

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical fibre cables –

Part 3-30: Outdoor cables – Family specification for optical telecommunication cables for lakes, river crossings and coastal application

Câbles à fibres optiques –

Partie 3-30: Câbles extérieurs – Spécification de famille pour les câbles optiques de télécommunication utilisés pour les traversées de lacs, de rivières, et pour applications côtières



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –**Part 3-30: Outdoor cables –
Family specification for optical telecommunication
cables for lakes, river crossings and coastal application**

FOREWORD

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International Standard IEC 60794-3-30 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This standard is to be used in conjunction with IEC 60794-1-1 and IEC 60794-1-2, and IEC 60794-3.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision. The main changes with respect to the previous edition are listed below:

- the title of the specification has been updated to include coastal applications;
- fibres specification have been enlarged to include fibre Type B5;
- an annex has been added for additional requirements according to the MICE table.

This bilingual version, published in 2008-07, corresponds to the English version.

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

FDIS	Report on voting
86A/1203/FDIS	86A/1222/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.

The French version of this standard has not been voted upon.

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

A list of all parts of IEC 60794 series, 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 maintenance result date indicated on the IEC web site 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- withdrawn;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.

OPTICAL FIBRE CABLES –

Part 3-30: Outdoor cables – Family specification for optical telecommunication cables for lakes, river crossings and coastal application

1 Scope

This family specification covers optical telecommunication cables to be used as underwater cables for lakes, river crossings and coastal applications. Requirements of the sectional specification IEC 60794-3 for duct, buried, aerial and lake, river crossings and coastal applications cables are applicable to cables covered by this standard. This standard does not cover methods of cable repair nor repair capability, nor does it cover cables for use with lake, river crossings and coastal applications line amplifiers.

Clause 4 of this standard describes a blank detail specification for optical telecommunication cables to be used for lakes, river crossings and coastal applications. It incorporates some minimum requirements.

Annex A describes a blank detail specification which may be used to prepare detail specifications.

Annex B describes the cable construction.

Annex C describes a blank detail specification for ISO/IEC 24702 applications (MICE).

The parameters specified in this standard may be affected by measurement uncertainty arising either from measurement errors or calibration errors due to lack of suitable standards. Acceptance criteria are interpreted with respect to this consideration (see IEC 60794-3, Clause 9).

The number of fibres tested should be representative of the cable design and should be agreed between the customer and the supplier.

2 Normative references

The following referenced documents are indispensable for the application 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.

They complete the normative references already listed in the generic specification (IEC 60794-1-1, Clause 2 and IEC 60794-1-2, Clause 2) and in the sectional specification (IEC 60794-3, Clause 2).

IEC 60793-1-48, *Optical fibres – Part 1-48: Measurement methods and test procedures – Polarization mode dispersion*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

3 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

λ_{cc}	cabled fibre cut-off wavelength
$\lambda_{operational}$	operational wavelength
d	nominal outer diameter of the cable
DS	detail specification
T_L	long term tensile load
T_M	the acceptable amount of short-term tensile load that can be applied to the cable without permanent degradation of the characteristics of the fibres in the tensile performance test
T_{A1}	temperature cycling test low-temperature limit according to IEC 60794-1-2, Method F1
T_{A2}	temperature cycling test low-temperature limit according to IEC 60794-1-2, Method F1
T_{B1}	temperature cycling test high-temperature limit according to IEC 60794-1-2, Method F1
T_{B2}	temperature cycling test high-temperature limit according to IEC 60794-1-2, Method F1
t_1	temperature cycling test dwell time
$n \times d$	a value times cable outer diameter used for bends, mandrels, etc.

4 Family specification for optical telecommunication cables to be used in lakes, river crossings and coastal application (blank detail specification and minimum requirements)

4.1 Optical fibres

Attenuation values at 1 625 nm are optionally specified by the user.

4.1.1 Single-mode dispersion unshifted (B1.1) optical fibre

Characteristics (9)	IEC 60794-3 Clause/sub-clause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2-50		
Attenuation coefficient (cabled fibres)	5.2	According DS	IEC 60793-1-40	
at 1 310 nm at 1 550 nm at 1 625 nm	5.2.1	$\leq 0,40$ dB/km $\leq 0,30$ dB/km $\leq 0,40$ dB/km		1 625 nm performance is optional depending on agreement between customer and supplier
Attenuation discontinuities at 1 310 and 1 550 nm	5.2.2	$\leq 0,10$ dB	IEC 60793-1-40	

Characteristics (9)	IEC 60794-3 Clause/sub-clause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda_{operational}$	IEC 60793-1-44	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Polarisation mode dispersion PMD _Q	5.5	As IEC 60794-3	IEC 60793-1-48	
Outer diameter including colouring	8.2.1.1	As IEC 60793-2-50	IEC 60793-1-21	

4.1.2 Single-mode dispersion unshifted (B1.2) optical fibre

Characteristics (9)	IEC 60794-3 Clause/sub-clause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2-50		
Attenuation coefficient (cabled fibres)	5.2	According DS	IEC 60793-1-40	
at 1 550 nm at 1 625 nm	5.2.1	$\leq 0,30$ dB/km $\leq 0,40$ dB/km		1 625 nm performance is optional depending on agreement between customer and supplier
Attenuation discontinuities at 1 310 and 1 550 nm	5.2.2	$\leq 0,10$ dB	IEC 60793-1-40	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda_{operational}$	IEC 60793-1-44	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Polarisation mode dispersion PMD _Q	5.5	As IEC 60794-3	IEC 60793-1-48	
Outer diameter including colouring	8.2.1.1	As IEC 60793-2-50	IEC 60793-1-21	

4.1.3 Single-mode dispersion unshifted (B1.3) optical fibre

Characteristics (9)	IEC 60794-3 Clause/sub-clause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2-50		
Attenuation coefficient (cabled fibres)	5.2	According DS	IEC 60793-1-40	
at 1 310 at 1 383 +/- 3 nm at 1 550 at 1 625 nm	5.2.1	$\leq 0,40$ dB/km $\leq 0,40$ dB/km $\leq 0,30$ dB/km $\leq 0,40$ dB/km		1 625 nm performance is optional depending on agreement between customer and supplier
Attenuation discontinuities at 1 310 and 1 550 nm	5.2.2	$\leq 0,10$ dB	IEC 60793-1-40	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda_{operational}$	IEC 60793-1-44	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Polarisation mode dispersion PMD ₀	5.5	As IEC 60794-3	IEC 60793-1-48	
Outer diameter including colouring	8.2.1.1	As IEC 60793-2-50	IEC 60793-1-21	

4.1.4 Single-mode dispersion shifted (B2) optical fibre

Characteristics (9)	IEC 60794-3 Clause/sub-clause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2-50		
Attenuation coefficient (cabled fibres)	5.2.1	According DS	IEC 60793-1-40	
at 1 550 nm	5.2.1	$\leq 0,30$ dB/km		
Attenuation discontinuities at 1 550 nm	5.2.2	$\leq 0,10$ dB	IEC 60793-1-40	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda_{operational}$	IEC 60793-1-44	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Polarisation mode dispersion PMD ₀	5.5	As IEC 60794-3	IEC 60793-1-48	
Outer diameter including colouring	8.2.1.1	As IEC 60793-2-50	IEC 60793-1-21	

4.1.5 Single-mode non-zero dispersion (B4) optical fibre

Characteristics (9)	IEC 60794-3 Clause/sub-clause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2-50		
Attenuation coefficient (cabled fibres)	5.2	According DS	IEC 60793-1-40	
at 1 550 nm at 1 625 nm	5.2.1	$\leq 0,30$ dB/km $\leq 0,40$ dB/km		1 625 nm performance is optional depending on agreement between customer and supplier
Attenuation discontinuities at 1 550 nm	5.2.2	$\leq 0,10$ dB	IEC 60793-1-40	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda_{operational}$	IEC 60793-1-44	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Polarisation mode dispersion PMD ₀	5.5	As IEC 60794-3	IEC 60793-1-48	
Outer diameter including colouring	8.2.1.1	As IEC 60793-2-50	IEC 60793-1-21	

4.1.6 Single-mode non-zero dispersion shifted (B5) optical fibre

Characteristics (9)	IEC 60794-3 Clause/sub clause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2-50		
Attenuation coefficient (cabled fibres)	5.2.1	According DS	IEC 60793-1-40	
at 1 460 nm at 1 550 nm and at 1 625 nm	5.2.1	$\leq 0,40$ dB/km $\leq 0,30$ dB/km $\leq 0,40$ dB/km		1625 nm performance is optional depending on agreement between customer and supplier
Attenuation discontinuities at 1 550 nm	5.2.2	$\leq 0,10$ dB	IEC 60793-1-40	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda_{operational}$	IEC 60793-1-44	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Polarisation mode dispersion PMD ₀	5.5	As IEC 60794-3	IEC 60793-1-48	
Outer diameter including colouring	8.2.1.1	As IEC 60793-2-50	IEC 60793-1-21	

4.2 Cable element

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Cable element				
Compatibility	6	According DS	Under consideration	
Slotted core	6.3	According DS	Visual inspection	
Loose tube	6.4	According DS	Visual inspection	
Compound flow and evaporation		According DS	IEC 60794-1-2 Methods E14 and E15	
Outer diameter	8.2.1.1	According DS	IEC 60811-1-1	
Tight buffer	6.1	According DS	Visual inspection	
Outer diameter	8.2.1.1	According DS	IEC 60793-1-21	
Ribbon	6.5	According DS	Visual inspection	
Filler		According DS		
Insulated copper conductor		According DS		
Central strength member		According DS		

4.3 Installation and operating conditions

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
General requirements	8.1	Agreement between customer and supplier		
Bend test	8.2.1.2	According DS	IEC 60794-1-2 Method G1	
Tube kinking	8.2.2.1	According DS	IEC 60794-1-2 Method G7	
Ribbons: - Dimensions	8.2.3.1	IEC 60794-3, Table 1	IEC 60794-1-2 Method G2, G3 or G4	
- Separability of individual fibres from a ribbon	8.2.3.2.1	IEC 60794-3, 8.2.3.2.1 or according DS	IEC 60794-1-2 Method G5 or according DS	
- Ribbon stripping	8.2.3.2.2	According DS	According DS	
- Torsion	8.2.3.2.3	According DS	IEC 60794-1-2 Method G6	

4.4 Mechanical and environmental tests ¹⁾

The number of fibres tested shall be representative of the cable design and shall be agreed between the customer and the supplier.

¹⁾ The cables may be tested with the appropriate suspension equipment during tensile testing

4.4.1 Tests applicable

Characteristics (9)	IEC 60794-3 Clause/sub- clause (10)	Family requirements (11)	Tests methods (12)	Remarks (13)
Tensile performance	9.1	See 4.4.2.1 and according DS	IEC 60794-1-2 Method E1A and E1B	See 4.4.2.1
Installation capability				
Repeated bending	9.2.2	See 4.4.2.2	IEC 60794-1-2 Method E6	
- Impact	9.2.3	See 4.4.2.3	IEC 60794-1-2 Method E4	
- Torsion	9.2.5	See 4.4.2.4	IEC 60794-1-2 Method E7	
- Temperature cycling	9.5	See 4.4.2.7	IEC 60794-1-2 Method F1	
- Hydrostatic pressure	9.2.6	See 4.4.2.8	IEC 60794-1-2 Method F10	
- Coiling performance	9.2.7	See 4.4.2.9	IEC 60794-1-2 Method E20	
Bending under tension	9.2.1	See 4.6.2.10	IEC 60794-1-2 Method E18	
Cable bend	9.3	See 4.4.2.5	IEC 60794-1-2 Method E11	See 4.4.2.5
Crush	9.4	See 4.4.2.6	IEC 60794-1-2 Method E3	See 4.4.2.6
Ageing	9.6			
- Coating adhesion stability	9.6.1	According DS	IEC 60794-1-2 Method E5	
- Finished cable	9.6.2	Under consideration	IEC 60794-1-2 Method F9	
Water penetration	9.7	Under consideration	IEC 60794-1-2 Method F5B	
Hydrogen resistance		Under consideration		

4.4.2 Details on family requirements and test conditions for optical fibre cable tests

The expression of "no change in attenuation" means that any change in measurement value, either positive or negative, within the uncertainty of measurement shall be ignored. The uncertainty of measurement for this standard shall be $< 0,05$ dB for attenuation.

4.4.2.1 Tensile performance

a) Family requirements

Under long term tensile load (T_L) the fibre strain shall not exceed 20 % of the fibre proof strain and there shall be no change in attenuation during the test. Under installation 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.

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

b) Test conditions

Cable length under tension: not less than 50 m. Taking into account the measurement accuracy and end effects, shorter lengths may be used by agreement between the customer and the supplier.

Fibre length: finished cable length.

Tensile load on cable: long term tensile load (T_L) and installation load (T_M). Other loads may be applied in accordance with particular user conditions.

T_L design water depth $\times$ weight of cable in water (N).

T_M $\geq 2,5 \times$ design water depth $\times$ weight of cable in water (N).

Diameter of test pulleys: 1 m but not less than the minimum loaded bending diameter specified for the cable.

4.4.2.2 Repeated bending

a) Family requirements

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

b) Test conditions

Bending radius: 20 d to 30 d for general use.

Load: sufficient to keep the cable in place during the test.

Number of cycles: > 30 .

Duration of cycle: > 10 s.

4.4.2.3 Impact

a) Family requirements

There shall be no change in attenuation at 1 550 nm after the test. For 1 625 nm applications, performance criteria shall be mutually agreed upon between the customer and supplier.