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**Optical fibre cables –
Part 3-40: Outdoor cables – Family specification for sewer cables and conduits
for installation by blowing and/or pulling in non-man accessible storm and
sanitary sewers**

[IEC 60794-3-40:2008](https://standards.iteh.ai/catalog/standards/sist/0d1b5710-0be5-4e42-bd0b-e0e569fd239/iec-60794-3-40-2008)

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Câbles à fibres optiques –

**Partie 3-40: Câbles extérieurs – Spécification de famille pour les câbles en
égouts et les conduites installés par soufflage et/ou tirage dans les évacuations
d'eaux sanitaires et pluviales non accessibles par l'homme**



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Optical fibre cables –
Part 3-40: Outdoor cables – Family specification for sewer cables and conduits for installation by blowing and/or pulling in non-man accessible storm and sanitary sewers

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Câbles à fibres optiques –

Partie 3-40: Câbles extérieurs – Spécification de famille pour les câbles en égouts et les conduites installés par soufflage et/ou tirage dans les évacuations d'eaux sanitaires et pluviales non accessibles par l'homme

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OPTICAL FIBRE CABLES –

Part 3-40: Outdoor cables – Family specification for sewer cables and conduits for installation by blowing and/or pulling in non-man accessible storm and sanitary sewers

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International Standard IEC 60794-3-40 Ed. 1 has been prepared by sub-committee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

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

This bilingual version corresponds to the monolingual English version, published in 2008-10.

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

FDIS	Report on voting
86A/1228/FDIS	86A/1241/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, 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 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,
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OPTICAL FIBRE CABLES –

Part 3-40: Outdoor cables – Family specification for sewer cables and conduits for installation by blowing and/or pulling in non-man accessible storm and sanitary sewers

1 Scope

This part of IEC 60794 is a family specification that covers sewer cables and conduits for installation by blowing and/ or pulling in non-man accessible storm and sanitary sewers, also applicable for man-accessible and lateral ones. Systems built with components covered by this standard are subject to the requirements of sectional specification IEC 60794-3.

Sewer cable and conduit constructions have to meet the different requirements of the sewer operating companies and/or associations regarding chemical, environmental, operational, cleaning and in general maintenance conditions.

Preferential applications, describing sewer cable characteristics versus methods of installation is reported in Annex A and Annex B for non-man accessible sewers.

Clause 4 describes a blank detail specification for sewer cables and conduits for installation by blowing and/or pulling in storm and sanitary sewers. It incorporates some minimum requirements.

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Detail specifications may be prepared on the basis of this family specification.

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 should be interpreted with respect to this consideration.

The number of fibres tested is representative of the sewer cable 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.

IEC 60304:1982, *Standard colours for insulation for low-frequency cables and wires*

IEC 60793-1-20, *Optical fibres – Part 1-20: Measurement methods and test procedures – Fibre geometry*

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*

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*

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

IEC 60794-3-10, *Optical fibre cables – Part 3-10: Outdoor cables – Family specification for duct and directly buried optical telecommunication cables*

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables and optical cables – Part 1-1: Methods for general application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*

IEC 60811-5-1:1990, *Insulating and sheathing materials of electric and optical cables – Common test methods – Part 5-1: Methods specific to filling compounds – Drop point – Separation of oil – Lower temperature brittleness – Total acid number – Absence of corrosive components – Permittivity at 23 °C – DC resistivity at 23 °C and 100 °C*

3 Symbols

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

APL	Aluminium/polyethylene laminate
SPL	Steel/polyethylene laminate
λ_{CC}	cabled fibre cut-off wavelength
d	nominal outer diameter of the sewer cable
d_c	nominal outer diameter of the conduit
DS	detail specification
$n \times d$	a value times cable outer diameter used for bends, mandrels, etc.
T_O	threshold tensile load below which no attenuation and/or fibre strain increase should occur in the tensile performance test
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 FI
T_{A2}	temperature cycling test low-temperature limit according to IEC 60794-1-2, method FI
T_{B1}	temperature cycling test high-temperature limit according to IEC 60794-1-2, method FI
T_{B2}	temperature cycling test high-temperature limit according to IEC 60794-1-2, method FI
t_1	temperature cycling dwell time

4 Family specification for sewer cables and conduits for installation by blowing and/or pulling in sewers (blank detail specification and minimum requirements)

4.1 Construction

4.1.1 General

In addition to the constructional requirements of sectional specification IEC 60794-3, the following considerations apply to the sewer cables and/or conduits.

The sewer cables and/or conduits shall be designed and manufactured for an expected operating lifetime of at least 15 years. It shall be possible to install or remove the cable in or from the sewer throughout the operational lifetime. Upon removal of the cable or conduit, no remnants which would snag normal sewage debris or which would affect laminar sewage flow shall remain. The materials in the sewer cable and/or as well as accessories including fixing elements and conduits shall not present a health hazard within its intended use.

4.1.2 Conduits

In case of use, the conduits with outer nominal diameters ranging from xx mm to yy mm shall be able to resist pressure differences needed for installation by blowing. They shall be circular and, if needed, corrugated in cross-section throughout their length. The material shall withstand all possible chemical attacks by the sewer liquid itself, as for instance the stainless steel type 1.4401 (X5CrNiMo17-12-2), 1.4571 (X6CrNiMoTi17-12-2), AISI 316L). Inner- and outer-diameter and overall minimum wall thickness shall be specified.

4.1.3 Sewer cables

IEC 60794-3-40:2008

A sewer cable in accordance to this specification should be suitable for installation in non-man accessible storm and sanitary sewers by the following installation methods, also applicable for man-accessible sewers and for lateral sewer systems:

- blowing and/or pulling into a conduit, previously fixed to the sewer wall or, for laterals, placed in between the lateral sewer wall and the in-liner system;
- direct installation into the sewer duct, according to the following applications:
 - drilling and screwing to the inner wall;
 - spanning between manholes, etc. similarly to aerial cables;
 - laying on the ground of the sewer.

The attenuation of the installed cable at the operational wavelength(s) shall not exceed values agreed between the customer and the supplier.

There shall be no fibre splice in a 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 sewer cable.

4.1.4 Rodent protection

Rodent protection is generally needed but there is presently no standard test to measure the level of rodent protection. Rodent protection can be provided by the cable or by the duct.

Tests and requirements are under consideration.

4.2 Optical fibres

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

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

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5	IEC 60793-2-50		
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40, method A, B or C	
at 1 310 nm at 1 550 nm and at 1 625 nm ¹ .		≤ 0,40 dB/km ≤ 0,35 dB/km ≤ 0,40 dB/km		
Attenuation discontinuities at 1 310 and 1 550 nm	5.2.2	≤ 0,10 dB	IEC 60793-1-40, method C	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda$ operational	IEC 60793-1-44, method B	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Outer diameter including colouring	8.2.1.1	IEC 60793-2	IEC 60793-1-20, method D	

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4.2.2 Single mode dispersion shifted (B2) optical fibre

Table 2 – Single mode dispersion shifted (B2) optical fibre

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2		
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40, method A, B or C	
at 1 550 nm	5.2.1	≤ 0,35 dB/km		
Attenuation discontinuities at 1 550 nm	5.2.2	≤ 0,10 dB/km	IEC 60793-1-40, method C	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda$ operational	IEC 60793-1-44, method B	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Outer diameter including colouring	8.2.1.1	IEC 60793-2	IEC 60793-1-20, method D	

¹ Measurements at 1 625 nm are optional

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

Table 3 – Single mode non-zero dispersion (B4) optical fibre

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2		
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40, method A, B or C	
at 1 550 nm	5.2.1	≤ 0,35 dB/km		
at 1 625 ² nm	5.2.1	≤ 0,40 dB/km		
Attenuation discontinuities at 1 550 nm	5.2.2	≤ 0,10 dB/km	IEC 60793-1-40, method C	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda$ operational	IEC 60793-1-44, method B	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Outer diameter including colouring	8.2.1.1	IEC 60793-2	IEC 60793-1-20, method D	

4.2.4 Single mode (B6) optical fibre

Table 4 – Single mode (B6) optical fibre

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2		
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40, method A, B or C	
at 1 550 nm	5.2.1	≤ 0,30 dB/km		
at 1 625 ³ nm	5.2.1	≤ 0,40 dB/km		
Attenuation discontinuities at 1 550 nm	5.2.2	≤ 0,10 dB/km	IEC 60793-1-40, method C	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda$ operational	IEC 60793-1-44, method B	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Outer diameter including colouring	8.2.1.1	IEC 60793-2	IEC 60793-1-20, method D	

4.2.5 Multimode fibres

Under consideration.

² Measurements at 1 625 nm are optional

³ Measurements at 1 625 nm are optional

4.3 Sewer cable constructions

4.3.1 Cable for installation within conduits (previously fixed to the sewer wall)

**Table 5 – Characteristics – Cable for installation within conduits
(previously fixed to the sewer wall)**

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Lay-up	7.2	According to DS	Visual inspection	
Sewer cable core	7.3	According to DS		
Filling compound (if used)		According to DS	Either IEC 60794-1-2, method E14 or IEC 60811-5-1, Clause 4 IEC 60811-5-1, Clause 5 IEC 60811-5-1, Clause 8	
Dry blocking compound	7.3	According to DS	Under consideration	
Strength member	7.4	According to DS	Visual inspection	
- central				
- peripheral				
Moisture barrier	7.5	According to DS		
Metallic tapes (if any):				
Outer cable sheath	7.6			
Material		IEC 60794-3-40:2008		
Minimum sheath thickness		According to DS	IEC 60811-1-1	
Outer cable diameter		According to DS	IEC 60811-1-1	
Optional protection		According to DS		
Sheath marking	7.7			
Configuration, dimensions		According to DS	Visual inspection	
Abrasion resistance		According to DS	IEC 60794-1-2, method E2B	Method 1 Steel needle diameter $d = 1,0$ mm load: 4 N Method 2 with: felt pad consisting of either 1) water soaked wool felt or 2) rayon felt with < 30 % wool Weight: > 450 g
Sheath abrasion	9.2.8	According to DS	IEC 60794-1-2, method E2A	
Sewer cable length			Under consideration	

4.3.2 Cable for direct installation into the sewer duct

Table 6 – Characteristics – Cable for direct installation into the sewer duct

Characteristics (9)	IEC60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Lay-up	7.2	According to DS	Visual inspection	
Sewer cable core	7.3	According to DS		
Filling compound (if used)		According to DS	Either IEC 60794-1-2, method E14 or IEC 60811-5-1, Clause 4 IEC 60811-5-1, Clause 5 IEC 60811-5-1, Clause 8	
Dry blocking compound	7.3	According to DS	Under consideration	
Strength member	7.4	According to DS	Visual inspection	
- central				
- peripheral				
Moisture barrier	7.5	According to DS		
Metallic tapes:				
Outer cable sheath	7.6			
Material				
Minimum sheath thickness		According to DS	IEC 60811-1-1	
Outer cable diameter		According to DS	IEC 60811-1-1	
Optional protection		According to DS		
Sheath marking	7.7			
Configuration, dimensions		According to DS	Visual inspection	
Abrasion resistance		According to DS	IEC 60794-1-2 method E2B	Method 1 Steel needle diameter $d = 1,0 \text{ mm}$ load: 4 N Method 2 with: felt pad consisting of either 1) water soaked wool felt or 2) rayon felt with < 30 % wool Weight: > 450 g
Sheath abrasion	9.2.8	According to DS	IEC 60794-1-2 method E2A	
Sewer cable length			Under consideration	

4.3.3 Conduit construction

Table 7 – Characteristics – Conduit construction

Characteristics (9)	IEC 60794-3 as applicable Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Material(s)				
Conduit inner diameter		According to DS	IEC 60811-1-1	
Conduit outer diameter		According to DS	IEC 60811-1-1	
Corrugated conduit (metallic) - metallic tape thickness - corrugated depth - pitch Non-corrugated conduit Inner tube (if any): - tube wall thickness Moisture barrier (if any): - metallic tapes Additional outer sheath (if any): - thickness	Under consideration	Under consideration	Under consideration	Under consideration
Conduit length			Under consideration	

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<https://standards.iteh.ai/catalog/standards/sist/0d1b5710-0be5-4e42-bd0b-60c56916d259/iec-60794-3-40-2008>

4.4 Installation and operating conditions

4.4.1 Tests applicable to cables/cable elements

Table 8 – Tests applicable to cables/cable elements

Characteristics (9)	IEC 60794-3 Clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
General requirements Tests applicable to loose tubes:	8.1	Agreement between customer and supplier		
Bend test	8.2.1.2	According to DS	IEC 60794-1-2, method G1	
Tube kinking	8.2.2.1	According to DS	IEC 60794-1-2, method G7	
Tests applicable to ribbons:				
- dimensions	8.2.3.1	IEC 60794-3, Table 1	IEC 60794-3, 8.2.3.1	
- separability of individual fibres from ribbon	8.2.3.2.1	IEC 60794-3, 7.2.3.2.1 or according to DS	IEC 60794-1-2, method G5 or according to DS	
- ribbon stripping	8.2.3.2.2	According to DS		
- torsion	8.2.3.2.3	According to DS	IEC 60794-1-2, method G6	