IEC 60794-4-20

Edition 2.0 2018-08
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Optical fibre cables –
Part 4-20: Sectional specification – Aerial optical cables along electrical power lines – Family specification for ADSS (all dielectric self-supported) optical cables

IEC 60794-4-20:2018-08 RLV(en)

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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FOREWORD

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International Standard IEC 60794-4-20 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2012 and constitutes a technical revision.

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

a) this document has been streamlined by cross-referencing IEC 60794-1-1, IEC 60794-4 (all parts) and IEC 60794-1-2;
b) reference to the MICE table has been deleted;
c) the example of test method for particular environment in Annex C has been deleted;

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

FDIS	Report on voting
86A/1867/FDIS	86A/1876/RVD

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

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

A list of all the 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 "http://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- withdrawn,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.

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OPTICAL FIBRE CABLES –

Part 4-20: Sectional specification – Aerial optical cables along electrical power lines – Family specification for ADSS (all dielectric self-supported) optical cables

1 Scope

This part of IEC 60794-4, which is a family specification, covers optical telecommunication cables, commonly with single-mode fibres[1] ~~to be~~ used primarily in overhead power lines applications. The cables ~~may~~ can also be used in other overhead utility networks, such as for telephony or TV services. Requirements of the sectional specification IEC 60794-4 for aerial optical cables along electrical power lines are applicable to cables covered by this document.

This document covers the construction, mechanical, electrical, and optical performance, installation guidelines, acceptance criteria, test requirements, environmental considerations, and accessories compatibility for an all dielectric, self-supporting fibre optic (ADSS) cable. This document provides construction and performance requirements that ensure, within the guidelines of this document, that the required mechanical ~~capabilities~~ integrity of the cable components ~~and maintenance of optical fibre integrity and optical transmissions are proper~~ as well as optical fibre mechanical reliability and transmission parameters are maintained.

The ADSS cable consists of single mode optical fibres contained in one or more protective dielectric fibre optic units surrounded by or attached to suitable dielectric strength members and sheaths. The cable does not contain metallic components. An ADSS cable is designed to meet the optical and mechanical requirements under different ~~types of~~ installation, operating and environmental conditions and loadings, as described in Annex B.

This document excludes any "lashed" or "wrapped" OPAC cables included in IEC 60794-4. Figure 8 aerial cables are also excluded; they are specified in IEC 60794-3-20.

~~Cables intended for installation in conformity with ISO/IEC 24702 and related standards may require the specification of additional tests to ensure their suitability in the applicable environments defined by the mechanical, ingress, climatic and chemical, and electromagnetic (MICE) classification. These tests are outside of the scope of IEC 60794 cable specifications, and MICE criteria are not part of the requirements for IEC 60794 specifications. The MICE tests may be the same as, similar to, or substantially different from, the tests required by IEC 60794 specifications. Cables manufactured per IEC 60794 specifications may or may not meet the MICE criteria. For supplemental discussion, see IEC/TR 62362.~~

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

~~IEC 60793-1-40, *Optical fibres – Part 1-40: Measurement methods and test procedures – Attenuation*~~

[1] In some particular situations in the electrical industry, short overhead links can be also designed with multimode fibres.

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

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

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: Generic specification – General*

~~IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures* [2], [3]~~

IEC 60794-1-21:2015, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical test methods*

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

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

IEC 60794-4, *Optical fibre cables – Part 4: Sectional Specification – Aerial optical cables along electrical power lines*

~~IEC 61395, *Overhead electrical conductors – Creep test procedures for stranded conductors*~~

ISO 9001, *Quality management systems – Requirements*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms, definitions and abbreviated terms given in IEC 60794-1-1 and IEC 60794-4~~, as well as the following,~~ apply.

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

~~**3.1**~~
~~**maximum allowable tension**~~
~~**MAT**~~
~~maximum tensile load that may be applied to the cable without detriment to the performance requirements (optical performance, fibre durability) due to fibre strain~~

~~[2] This document has been withdrawn, but can still be purchased, if necessary. Until IEC 60794-1-21 will be available, the tests stated in Clause 9 have to be taken from IEC 60794-1-2.~~

~~[3] This standard will be replaced by IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical test methods* (see also Bibliography), as soon as it will be available.~~

Note 1 to entry: Due to installation codes the MAT value is sometimes restricted to be less than 60 % of the breaking tension of the cable.

3.2
maximum operation tension
MOT
tensile load that can be applied to the cable either permanently or for a long term without producing any strain to the fibres

Note 1 to entry: This condition should correspond to the tension with no ice and no gale wind at average mean temperatures throughout the year, assumed to be between 16 °C and 20 °C.

3.3
zero strain margin
tensile load that the cable can sustain without strain on fibres due to cable elongation

3.4
breaking tension
tensile load that will produce physical rupture of the cable

Note 1 to entry: There is no optical consideration related to this parameter.

Note 2 to entry: The breaking tension should be calculated. The design model shall be validated; the cables do not need to be tested.

3.5
maximum installation tension
MIT
maximum load that should be applied during the installation procedure

Note 1 to entry: The maximum installation tension refers mainly to the final adjust of sag (also called sagging load), and the same tension limit can be used for the deployment of the cable (also called stringing load).

Note 2 to entry: This is a recommended value aimed at avoiding tension values higher than MAT during operational life due to wind, ice or temperature changes.

3.6
ADSS
all dielectric self supported cable
dielectric cable that is capable of enduring aerial installation and providing long term service, without any external tensile support

3.7
OPAC
optical attached cable
dielectric, not self-supported, optical attached cable

Note 1 to entry: OPACs can be used with one of the following attachment methods:

- wrapped, known as an all-dielectric (wrap): using special machinery, a lightweight flexible non-metallic cable is wrapped helically around either the earth wire or the phase conductor;
- lashed: non-metallic cables are installed longitudinally alongside the earth wire, the phase conductor or on a separate support cable (on a pole route) and are held in position with a binder or adhesive cord;
- spiral attached: similar to the lashed cables except that the method of attachment involves the use of special preformed spiral attachment clips.

Note 2 to entry: OPAC cable designs are not covered by this specification.

~~**3.8**~~
~~**cable fittings and dampers**~~

~~**3.8.1**~~
~~**suspension cable fitting**~~
~~device to hold up the cable in intermediate support points along an aerial line, where the cable is under tension at both sides of the fitting~~

~~**3.8.2**~~
~~**dead end cable fitting**~~
~~device designed to terminate an installation run, isolate a splice location or maintenance coil, provide slack span locations, or provide for extreme angle turns, where the cable is under tensional load on one side of the fitting and tension free on the other~~

~~**3.8.2**~~
~~**damper**~~
~~device attached to a cable in order to suppress or minimize vibrations due to wind~~

4 Optical fibres

~~4.1 General~~

Single mode optical fibres shall be used that meet the requirements of IEC 60793-2-50. ~~In this clause only the main characteristics are mentioned.~~ Other types of fibre can be agreed upon between the customer and the supplier; such fibre shall conform to IEC 60793-2. The cabled fibre shall conform to IEC 60794-4.

~~Fibres other than those specified above can be used, if mutually agreed between the customer and supplier. In this case, fibre characteristics and attenuation criteria for mechanical tests shall be specified in the detail specification.~~

~~4.2 Attenuation~~

~~4.2.1 Attenuation coefficient~~

~~The requirements for the uncabled fibres shall be according to IEC 60793-2-50.~~

~~Unless other values are agreed between supplier and customer, the maximum attenuation coefficient of the cabled fibres shall be 0,35 dB/km when measured at 1 310 nm and/or 0,25 dB/km at 1 550 nm.~~

~~Different values from those stated above can be agreed between customer and supplier.~~

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

~~4.2.2 Attenuation discontinuities~~

~~The local attenuation shall not have point discontinuities in excess of 0,10 dB.~~

~~The test method used to verify the functional requirements shall be in accordance with IEC 60793-1-40.~~

~~4.3 Cut-off wavelength of cabled fibre~~

~~The cabled fibre cut-off wavelength λ_{cc} shall be lower than the operational wavelength when measured in accordance with IEC 60793-1-44.~~

~~**4.4 Fibre colouring**~~

~~The primary coated fibres shall be coloured for identification. The coloured coating shall be readily identifiable throughout the lifetime of the cable and shall be at a reasonable match to the requirements stated on IEC 60304. If required, the colouring shall permit sufficient light to be transmitted through the primary coating to allow local light injection and detection.~~

~~**4.5 Polarisation mode dispersion (PMD)**~~

~~PMD shall meet the values indicated in IEC 60793-2-50. The measurement procedure shall be in accordance with IEC 60793-1-48.~~

5 Cable elements

Refer to the relevant parts of the sectional specification IEC 60794-4~~; the following requirements apply specifically to ADSS cables~~.

~~The material(s) used for a cable element shall be selected to be compatible with the other elements in contact with it.~~

~~Optical elements (cable elements containing optical fibres) and each fibre within a cable element shall be uniquely identified, for example, by colours, by a positional scheme, by markings or as agreed between customer and manufacturer.~~

~~For loose tube construction, one or more primary coated fibres or optical elements are packaged, loosely in a tube construction, with a suitable water-blocking system. The plastic tube may be reinforced with a composite wall.~~

~~If required by the customer, the suitability of the tube shall be determined by an evaluation of its kink resistance in accordance with IEC 60794-1-23, Method G7.~~

~~When used, optical fibre ribbons should comply with the requirements stated in IEC 60794-3.~~

6 Optical fibre cable constructions

6.1 General

The construction and characteristics of cable elements shall conform to IEC 60794-4. The cable shall not contain any metallic material.

~~**6.2 Optical unit**~~

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

~~Single optical unit in the cable centre, which may contain one or more optical elements:~~

~~a) number of loose tubes using helical or SZ stranding configurations around a central element of reinforced plastic, epoxy-glass, or other dielectric material. Ribbon elements may be laid up by stacking two or more elements inside the loose tubes;~~

~~b) configuration based on a channelled dielectric rod, containing units such as ribbons or plastic tubes, which may contain one or more optical elements.~~

6.2 Cable protection elements

In addition to the optical unit, the cable construction may consist of the following.

a) The outer sheath shall be a weather-resistant type material. In certain conditions, it shall be necessary to consider the use of a tracking-resistant sheath.

b) An ADSS cable shall contain self-supported systems that are integral to the cable. The purpose of the support system is to ensure that the cable meets the optical requirements under specified installation conditions, temperatures, and environmental loading for its whole operating design life.~~ This standard excludes any “lashed” or “wrapped” OPAC cables.~~

c) The basic annular construction may have strength yarns (e.g. aramid yarns) or other dielectric strands or~~ a channelled~~ dielectric rods as a support structure.~~ In addition, other cable elements, such as central members, may be load bearing.~~ A single central dielectric shaft, channelled to accommodate the optical elements, is also accepted.

~~d) Fibre strain allowance.~~

~~e~~d) The cable shall be designed such that fibre strain does not exceed the limit allowed by the cable manufacturer under design tension limits of the cable (MAT). Maximum allowable fibre strain under MAT condition~~ will generally be a function of the proof test level and strength and fatigue parameters of the optical fibre, 0,33 % is specified for fibre proof tested to 1 %~~ shall be ≤ 0,2 % for 0,69 GPa proof-tested fibres.

~~f) A water blocking material shall be used to prevent water penetration to the optical units and to the cable core. The material shall be easily removed without the use of materials considered to be hazardous or dangerous. Water swell able blocking materials can also be used.~~

~~When used in the cable construction, the filling compound shall not flow at temperatures lower than the maximum specified operation temperature of cable.~~

~~NOTE In some countries, a special requirement of shotgun resistance can be specified for aerial cables. ADSS covered by this standard are not designed for this condition.~~

~~Cables with reinforced textile protection, could still meet the dielectric condition, but the increase in diameter and weight would require a significant enhancement of the tensile performance of the cable.~~

NOTE In some countries, a special requirement of shotgun resistance can be specified for aerial cables. ADSS cables covered by this document are not designed for such a condition. Cables with reinforced textile protection could still meet the dielectric condition, but the increase in diameter and weight would make necessary a significant enhancement of the tensile performance of the cable.

7 Main requirements for installation and operating conditions

Operating conditions are particularly important for ADSS cables.

Installation and operating conditions shall be agreed between the customer and the supplier. For the ADSS cable, a detailed study of the field conditions and~~ an important amount~~ a certain level of technical support by the supplier or third-party expert should precede the agreement. Annex B provides a general view of such considerations.

The type of fittings and hardware used to attach the ADSS to the structures shall be approved between the customer and the supplier. Their compatibility~~ has to be checked according to 9.11 and the supplier or the customer fittings' specification~~ shall be verified in accordance with 9.15 and the fittings product specification.

8 Cable design considerations

Table 1 is a summary of cable characteristics which may be of importance as specifications to both the customer and the supplier. Table 2 includes optional engineering parameters relevant for the design and installation of the overhead line with an ADSS cable. Other characteristics may be mutually agreed upon by both the customer and the supplier. A complete blank specification is shown in Annex D.