SLOVENSKI STANDARD
SIST EN 187000:1999

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Generic Specification: Optical fibre cables

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Fachgrundspezifikation: Lichtwellenleiterkabel

Spécification Genérique: Câbles à fibres optiques

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Generic specification: Optical fibre cables

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Spécification générique:
Câbles à fibres optiques
(inclut l'amendement A1 : 1995)

Fachgrundspezifikation:
Lichtwellenleiterkabel
(enthält Änderung A1 : 1995)

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CECC General Secretariat has the same status as the official versions.

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CECC

CENELEC Electronic Components Committee
Comité des Composants Electroniques du CENELEC
CENELEC-Komitee für Bauelemente der Elektronik

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Foreword

This specification was prepared by CECC WG 28 'Optical fibres and optical fibre cables'.

It is based, wherever possible, on the publications of the International Electrotechnical Commission (IEC).

The CECC voting procedure for the conversion of publication CECC 87000 Issue 1 : 1991 to EN has resulted in a positive vote.

The voting report document (CECC(Secretariat)3076/03.92) has been submitted for formal approval and has been accepted. The following reference documents were approved by CECC as EN 187000 : 1992 on 23 April 1992:

CECC 87000 Issue 1 - 1991

CECC(Secretariat)2926/10.91

The following dates were fixed:

- latest date of announcement of the EN at national level (doa) 1993-06-21
- latest date of publication of an identical national standard (dop) 1993-12-21
- latest date of declaration of national standards obsolescence 1993-12-21
- latest date of withdrawal of conflicting national standards (dow) 2003-06-21

Preface

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby acceptable in all member countries without further testing.

This specification has been formally approved by the CECC, and has been prepared for those countries taking part in the System who wish to issue national harmonized specifications for optical fibre cables. It should be read in conjunction with the current regulations for the CECC System.

Foreword to amendment A1

This amendment to the European standard was prepared by Working Group CLC/TC CECC/WG 28.

The text of the draft based on document CECC (Secretariat) 3591 was submitted to the formal vote; together with the voting report, circulated as document CECC (Secretariat) 3650, it was approved as amendment A1 to EN 187000 : 1992 on 1995-04-30.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1995-12-24
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-12-24

this amendment includes:

- Methods 501 and 609 - replacement of existing text;
- Methods 515, 516, 517, 604, 610 and 611 - new clauses.

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SECTION ONE - GENERAL

1.1 Scope

This specification applies to optical fibre cables for use with telecommunication equipment and devices employing similar techniques and to cables having a combination of both optical fibres and electrical conductors.

1.2 Object

To establish uniform requirements for the geometrical, transmission, mechanical and climatic characteristics of optical fibre cables, and electrical requirements where appropriate.

1.3 Definitions

Under consideration.

1.4 Optical fibre cables

Optical fibre cables, containing optical fibres and possibly electrical conductors, consist of the following types:

1.4.1 Cables for direct burial

1.4.2 Cables for installation in ducts or tunnels

1.4.3 Overhead cables

1.4.4 Underwater cables (cables for relatively short water crossings)

1.4.5 Indoor cables

1.4.6 Portable cables

1.4.7 Equipment cables

1.4.8 Special purpose cables

1.4.9 Submarine cables

1.5 Materials

1.5.1 Optical fibre material

Optical fibres shall be uniform in quality and their characteristics shall meet the requirements of EN 188 000 : 1992.

Fibres coated by UV-curable acrylic resins can be cleaned (e.g. from cable filling compounds), for jointing purposes or just before a measurement, without causing damages to the coating, using any cleaning agent recommended by the manufacturer of the fibres. However, the use of chlorine-based cleaning agents should be absolutely avoided, since they can attack the coating even after their use and in vapour phase.

1.5.2 Electrical conductors

Any electrical conductors shall be uniform in quality and free from defects. Their characteristics shall be in accordance with the relevant IEC standards as stated in the detail specification.

1.5.3 Other materials

Material used in the construction of optical fibre cables shall be compatible with the physical and optical properties of the fibres and shall be in accordance with the relevant IEC standards as stated in the detail specification.

1.6 Cable construction

The construction, dimensions, weight, mechanical, optical, electrical and climatic properties of each type of optical fibre cable shall be as stated in the relevant detail specification.

1.7 Related documents

In each case the latest issue of the document prior to the date of issue of this document is valid.

EN 188 000 : Generic specification : Optical fibres (1992).

IEC 68-1 : Environmental testing - Part 1 : General and guidance (1988).

IEC 68-2-10 : Part 2 - Tests - Test J and guidance : Mould growth (1988).

IEC 68-2-14 : Part 2 - Tests - Test N : Change of temperature (1984).

IEC 189-1 : Low-frequency cables and wires with p.v.c. insulation and p.v.c. sheath - Part 1 : General test and measuring methods (1986).

IEC 212 : Standard conditions for use prior to and during the testing of solid electrical insulating materials (1971).

IEC 227-2 : Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V - Part 2 : Test methods (1979).

IEC 331 : Fire-resisting characteristics of electric cables (1970).

IEC 332 : Tests on electric cables under fire conditions.

IEC 793-1 : Optical fibres - Part 1 : Generic specification (1989).

IEC 793-2 : Optical fibres - Part 2 : Product specifications (1989).

IEC 794-1 : Optical fibre cables - Part 1 : Generic specification (1989).

IEC 794-2 : Optical fibre cables - Part 2 : Product specifications (1989).

IEC 811-1-4 : Common test methods for insulating and sheathing materials of electric cables - Section 4 : Tests at low temperature (1985).

IEC 874-1 : Connectors for optical fibres and cables - Part 1 : Generic specification (1987).

SECTION TWO - MEASURING METHODS FOR DIMENSIONS

2.1 Object

The dimensions of the optical fibres, electrical conductors and cables shall be determined by subjecting samples to tests selected from table I. The tests applied, acceptance criteria and number of samples shall be as stated in the detail specification.

TABLE I

Measuring methods for dimensions

Test method EN 188 000	Test	Characteristics covered by test method
101	Refracted near field	Diameter of core Diameter of cladding Non-circularities Concentricity errors
102	Near field light distribution (imaging)	Diameter of core Diameter of cladding Diameter of primary coating Diameter of buffer Non-circularities Concentricity errors
103	Four concentric circle method	Diameter of core Diameter of cladding Non-circularities Concentricity errors
104	Mechanical	Diameter of cladding Diameter of primary coating Diameter of buffer Non-circularities
	Mechanical (under consideration)	Length of cable
105	Delay of transmitted pulse	Length of fibre
IEC 189[1]	Mechanical	Diameter of electrical conductor
IEC 811[2] IEC 189[1]	Mechanical	Thickness of insulation Thickness of sheaths Overall dimensions

1 Low-frequency cables and wires with PVC insulation and PVC sheath

2 Test methods for insulations and sheaths of electric cables and cords (Elastomeric and thermoplastic compounds).

SECTION THREE - MEASURING METHODS FOR MECHANICAL CHARACTERISTICS

3.1 Object

This section describes measuring methods applying to mechanical tests of optical fibre cables. The methods are to be used for inspection of optical fibre cables for the sake of trade and commerce.

The mechanical characteristics of optical fibre cables shall be verified by subjecting samples to tests selected from table II. The tests applied, acceptance criteria and number of samples shall be as laid down in the detail specification.

Note - Not all tests are applicable to all cables.

TABLE II

Measuring methods for mechanical characteristics

Test method EN 187 000	Test	Characteristics covered by test method
501	Tensile performance	Mechanical strength
502	Abrasion resistance of sheath	
503	Abrasion resistance of marking	
504	Crush	
505	Impact	
506	Isostatic pressure (under consideration)	
507	Repeated bending	Ease of handling
508	Torsion	
509	Flexing	
510	Snatch	
511	Cable kinking test	
512	Tube kinking test	
513	Cable bend	
514	Cut-through resistance	
515	Vibration (under consideration)	

3.2 Operational definitions

Under consideration.

3.3 Method 501 - Tensile performance

3.3.1 Object

This measuring method applies to optical fibre cables which are tested at a particular tensile strength in order to examine the behaviour of attenuation and/or fibre strain as a function of the load on a cable which may occur during installation. This method is intended to be non-destructive (the tension applied shall be within the operational values).

Two measuring methods are described below:

- Method 501A : procedure for determining attenuation changes;
- Method 501B : procedure for determining fibre elongation strain.

Method 501B can provide information on both the maximum allowable pulling force for field installation, as well as information about the strain margin of the cable.

One method or the other, or both, either separately or in combination, shall be used according to the Detail Specification or upon agreement between user and manufacturer.

3.3.2 Sample preparation

a) Test sample

A length of cable under test, sufficient to achieve the desired accuracy, is removed from the reel or coil.

A flat endface shall be prepared at both ends of the test fibre.

b) Calibration fibre

Refer to EN 188000 - Method XXX.(Fibre elongation measurement method)*.

3.3.3 Apparatus

a) Method 501A : Attenuation measuring apparatus for determination of attenuation change : (see EN 188000, Section 4)

and/or

Method 501B : Fibre elongation strain measuring apparatus : (see EN 188000 Method XXX : Fibre elongation measurement method)*.

b) 1) Tensile strength measuring apparatus which is able to accommodate the minimum length to be tested (see figure 101).

2) Load cell with a maximum error of ± 3 % of its maximum range.

3) Clamping device : Chuck drums with appropriate core diameter or an equivalent system. A transfer device with an appropriate diameter can be used to shorten the equipment.

NOTE - Care should be taken that the specific method of capturing the cable components does not affect the results.

* Revision in progress based on IEC 793-1-A7 presently in IEC 86A/301/DIS.

c) If required, mechanical or electrical means for measuring the cable elongation shall be provided.
The minimum measurement accuracy needed shall be specified in the Detail Specification.

d) Examples of suitable apparatus are shown in figure 101A or 101B.

It shall be checked that the distance between the transfer devices and also the diameters of the transfer devices are such that they do not affect the test conditions.

3.3.4 Procedure

a) The test shall be carried out at ambient temperature.

b) Load the cable onto the tensile rig and secure it. At both ends of the tensile rig a method of securing the cable shall be used which uniformly locks the cable so that all components of the cable are restricted in their movement. For most cable constructions (e.g. stranded type cables), clamping on cable elements, except the fibres, is practical and sufficient to obtain attenuation changes and/or both the maximum allowable pulling load and the strain margin of the cable. However, for certain cable constructions (e.g. single loose tube) it may be necessary to prevent the fibres from slipping in order to obtain the correct strain margin figures. Chuck drums or mandrels with a minimum of three cable turns around the drum are a suitable technique.

Where multiple pass of the cable on the rig is used, in order to accommodate the specified minimum length of cable to be strained, the fixing at the ends shall be freely rotating.

NOTE - For aerial cable types, if required by the Detail Specification, the clamping of the cable shall be made by means of the anchoring devices relevant to the type of cable considered.

c) Connect the test fibre of the cable under tensile test to the measurement apparatus.

Carry out the cable tensile test. For method 501B, and when using method XXX of EN 188000 (Fibre elongation measurement method)*, care shall be taken that during the pulling of the sample the reference length does not change.

d) The tension shall be continuously increased to the required value(s) given in the Detail Specification.

NOTE - The rate of tension increase is under consideration.

e) The change of attenuation and/or fibre strain shall be recorded, preferably as a function of cable load or elongation.

f) For cables with a large number of fibres a multiple attenuation and/or fibre strain measuring device can be used.

g) A representative number of fibres and/or a number of test cycles shall be agreed between manufacturer and customer.

* Revision in progress based on IEC 793-1-A7 presently in IEC 86A/301/DIS.

3.3.5 Results

a) Final measurements

The attenuation and/or fibre strain of the sample shall not exceed the values given in the relevant detail specification.

b) The following data shall be presented with the results :

1) length of the cable and length under tension ;

2) end preparation ;

3) details of the load cell ;

4) details of the launching conditions and attenuation measuring device ;

5) details of fibre strain measuring device, if applicable ;

6) change of attenuation and/or fibre strain at a specified wavelength as a function of the load ;

7) rate of tension increase;

8) temperature.

9) for method 501B :

- If required by the Detail Specification, the residual elongation strain after removal of the load shall be measured.

- Data presented with the results shall include the calibration curve or factor of the measured phase shift or pulse delay versus fibre elongation of the relevant fibre.

- An example of a presentation of the cable and fibre elongation for a loosely packaged construction is given in figure 102.

If required, the load value where the beginning of fibre strain occurs is defined, on the plot of fibre strain versus load, as the intersection of the linear portion of the curve with the load axis.

NOTE - As a first approximation, the length of fibre under elongation strain is taken as equal to the length of cable under tensile load except for cables with tightly assembled constructions. It should be noted, however, that the calculated value of fibre elongation strain is affected by the accuracy of the value of this cable length and also by the excess length of fibre in the cable, which depends on the cable design (loose structures).

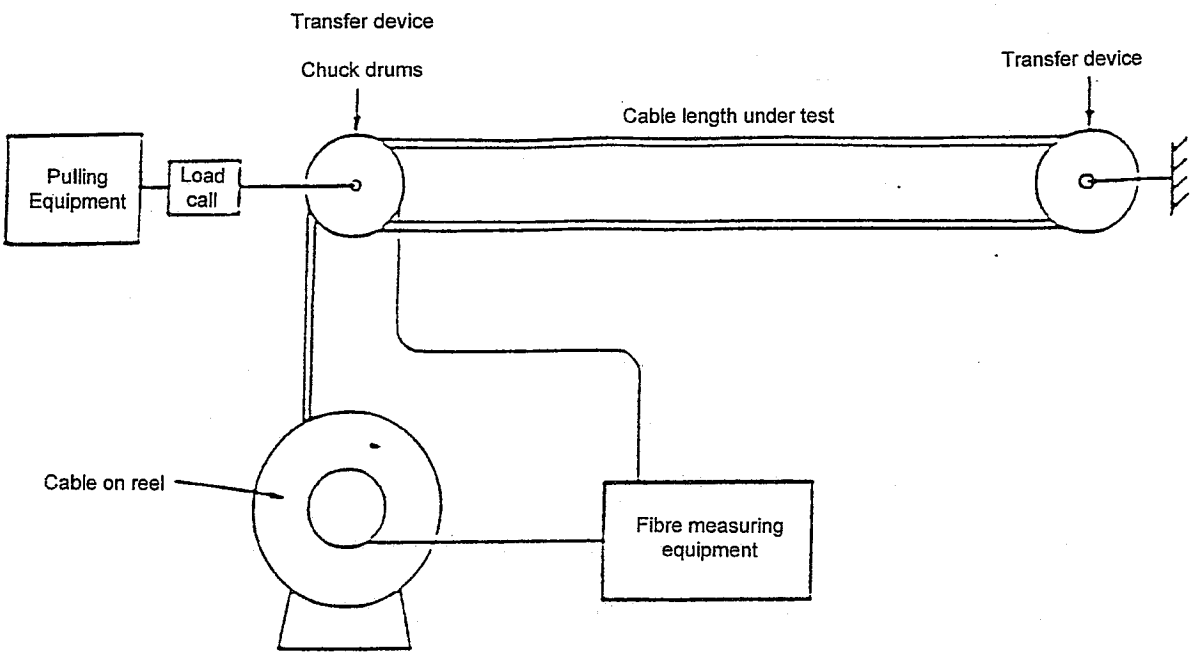


Fig. 101A - Tensile performance measuring apparatus with multiple pass of the cable on the ring

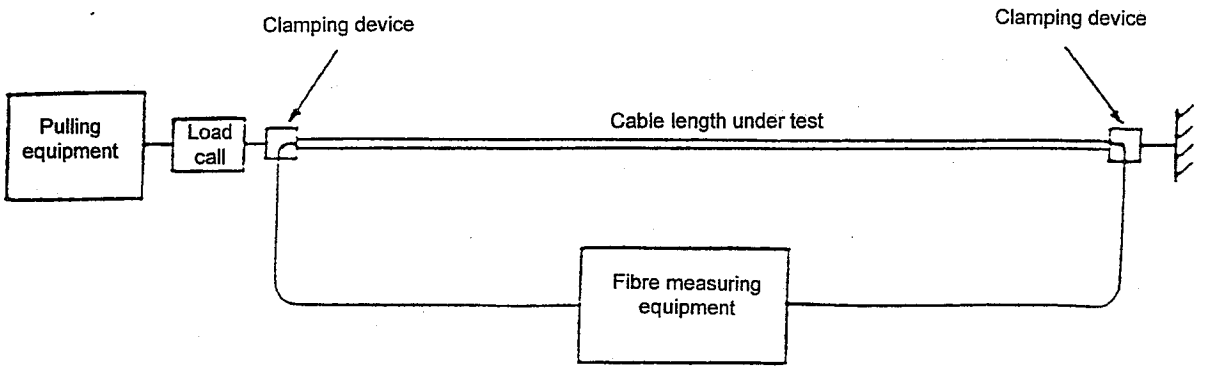
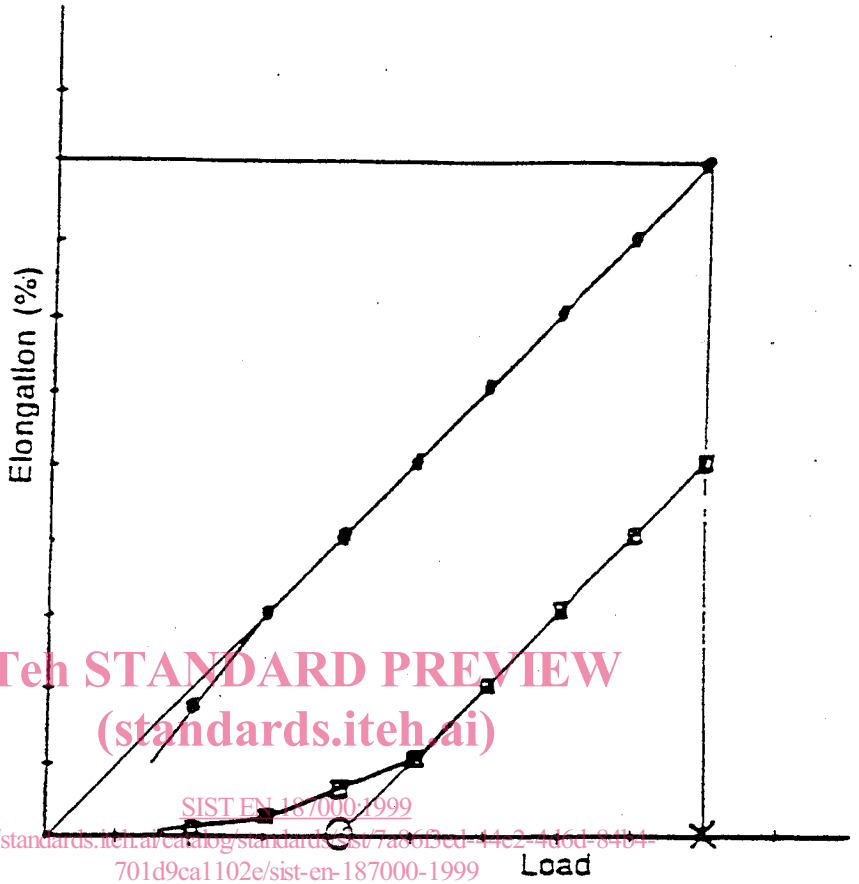


Fig. 101B - Tensile performance measuring apparatus in straight configuration



● Cable elongation (optional)

□ Fibre elongation

○ T_o

× T_{max}

Note T_o corresponds to the load at which the fibre becomes under strain.

T_{max} corresponds to the maximum specified pulling load.

Fig. 102 - Example of fibre and cable elongation as a function of load