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Hybrid communication cables – Part 3-10: Outdoor hybrid cables – Family specification for FTTA hybrid communication cables

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FOREWORD

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IEC 62807-3-10 has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

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

Draft	Report on voting
46C/1246/FDIS	46C/1251/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/publications.

This part of IEC 62807 is to be used in conjunction with IEC 62807-3:2023. It is based on the first edition of that document.

A list of all parts in the IEC 62807 series, published under the general title *Hybrid communication 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- withdrawn,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.

HYBRID COMMUNICATION CABLES –

Part 3-10: Outdoor hybrid cables – Family specification for FTTA hybrid communication cables

1 Scope

This part of IEC 62807 is a family specification for FTTA (Fibre-To-The-Antenna) outdoor hybrid communication cables. It specifies the design and construction, rated values and characteristics, requirements and test methods, packaging and quality assurance, etc.

The FTTA hybrid communication cables are typically but not only installed between the Base Band Unit (BBU) and Remote Radio Unit (RRU; or often called RRH – Remote Radio Head or AAU – Active Antenna Unit), and other scenario that supply electric current to optical communication equipment.

The FTTA hybrid communication cables contain optical fibre elements and current carrying elements under a common outer sheath or other constructions unifying the elements. The current carrying elements are used only to supply power to the equipment within the communication network. The current carrying elements are not used for electricity distribution or transmission, nor for power supply to domestic appliances.

The relationship between each of the MICE classifications in ISO/IEC 11801-1, the requirements and test methods of hybrid cables being proposed in a specific application are fully considered and aligned (see Annex A).

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 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60227-1, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60228:2004, *Conductors of insulated cables*

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

IEC 60502-1, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) − Part 1: Cables for rated voltages of 1 kV (Um = 1,2 kV) and 3 kV (Um = 3,6 kV)*

IEC 60793-1-40, *Optical fibres – Part 1-40: Attenuation measurement methods*

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

IEC 60793-1-46, *Optical fibres – Part 1-46: Measurement methods and test procedures – Monitoring of changes in optical transmittance*

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

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

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 60794-1-21, *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 60794-1-31, *Optical fibre cables – Part 1-31: Generic specification – Optical cable elements – Optical fibre ribbon*

IEC 60794-1-403, *Optical fibre cables – Part 1-403: Generic specification – Basic optical cable test procedures – Electrical test methods – Electrical continuity test of cable metallic elements, method H3*

IEC 60794-2, *Optical fibre cables – Part 2: Indoor cables − Sectional specification*

IEC 60794-3:2022, *Optical fibre cables – Part 3: Outdoor cables – Sectional specification*

IEC 62807-3:2023, *Hybrid communication cables – Part 3: Outdoor hybrid cables – Sectional specification*

IEC 62821 (all parts), *Electric cables – Halogen-free, low smoke, thermoplastic insulated and sheathed cables of rated voltages up to and including 450/750 V*

IEC 62821-1, *Electric cables – Halogen-free, low smoke, thermoplastic insulated and sheathed cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 63294, *Test methods for electric cables with rated voltages up to and including 450/750 V*

ISO/IEC 11801-1:2017, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms, definitions, symbols and abbreviated terms given in IEC 62807-3, IEC 60794-1-1, IEC 60227-1, IEC 62821-1 and IEC 60502-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 Design and construction

4.1 General

This hybrid cable is typically composed of optical fibre elements and current carrying elements with strength member, filler, yarn, tape, ripcord, screening and/or shield, moisture barrier, sheath or armouring, etc. The hybrid cable shall be designed to meet the requirements of cable application and operating environment.

Some examples of structures of typical FTTA hybrid cables are shown in Annex B. Annex C describes a blank detail specification for FTTA hybrid cables and incorporates some minimum requirements.

4.2 Optical fibre elements

The optical fibre elements shall be in accordance with the following:

a) The optical fibre elements shall be composed of one or more optical fibres, tight or semi-tight buffered fibres, fibre ribbons, buffer tubes, other optical core structures, or independent optical fibre cables (such as loose tube cable). The construction and number of optical fibre elements shall be specified in the relevant specification.

b) The optical fibres can be single-mode fibres and shall comply with the requirements of IEC 60793-2-50, or may be multi-mode fibres and shall comply with the requirements of IEC 60793-2-10.

c) The tight buffer shall be removable from the fibre for termination. The semi-tight buffer shall be easily removable from the fibre in longer strip lengths than the tight buffer. The tight or semi-tight buffer should be made of thermoplastic material or ultraviolet cured resin.

d) The optical fibre ribbon shall comply with IEC 60794-1-31 or the relevant specification.

e) Optical core structures shall comply with IEC 60794-2 or IEC 60794-3 or the relevant specification.

f) For ease of identification, all the optical fibre and optical fibre elements shall be identified, for example colour coding, ring marking, printing or some other methods agreed between the customer and supplier. If the primary coated fibres are coloured for identification, the coloured coating shall be readily identifiable throughout the lifetime of the cable and the coloured coating shall comply with IEC 60304. Additional information can be found in IEC TR 63194.

g) The material of the optical elements' sheath or loose tube may be polyethylene, polypropylene, polybutylene terephthalate (PBT), low smoke halogen free material, polyvinyl chloride, or other materials suitable to the application.

4.3 Current carrying elements

The design of conductor cross-sections shall be in accordance with the rated voltage, transmission distance and consumed power of the powered device. Under normal operating conditions, the temperature increase caused by the power transmission shall not exceed the maximum conductor temperature of the current carrying elements as specified in Table D.1 of Annex D.

Current carrying elements shall meet the requirements of the appropriate specification before being assembled into hybrid cables. For example, for a rating voltage up to and including 450/750 V, current carrying elements shall meet the requirements of the IEC 60227 series or the IEC 62821 series. For a rating voltage of 0,6/1 kV, the current carrying elements shall meet the requirements of IEC 60502-1.

The conductor should be continuous and without joints through the length of the hybrid cable.

4.4 Strength member

For a layer stranded cable core with strength members in the centre of the optical element, materials specified in IEC 60794-3 should be used. Other strength members shall be placed in a suitable position, according to the structure of the hybrid cable.

4.5 Filler

To make the cable core achieve its design shape, fillers with specified outside diameter or other shape are used to fill the vacancy in the cable core.

4.6 Yarn

Hybrid cables may have yarns. Those yarns should be non-hygroscopic and non-oil absorption with enough tensile strength to meet cable tensile requirements. Water blocking yarns may be used.

4.7 Tape

The cable core may be protected by a tape or tapes, applied longitudinally or helically. The tape may provide thermal insulation and/or provide dielectric properties. Yarns per 4.6 may be used in conjunction with tapes.

The material may be polyester, polyester non-woven tape, water-blocking tape or other materials specified in the detail specifications.

4.8 Ripcord

If required, a ripcord(s) may be provided over the cable core and should be continuous through the entire length of the hybrid cable. It shall be non-hygroscopic, non-oil absorption and have enough strength to cut the hybrid cable sheath.

The ripcord shall be capable of ripping the sheath for a distance of 1 m when tested in accordance with IEC 60794-1-21, method E25.

4.9 Screen and/or shield

A screen may be used to minimize electromagnetic noise induced by currents. The screen may be outside the metallic core components or within them.

Screens or shields may be single/multi-layer longitudinal or wrapped metallic tapes, or may be foils laminated to a plastic tape, or single/multi-layer wrapped or braided (woven) wires, or a combination of all of these.

In case a collective screen is needed for national safety region, the design shall follow these requirements i.e. the same cross-section as the current carrying elements. When a braided single-layer shield or screen is employed, the braid coverage factor should not be less than 80 %. When a braided double-layer shield or screen is employed, or a combined structure of metal band and woven layer, the braid coverage factor should not be less than 30 %. Different coverage factors for both cases could be agreed between customer and supplier and those should be indicated in the data sheet. Annex E provides an example of how to calculate the coverage factor formulae of the shield. The braided screen or shield can be on its own or be part of another tape screen.

4.10 Moisture barrier

The screen or shield may act as a moisture barrier when it is a metallic foil or tape. It shall be continuous and has a hermetically sealed overlap or seamless construction.

4.11 Inner sheath

If needed, an inner sheath may be applied between the cable core(s) and the armouring layer. The material of the inner sheath may vary according to the design of the cable and customer requirements.

4.12 Armouring

Where additional tensile strength or protection from external damage is required, armouring may be provided. The armouring is generally applied under the outer sheath. Tapes, wire wrapping and braiding can be of metallic or dielectric materials and can be applied as agreed between the customer and manufacturer.

4.13 Outer sheath

The outer sheath should protect the cable against environmental conditions (such as humidity, UV radiation) and mechanical loads (such as crush, tensile, impact). Suitable materials, such as polyethylene, polypropylene, PVC, polyurethane and flame-retardant low smoke polyolefins can be used.

4.14 Sheath marking

If required, the cable shall be marked according to the agreement between the customer and supplier, or according to IEC 60794-3:2022, 6.7.

5 Rated values and characteristics

5.1 Minimum bending radius for installation

Minimum bending diameter for installation:

Static: 20 × D (unarmoured), 30 × D (armoured)

Dynamic: 40 × D (unarmoured), 60 × D (armoured)

NOTE D is the outer diameter of hybrid cable; for non-round shape hybrid cable, the diameter is the minor dimension, in mm.

5.2 Temperature range

Operation environment temperature range: −25 °C to +70 °C [1] or −40 °C to +70 °C [2]

An additional temperature range can be agreed between customer and supplier.

NOTE The maximum temperatures of conductors are given in Table D.1.

5.3 Rated voltages

Rated voltages: 300/500 V, 450/750 V, or 0,6/1 kV

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1 This environment performance reaches C_2 in MICE classification.

2 This environment performance reaches C_3 in MICE classification.

NOTE For a guide on how to use or select cables, including limitations on current carrying capacity, refer to IEC 62440 for rated voltages up to 450/750 V, or to IEC 60183 for rated voltages up to 0,6/1 kV and above.

6 Requirements and test methods

6.1 General

Compliance with the specification requirements of the overall hybrid cable shall be verified by carrying out tests selected from Clause 6, and in accordance with the safety requirements as defined by the specific application.

It is not intended that all tests be carried out in all cases. The tests to be applied on cabled optical fibre elements should be agreed between the customer and the supplier. Current carrying elements shall be tested according to the requirements specified in this document and cited references.

NOTE The issue of DC rating and DC stability is currently under consideration and needs to be further addressed.

6.2 Construction and length inspection

6.2.1 Construction

The manufacturer shall implement measures to ensure that the construction, colour coding and various structure dimensions comply with the requirements. The visual and mechanical inspection shall be at the position which is at least 100 mm away from the cable end.

6.2.2 Cable length and marking accuracy

The cable length shall be determined by measuring the points at which the meter mark can be identified near the end of the cable (if the cable has been re-printed (marked), choose this marking as the reference). The actual length of the cable shall be within $^{+1}_{-0}$ % of the length indicated by the length marking.

Measure a segment of the cable metre marking using a calibrated length scale or tape. The measured length under test shall not be less than 3 m. The measured segment shall be at least 10 m inside the run of the cable. The measured length under test shall match the calibrated length scale to within ± 0,5 %.

6.3 Optical transmission requirements for cabled optical fibre

Unless otherwise specified in the detail specification, the cabled optical fibre elements shall conform to Table 1.