

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Optical fibre cables –
Part 3-10: Outdoor cables – Family specification for duct, directly buried or
lashed aerial optical telecommunication cables

Câbles à fibres optiques –
Partie 3-10: Câbles extérieurs – Spécification de famille pour les câbles optiques
de télécommunication destinés à être installés dans des conduites, directement
enterrés ou attachés en aérien



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

Part 3-10: Outdoor cables – Family specification for duct, directly buried or lashed aerial optical telecommunication cables

FOREWORD

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International Standard IEC 60794-3-10 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2009 and constitutes a technical revision.

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

- a) the specification has been streamlined by cross-referencing IEC 60794-1-1, the IEC 60794-3 series and IEC 60794-1-2;
- b) reference to the MICE table in the previous Annex A has been deleted;
- c) lashed aerial installation techniques as referenced in the previous Annex B has been removed for inclusion in the next edition of IEC TR 62691.

The text of this standard is based on the following documents:

FDIS	Report on voting
86A/1630/FDIS	86A/1639/RVD

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

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

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 publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

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[IEC 60794-3-10:2015](#)

<https://standards.iteh.ai/catalog/standards/sist/5efbc084-07cd-4aa8-8bad-5ffc9e44ab9/iec-60794-3-10-2015>

OPTICAL FIBRE CABLES –

Part 3-10: Outdoor cables – Family specification for duct, directly buried or lashed aerial optical telecommunication cables

1 Scope

This part of IEC 60794, which is a family specification, covers optical telecommunication cables to be used in ducts or direct buried applications. The cable may also be used for lashed aerial applications. Requirements of the sectional specification IEC 60794-3 for duct, buried and aerial cables are applicable to cables covered by this standard.

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

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 – Cross reference table for optical cable test procedures*

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

IEC 60794-1-22:2012, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods*

IEC 60794-3:2001, *Optical fibre cables – Part 3: Sectional specification – Outdoor cables*

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 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*

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.

¹ To be published.

4 General requirements

4.1 Optical fibres

The optical fibre shall conform to the requirements of IEC 60793-2. The fibre type shall be agreed between the customer and supplier. The cabled fibre shall conform to IEC 60794-3.

4.2 Cable element

The cable elements shall conform to IEC 60794-3.

4.3 Optical fibre cable construction

The cable construction shall conform to IEC 60794-3.

5 Details of family requirements and test conditions for optical fibre cable tests

5.1 General

Tests on single-mode fibre cables are typically carried out at 1 550 nm. Multimode fibre cables are typically tested at 1 300 nm. Measurement at other wavelengths or range of wavelengths may be agreed upon between the customer and supplier.

5.2 Tensile performance

5.2.1 Family requirements

For 1 % proof-tested fibres, the fibre strain under long-term tensile load (T_L) shall not exceed 20 % of this fibre proof strain (equal to absolute 0,2 % strain) and there shall be no change in attenuation during the test. Under short-term tensile load (T_M) the fibre strain shall not exceed 60 % of the fibre proof strain and the attenuation change during test shall be measured and recorded. Other criteria may be agreed between the customer and the supplier. For fibres proof tested at higher levels the safe long-term load will not scale linearly with proof strain, so a lower percentage of the proof strain is applicable. For greater than 1 % up to 2 % proof-tested fibres, T_L shall be limited to 17 % of the proof-test strain (equal to absolute 0,34 % strain for 2 % proof tested fibres). Under visual examination without magnification, there shall be no damage to the sheath or to the cable elements.

5.2.2 Test conditions

Method:	IEC 60794-1-21, Method E1
Fibre length:	Finished cable length
Tensile load on cable:	Long-term tensile load (T_L) and short-term tensile load (T_M), where: <ul style="list-style-type: none"> – $T_M \geq 1 \times W$ (direct burial or blowing in duct); – $T_M \geq 1,5 \times W$ (pulling in duct); Other loads may be applied in accordance with particular user conditions, e.g. 2 700 N <ul style="list-style-type: none"> – $T_L = 0,3 \times T_M$ For aerial cables, the long-term tensile load may be greater than or equal to the short-term tensile load.
Diameter of test pulleys:	Typically 1 m but not less than the minimum loaded bending diameter specified for the cable.

5.3 Crush

5.3.1 Family requirements

Under long-term load there shall be no change in attenuation at 1 550 nm during the test and under short-term load there shall be no change in attenuation at 1 550 nm after the test. The installation load shall not be less than the long-term load.

Under visual examination there shall be no damage to the sheath or to the cable elements. The imprint of the plate or mandrel on the sheath is not considered mechanical damage.

5.3.2 Test conditions

Method: IEC 60794-1-21, Method E3A

The default method is the plate/plate test, Method E3A. Optionally, the mandrel/plate test, Method E3B, may be conducted if requested by the detail specification. Short- and long-term tests may be conducted separately.

Load (short term): 1,5 kN (un-armoured); 2,2 kN (armoured)

Load (long term): 0,75 kN (un-armoured); 1,1 kN (armoured)

5.4 Impact

5.4.1 Family requirements

Under visual examination without magnification there shall be no damage to the sheath or to the cable elements. The imprint of the striking surface on the sheath is not considered mechanical damage.

There shall be no permanent change in attenuation after the test.

5.4.2 Test conditions

Method: IEC 60794-1-21, Method E4

Number of impacts: One in 3 different places spaced not less than 500 mm apart

Impact energy: Un-armoured cable: 10 J

Armoured cable: 20 J to 30 J, depending on particular user conditions

Striking surface curvature radius: 300 mm

5.5 Repeated bending

5.5.1 Family requirements

Under visual examination without magnification there shall be no damage to the sheath and to the cable elements.

5.5.2 Test conditions

Method: IEC 60794-1-21, Method E6

Number of cycles: 25 or different number of cycles may be applied in accordance with the particular user conditions

Load: Adequate to assure uniform contact with the mandrel

Bending radius: 20 d

5.6 Torsion

5.6.1 Family requirements

Under visual examination without magnification, there shall be no damage to the sheath or to the cable elements.

5.6.2 Test conditions

Method: IEC 60794-1-21, Method E7

5.7 Bend

5.7.1 Family requirements

There shall be no permanent change in attenuation after the test.

5.7.2 Test conditions

Method: IEC 60794-1-21, Method E11

The default method is Method E11A.

For large and/or stiff cables (e.g. where the mandrel diameter required is $>20 d$,

IEC 60794-1-21, Method E11B may be used.

Diameter of mandrel: 20 d

For cable incorporating a non-metallic rod and/or metallic armouring, bending shall be limited to a value from 20 d to 80 d.

Number of cycles: 3

Number of turns/helix: 4

Test temperature: Ambient (unless specifically requested otherwise)

5.8 Temperature cycling

5.8.1 Family requirements

Attenuation measurements shall be taken during the last cycle.

For T_{A1} to T_{B1} there shall be no change in attenuation as defined in IEC 60794-1-1.

For T_{A1} to T_{A2} and T_{B1} to T_{B2} , the change in attenuation coefficient shall be

- $\leq 0,15$ dB/km for single-mode fibre and shall be reversible to measurement uncertainty when measured in the 1 550 nm region,
- $\leq 0,3$ dB/km for multimode fibre and shall be reversible to measurement uncertainty when measured in the 1 300 nm region.

On completion of the test there shall be no change in attenuation.

5.8.2 Test conditions

Method: IEC 60794-1-22, Method F1

Sample length: finished cable length of at least 1 000 m

High temperature, T_{B2} : +60 °C to +70 °C, depending on customer requirements

High temperature, T_{B1} : +30 °C to +60 °C, depending on customer requirements

Low temperature, T_{A1} : –10 °C to –20 °C, depending on customer requirements

Low temperature, T_{A2} : T_{A1} to –40 °C or –45 °C, depending on customer requirements

Alternative high and low temperatures may be agreed between the customer and the supplier for warmer or colder climates.

Rate of heating and cooling: sufficiently slow that the effect of changing the temperature does not cause temperature shock.

Number of cycles: 2, but additional cycles may be required in accordance with particular customer requirements.

5.9 Water penetration

5.9.1 Family requirements

The cable shall not propagate water longitudinally according to the requirements of Method F5B of IEC 60794-1- 2. Method F5C may be used if agreed between customer and supplier.

5.9.2 Test conditions

Method: IEC 60794-1-22, Method F5B or F5C, as applicable.

5.10 Ageing

5.10.1 Family requirements

As per 11.5 of IEC 60794-1-22:2012, Method F9.

5.10.2 Test conditions

Method: IEC 60794-1-22, Method F9.

Annex A (normative)

Blank detail specification and minimum requirements

A.1 Blank detail specification

See Table A.1 for the cable description.

Table A.1 – Cable description

(1) Prepared by		(2) Document No.: Issue : Date :
(3) Available from	(4) Generic specifications: Sectional specification:	IEC 60794-1 series IEC 60794-3
(5) Additional references:		
(6) Cable description:		
(7) Cable construction:		
Optical fibres		
Range of fibre count		
Modularity		
Construction <ul style="list-style-type: none"> - Single coloured fibre - Tube, waterblocked - Tube, non-waterblocked - Micromodules, waterblocked - Micromodules, non-waterblocked - Slotted core, waterblocked - Slotted core, non-waterblocked - Tight secondary coating - Ribbon in slotted core - Ribbon in tube - Tube in tube - Central member, metallic - Central member, non-metallic - Core filling, jelly - Core filling, water swellable materials 		Additional remarks
Lay-up <ul style="list-style-type: none"> - Stranding (helical or SZ) - Single unit - Hybrid configuration 		
Insulated copper conductors		
Inner sheath		
Peripheral strength member <ul style="list-style-type: none"> - Metallic - Non-metallic 		
Moisture barrier <ul style="list-style-type: none"> - Single coated aluminium tape - Double coated aluminium tape - Double coated steel tape - Hermetic barrier (metal tube) 		
Outer sheath		
Additional armouring <ul style="list-style-type: none"> - Non-metallic armouring - Metallic armouring 		
Additional outer sheath		