IEC 60794-1-219

Edition 1.0 2021-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical fibre cables –
Part 1-219: Generic specification – Basic optical cable test procedures – Material compatibility test, method F19

Câbles à fibres optiques –
Partie 1-219: Spécification générique – Procédures fondamentales d'essais des câbles optiques – Essai de compatibilité des matériaux, méthode F19

IEC 60794-1-219:2021-11(en-fr)

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ICS 33.180.10 ISBN 978-2-8322-1053-9

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FOREWORD

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IEC 60794-1-219 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

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

Draft	Report on voting
86A/2138/FDIS	86A/2143/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.

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- withdrawn,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 1-219: Generic specification – Basic optical cable test procedures – Material compatibility test, method F19

1 Scope

This part of IEC 60794 applies to optical fibre cables for use with telecommunication equipment and devices employing similar techniques, as well as hybrid telecommunication cables having a combination of both optical fibres and electrical conductors.

The object of this document is to define test procedures to be used in establishing uniform requirements for the material compatibility performance of cables, cable components, and cable subassemblies.

Compatibility of materials within a cable has the potential to involve a range of material pairs. However, experience has shown that the most pertinent evaluations are of the cable filling and flooding materials' interactions with other materials in the cable.

NOTE Throughout the document the wording "optical cable" can also include optical fibre units, microduct fibre units, etc.

See IEC 60794-1-2 for general requirements and definitions, as well as for a reference guide to test methods of all types.

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 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures – General guidance*

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

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

IEC 61196-1-101, *Coaxial communication cables – Part 1-101: Electrical test methods – Test for conductor d.c. resistance of cable*

IEC 61196-1-102, *Coaxial communication cables – Part 1-102: Electrical test methods – Test for insulation resistance of cable dielectric*

IEC 61196-1-105, *Coaxial communication cables – Part 1-105: Electrical test methods – Test for withstand voltage of cable dielectric*

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 Method F19 – Material compatibility test

4.1 Object

The object of this test is to determine the components' compatibility with polymeric tube/cable core filling material(s) and/or water-blocking materials that are in direct contact with the identified components within the cable structure. This test applies to all water-blocked cables. Typical water-blocking materials include, but are not limited to, filling compounds, absorbent powders, and flooding compounds.

4.2 Sample

4.2.1 General

Material compatibility can be tested using either the completed cable or individual components. The choice of the method will depend on material availability and the final intent of the test program.

4.2.2 Completed cable samples

Cable specimens of sufficient length to perform applicable tests shall be taken from each test cable sample (a typical length is 3 m).The cable ends shall be capped to prevent the migration of water-blocking material out of the cable. The minimum specimen coil diameter shall be the larger one of 500 mm and the minimum cable bend diameter.

4.2.3 Individual components samples

4.2.3.1 General

The sample of individual components shall consist of a container of sufficient size to contain the component specimens, the specimens to be tested, and an amount of filling or flooding compound (as appropriate) to completely cover the specimens in the container or, in the case of the sheath, to coat the specimens. The preparation of the samples includes the steps of placing specimens in the container and pouring the filling or flooding compound over those specimens. Whether to use the filling or flooding compound depends on what material is adjacent to the component to be tested in the actual cable. A filling or flooding compound can also include an activated dry water-blocking material. The exact test details for the compatibility between dry water-blocking material containing absorbent powders and other cable components are still under consideration.

4.2.3.2 Fibre and buffered fibre

A fibre, semi-tight buffered fibre or tight buffered fibre of sufficient length to perform the coating strip force test in accordance with IEC 60794-1-23, methods G10A and G10C, shall be used in this test. The specimen shall coil and fit easily into a container. The coil diameter should be 75 mm minimum. Cover the fibre specimens with the filling compound.

4.2.3.3 Optical fibre ribbon

An optical fibre ribbon of sufficient length suitable to perform the ribbon stripping test in accordance with IEC 60794-1-23, method G10B, shall be used. The specimen shall coil and fit easily into a container. The coil diameter should be 75 mm minimum. Cover the optical fibre ribbon specimens with the filling compound.

4.2.3.4 Polymeric tube

Step 1 – Cut a minimum of five polymeric tube specimens of suitable length with the filling material inside. The ends shall be capped to prevent the migration of the filling material out of the specimens. If the specimens need to be coiled, the minimum coil diameter should be the larger one of 300 mm and 50 times tube diameter.

Step 2 – Cut a minimum of five polymeric tube specimens of suitable length with the filling material inside from the same batch as in step 1. The ends shall be capped to prevent the migration of the filling material out of the specimens. Fit the specimens into a suitable container. If the specimens need to be coiled, the minimum coil diameter should be the larger one of 300 mm and 50 times tube diameter. Cover the polymeric tube specimens with the flooding compound.

Perform only Step 1 of the test, if polymeric tube is exposed only to the filling compound and the flooding compound is not used in cable construction. It is allowed to perform only Step 2 of the test in the case that polymeric tube is exposed to both filling compound and flooding compound. If the test fails, performing Step 1 may be useful to determine which parts of the cable are not compatible. If only the filling compound in cable construction has been changed, just perform Step 1 and if only the flooding compound in cable construction has been changed, just perform Step 2.

4.2.3.5 Sheath

Perform tests on specimens of sheath material prepared from the granular or pelletized raw materials on extruded tubes of sheath material using parameters similar to the actual sheath, or on specimens of actual extruded sheaths removed from cables. Unless otherwise specified, prepare specimens in accordance with IEC 60811-501. A minimum of five aged and five unaged (control) specimens shall be used for the test.

The sheath material specimens to be aged shall be prepared for testing by coating these sheath specimens with the flooding material on only one side. The flooding compound shall be heated to (100 ± 2) °C in order to produce uniform distribution. Apply a thin layer of the flooding material using a spatula, or paint the heated and liquified material on with a brush, etc., so the outer surface is completely covered. Do not soak the specimens in the compound.

4.2.3.6 Composite strength member

Cut a minimum of five strength members (composite rods or yarns, central or peripheral) specimens of suitable length. Fit the specimens in a suitable container. Cover the composite strength member specimens with the flooding compound.

4.2.3.7 Coated metal tape

Cut a specimen of coated metal tape (shielding tape, armour tape, screen tape) 150 mm long for evaluation. If a choice of tape width is possible, select a width narrow enough to fit easily into a container (beaker, graduated cylinder, etc.). Cover the specimen with the flooding compound.

4.2.3.8 Conductor unit

A suitable length of conductor unit (coaxial cable, pair/quad cable, current carrying conductor and so on) shall coil and fit easily into a container. Cover the conductor unit specimen with the flooding compound.

4.3 Ageing procedure

Completed cable and sheath samples should be aged at a temperature of (85 ± 3) °C and a noncondensing relative humidity of (85 ± 5) % for a period of 30 days, or exposed to the conditions and during the time specified in the detailed specification.

For individual components encapsulated in or treated with the filling or flooding material, the samples mentioned in 4.2.3.1, except the sheath, should be aged at a temperature of (85 ± 3) °C and uncontrolled humidity for a period of 30 days, or exposed to the conditions and during the time specified in the detailed specification.

For individual components along with dry water-blocking material containing absorbent powders, the samples should be aged at a temperature of (85 ± 3) °C and a noncondensing relative humidity of (85 ± 5) % for a period of 30 days, or exposed to the conditions and during the time specified in the detailed specification.

After conditioning, allow the sample to cool to room ambient conditions for about 2 h. The components in contact with the water blocking material shall be removed from the cable or from the container. Allow as much of the compound as possible to drain from the sample. Except for the metal tape (avoid wiping the specimen), clean the samples carefully (typically using a paper towel or a clean dry cloth). Do not expose the coated metal tape, optical fibre and buffered fibre, and optical fibre ribbon to solvents to remove the filling or flooding material.

4.4 Applicable tests

4.4.1 General

After ageing, tests shall be selected from Table 1, in accordance with the sample type or customer's requirements.

NOTE If hydrogen is of concern, IEC TR 62690 is considered.

Table 1 – Tests applicable for material compatibility evaluation

Component	Fibre/Buffered fibre	Optical fibre ribbon	Polymeric tube	Sheath	Composite strength member	Coated metal tape	Conductor unit
Tests on individual components	**With tube filling** Visual inspection Coloured fibre wiping Fibre strippability	**With tube filling** Visual inspection Optical fibre ribbon strippability	**With tube filling (inside) and flooding (outside)** Visual inspection Polymeric tube kink Polymeric tube bend	**With flooding** Visual inspection Tensile strength and elongation	**With flooding** Visual inspection (stability)	**With flooding** Visual inspection (delamination)	**With flooding** Visual inspection DC resistance Insulation resistance Withstand voltage of dielectric
Tests on cable	Visual inspection Coloured fibre wiping Fibre strippability	Visual inspection Optical fibre ribbon strippability	Visual inspection Polymeric tube kink Polymeric tube bend	Visual inspection Tensile strength and elongation	Visual inspection (stability)	Visual inspection (delamination)	Visual inspection DC resistance Insulation resistance Withstand voltage of dielectric

4.4.2 Visual inspection

Visual inspection shall be carried out using normal or normal corrected vision. Inspection for splitting and cracking shall be carried out using a 5X magnification. The requirement of visual inspection shall be given in the detailed specification.

Examine the fibre or buffered fibre to see whether the fibre coatings exhibit cracking, splitting, or delamination. For coloured fibres, check the specimen surface to see whether the colour is identifiable and whether the colour transfers to the water-blocking compound.

Examine the optical fibre ribbon to see whether it exhibits delamination or fibre separation.

Examine the polymeric tube surface to see whether it exhibits any cracking or splitting. For coloured tubes, check the specimen surface to see whether the colour is identifiable and whether the colour transfers to the water-blocking compound.

Examine the specimens of sheath material to see whether they exhibit swelling/distortion.

Examine the specimens of composite strength members to see if there is separation, delamination or loss of physical integrity.

Examine the specimen of coated metal tape to see whether it exhibits delamination.

Examine the specimen of conductor unit to see whether insulations exhibit any cracking or splitting, whether the colour of insulations is identifiable and whether the colour transfers to the water-blocking compound.

4.4.3 Physical testing

4.4.3.1 Coloured fibre wiping test

After ageing, the wiping test should be used to determine the durability of the fibre colour. Alternative test methods may be agreed between the customer and the supplier. See Figure 1.

a) Wipe solvent: industrial alcohol.
b) Load: 5 N applied over a length of 100 mm (0,5 N/cm), or as specified by the detailed specification.
c) Fibre length under test: 200 mm or as specified by the detailed specification.
d) Number of wipes: 3 cycles to 10 cycles.
e) Wiping tool: alcohol swabs.
f) Wiping frequency: 10 wipes/min to 60 wipes/min.

NOTE One cycle contains two wipes. If the specimen contains ring marking, the marking will be in the sample length subjected to the wipes. The pad is kept wet.

The load is applied by a mechanical machine. Manual testing should follow the detailed specification.

The requirements shall be given in the detailed specification (for example, no colour shall transfer to the alcohol swabs).