IEC 60794-2-50

Edition 1.0 2008-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Withdrawn

Optical fibre cables –
Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies

Câbles à fibres optiques –
Partie 2-50: Câbles intérieurs – Spécification de famille pour les câbles simplex et duplex utilisés dans les ensembles de câbles équipés

IEC 60794-2-50:2008

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CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 Construction 7
4.1 General 7
4.2 Optical fibres and primary coating 7
4.3 Buffer 7
4.4 Tube 8
4.5 Strength and anti-buckling members 8
4.6 Sheath 8
4.7 Sheath marking 8
4.8 Examples of cable constructions 8
5 Tests 8
5.1 Dimensions 9
5.2 Mechanical requirements 9
5.2.1 Tensile performance 9
5.2.2 Crush 9
5.2.3 Impact 10
5.2.4 Repeated bending 10
5.2.5 Bend 10
5.2.6 Torsion 11
5.2.7 Bend at low temperature 11
5.2.8 Kink 11
5.2.9 Sheath pull-off force 11
5.2.10 Buffered fibre movement in compression 12
5.3 Environmental requirements 12
5.3.1 Temperature cycling 12
5.3.2 Sheath shrinkage 13
5.4 Transmission requirements 13
5.5 Fire performance 13
Annex A (informative) Examples of some types of cable construction 14
Annex B (normative) METHOD E21 – Sheath pull-off force for optical fibre cable for use in patch cords 17
Annex C (normative) METHOD F11 – Sheath shrinkage for optical fibre cable for use in patchcords 22
Annex D (normative) METHOD E22 – Buffered fibre movement under compression in optical fibre cables for use in patchcords 24
Annex E (normative) METHOD F12 – Temperature cycling for optical fibre cable for use in patchcords 26
Annex F (normative) Guidance on the selection of tests applicable to optical fibre cables for use in patchcords 28
Bibliography 31

Figure A.1 – Simplex loose non-buffered fibre cable 14

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Figure A.2 – Simplex ruggedized fibre cable 14
Figure A.3 – Duplex loose non-buffered fibre cable 14
Figure A.4 – Duplex ruggedized fibre cable 15
Figure A.5 – Duplex ruggedized fibre zip cord 15
Figure A.6 – Duplex ruggedized flat cable 15
Figure A.7 – Duplex ruggedized round cable 16
Figure B.1 – Schematic of test arrangement 19
Figure B.2 – Example of pulling jig 20
Figure B.3 – Cable sample preparation 21
Figure D.1 – Test set up for fibre movement under compression 25

Table 1 – Dimensions of buffered fibres 8
Table 2 – Temperature cycling severities 12
Table F.1 – Cable test method summary 28
Table F.2 – Cable testing agreement 30

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OPTICAL FIBRE CABLES –

Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies

FOREWORD

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International Standard IEC 60794-2-50 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This standard cancels and replaces IEC/PAS 60794-2-50 published in 2004. This first edition constitutes a technical revision.

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

This bilingual version, published in 2008-07, corresponds to the English version.

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

FDIS	Report on voting
86A/1204/FDIS	86A/1223/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, 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

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- replaced by a revised edition, or
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OPTICAL FIBRE CABLES –

Part 2-50: Indoor cables – Family specification for simplex and duplex cables for use in terminated cable assemblies

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1 Scope

This part of IEC 60794 is a family specification that covers requirements for simplex and duplex optical fibre cables for use in terminated cable assemblies or for termination with optical fibre passive components.

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.

They complete the normative references already listed in the generic specification (IEC 60794-1-1 and IEC 60794-1-2) or in the sectional specification (IEC 60794-2 series).

IEC 60068-2-14, *Environmental testing – Part 2: Tests. Test N: Change of temperature*

IEC 60189-1, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60793-1-1:2008, *Optical fibres – Part 1-1: Measurement methods and test procedures – General and guidance*

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

IEC 60793-1-21, *Optical fibres – Part 1-21: Measurement methods and test procedures – Coating geometry*

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

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

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 60794-1-2:2003, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

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

IEC 60811-1-3, *Common test methods for insulating and sheathing materials of electric and optical cables – Part 1-3: General application – Methods for determining the density – Water absorption tests – Shrinkage test*

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Tests at low temperature*
Amendment 1 (1993)
Amendment 2 (2001)

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
terminated cable assembly
short length of cable provisioned with a connector at both ends

NOTE Examples from ISO/IEC 11801 are:

Patchcords are used to establish connections on a patch panel. Typical length of the patchcord 1 m to 10 m.

Work area cords are used to connect outlet to the terminal equipment. Typical length of the work area cords according to this specification is between 1 m and 35 m.

Equipment cords should fulfill the requirements of patchcords or work area cords depending on their application.

4 Construction

4.1 General

In addition to the constructional requirements in IEC 60794-2, the following considerations apply to simplex and duplex indoor cables for use in terminated cable assemblies.

It is not the intention of this standard to specify the finished terminated cable assembly complete with terminations.

The cable shall be designed and manufactured for an expected operating lifetime of 15 years. The materials in the cable shall not present a health hazard within its intended use.

There shall be no fibre splice in a delivery length. It shall be possible to identify each individual fibre throughout the length of the cable.

4.2 Optical fibres and primary coating

Multimode or single-mode optical fibres meeting the requirements of IEC 60793-2-10, type A1a and A1b, and IEC 60793-2-50, type B, shall be used.

4.3 Buffer

If a tight or semi-tight (loosely applied) buffer is required, it shall consist of one or more layers of inert material. Semi-tight tubes may be filled. Unless otherwise specified, the buffer shall be removable in one operation over a length of 15 mm.

Buffer dimensions are shown in Table 1.

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Table 1 – Dimensions of buffered fibres

Nominal diameter (mm)	0,3 – 1,3
Tolerances (mm)	± 0,05

4.4 Tube

One or two primary coated or buffered fibres are packaged (loosely or not) in a tube construction which may be filled. The tube may be reinforced with a composite wall.

If required the suitability of the tube shall be determined by an evaluation of its kink resistance in accordance with IEC 60794-1-2, Method G7.

4.5 Strength and anti-buckling members

The cable shall be designed with sufficient strength members to meet the requirements of this standard.

The strength and/or anti-buckling member may be either metallic or non-metallic and may be located in the cable core and/or under the sheath and/or in the sheath.

4.6 Sheath

The cable shall have a uniform overall protective sheath. The cable diameter shall be specified in the relevant detail specification (or product specification). Sheath removal is an important feature of these cables. This is tested by the method E21 described in Annex B of this standard.

4.7 Sheath marking

If required, the cable shall be marked as agreed between the customer and supplier. The marking shall be resistant to abrasion.

4.8 Examples of cable constructions

Examples of some main types of cable construction are shown in Figures A.1 to A.7.

Other configurations are not excluded if they meet the mechanical, environmental, transmission and termination requirements given in this standard.

5 Tests

Compliance with the specification requirements shall be verified by carrying out tests selected from the following subclauses. It is not intended that all tests be carried out in all cases, and Annex F provides guidance on the selection of tests. The tests to be applied and the frequency of testing shall be agreed between the customer and supplier.

Some of the following tests can be performed on a short sample length of cable which is still an integral part of a longer length, thus making it possible to detect permanent changes in attenuation.

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Single-mode cables shall be measured at 1 550 nm and 1 625 nm and multimode[1)] cables shall be measured at 1 300 nm unless otherwise agreed. Measurements shall be carried out according to IEC 60793-1-40.

If loops are used within a test to fix the ends of a cable, the diameter shall not be so small as to cause excessive mode filtering in multimode fibre.

Unless otherwise specified, all tests shall be carried out at ambient temperature, as described in IEC 60793-1-1, Clause 5.

5.1 Dimensions

The fibre dimensions and tolerances shall be checked in accordance with test method of IEC 60793-1-20 or IEC 60793-1-21. The diameter of the buffer and of the cable, as well as the thickness of the sheath, shall be measured in accordance with the methods of IEC 60189-1.

5.2 Mechanical requirements

5.2.1 Tensile performance

Method: IEC 60794-1-2-E1A.

Diameter of chuck drums and transfer devices: not less than the minimum dynamic bending diameter specified for the cable, at least 250 mm diameter.

Rate of transfer device: either 100 mm/min or 100 N/min.

Load: 100 N applied for 5 min for simplex cables, 200 N for 5 min for duplex cables.

Length of sample: sufficient to achieve the desired accuracy of measurement of attenuation change and shall be agreed between the customer and the supplier.

Requirements: the maximum increase in attenuation during the test shall be specified in the product specification, there shall be no change in attenuation after the test, and there shall be no damage to the cable elements.

5.2.2 Crush

Method: IEC 60794-1-2-E3.

Force: 500 N.

Duration: 1 min.

Length between test locations: 500 mm.

Requirements: the maximum increase in attenuation during the test shall be specified in the product specification, there shall be no change in attenuation after the test, and there shall be no damage to the cable elements.

NOTE For cables having a non-circular cross section, the force should be applied in the direction of the minor axis (perpendicular to the major axis).

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1) OM3 multimode cables should be tested at 850 nm and may be tested at 1 300 in addition, all other multimode cables should be tested at 1 300 nm.

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5.2.3 Impact

Method: IEC 60794-1-2-E4.

Radius of striking surface: 12,5 mm.

Impact energy: 1,0 J.

Number of impacts: at least 3, each separated at least 500 mm.

Requirements: the maximum increase in attenuation after the test shall be specified in the product specification and there shall be no fibre breakage or damage to the cable elements. Any imprint of the striking surface on the cable sheath is not considered as a mechanical damage.

NOTE For cables having a non-circular cross section, the force should be applied in the direction of the minor axis (perpendicular to the major axis).

5.2.4 Repeated bending

Method: IEC 60794-1-2-E6.

Bending radius: 30 mm for simplex, 20 times cable diameter for duplex (for non-circular cables, the cable diameter is the minor dimension).

Number of cycles: 200.

Mass of weights: sufficient to contour the apparatus e.g. 1 kg to 2 kg.

Requirements: the maximum increase in attenuation during the test shall be specified in the product specification, there shall be no change in attenuation after the test, and there shall be no damage to the cable elements.

NOTE For cables having a non-circular cross section, the bend requirements are determined using the minor axis as the cable diameter with bending in the direction of the preferential bend.

5.2.5 Bend

Method: IEC 60794-1-2-E11A.

Mandrel diameter: 60 mm.

Number of turns per helix: 6.

Number of cycles: 3.

Length of sample: sufficient to carry out the test.

Prior to bending: at both ends of the sample all the cable components shall be fixed together, e.g. by loops or glue.

Requirements: the maximum increase in attenuation during the test shall be specified in the product specification, there shall be no change in attenuation after the test, and there shall be no damage to the cable elements.

NOTE For cables having a non-circular cross section, the bend requirements are determined using the minor axis as the cable diameter with bending in the direction of the preferential bend.

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5.2.6 Torsion

Method: IEC 60794-1-2-E7.

Number of cycles: 10.

Distance between fixed and rotating clamps: 250 mm.

Tension load: according to Table 1 of IEC 60794-1-2-E7.

Length of sample: sufficient to carry out the test.

Requirements: the maximum increase in attenuation during the test shall be specified in the product specification, there shall be no change in attenuation after the test, and there shall be no damage to the cable elements.

5.2.7 Bend at low temperature

Method: IEC 60794-1-2-E11A (see IEC 60811-1-4, Clause 8)

Bending radius: 10 times cable diameter (for non-circular cables, the cable diameter is the minor dimension) but not less than 30 mm.

Number of cycles: 2.

Test temperature: 0 °C, –10 °C or –15 °C depending on application and customer requirements.

Number of turns per helix: according to Clause 8 of IEC 60811-1-4.

Requirements: in addition to the requirement of Clause 8 of IEC 60811-1-4, no fibre shall break during the test and there shall be no damage to the cable elements.

5.2.8 Kink

Method: IEC 60794-1-2-E10.

Minimum loop, horizontal inner dimension: (for non-circular cables, the cable diameter is the minor dimension), see Figure E.10.

– For cables outer diameter ≤ 3,0 mm, to be 10 mm.
– For cables outer diameter > 3,0 mm, to be 5 × the cable diameter.

NOTE This is not an operational parameter; this is to address short-term installation/handling performance.

Requirement: no kink shall occur.

5.2.9 Sheath pull-off force

Method: see Annex B.

Rate of separation: ≤ 200 mm/min.

Strip length: 50 mm.

Requirement: the force to strip the sheath shall not be greater than 15 N.

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5.2.10 Buffered fibre movement in compression

Method: See Annex D.

Compression distance: 1 mm.

Number of movements: 5.

Requirement: the maximum increase in attenuation during the test shall be specified in the product specification and the reaction force shall be less than 1 N at 0,4 mm.

5.3 Environmental requirements

5.3.1 Temperature cycling

Method: See Annex E.

Severity taken from Table 2 below.

Period: t_1 sufficient that the cable has reached, and stabilised to, the specified temperature.

Number of cycles: 4.

Length of sample: 10 m.

Requirements: maximum increase in attenuation shall be as shown in Table 2 below.

Measurement uncertainty:

– 0,05 dB for cables with single-mode fibres;
– 0,10 dB for cables with multimode fibres.

Table 2 – Temperature cycling severities

	Low temperature T_A °C	High temperature T_B °C	Maximum increase in attenuation at 1 300 nm dB	Maximum increase in attenuation at 1 550 nm dB	Maximum increase in attenuation at 1 625 nm dB
a)	0	+50	0,1	0,1	0,2
b)	–5	+50	0,1	0,2	0,3
c)	–20	+60	0,3	0,5	1,0
d)	–45	+60	0,3	0,5	1,0
e)	–25	+70	0,3	0,5	1,0
f)	–40	+85	0,3	0,5	1,0
NOTE Condition a), b), c), d) e) or f) should be selected depending on application and user requirements, for example condition c) is appropriate for applications to ISO/IEC 11801. The low temperature requirement for the completed patchcord assembly is –10 °C.					

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5.3.2 Sheath shrinkage

Method: see Annex C.

Exposure temperature: 70 °C.

Exposure duration: 24 hours per cycle.

Number of cycles: 4.

Requirement: the average of the sheath shrinkage values shall not exceed 20 mm.

5.4 Transmission requirements

The transmission requirements shall be verified in accordance with IEC 60794-1-2 and shall be agreed between customer and supplier. Maximum cable attenuation shall comply with IEC 60794-1-1.

5.5 Fire performance

IEC/TR 62222 provides guidance and recommendations for the requirements and test methods for the fire performance of communication cables when installed in buildings. The recommendations relate to typical applications and installation practices, and an assessment of the fire hazards presented. Account is also taken of applicable legislation and regulation.

IEC/TR 62222 references several IEC fire performance test methods and also other test methods that may be required by local or National legislation and regulation. The tests to be applied, and the requirements, shall be agreed between the customer and supplier taking into account the fire hazard presented by the end use application of the terminated cable assembly in which the cable is intended to be used.

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Annex A
(informative)

Examples of some types of cable construction

NOTE The main dimensions should be agreed between the customer and the supplier.

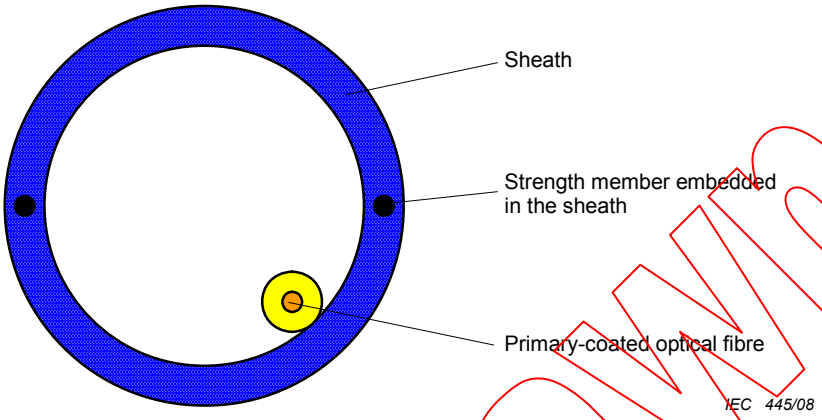

Figure A.1 – Simplex loose non-buffered fibre cable

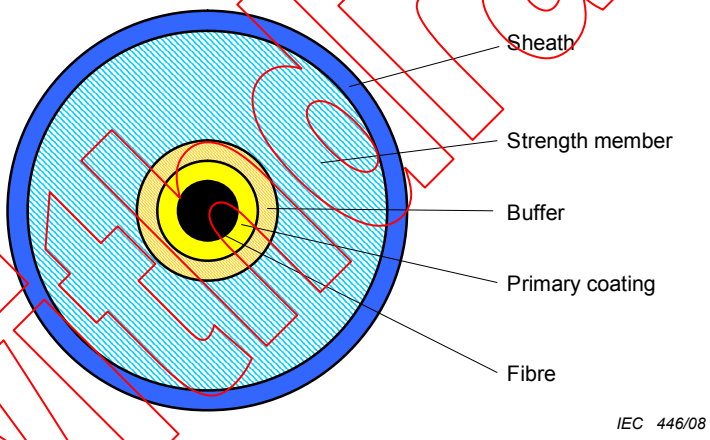

Figure A.2 – Simplex ruggedized fibre cable

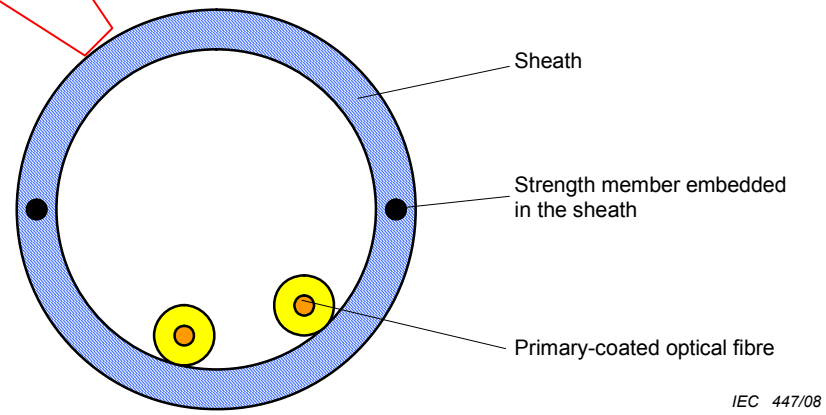

Figure A.3 – Duplex loose non-buffered fibre cable

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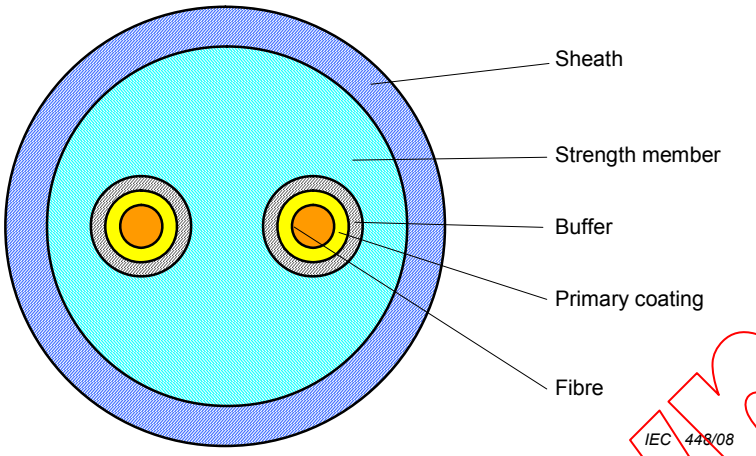

Figure A.4 – Duplex ruggedized fibre cable

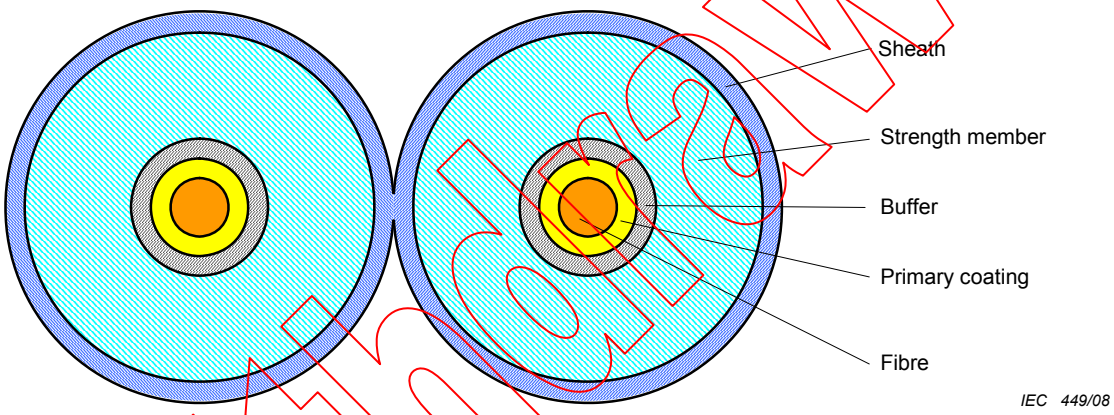

Figure A.5 – Duplex ruggedized fibre zip cord

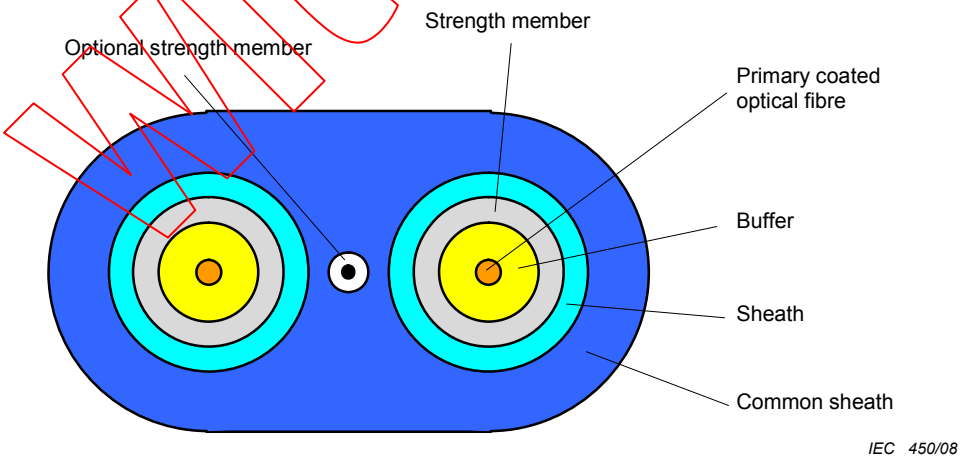

Figure A.6 – Duplex ruggedized flat cable

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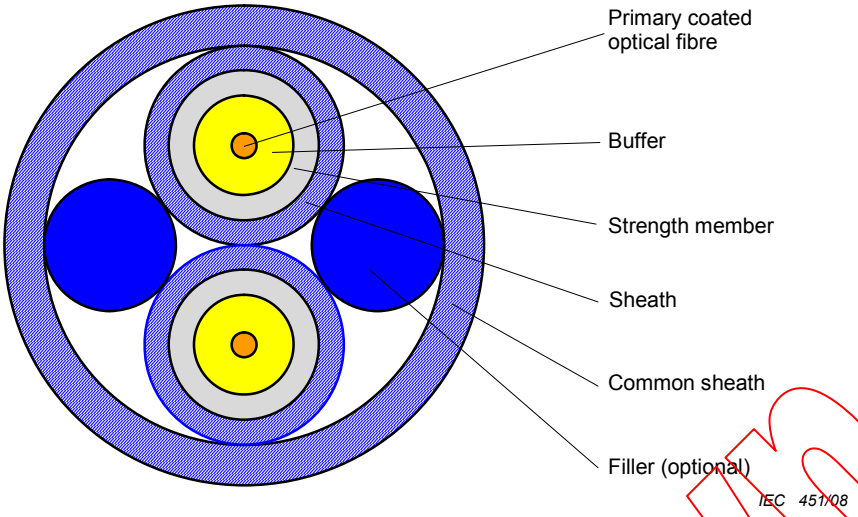

Figure A.7 – Duplex ruggedized round cable

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Annex B
(normative)

METHOD E21 –
Sheath pull-off force for optical fibre cable for use in patch cords

B.1 Object

The purpose of this test is to measure the force required to remove a length of sheath from an optical fibre cable intended for use in patchcords.

B.2 General

This test method is designed to measure the force required to remove the cable sheath. It can be applied to round simplex and round duplex optical fibre cables for use in patchcords, or round single fibre elements or sub-elements of larger cables.

B.3 Sample

A length of cable long enough to be retained in the tensile rig shall be cut and removed from the supply reel. The sample is prepared as shown in Figure B.3, using the following method.

At one end of the sample, mark the cable at distances 50 mm and 53 mm from the end. A circumferential cut is then made at the two marked points where the section of sheath is to be removed. A longitudinal cut is then made between the two circumferential cuts. Remove the sheathing between the two cuts. During sample preparation, if any damage is imparted to the cable core, that sample shall be discarded.

B.4 Apparatus

A schematic of the test arrangement is shown in Figure B.1.

B.4.1 Tensile test rig

A controllable tensile facility shall be used with the ability to pull over a specified distance at a controlled speed.

B.4.2 Recording equipment

A set of measurement equipment shall be used, linked to the tensile test rig that can record the forces required to remove the sheath from the cable core. Measurements shall be recorded in newtons.

B.4.3 Stripping tools

Tools capable of removing at least a 3 mm length of outer sheath at a distance 50 mm from the end of the cable, leaving the cable core undamaged, may be used.

B.4.4 Pulling jig

A pulling jig as shown in Figure B.2 shall be designed to fit into the gap formed in the sample sheath by removing the 3 mm section, allowing the 50 mm strip length of sheath to be pulled longitudinally from the prepared end of the cable.

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B.4.5 Cable anchor

A method shall be provided to secure the anchor end of the cable while the pull is carried out.

B.5 Procedure

The prepared end of the cable is inserted into the pulling jig (see Figure B.1) mounted on the test rig. The opposite end of the sample is then mounted in the cable anchor at zero load. A controlled pull is then carried out at the specified speed. Readings are taken to record the peak values of each test pull.

B.6 Requirements

The force required to remove the sheath from the cable core shall comply with the values given in the detail specification.

B.7 Details to be specified

The detail specification shall include:

a) rate of separation (speed of pull);

b) strip length (length of sheath removed);

c) force to strip the length of sheath.

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