3.5 Bend

Method: IEC 60794-1-21, E11A

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Bending diameter: 20 times cable diameter, but not less than 60 mm (for non-circular cables see note below).

Number of turns per helix: 6

Number of cycles: 3

Length of sample: sufficient to carry out the test.

Prior to bending: at both ends of the sample, all the cable components shall be fixed together, for example by loops or glue.

Requirements:

- the maximum increase in attenuation during the test shall be specified in the product specification;
- there shall be no change in attenuation after the test, and there shall be no damage to the cable elements.

NOTE For cables having a non-circular cross section, the bend requirements are determined using the minor axis as the cable diameter with bending in the direction of the preferential bend.

5.3.6 Torsion

Method: IEC 60794-1-21, E7

Number of cycles: 10