PUBLICLY
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SPECIFICATION

IEC PAS 60794-2-50

Pre-Standard

First edition
2004-11

Optical fibre cables –

Part 2-50:
Indoor optical fibre cables –
Family specification for simplex and duplex cables for use in patch cords

Reference number
IEC/PAS 60794-2-50:2004(E)

Publication numbering

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

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PRICE CODE T

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OPTICAL FIBRE CABLES –

Part 2-50: Indoor optical fibre cables – Family specification for simplex and duplex cables for use in patch cords

FOREWORD

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IEC-PAS 60794-2-50 has been processed by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre Optics.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
86A/856/NP	86A/878/RVN

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned will transform it into an International Standard.

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OPTICAL FIBRE CABLES –

Part 2-50: Indoor optical fibre cables – Family specification for simplex and duplex cables for use in patch cords

1 Scope

This part of IEC 60794 is a family specification that covers simplex and duplex optical fibre cables for use in patch cords. The requirements of the Sectional specification IEC 60794-2 are applicable to cables covered by this document.

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, Clause 2, and IEC 60794-1-2, Clause 2) or in the sectional specification (IEC 60794-2, Clause 2).

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

IEC 60189-1:1986, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60332-1: *Tests on electric and optic fibre cables under fire conditions – Part 1: Test for vertical flame propagation for a single insulated wire or cable*

IEC 60332-3: *Tests on electric and optic fibre cables under fire conditions – Part 3: Test for vertical flame spread of vertically-mounted bunched wires or cables*

IEC 60754-1: *Test on gases evolved during combustion of electric cables – Part 1: Determination of the amount of halogen acid gas*

IEC 60754-2: *Test on gases evolved during combustion of electric cables – Part 2: Determination of degree of acidity of gases evolved during the combustion of material taken from electric cables by measuring pH and conductivity*

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

IEC 60793-2: *Optical fibres – Part 2: Product specifications – General*

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*

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

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Test at low temperatures*

IEC 61034-1: *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC 61034-2: *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

3 Construction

3.1 General

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

It is not the intention of this document to specify the finished patchcord assembly 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 unless otherwise agreed by the customer and supplier.

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

3.2 Optical fibres and primary coating

Multimode or single-mode optical fibres meeting the requirements of IEC 60793-2 shall be used.

3.3 Buffer

If a tight or semi-tight (loosely applied) buffer is required, it shall consist of one or more layers of inert material. Unless otherwise specified, for tight buffers, the buffer and fibre primary coating shall be removable in one operation over a length of 15 mm, depending on user requirements.

Buffer dimensions are shown in Table 1.

Table 1 – Dimensions of buffered fibres

Buffer type mm	**Semi-tight buffer**	**Tight buffer**
Nominal diameter Tolerances	0,3 – 1,3 ± 0,05	0,3 – 1,0 ± 0,05

3.4 Ruggedized fibre

Further protection can be provided to tight or semi-tight (loosely applied) fibres by surrounding one or two with non-metallic strength members within a sheath of suitable material.

3.5 Tube

One or two primary coated or buffered fibres are packaged (loosely or not) in a tube construction that 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.

3.6 Strength and anti-buckling members

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

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.

3.7 Sheath

The cable shall have an overall protective sheath. The cable diameter shall be specified in the relevant product specification.

3.8 Sheath marking

If required, the cable shall be marked as agreed between the customer and supplier.

3.9 Examples of cable constructions

Examples of some main types of cable construction are shown in Figures 1-7. Other configurations are not excluded if they meet the mechanical, environmental and transmission requirements given in this specification.

4 Tests

Compliance with specification requirements shall be verified by carrying out tests selected from the following subclauses.

Unless otherwise specified, all tests shall be carried out at ambient temperature.

4.1 Dimensions

The fibre dimensions and tolerances shall be checked in accordance with test method 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.

4.2 Mechanical requirements

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

4.2.1 Tensile performance

Method: IEC 60794-1-2-E1A.

Diameter of chuck drums and transfer devices: approximately 250 mm.

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.

Requirements: ≤0,1dB /10 m during the test and no change in attenuation after the test. There shall be no damage to the cable elements.

4.2.2 Crush

Method: IEC 60794-1-2-E3.

Force: 500 N.

Duration: 1 min.

Length between test locations: 500 mm.

Requirements: no change in attenuation after the test, and there shall be no damage to the cable elements.

NOTE In the case of flat cables the force shall be applied on the flat sides of the cable.

4.2.3 Impact

Method: IEC 60794-1-2-E4.

Radius of striking surface: 12,5 mm.

Impact energy: 1,0 Joules.

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

Requirements: no fibre breakage.

NOTE In the case of flat cables, the force shall be applied on the flat sides of the cable.

4.2.4 Repeated bending

Method: IEC 60794-1-2-E6.

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

Number of cycles: 300.

Mass of weight: 2 kg.

Requirements: ≤0,1dB change in attenuation during the test.

NOTE In the case of flat cables, the sample shall be fixed to the apparatus so that bending is perpendicular to the flat surface of the cable.

4.2.5 Flexing

Method: IEC 60794-1-2-E8.

Number of cycles: 300.

Pulley diameter: 100 mm.

Mass of weights: 2 kg.

Requirements: no fibre breakage.

NOTE In the case of flat cables, the force shall be applied on the flat sides of the cable.

4.2.6 Bend

Method: IEC 60794-1-2-E11A.

Mandrel diameter: 50 mm.

Number of turns per helix: 6.

Number of cycles: 10.

Requirements: ≤0,1dB change in attenuation during the test.

NOTE In the case of flat cables, the force shall be applied on the flat sides of the cable.

4.2.7 Torsion

Method: IEC 60794-1-2-E7.

Number of cycles: 20.

Distance between fixed and rotating clamp: 250 mm.

Tension load: 20 N.

Requirements: ≤0,1dB change in attenuation during the test.

4.2.8 Bend at low temperature

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

Bending radius: 10 times cable diameter (for flat cables, the diameter is the minor dimension).

Number of cycles: 2.

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

4.2.9 Kink

Method: IEC 60794-1-2-E10.

Minimum loop diameter: 20 times cable diameter.

Requirement: no kink shall occur.

4.2.10 Sheath pull-off force

Method: See Annex A.

Rate of separation: ≤ 200mm/min.

Strip length: 50 mm.

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

4.2.11 Sheath shrinkage

Method: See Annex B.

Requirement: The summed distances between the markings before and after ageing shall be less than 11 mm.

4.2.12 Fibre movement in compression

Method: See Annex C.

Compression distance: uc

Velocity of compression: uc.

Number of movements: uc.

Requirement: No change in attenuation.

Force to move the buffer in the cable: uc

4.3 Environmental requirements

4.3.1 Temperature cycling

Method: See Annex D.

Table 2 – Temperature cycle severity

Conditions	Low temperature T_A	High temperature T_B	Requirement Max. increase in attentuation
a)	0°C	+50°C	No change
b)	–5°C	+50°C	0,1dB
c)	–20°C	+60°C	0,2 dB (see note 1)
d)	–45°C	+60°C	(0,2 dB)
e)	–25°C	+70°C	0,2 dB (see note 1)
f)	–40°C	+85°C	0,2 dB (see note 1)
NOTE 1 0,1 dB is under consideration NOTE 2 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 [1]			

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

Number of cycles: 12.

Length of sample: 10 m.

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

4.4 Transmission requirements

The transmission requirements shall be verified in accordance with IEC 60793-2 and shall be agreed between customer and supplier. Maximum cable attenuation shall comply with IEC 60794-1.

4.5 Fire performance

Depending on the particular user requirements, the fire performance of the cable shall be demonstrated by selecting from the following tests. Other fire parameters and test methods are under consideration.

4.5.1 Flame propagation

Method: IEC 60332-1 or IEC 60332-3, C.

4.5.2 Emission of smoke

Method: IEC 61034-1 and IEC 61034-2.

4.5.3 Emission of corrosive gases

Method: IEC 60754-1 and IEC 60754-2.

1 ISO/IEC 11801: *Information technology – Generic cabling for customer premises.*

4.6 Examples of some types of cable construction

Figure 1-7 show some examples of types of cable construction. The main dimensions shall be agreed between customer and supplier.

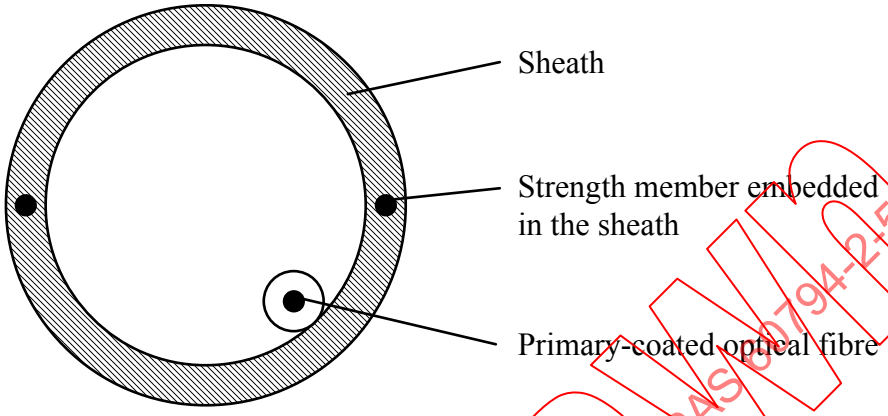

Figure 1 – Simplex loose non-buffered fibre cable

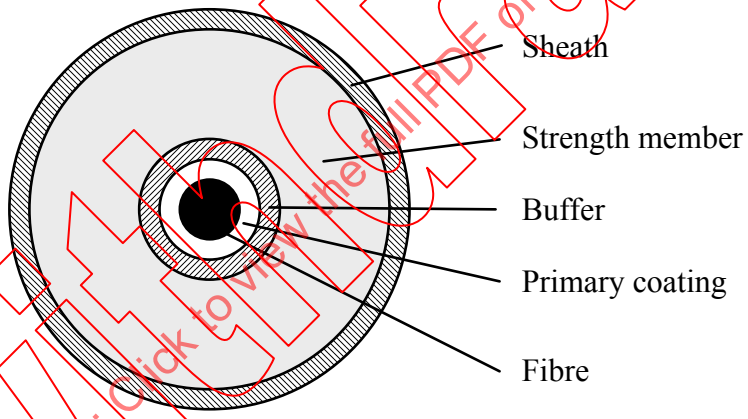

Figure 2 – Simplex ruggedized fibre cable

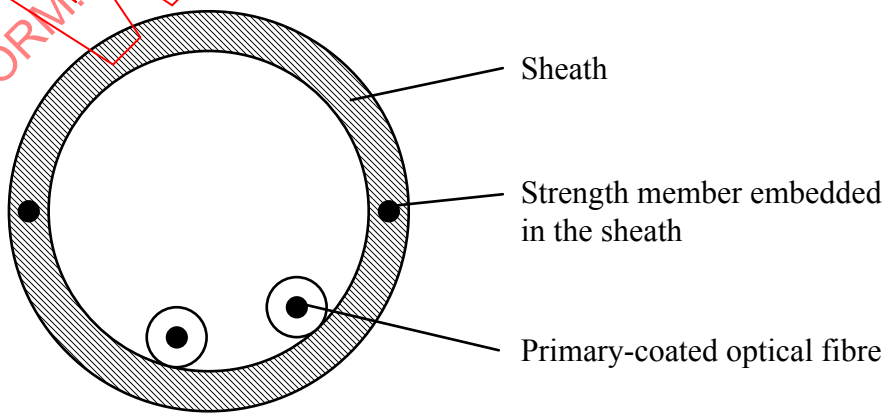

Figure 3 – Duplex loose non-buffered fibre cable

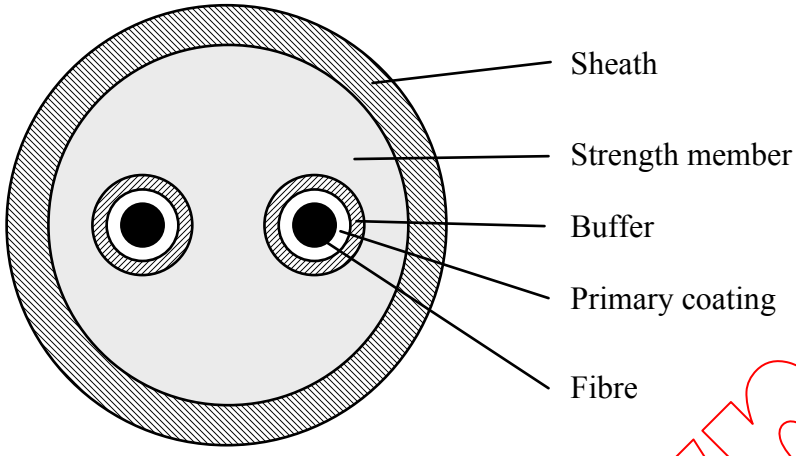

Figure 4 – Duplex ruggedized fibre cable

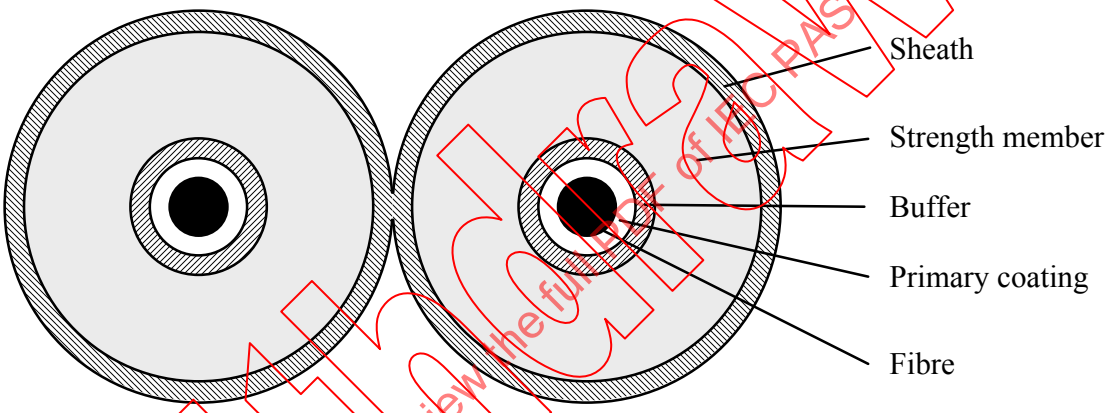

Figure 5 – Duplex ruggedized fibre zip cord

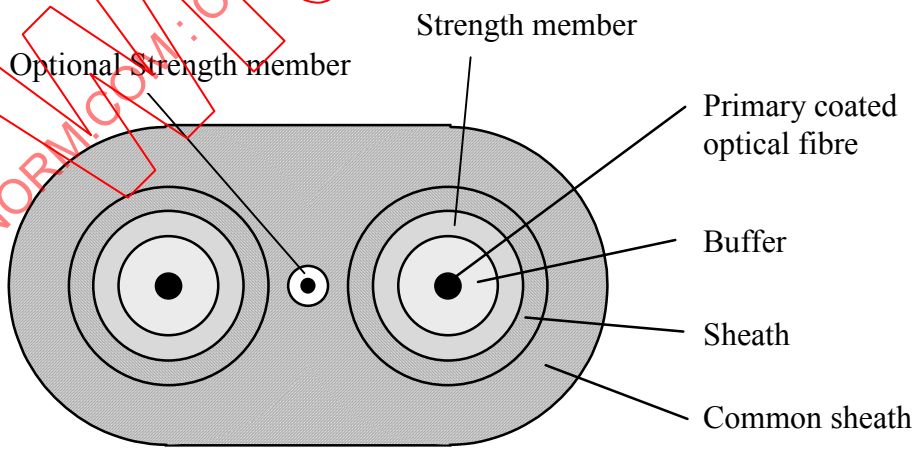

Figure 6 – Duplex flat cable

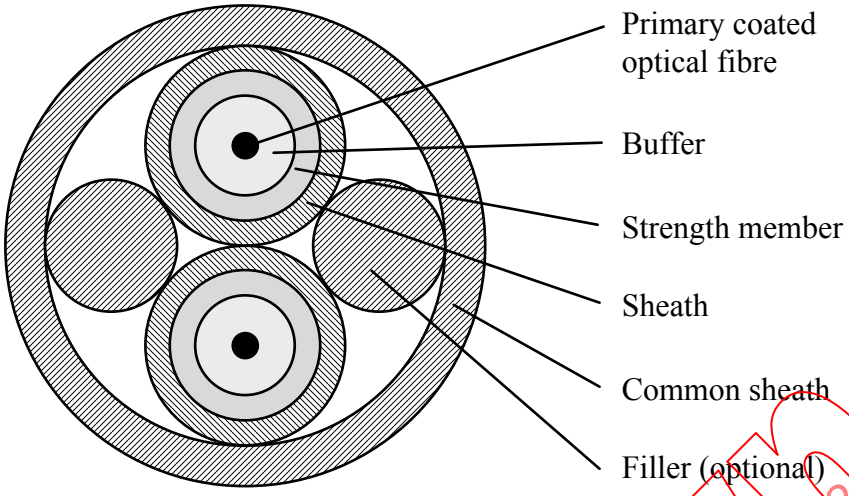

Figure 7 – Duplex round cable

Annex A
(normative)

Method E20: Sheath pull-off force for optical fibre cable used for patch cords

A.1 Object

The purpose of this test is to measure the force required to remove a cable sheath from an optical fibre patch cord cable.

A.2 General

The strippability characteristics of optical fibre cables used for patch cords are dependant on the degree of adhesion, for example, between strength members and the cable sheath. 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 used for patch cords, or round single-fibre elements or subelements of larger cables.

A.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 A.3 using the method detailed below.

From one end of the sample, mark the cable as shown in Figure A 3. A circumferential cut is then made at the 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.

A.4 Apparatus

A schematic of the test set-up is shown in Figure A.1.

A.4.1 Tensile test rig

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

A.4.2 Recording equipment

A set of measurement equipment, 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.

A.4.3 Stripping tools

Tools capable of stripping at least a 3 mm length of outer sheath 50 mm from the end of the cable leaving the cable core undamaged.

A.4.4 Pulling jig

A pulling jig as shown in Figure 2, is designed to fit into the gap removed from the sample allowing a section of sheath to be pulled longitudinally from the cable.

A.4.5 Cable anchor

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

A.5 Procedure

The prepared end of the cable is inserted into the pulling jig (see Figure A.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.

A.6 Requirements

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

A.7 Details to be specified.

The detail specification shall include:

a) speed of pull (velocity of separation);

b) length of sheath removed (strip length).

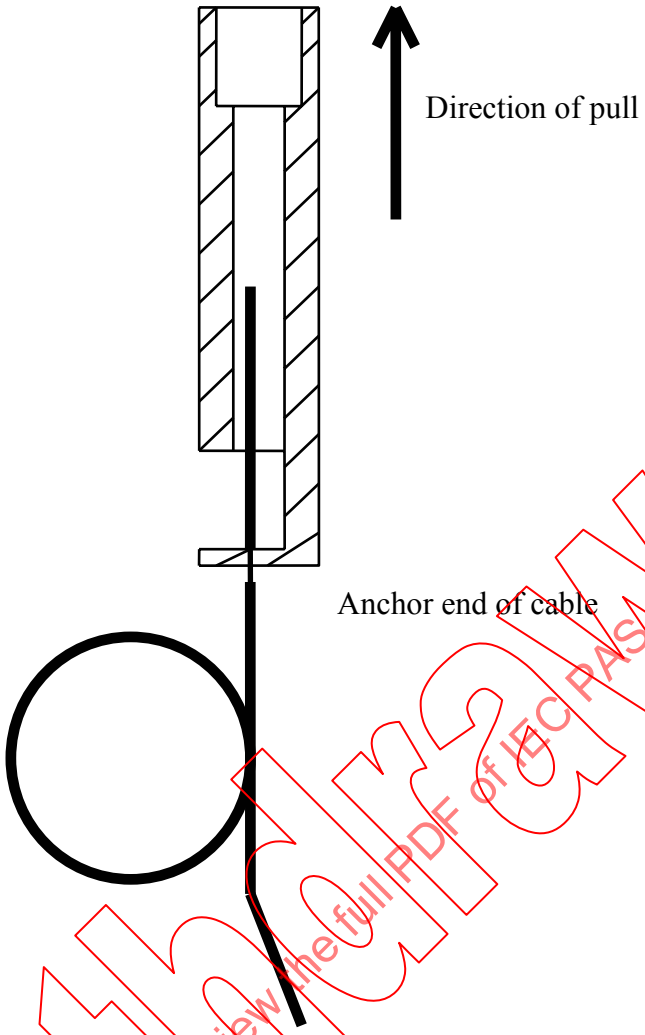

Figure A.1 – Schematic of test arrangement

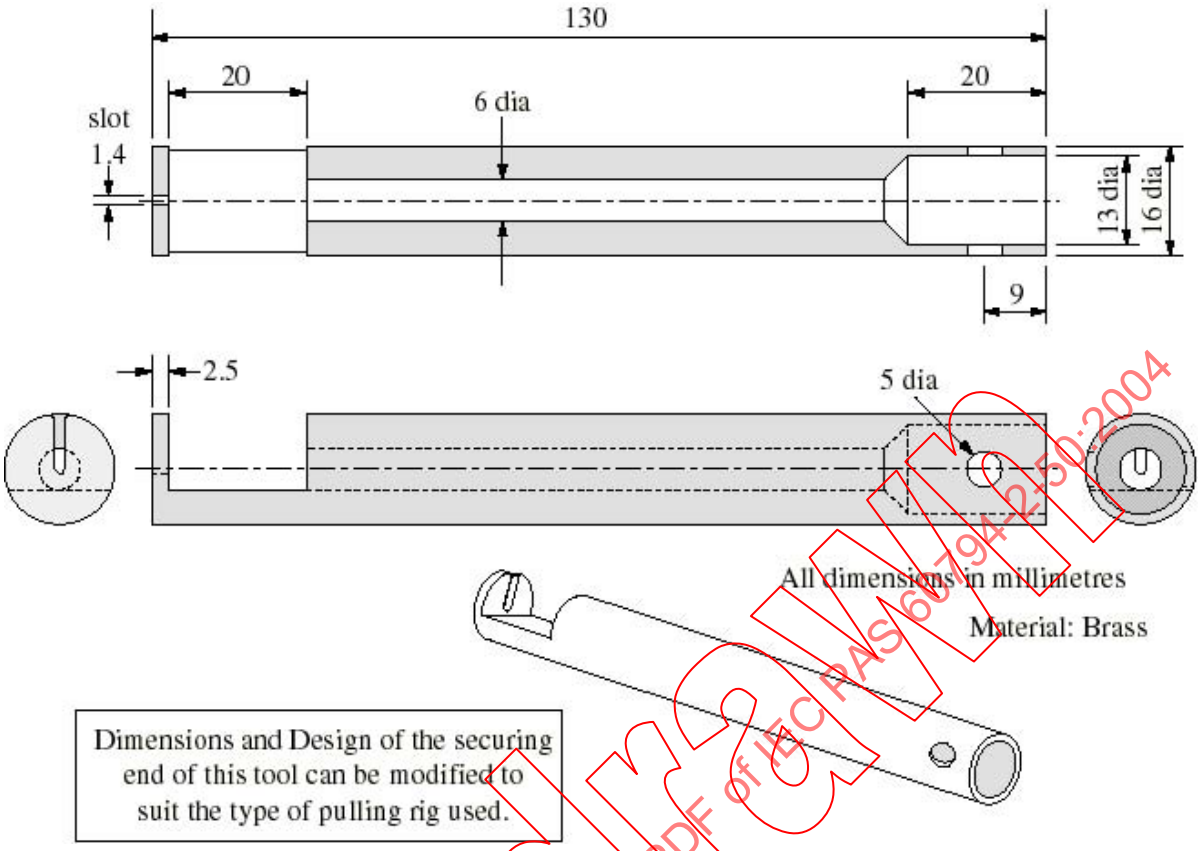

Figure A.2 – Example of pulling jig

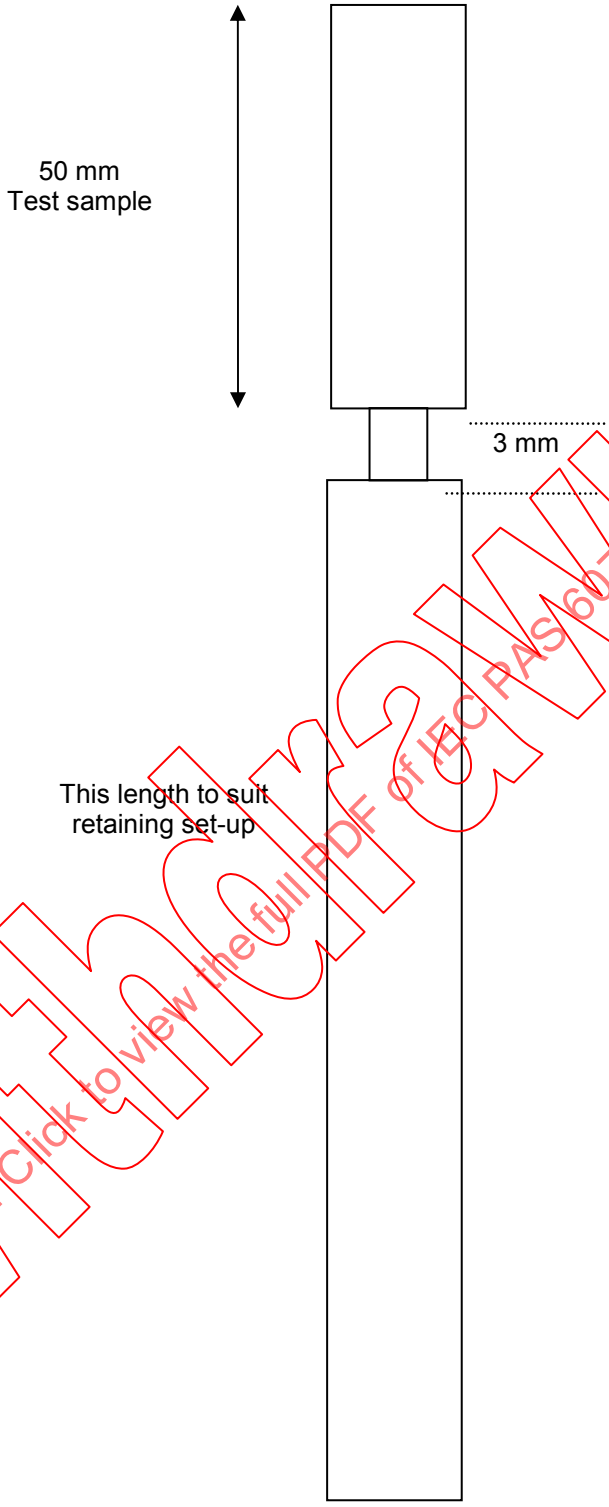

Figure A.3 – Cable sample preparation

Annex B
(normative)

Method F10: Sheath shrinkage for patch cord cables

B.1 Object

The purpose of this test is to measure the shrinkage of the sheath material due to ageing. This is relevant for connectorization of these cables and to avoid permanent attenuation increase after connectorization.

B.2 Apparatus

Temperature chamber suitable to accommodate the sample and to maintain the specified temperature within ± 3 °C, as described in IEC 60068-2-14 method Nb.

Steel tube with an inner diameter of 1,5 – 2,5 × cable diameter and a length of 1,0 m.

B.3 Sample

The sample shall be taken from a finished cable length.

The sample length shall be 1,1 m.

B.4 Test procedure

The sample shall be put straight into the tube protruding equally at both ends.

The cable ends shall be marked exactly at the ends of the tube.

The tube containing the sample is laid horizontally into the temperature chamber.

The temperature chamber is heated up to 85 °C, maintained at this value for 24 h and then cooled down to ambient temperature.

The cable is marked again exactly at the ends of the tube.

At both ends the distance between the markings before and after ageing is measured.

The recorded distances between the markings at each end are summed.

B.5 Requirements

The sheath shrinkage shall not exceed the values given in the relevant detail specification.

Annex C
(normative)

Method E21: Fibre movement under compression in patch-cord cables

C.1 Object

The purpose of this test is to examine the behaviour of attenuation when the buffered fibre in a cable moves under compression. Such behaviour assesses the ability of the cable to be used for patch-cords to accommodate the additional buffered fibre length, which is pushed into the cable when a connector with a movable ferrule is mated.

C.2 Apparatus

A device to fix one cable end without compression and a chuck to fix the buffered fibre protruding from this cable end. The chuck shall be movable towards the cable end for an adjustable distance (see Figure C.1). The fixed distance between the chuck and the cable end shall be 15 mm. Load cell for monitoring the force on the chuck with a maximum error of ± 3%. Attenuation monitoring equipment as described in IEC 60793-1-46.

C.3 Sampling

A 5m long cable sample shall be taken from a finished cable length.

At both ends of the sample 2 m of the cable sheath and other cable elements are removed, leaving a central 1 m length of cable sheath on the sample.

C.4 Test procedure

One end of the 1,00 m length of sheathed cable sample is fixed at one side in the cable fixing device (1) and the exposed buffered fibre is fixed in the fibre chuck (2).

At the other end of the 1.0 m sample the fibre and the sheath are glued together by e.g. epoxy to prevent any movement of the fibre within the cable sample.

The unsheathed fibres are connected to the attenuation monitoring equipment (see FigureC.1)

The chuck is moved towards the fixed cable end for the required compression distance given in the relevant detail specification.

During the movement the attenuation change and the force is monitored.

The test shall be carried out at ambient temperature.

C.5 Requirements

The change in attenuation and load during the movement shall not exceed the values given in the relevant detail specification.