IEC 60794-2-20

Edition 2.0 2008-11

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Optical fibre cables –
Part 2-20: Indoor cables – Family specification for multi-fibre optical distribution cables

Câbles à fibres optiques –
Partie 2-20: Câbles intérieurs – Spécification de famille pour les câbles de distribution optiques multifibres

IEC 60794-2-20:2008

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OPTICAL FIBRE CABLES –

Part 2-20: Indoor cables – Family specification for multi-fibre optical distribution cables

FOREWORD

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International Standard IEC 60794-2-20 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 2003. It constitutes a technical revision.

The main changes from the previous edition include:

– cable crush to be measured both during and after load;
– cable torsion test length parameter correlated to cable outer diameter;
– cable description and construction blank detail specification annexes;
– MICE environment blank detail specification is addressed in Annex B.

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

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This bilingual version, published in 2011-07, corresponds to the English version.

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

CDV	Report on voting
86A/1187/CDV	86A/1221/RVC

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, published 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 stability 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

- reconfirmed,
- withdrawn,
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OPTICAL FIBRE CABLES –

Part 2-20: Indoor cables – Family specification for multi-fibre optical distribution cables

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1 Scope

This part of IEC 60794 is a family specification covering multi-fibre optical distribution cables for indoor use. The requirements of the sectional specification IEC 60794-2 are applicable to cables covered by this standard.

Annex B contains requirements that supersede the normal requirements in case the cables are intended to be used in installation governed by the MICE table of ISO/IEC 24702 (i.e. industrial premises).

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).

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

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

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

IEC 60811-1-4, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section four: Tests at low temperature*

IEC 62222, *Fire performance of communication cables installed in buildings*

3 Construction

3.1 General

In addition to the constructional requirements in IEC 60794-2, the following considerations apply to multi-fibre indoor cables.

The cable shall be designed and manufactured for an expected operating lifetime of at least 15 years. In this context, the attenuation at the operational wavelength(s) of the optical fibres contained in the installed cable shall not exceed values agreed between customer and

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supplier. The materials in the cable shall not present a health or environmental hazard within its intended use.

There shall be no fibre splice in a delivery length unless otherwise agreed by 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

A1 multimode fibres which meet the requirements of IEC 60793-2-10 or B1.1, B1.3, B6_a, and B6_b single-mode optical fibres which meet the requirements of IEC 60793-2-50 shall be used. The linear coefficient of optical fibre attenuation and attenuation point discontinuity may be affected by the cable manufacturing process. Maximum values for these optical characteristics shall be agreed between customer and supplier.

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. The buffer shall be easily removable. For tight buffers, the buffer and fibre primary coating shall be removable in one operation over a length of 15 mm to 25 mm, depending on customer requirements. For semi-tight buffers, the buffer shall be easily removable over a length of 0,3 m to 2,0 m.

Buffer dimensions are shown in Table 1.

Table 1 – Dimensions of buffered fibres

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

3.4 Ruggedised fibre

Further protection can be provided to tight or semi-tight secondary coated fibres by surrounding them with non-metallic strength members within a sheath of suitable material.

3.5 Slotted core

The slotted core is obtained by extruding a suitable material with a defined number of slots, providing helical or SZ (reverse-oscillating lay) configuration along the core. One or more primary coated fibres or optical elements such as ribbons or fibre bundles are located in each slot.

3.6 Tube

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

3.7 Stranded tube

Multiple tubes, containing one or more primary coated or buffered fibres or ribbons, are stranded around a central member. For the sake of preserving cable geometry, some tubes may be "filler" or "empty" elements not containing optical fibres.

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3.8 Ribbon structure

Ribbon structures shall conform to IEC 60794-3, 6.5 and 8.2.3. Fibres shall be arranged to be parallel and formed into ribbons so that the fibres remain parallel and do not cross over. Unless otherwise specified, each ribbon shall be uniquely identified with a printed legend or by uniquely colouring the reference fibre and/or by colouring the matrix material of the ribbon.

3.9 Strength and anti-buckling members

The cable shall be designed with sufficient strength members to meet installation and service conditions so that the fibres are not subjected to strain in excess of limits agreed between customer and supplier.

The strength and/or anti-buckling members 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.

3.10 Ripcord

If required, a ripcord may be provided beneath the sheath.

3.11 Sheath

The cable shall have an overall protective sheath. The cable diameter shall be specified in the relevant blank detail specification (or product) specification.

3.12 Sheath marking

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

3.13 Identification

Optical fibres, secondary coatings and sub-unit sheaths shall be easily and uniquely identifiable through the use of a suitable colour code (i.e. IEC 60304) and/or an easily visible numbering scheme to be agreed between the customer and the supplier.

3.14 Examples of cable constructions

Examples of some main types of cable construction are shown in Annex A. Other configurations (e.g. multi-layer constructions) are not precluded if they meet the mechanical, environmental and transmission requirements given in this specification.

4 Tests

Compliance with relevant detail specification requirements shall be verified by carrying out tests selected from the following subclauses. It is not intended that all tests be carried out; the frequency of testing shall be agreed between the customer and the supplier.

Unless otherwise specified, all tests shall be carried out at ambient temperature. Attenuation measurements shall be conducted at the highest specified wavelength.

4.1 Dimensions

The fibre dimensions and tolerances shall be verified in accordance with test method IEC 60793-1-20, method C 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.

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4.2 Mechanical requirements

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 it becomes possible to detect permanent changes in attenuation within the measurement uncertainty of the equipment used (see 3.8.2, Assessment of uncertainties in IEC 60794-1-2). The wavelength and maximum value of this attenuation change shall be agreed between the customer and the supplier.

4.2.1 Cable tensile performance

Method:	IEC 60794-1-2-E1A and/or E1B
Diameter of chuck drums and transfer devices:	not smaller than the minimum bending diameter specified for the cable under load
Velocity of transfer device:	either 100 mm/min or 100 N/min
Load and duration:	400 N or the weight of 1 km of cable, whichever is greater, and for a minimum period of 5 min
Length of sample:	sufficient to achieve the desired accuracy of measurement of attenuation change (typically 300 m) and shall be agreed between the customer and the supplier
Requirements:	for E1A there shall be no change in attenuation after the test, for E1B allowed fibre strain to be agreed between supplier and customer. There shall be no visible damage to the cable elements

NOTE 1 Fibre strain above 60 % of the proof test of the all-glass fibre while under test load is not recommended.

NOTE 2 For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different load and duration values may be agreed between the customer and the supplier.

4.2.2 Cable crush

Method:	IEC 60794-1-2-E3
Force during installation:	500 N
Duration during installation:	1 min
Force during operation:	ffs
Duration during operation:	ffs
Length between test locations:	500 mm
Requirements:	no change in attenuation during the operational test and after the installation test. There shall be no visible damage to the cable elements

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different force values may be agreed between the customer and the supplier.

4.2.3 Cable 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 by at least 500 mm
Requirements:	no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, impact energy values may be agreed between customer and supplier.

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4.2.4 Cable bending

Method: IEC 60794-1-2-E11A

Mandrel diameter: 20 times cable diameter

Number of turns per helix: 6

Number of cycles: 10

Requirements: no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different mandrel diameter values may be agreed between the customer and the supplier.

4.2.5 Cable repeated bending

Method: IEC 60794-1-2-E6

Bending radius: 20 times cable diameter

Number of cycles: 25

Mass of weights: 4 kg

Requirements: under visual examination without magnification there shall be no damage to the sheath and to the cable elements

4.2.6 Cable bending under tension

Method: IEC 60794-1-2-E18

Bending radius: 20 times cable diameter

Load: 400 N or weight of 1 km of cable, whichever is greater

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

4.2.7 Cable bending at low temperature

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

Bending radius: 10 times cable diameter

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

Number of cycles: 2

Requirements: in addition to the requirements of Clause 8 of IEC 60811-1-4, no fibre shall break during the test

4.2.8 Cable flexing

Method: IEC 60794-1-2-E8

Number of cycles: 100

Pulley diameter: 20 times cable diameter

Mass of weights: 2 kg (minimum)

Requirements: no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different pulley diameter values may be agreed between the customer and the supplier.

4.2.9 Cable torsion

Method: IEC 60794-1-2-E7

Number of cycles: 10

Distance between fixed and rotation clamp: 125 times cable diameter but not more than 2,0 m

Tension load: 20 N

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Requirements: no fibre breakage

NOTE For certain applications specifying MICE classification of ISO/IEC 24702 and related standards, different values for the number of cycles may be agreed between customer and supplier.

4.2.10 Cable kink

Method: IEC 60794-1-2-E10

Minimum loop diameter: 20 times cable diameter

Requirement: no kink shall occur

4.3 Environmental requirements – Temperature cycling

Method: IEC 60794-1-2-F1

Table 2 – Sample temperature cycling values

	Low temperature T_A	*High temperature* T_B
a) [a]	0 °C	+50 °C
b) [a]	–5 °C	+50 °C
c) [a]	–20 °C	+60 °C
d) [a]	–40 °C	+75 °C

[a] Condition a), b) c) or d) shall be selected depending on application and customer requirements, for example condition c) is appropriate for applications to ISO/IEC 11801.

Period: t_1 = sufficient time such that the cable has reached thermal stability throughout its entire length at the specified temperature (e.g. 8 h ≤ t_1 ≤ 24 h)

Number of cycles: 2

Length of sample: sufficient to achieve the desired accuracy of measurement of attenuation

Requirements: the wavelength and maximum increase in attenuation both at T_A and T_B and after returning to thermal stability at ambient temperature shall be agreed between the customer and the supplier

4.4 Transmission requirements

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

4.5 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. Applicable legislation and regulation are also taken into account.

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

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account the fire hazard presented by the end use application of the patchcord assembly in which the cable is intended to be used.

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Annex A
(informative)

Examples of cable constructions

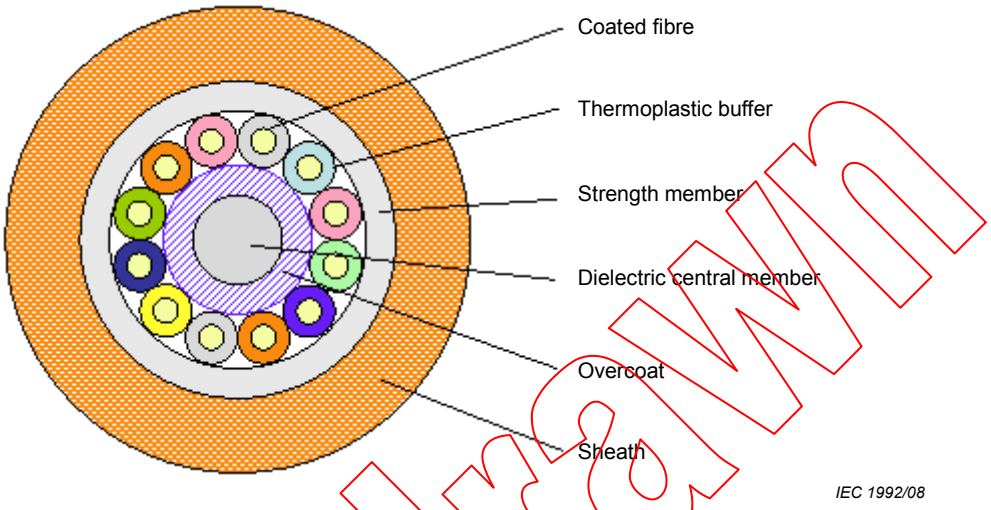

Figure A.1 – Example of cross-section of a 12 fibre distribution cable

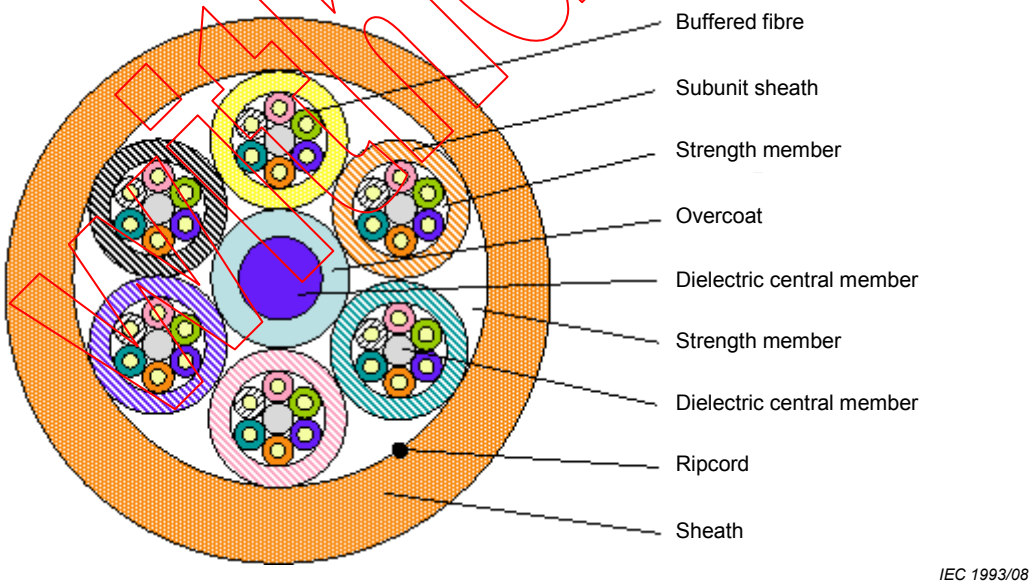

Figure A.2 – Example of cross-section of a 36 fibre distribution cable

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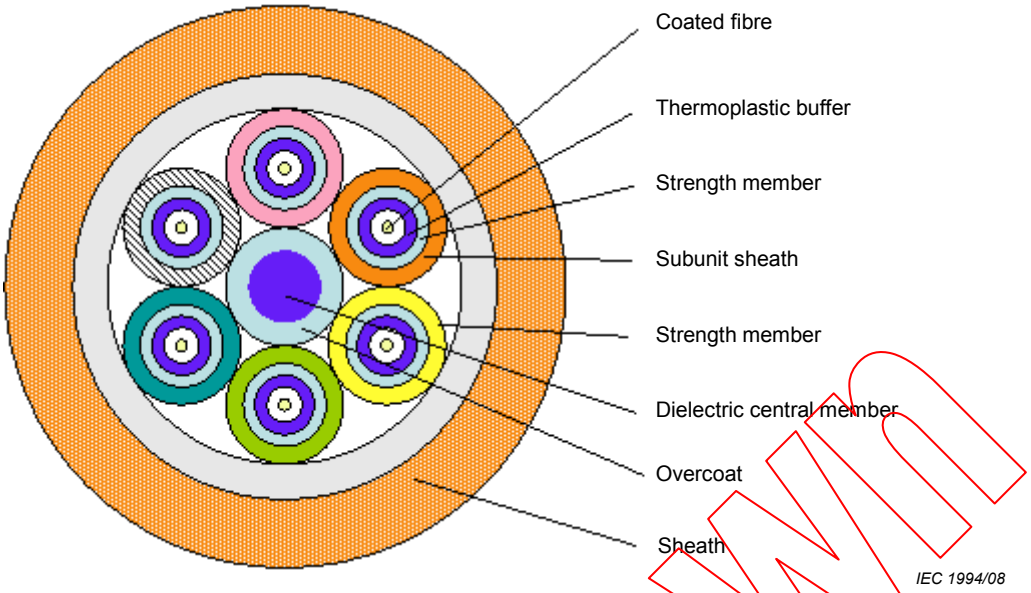

Figure A.3 – Example of cross-section of a 6 fibre break-out cable

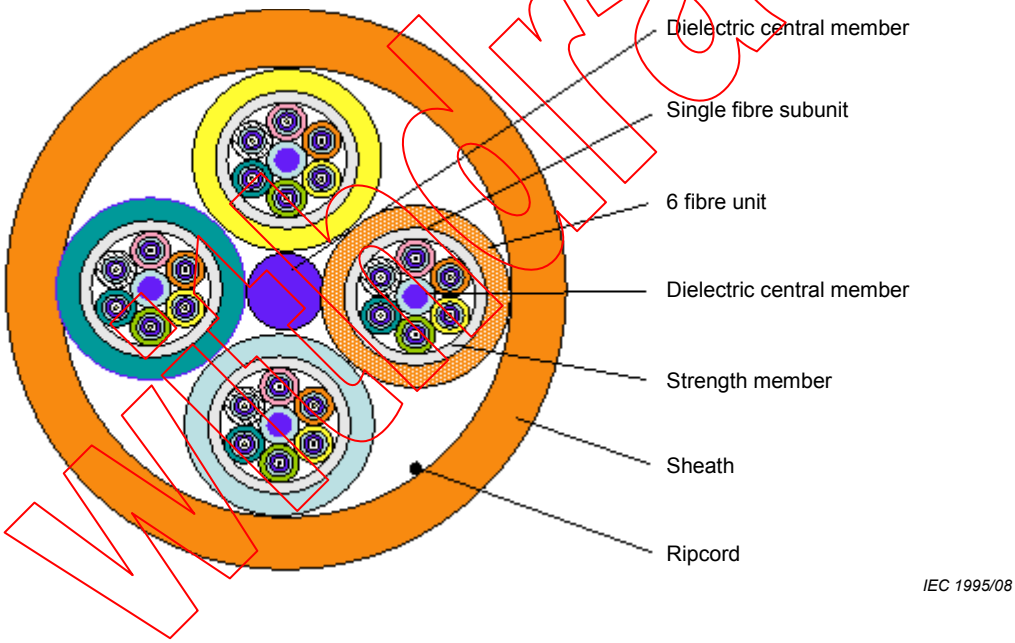

Figure A.4 – Example of cross-section of a 24 fibre break-out cable

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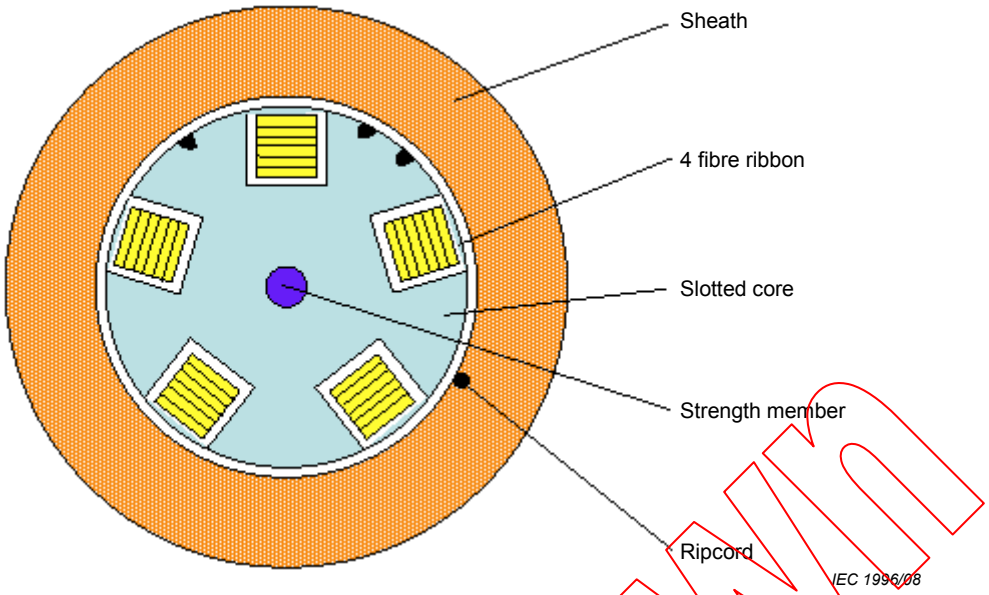

Figure A.5 – Example of cross-section of a slotted core type indoor cable with 4 fibre ribbons

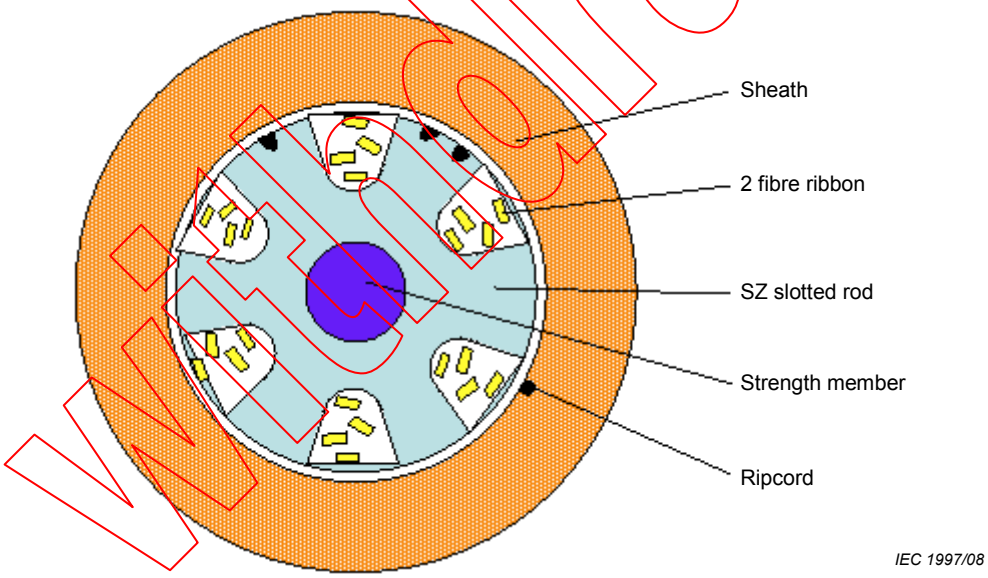

Figure A.6 – Example of cross-section of an SZ (reverse oscillating lay) slotted core type indoor cable with 2 fibre ribbons

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