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INTERNATIONAL STANDARD

Optical fibre cables –
Part 3-70: Outdoor cables – Family specification for outdoor optical fibre cables for rapid/multiple deployment

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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OPTICAL FIBRE CABLES –

Part 3-70: Outdoor cables – Family specification for outdoor optical fibre cables for rapid/multiple deployment

FOREWORD

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IEC 60794-3-70 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

This second edition cancels and replaces the first edition published in 2016. It constitutes a technical revision.

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

a) incorporation of the new classification system for optical fibre categories, sub-categories in IEC 60793-2-10;
b) incorporation of the new classification system for optical fibre categories, sub-categories and models in IEC 60793-2-50;
c) updating of cabled fibre performance categories in alignment with ISO/IEC 11801-1;
d) updating of bibliographical references.

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

FDIS	Report on voting
86A/2086/FDIS	86A/2091/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

OPTICAL FIBRE CABLES –

Part 3-70: Outdoor cables – Family specification for outdoor optical fibre cables for rapid/multiple deployment

1 Scope

This part of IEC 60794 is a family specification that covers outdoor optical fibre cables intended for rugged terrestrial rapid/multiple deployment. These cables, with enhanced mechanical, environmental and ingress performance can be used wherever a rapid or multiple deployment is relevant (e.g. mobile broadcast units, emergency rescue services, tactical ground-forces, outdoor motion-robotics, mining machinery, temporary repair cables for damaged links, etc.).

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 60793-2-10:2019, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 60793-2-50:2019, *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 60794-1-21:2015, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods*
IEC 60794-1-21:2015/AMD1:2020

IEC 60794-1-22:2017, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental tests methods*

IEC 60794-1-23:2019, *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable element test methods*

IEC 60794-1-215, *Optical fibre cables – Part 1-215: Generic specification – Basic optical cable test procedures – Environmental test methods – Cable external freezing test, Method F15*

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

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

3 Terms and definitions

No terms and definitions are listed in this document.

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

4 General requirements

The cable shall comply with the sectional specification, IEC 60794-3, and meet the requirements which are defined in it.

The optical fibre contained in cables covered by this document shall comply with one of the following standards, and meet the normative requirements defined within them as applicable:

- IEC 60793-2-10:2019, Annex A (multimode fibre sub-categories A1-OM2, A1-OM3, A1-OM4, and A1-OM5, fibre models a and b);
- IEC 60793-2-10:2019, Annex B (multimode fibre sub-category A1-OM1);
- IEC 60793-2-50:2019, Annex A (single-mode fibre sub-category B-652.B and B-652.D);
- IEC 60793-2-50:2019, Annex F (single-mode fibre category B-657);

To enable compatibility with ISO/IEC 11801-1, optical performance level requirements are presented in terms of the performance classification codes as follows:

- OS1a: single-mode fibre, sub-categories B-652.D, B-657.A1, B-657.A2, B-657.B2 and B-657.B3;
- OS2: single-mode fibre, sub-categories B-652.D, B-657.A1, B-657.A2, B-657.B2 and B-657.B3;
- OM3: multimode fibre, models A1-OM3a and A1-OM3b;
- OM4: multimode fibre, models A1-OM4a and A1-OM4b;
- OM5: multimode fibre, models A1-OM5a and A1-OM5b.

NOTE These codes are informative from the perspective of the requirements defined in this document.

5 Specification for outdoor optical fibre cables for rapid/multiple deployment

5.1 Construction

5.1.1 General

In addition to the construction requirements of IEC 60794-3, where applicable, the following considerations apply to outdoor optical fibre cables for rapid/multiple deployment.

Rapid/multiple deployment optical fibre cables are designed to be used in un-protected outdoor terrestrial environments thereby requiring enhanced mechanical, environmental and ingress performance.

A blank detail specification for outdoor optical fibre cables for rapid/multiple deployment is provided in Annex A.

5.1.2 Rapid/multiple deployment optical fibre cables

Rapid/multiple deployment optical fibre cables are suitable for use by manual or mechanically assisted deployment. They are differentiated from other outdoor optical fibre cables due to:

- repeated deployment/installation;
- unprotected working environment;

- often stored on relatively small diameter drums;
- uncontrolled or non-regulated cable route.

All the above, as well as additional factors, require these cables to have enhanced mechanical (i.e. tensile, crush, bend radius, torsion, abrasion, kink, memory) environmental (i.e. temperature, UV resistance, cold-bend) and ingress (i.e. fuel, solvent and oil resistance, waterblocking) performance over the cable's lifetime. These shall be incorporated into the cable's design.

5.2 Optical fibres

For the purposes of this document, supported optical fibres are those detailed in Clause 4. There shall be no fibre splice in a delivered length unless otherwise agreed by customer and supplier.

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

Transmission performance of the cabled optical fibres shall be in accordance with IEC 60794-1-1.

5.3 Secondary coating

Although the different recognized secondary coatings detailed in IEC 60794-3 (tight buffer, tube, ribbon, slotted core, etc.) are supported by this document, the type of secondary coating, materials and dimensions shall be as required by the cable detail specification.

NOTE Both laboratory testing as well as field use have demonstrated the tight buffer to be most optimized to meet all the relevant performance test requirements detailed in Clause 6.

5.4 Outer sheath

The cable shall have a seamless sheath made of a UV-stabilised weather-resistant polymeric compound, unless otherwise agreed between the customer and supplier.

The sheath thickness and cable overall diameter and its variations shall take into account the operating conditions and shall be determined by agreement between the customer and supplier.

5.5 Mechanical and environmental tests

Based on the expected operating conditions over the life of the product, including the mechanical loads exerted on the product during deployment and operation, Clause 6 specifies product performance for rapid/multiple deployment optical fibre cables. Unless otherwise specified, the installation temperature range shall be: –40 ºC to +70 ºC.

6 Testing of rapid/multiple deployment optical fibre cables

6.1 General

Some of the tests detailed in Table 1 below may not be applicable to certain cable designs and intended applications. For further guidance on the applicability of test methods and frequency of testing, see IEC 60794-1-1.

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

6.2 Applicable tests

See Table 1.

Table 1 – Tests applicable for mechanical and environmental performance of a rapid/multiple deployment optical fibre cable

Characteristic	Family requirement	Test method	Remark
Tensile performance	6.3	IEC 60794-1-21 method E1	
Abrasion	6.4	IEC 60794-1-21 method E2A	
Crush	6.5	IEC 60794-1-21 method E3	
Impact	6.6	IEC 60794-1-21 method E4	
Ribbon stripping	6.7	IEC 60794-1-23 method G10B	If ribbons are used
Repeated bending	6.8	IEC 60794-1-21 method E6	
Torsion	6.9	IEC 60794-1-21 method E7	
Flexing	6.10	IEC 60794-1-21 method E8	
Kink	6.11	IEC 60794-1-21 method E10	
Bend	6.12	IEC 60794-1-21 method E11A	
Bending under tension	6.13	IEC 60794-1-21 method E18A	
Multiple cable coiling and uncoiling performance	6.14	IEC 60794-1-21 Method E33	
Temperature cycling	6.15	IEC 60794-1-22 Method F1	
Water penetration	6.16	IEC 60794-1-22 Method F5B/F5C	
Ageing	6.17	IEC 60794-1-22 Method F9	
UV resistance	6.18	IEC 60794-1-22 Method F14	
External freezing	6.19	IEC 60794-1-215 Method F15A	
Separability of individual fibres from ribbon	6.20	IEC 60794-1-23 Method G5	If ribbons are used
Tube kinking	6.21	IEC 60794-1-23 Method G7	If loose tubes are used
Fuel solvent resistance			IEC 60811-404 may be applicable

6.3 Tensile performance

a) Family requirements

For some of the parameters specified, the objective is a level of strain that will not compromise fibre mechanical reliability. 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, fibre strain at T_L shall be limited to 17 % of the proof-test strain (equal to absolute 0,34 % strain for 2 % proof tested fibres).

b) Test conditions

Method:	IEC 60794-1-21, method E1
Tensile short-term load on cable:	2 700 N or 1 × the weight of 1,0 km length of cable in N, the smaller of the two.

NOTE Other tensile loads can be agreed between customer and supplier.

6.4 Abrasion

a) Family requirements

There shall be no perforation of the sheath after performing 100 cycles. Other criteria may be agreed between customer and supplier.

b) Test conditions

Method:	IEC 60794-1-21, method E2A
Applied force:	7 N
Diameter of needle:	10 mm

6.5 Crush

a) Family requirements

After removal of the short-term load, there shall be no change in attenuation. 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 cable is not considered mechanical damage.

b) Test conditions

Method:	IEC 60794-1-21, method E3A
Short-term load (plate/plate):	8 000 N
Duration of load:	1 min

NOTE Other compression loads can be agreed between customer and supplier.

6.6 Impact

a) 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.

b) Test conditions

Method:	IEC 60794-1-21, Method E4
Number of impacts:	One in 3 different places spaced not less than 500 mm apart
Striking surface curvature radius:	300 mm
Impact energy:	22 J