BS EN 60794-3:2015

BSI Standards Publication

Optical fibre cables

Part 3: Sectional specification - Outdoor cables

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National foreword

This British Standard is the UK implementation of EN 60794-3:2015. It is identical to IEC 60794-3:2014. It supersedes BS EN 60794-3:2002 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/1, Optical fibres and cables.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

The text of document 86A/1589/CDV, future edition 4 of IEC 60794-3, prepared by SC 86A "Fibres and cables" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60794-3:2015.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-07-16
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-10-14

This document supersedes EN 60794-3:2002.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60794-3:2014 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60304	-	Standard colours for insulation for low-frequency cables and wires	HD 402 S2	-
IEC 60708	-	Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath	EN 60708	-
IEC 60793-1-21	-	Optical fibres -- Part 1-21: Measurement methods and test procedures - Coating geometry	EN 60793-1-21	-
IEC 60793-1-32	-	Optical fibres -- Part 1-32: Measurement methods and test procedures - Coating strippability	EN 60793-1-32	-
IEC 60793-1-40 (mod)	-	Optical fibres -- Part 1-40: Measurement methods and test procedures - Attenuation	EN 60793-1-40 +AA	-
IEC 60793-1-44	-	Optical fibres -- Part 1-44: Measurement methods and test procedures - Cut-off wavelength	EN 60793-1-44	-
IEC 60793-2	-	Optical fibres -- Part 2: Product specifications - General	EN 60793-2	-
IEC 60794-1-1	-	Optical fibre cables -- Part 1-1: Generic specification - General	EN 60794-1-1	-
IEC 60794-1-21	-	Optical fibre cables -- Part 1-21: Generic specification - Basic optical cable test procedures - Mechanical tests methods	FprEN 60794-1-21	-
IEC 60794-1-22	-	Optical fibre cables -- Part 1-22: Generic specification - Basic optical cable test procedures - Environmental test methods	EN 60794-1-22	-
IEC 60794-1-23	-	Optical fibre cables -- Part 1-23: Generic specification - Basic optical cable test procedures - Cable element test methods	EN 60794-1-23	-
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	EN 60811-202	-
IEC 60811-203	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 203: General tests - Measurement of overall dimensions	EN 60811-203	-
IEC 60811-401	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven	EN 60811-401	-

IEC 60811-406	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 406: Miscellaneous tests - Resistance to stress cracking of polyethylene and polypropylene compounds	EN 60811-406	-
IEC 60811-501	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 501: Mechanical tests - Tests for determining the mechanical properties of insulating and sheathing compounds	EN 60811-501	-
IEC 60811-604	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 604: Physical tests - Measurement of absence of corrosive components in filling compounds	EN 60811-604	-
IEC 60811-607	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 607: Physical tests - Test for the assessment of carbon black dispersion in polyethylene and polypropylene	EN 60811-607	-
IEC/TR 62690	-	Hydrogen effects in optical fibre cables - Guidelines	-	-
IEC/TR 62691	-	Optical fibre cables - Guide to the installation of optical fibre cables	-	-

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OPTICAL FIBRE CABLES –

Part 3: Outdoor cables – Sectional specification

1 Scope

This part of IEC 60794 specifies the requirements for optical fibre cables and cable elements which are intended to be used externally in communications networks. Other types of applications requiring similar types of cables can be considered.

Requirements for cables to be used in ducts, for directly buried applications, aerial cables and cables for lake and river crossings are included in this standard. Also included are cables for specialized use in sewers and in water and gas pipes.

For aerial application, this standard does not cover all functional aspects of cables installed in the vicinity of overhead power lines. For such applications, additional requirements and test methods may be necessary. Moreover, this standard excludes optical ground wires and cables attached to the phase or earth conductors of overhead power lines.

For cables for lake and river crossings, this standard does not cover methods of cable repair, nor repair capability, nor does it cover cables for use with underwater line amplifiers.

NOTE IEC TR 62839-1 [1] gives rules to built an environmental declaration if needed.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60304, *Standard colours for insulation for low-frequency cables and wires*

IEC 60708, *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath*

IEC 60793-1-21, *Optical fibres – Part 1-21: Measurement methods and test procedures – Coating geometry* [1]

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: Measurement methods and test procedures – Attenuation*

IEC 60793-1-44, *Optical fibres – Part 1-44: Measurement methods and test procedures – Cut-off wavelength*

IEC 60793-2, *Optical fibres – Part 2: Product specifications – General*

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1 To be published.

IEC 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General*

IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical test methods*[2]

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

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

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

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

IEC 60811-401, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 401: Miscellaneous tests – Thermal ageing methods – Ageing in an air oven*

IEC 60811-406, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 406: Miscellaneous tests – Resistance to stress cracking of polyethylene and polypropylene compounds*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: General tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

IEC 60811-604:2012, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 604: Physical tests – Measurement of absence of corrosive components in filling compounds*

IEC 60811-607, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 607: Physical tests – Test for the assessment of carbon black dispersion in polyethylene and polypropylene*

IEC TR 62690, *Hydrogen effects in optical fibre cables – Guidelines*

IEC TR 62691, *Optical fibre cables – Guide to the installation of optical fibre cables*

3 Terms, definitions, symbols and abbreviations

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

4 Optical fibre

4.1 General

Optical fibre shall be used which meets the requirements of IEC 60793-2. The fibre type shall be agreed between the customer and supplier.

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2 To be published.

4.2 Attenuation

4.2.1 Attenuation coefficient

The maximum cabled fibre attenuation coefficient shall conform to IEC 60794-1-1. Particular values may be agreed between the customer and supplier.

The attenuation coefficient shall be measured in accordance with IEC 60793-1-40.

4.2.2 Attenuation uniformity – Attenuation discontinuities

Attenuation uniformity shall conform to IEC 60794-1-1.

4.3 Cut-off wavelength

For single-mode fibre, the cabled fibre cut-off wavelength λ_{cc} shall be less than the operational wavelength, when measured in accordance with IEC 60793-1-44, and in conformity with IEC 60794 1-1.

4.4 Fibre colouring

If the primary coated fibres are coloured for identification, the coloured coating shall be readily identifiable throughout the lifetime of the cable and shall be a reasonable match to IEC 60304.

4.5 Polarization mode dispersion (PMD)

Cabled single-mode fibre PMD shall conform to IEC 60794-1-1.

5 Cable element

5.1 General

Generally, optical cables comprise several elements or individual constituents, depending on the cable design which takes into account the cable application, operating environment and manufacturing processes, as well as the need to protect the fibre during handling and cabling.

The material(s) used for a cable element shall be selected to be compatible with the other elements in contact with it. An appropriate compatibility test method shall be defined in the family or detail specification.

When the fibres are in contact with a filling compound, the compatibility of the filling compound with the fibre coating shall be demonstrated by testing coating stripping force stability after accelerated ageing in accordance with IEC 60794-1-21, Method E5. Alternative ageing conditions and tests may be agreed between the customer and supplier.

Optical elements are cable elements containing optical fibres and are designed to be a primary functional unit of the cable core. They may comprise any of the cable elements described below. Optical elements and each fibre within a cable element shall be uniquely identified, for example by colours, a positional configuration, markings, tapes, threads or as specified in the detail specification.

Tests may be performed on cable elements either in uncabled form or in a finished cable. Unless otherwise specified, testing shall be performed on cable elements in a finished cable. (This means that testing shall be performed only on a finished cable if the cable element manufacturing operation is done by the same manufacturer as the cabling operation. Testing shall be performed on cable elements only if the cable element is supplied by a third party; this does not exclude testing of the finished cable.)

Different types of optical elements are described below.

5.2 Tight secondary coating or buffer

If a tight secondary coating is required, it shall consist of one or more layers of polymeric material. The coating shall be easily removable for splicing. For tight buffers, the buffer and fibre primary coating shall be removable in one operation over a length of 10 mm to 25 mm, depending on customer requirements. The nominal overall diameter of the secondary coating shall be between 800 μm and 900 μm. The value, which shall be agreed between the customer and supplier, shall have a tolerance of ±50 μm. The fibre/secondary coating eccentricity shall not exceed 75 μm, unless otherwise agreed between the customer and supplier.

The colour of the tight secondary coating shall be readily identifiable throughout the life-time of the cable and shall be a reasonable match to IEC 60304.

5.3 Ruggedized fibre

Further protection can be provided to tight secondary coated fibres by surrounding one or more with non-metallic strength members within a sheath of suitable material (e.g. for fan-out cables).

5.4 Slotted core

The slotted core is obtained by extruding a suitable material (for example polyethylene or polypropylene) with a defined number of slots, providing helical or SZ configuration along the core. One or more primary coated fibres or optical element is located in each slot which may be filled by compound.

The slotted core usually contains a central element which may be either metallic or non-metallic. In this case, there shall be adequate adhesion between the central element and the extruded core in order to obtain the required temperature stability and tensile behaviour for the slotted core element.

The profile of the slot shall be uniform and shall ensure the optical and mechanical performance required of the optical cable.

5.5 Polymeric tube

One or more primary coated fibres or other optical elements are packaged (loosely or not) in a tube construction which may be filled by compound. The tube may be reinforced with a composite wall. The polymeric tube may be hard, to provide some crush protection to the fibre bundle, or soft to enable easy strippability of the tube without specialized tools.

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.

If used, the filling compound in the tube shall comply with IEC 60794-1-21, Method E15. The filled tube shall comply with IEC 60794-1-21, Method E14, when tested in tube or cabled form.

5.6 Ribbon

5.6.1 General

Optical fibre ribbons are optical fibres assembled in a composite linear array.

Fibres shall be arranged in parallel and formed into ribbons of typically 4, 6, 8, 12, 24 or 36 fibres each according to user requirements. The fibres within the ribbons shall remain parallel and not cross over.

The design intent is that adjacent fibres within a ribbon are contiguous and that fibre centre lines are straight, parallel and coplanar.

Unless otherwise specified, each ribbon shall be uniquely identified with a printed legend or by uniquely colouring the reference fibre in the ribbon and/or by colouring the matrix material of the ribbon.

Some parameters shall be measured in the ribbon since the corresponding tests on the primary coated fibre or finished cable are not sufficient for complete characterization. These parameters are identified below.

5.6.2 Dimensions

Unless otherwise specified in the detail specification, the maximum dimensions and the structural geometry of optical fibre ribbons shall be as shown in Table 1.

Table 1 – Maximum dimensions of optical fibre ribbons

			Fibre alignment	
	Width	**Height**	**Extreme fibres**	**Planarity**
Number of fibres [a]	w	h	b	p
	µm	µm	µm	µm
4	1 220	360	786	50
6	1 648	360	1 310	50
8	2 172	360	1 834	50
12	3 220	360	2 882	75
24	6 500	360	Per 12f unit [a]	Per 12f uni [a]
36	9 800	360	Per 12f unit [a]	Per 12f unit [a]

[a] Per unit values are measured with the ribbon separated into the intended sub-units.

More stringent requirements may need to be agreed between the customer and supplier, depending on the splice or the connector technique employed.

The dimensions and structural geometry can be verified with a type test, described as the visual measurement method (IEC 60794-1-23, Method G2) to establish and ensure proper control of the ribbon manufacturing process. Once the process is established, and in order to ensure functional performance, the width and height of the ribbons may be controlled and verified, for final inspection purposes, with an aperture gauge (IEC 60794-1-23, Method G3) or a dial gauge (IEC 60794-1-23, Method G4) or by the visual measurement methods.

5.6.3 Mechanical requirements

5.6.3.1 Separability of individual fibres from a ribbon

If fibre breakout capability is required, the ribbons shall be constructed in such a way that fibres can be separated from the ribbon construction, into sub-units or individual optical fibres, while meeting the following criteria:

a) the ribbon shall be tested for the ability to break out individual fibres using the tear (separability) test shown in IEC 60794-1-23, Method G5, or a method agreed upon between the customer and supplier;

b) breakout shall be accomplished without specialized tools or apparatus;

c) the fibre breakout procedure shall not be permanently detrimental to the fibre optical and mechanical performance;

d) any colour coding of fibres shall remain sufficiently intact to enable individual fibres to be distinguished from each other.

5.6.3.2 Ribbon stripping

The coating of individual fibres as well as the residual ribbon bonding material shall be easily removable. The method of removal shall be agreed between the customer and supplier or shall be defined in the detail specification.

5.6.3.3 Torsion

The mechanical and functional integrity of a fibre ribbon can be verified by carrying out the torsion test shown in IEC 60794-1-23, Method G6.

5.7 Metallic tube

5.7.1 Metallic tube on the optical core

A metallic tube (for example, aluminium tube) may be applied over the optical core (for example, aluminium spacer or stranded tube).

5.7.2 Fibres directly located in a metallic tube

One or more primary coated and coloured fibres are packaged in a metallic hermetically sealed tube, which shall be filled, if necessary, with a suitable compound to avoid water penetration.

The inside surface of the tube should be smooth without any defects.

6 Optical fibre cable construction

6.1 General

The intention is that the cable should be designed and manufactured for a predicted operating lifetime of at least 20 years. In this context, the attenuation of the installed cable at the operational wavelength(s) shall not exceed values agreed between the customer and supplier. The tests of this specification are intended to assess the performance of cables, as manufactured and under agreed ageing and performance-limit tests. These tests are not intended to define end-of-life performance, but may be used as agreed between customer and supplier to predict such performance. The materials in the cable shall not present a health hazard within its intended use.

The fibres in the cables are usually of the same type, but some cables may contain multiple specified fibre types and fibres of the same type may have different origins.

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

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

For the particular case of cables for aerial application, to avoid excess fibre strain induced by the environmental conditions, such as wind loading or ice loading, the cable construction, and particularly the strength members, shall be selected to limit this strain to the value agreed between the customer and supplier.

6.2 Lay-up of the cable elements

Optical elements as described in Clause 5 may be laid up as follows:

a) optical element(s) without a stranding lay;

b) a number of homogeneous optical elements using helical or SZ configurations (ribbon elements may be laid up by stacking two or more elements);

c) a number of different configurations in slotted core such as tight coated, ribbon or tube;

d) a number of different configurations in a tube such as tight coated or ribbon;

e) if required, insulated copper conductors in single, pair or quad construction may be laid up with the optical elements.

6.3 Cable core filling

If specified, the element(s) and in addition the cable core shall contain water blocking material, such as grease-like and/or dry-block materials, to prevent longitudinal water penetration in accordance with IEC 60794-1-22, Method F5. The material shall be easily removed without the use of substances considered to be hazardous or dangerous. The grease-like compound shall comply with IEC 60794-1-21, Method E15. The cable shall pass the compound flow test of Method E14 of IEC 60794-1-21.

The blocking material used shall be compatible with the other relevant cable elements. Where a grease-like filling compound is used in cables containing metallic elements, it shall be tested for the presence of corrosive compounds in accordance with Clause 8 of IEC 60811-604:2012.

6.4 Strength member

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

The strength 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.

If required, the aerial cable shall be equipped with a separate suspension strand. The location and the type of suspension strand depend on the installation practice and environmental conditions and shall be determined by agreement between the customer and supplier.

For example, the suspension strand and the cable core may form a “figure 8” construction or the cable may be fastened to a separate suspension strand by lashing or by other suitable means.

6.5 Moisture barrier

If specified, a moisture barrier shall be provided either by a continuous metallic sheath or by a metallic tape applied over the cable core with a longitudinal overlap and bonded to the sheath.

Alternatively, other constructions may be adopted by agreement between the customer and supplier.

In the case of a continuous metallic sheath, the material and its thickness shall be agreed between the customer and supplier.

Metallic materials that may be used include, but are not limited to, coated and uncoated aluminium and steel, copper and copper alloys. These metals may be either flat or corrugated

as designated by the detail specification. Splicing of metallic tapes may be allowed, provided electrical continuity is ensured in the finished cable.

In the case of an aluminium moisture barrier tape, the thickness of the aluminium tape, the amount of overlap and the adhesion of the aluminium tape to the sheath shall be in accordance with IEC 60708. The tape may have a reduced nominal thickness by agreement between the user and the manufacturer. The effectiveness of the moisture barrier may be proved by an alternative test with agreement between the customer and supplier.

6.6 Cable sheath and armouring

6.6.1 Inner sheath

A cable inner sheath may be applied by agreement between the customer and supplier. When required for a specific construction, or for manufacturing purposes, cable cores or sub-units within the core, or both, may be covered by inner sheaths. Unless otherwise specified, the inner sheath shall be made of polyethylene.

6.6.2 Armouring

Where additional tensile strength or protection from external damage is required, armouring shall be provided (for example, corrugated steel tape or steel wire armour).

6.6.3 Outer sheath

6.6.3.1 General

The cable shall have a seamless sheath made of UV-stabilized weather-resistant polyethylene, containing 2,0 % minimum well dispersed carbon black in accordance with IEC 60811-607, unless otherwise agreed between the customer and supplier.

The sheath thickness (tested in accordance with IEC 60811-202) and cable overall diameter (tested in accordance with IEC 60811-203) and its variations shall take into account the installation conditions and shall be determined by the relevant specification or by agreement between the customer and supplier.

6.6.3.2 Tensile strength and elongation

When tested in accordance with IEC 60811-501, the measured values of tensile strength shall be not less than

a) 10 MPa for low- or linear-low-density polyethylene,

b) 12,0 MPa for medium-density polyethylene,

c) 16,5 MPa for high-density polyethylene.

The measured values of elongation at break shall be not less than 300 %.

6.6.3.3 Elongation at break after ageing

The mechanical characteristics of the sheath shall remain sufficiently constant during normal use. This is checked by determining the elongation at break according to IEC 60811-501 after an ageing test at 100 °C ±2 °C for 10 × 24 h according to IEC 60811-401. The median of the values of elongation at break shall be not less than 300 %.

6.6.3.4 Resistance to environmental stress cracking

The resistance to environmental stress cracking shall comply with the requirements of IEC 60811-406. Procedure B shall be applied.

6.6.3.5 Outer protection of cables for lake and river crossings

The outer protection may be either a layer of polypropylene roves or an outer sheath of polyethylene or appropriate materials. The particular outer sheath shall be agreed between the customer and supplier.

If required, the outermost layer shall have a contrasting colour incorporated to facilitate visibility of cable movement during installation and maintenance operations.

6.7 Sheath marking

If required, the cable shall be marked by a method agreed between the customer and supplier. Common methods of marking are embossing, sintering, imprinting, hot foil and surface printing.

The information given in the marking text may include cable length, the number of fibres, fibre type, manufacturer's name and the date of manufacture.

The characters shall be spaced at intervals of not more than 1 m. The actual length of the cable shall be within $^{+1}_{0}$ % of the length indicated by the length marking. For example, 1 000 m of cable, if the starting sheath length mark was 0, should have a final sheath mark in the range 990 m to 1 000 m. Occasional illegible markings are permitted, provided that a legible mark is located within 5 m of the illegible mark. Cables may be remarked in a second contrasting colour, if the first marking process is unsuccessful.

Marking may be provided as a single or double line of marking. A single line of marking shall be provided by marking longitudinally along the length of the cable. A double line of marking shall be provided with the two lines diametrically opposite each other, longitudinally along the length of the cable.

The abrasion resistance of the sheath markings shall be demonstrated in accordance with IEC 60794-1-21, Method E2B.

For a double line of marking, the abrasion resistance test needs only be carried out on one line of marking.

6.8 Hydrogen gas

An informative guideline is given in IEC TR 62690.

7 Installation and operating conditions

Installation and operating conditions shall be agreed between the customer and supplier. Guidance is given in IEC TR 62691.

8 Characterization of cable elements

The following tests, as indicated in Table 2, are intended to characterize the different types of cable elements.

Table 2 – Characteristics of different types of cable elements

Characteristics	Family requirements IEC 60794-3	Test methods	Remarks
Dimensions	5.2	IEC 60793-1-21	Secondary coating
Dimensions	5.3, 5.4, 5.6, 5.7	IEC 60811-202 and IEC 60811-203	Tight buffer, tube, slotted core and ruggedized elements
Dimensions	5.6.1	IEC 60794-1-23 Methods G2, G3 or G4	Ribbons
Bend		IEC 60794-1-23 Method G1	Secondary coating, tight buffer, tube
Strippability	5.2	IEC 60793-1-32	Primary or secondary fibre coatings and tight buffers
Strippability	5.6.3.2	As agreed between supplier and manufacturer	Ribbon
Separability of individual fibres from ribbon	5.6.3.1	IEC 60794-1-23 Method G5	Ribbon
Kink	5.5	IEC 60794-1-23 Method G7	Tube
Torsion	5.6.3.3	IEC 60794-1-23 Method G6	Ribbon
Compound flow	5.5	IEC 60794-1-21, method E14	Tube

9 Optical fibre cable tests

Compliance with specification requirements shall be verified by carrying out tests as required by the relevant family or detail specification. Suitable tests are detailed in Table 3. It is not intended that all tests shall be carried out; the frequency of testing shall be agreed between the customer and supplier.

Guidance on qualification sampling and interpretation of test results are given in IEC 60794-1-1. The number of fibres tested shall be representative of the cable design and shall be agreed between the customer and supplier.

For some tests applicable to “figure 8” constructions, the tests shall be carried out with the suspension strand. If required by certain installation practices, the “figure 8” cable shall also be tested without the suspension strand.

Table 3 – Mechanical and environmental applicable tests

Characteristics	Family requirements	Test methods	Remarks
Tensile performance		IEC 60794-1-21 Method E1	
Sheath abrasion resistance		IEC 60794-1-21 Method E2A	
Crush		IEC 60794-1-21 Method E3	
Impact		IEC 60794-1-21 Method E4	
Repeated bending		IEC 60794-1-21 Method E6	
Torsion		IEC 60794-1-21 Method E7	
Kink		IEC 60794-1-21 Method E10	
Bend		IEC 60794-1-21 Method E11	
Shotgun resistance		IEC 60794-1-21 Method E13	Aerial cables with specific shotgun protection
Bending under tension		IEC 60794-1-21 Method E18	
Aeolian vibration		IEC 60794-1-21 Method E19	Longspan aerial cables
Coiling performance		IEC 60794-1-21 Method E20	Lake and river crossings
Temperature cycling		IEC 60794-1-22 Method F1	
Water penetration		IEC 60794-1-22 Method F5B or F5C	Water-blocked cables
Pneumatic resistance		IEC 60794-1-22 Method F8	Unfilled cables protected by pressurisation
Ageing		IEC 60794-1-22 Method F9	
Hydrostatic pressure		IEC 60794-1-22 Method F10	Lake and river crossings
Ribbon stripping		IEC 60794-1-21 Method E5B	Ribbon cables

10 Quality assurance

It is the responsibility of the manufacturer to establish quality assurance by quality control procedures which ensure that the product meets the requirements of this standard. When the customer wishes to specify acceptance tests to other quality procedures, it is essential that an agreement is reached between the customer and supplier at the time of ordering.

Bibliography

IEC TR 61282-3, *Fibre optic communication system design guides – Part 3: Calculation of link polarization mode dispersion*

IEC TR 62839-1, *Environmental declaration – Part 1: Wires and cables and accessories products specific rules* [3]

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[3] To be published.

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