

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Optical fibre cables –  
Part 1-101: Generic specification – Basic optical cable test procedures –  
Mechanical tests methods – Tensile, method E1**

**Câbles à fibres optiques –  
Partie 1-101: Spécification générique – Procédures fondamentales d'essais des  
câbles optiques – Méthodes d'essais mécaniques – Traction, méthode E1**

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## OPTICAL FIBRE CABLES –

**Part 1-101: Generic specification –  
Basic optical cable test procedures –  
Mechanical tests methods – Tensile, method E1**

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IEC 60794-1-101 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

This document cancels and replaces IEC 60794-1-21:2015, which will be withdrawn. It includes an editorial revision, based on the new structure and numbering system for optical fibre cable test methods.

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

Draft	Report on voting
86A/2359/CDV	86A/2420/RVC

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/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](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

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## INTRODUCTION

This document cancels and replaces test method E1 of IEC 60794-1-21:2015, which will be withdrawn. It includes an editorial revision, based on the new structure and numbering system for optical fibre cable test methods. The mechanical tests contained in IEC 60794-1-21:2015 will be individually numbered in the IEC 60794-1-1xx series. Each test method is now considered to be an individual document rather than part of a multi-test method compendium. Full cross-reference details are given in IEC 60794-1-2.

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## OPTICAL FIBRE CABLES –

### Part 1-101: Generic specification – Basic optical cable test procedures – Mechanical tests methods – Tensile, method E1

#### 1 Scope

This part of IEC 60794 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.

This document defines test procedures to be used in establishing uniform requirements for tensile performance.

Throughout this document the wording "optical cable" includes optical fibre units, microduct fibre units, etc.

See IEC 60794-1-2 for general requirements and definitions and for a complete 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.

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IEC 60793-1-22, *Optical fibres – Part 1-22: Measurement methods and test procedures – Length measurement*

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

IEC 60794-1-1:2023, *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 – General guidance*

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60794-1-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>



## 4 Method E1: Tensile performance

### 4.1 Object

This test method applies to optical fibre cables which are tested at a particular tensile strength to examine the behaviour of either the attenuation or the fibre elongation strain, or both, as a function of the load on a cable which can occur during installation and operation. This method is intended to be non-destructive.

### 4.2 Sample length

Length under tension  $\geq 50$  m unless otherwise defined in the relevant specification. For cables requiring specialized anchoring devices (e.g. OPGW, all-dielectric self-supporting (ADSS), heavy wire armored cables, etc.), the minimum length shall be 25 m.

Short lengths in the tensile test will adversely affect the accuracy of the measurement. The lengths shown above are the recommended minimum lengths for this test.

Total sample length is longer than the length under tension to allow for clamping and connection to test equipment.

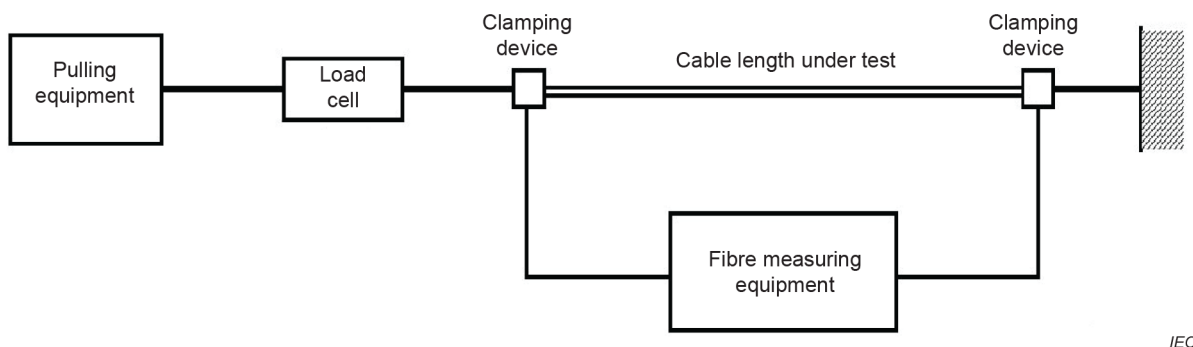
### 4.3 Apparatus

The apparatus shall consist of

- either an attenuation measuring apparatus for the determination of attenuation changes (see IEC 60793-1-46), or a fibre elongation strain measuring apparatus (see IEC 60793-1-22, method C: Fibre elongation), or both;
- a tensile strength measuring apparatus which can accommodate the minimum length to be tested. Transfer devices can be used for testing longer samples under tension (see Figure 2). The diameters of sheaves in the transfer device shall be no smaller than the minimum bending diameter of the cable under test; for example, 1 m diameter;
- a load cell with a maximum error of  $\pm 3$  % of its maximum range;
- a clamping device to secure all cable components at the ends of the length under test: care should be taken that the specific method of capturing the cable components does not affect the results. A mandrel is frequently an appropriate device, with a diameter for example 1 m, but not less than the minimum bending diameter specified for the cable.

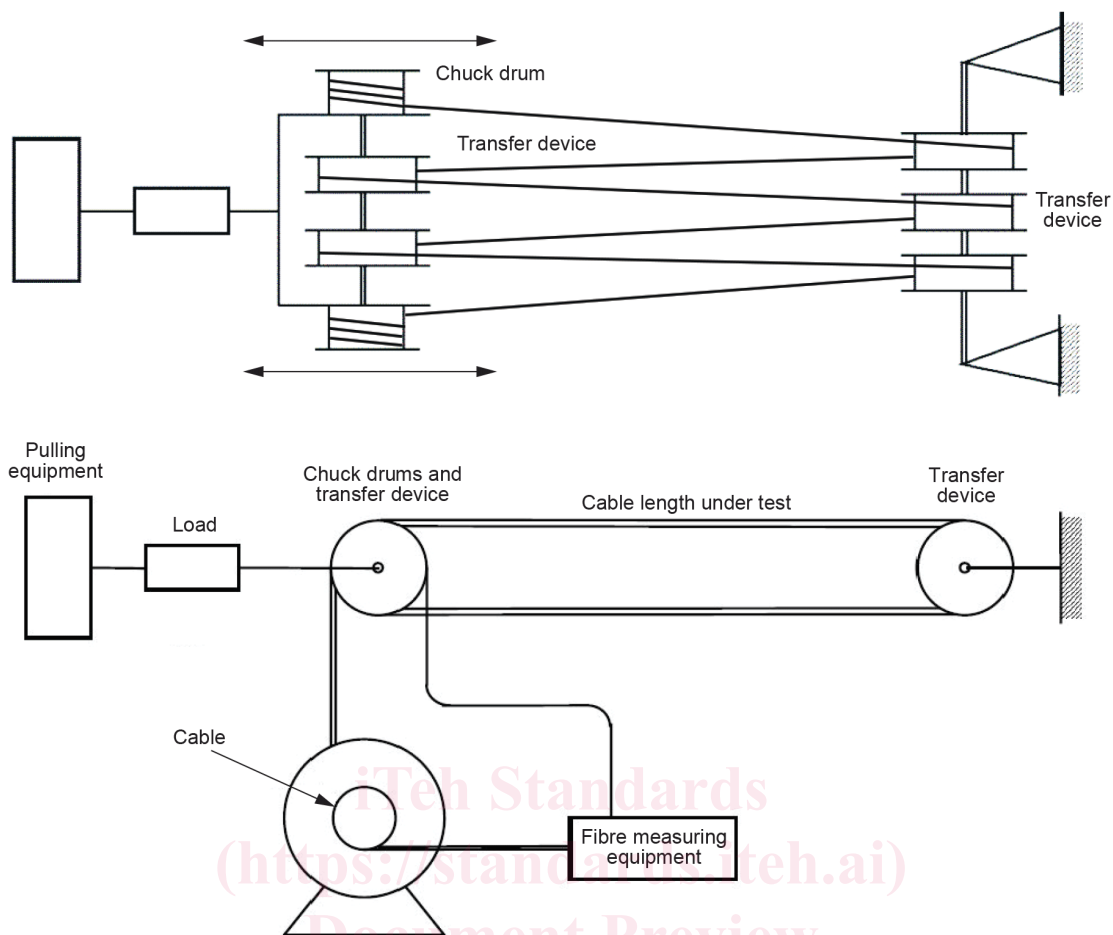
If required, mechanical or electrical means for measuring the cable load or elongation, per the detail specification shall be provided.

Examples of suitable apparatus are shown in Figure 1 and Figure 2.



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Figure 1 – Tensile performance measuring apparatus



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**Figure 2 – Example of tensile performance measuring apparatus using transfer devices and chuck drums**

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## 4.4 Procedure

### 4.4.1 General requirements and preparation

- a) Unless otherwise specified, the conditions for testing shall be in accordance with the expanded test conditions as defined in IEC 60794-1-2.
- b) Cable should be loaded into tensile apparatus and cable ends should be secured in such a way that all cable components, including fibres, are restricted in movement and no slippage occurs. For most cable constructions (e.g. stranded type cables), clamping on cable elements, except the fibres, is practical and sufficient to obtain either attenuation changes or the maximum allowable pulling load and the strain margin of the cable or both. However, for certain cable constructions (e.g. single loose tube), it can be necessary to prevent the fibres from slipping to obtain the correct strain margin figures.

For aerial cable types, if required by the detail specification, the fixing of the cable can be made by means of the anchoring devices relevant to the type of cable considered. For certain heavily armoured cables, a clamping device involving a stocking grip or similar anchoring device can be used.

- c) Connect the test fibre of the cable under tensile test to the measurement apparatus. For the pulse delay (time of flight) technique of method C of IEC 60793-1-22, 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 relevant specification.
- e) Either the change of attenuation or fibre strain, or both, shall be recorded as a function of cable load or elongation.