

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



Optical fibre cables – **STANDARD PREVIEW**  
Part 1-21: Generic specification – Basic optical cable test procedures –  
Mechanical test methods [\(standards.iteh.ai\)](https://standards.iteh.ai/)

Câbles à fibres optiques – [IEC 60794-1-21:2015](https://standards.iteh.ai/catalog/standards/sist/53f54def-f62e-402a-a2b0-107e01000000/iec-60794-1-21-2015)  
Partie 1-21: Spécification générique – Procédures fondamentales d'essais des  
câbles optiques – Méthodes d'essai mécanique





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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Optical fibre cables –**  
**Part 1-21: Generic specification – Basic optical cable test procedures –**  
**Mechanical test methods**

**Câbles à fibres optiques –**  
**Partie 1-21: Spécification générique – Procédures fondamentales d'essais des**  
**câbles optiques – Méthodes d'essai mécanique**

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**OPTICAL FIBRE CABLES –****Part 1-21: Generic specification –  
Basic optical cable test procedures –  
Mechanical test methods**

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International Standard IEC 60794-1-21 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This first edition of IEC 60794-1-21 cancels and replaces the mechanical tests part of the second edition of IEC 60794-1-2, published in 2003. It constitutes a technical revision.

It has been decided to split the second edition of IEC 60794-1-2 into six new documents:

- IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*
- IEC 60794-1-20, *Optical fibre cables – Part 1-20: Generic specification – Basic optical cable test procedures – General and definitions*
- IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods*

- IEC 60794-1-22, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental tests methods*
- IEC 60794-1-23, *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable elements tests methods*
- IEC 60794-1-24, *Optical fibre cables – Part 1-24: Generic specification – Basic optical cable test procedures – Electrical tests methods*

This bilingual version (2019-03) corresponds to the monolingual English version, published in 2015-03.

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

FDIS	Report on voting
86A/1638/FDIS	86A/1655/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.

This standard is intended to be used in conjunction with IEC 60794-1-1.

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.

IEC 60794-1-21:2015

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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## OPTICAL FIBRE CABLES –

### Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical test methods

#### 1 Scope and object

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.

The object of this standard is to define test procedures to be used in establishing uniform requirements for mechanical requirement performance.

Throughout this standard the wording “optical cable” may also include optical fibre units, microduct fibre units, etc.

General requirements and definitions are given in IEC 60794-1-20 and a complete reference guide to test method of all types in the IEC 60794-1-2.

#### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60227-2, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60793-1-22:2001, *Optical fibres – Part 1-22: Measurement methods and test procedures – Length measurement*

IEC 60793-1-32:2010, *Optical fibres – Part 1-32: Measurement methods and test procedures – Coating strippability*

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

IEC 60793-1-46:2001, *Optical fibres – Part 1-46: Measurement methods and test procedures – Monitoring of changes in optical transmittance*

IEC 60794-1-1, *Optical fibres – Part 1-1: Generic specification – General*

IEC 60794-1-2:2013, *Optical fibre cables – Part 1-2: Generic specification – Cross reference table for optical cable test procedures*

IEC 60794-1-20:2014, *Optical fibre cables – Part 1-20: Generic specification – Basic optical cable test procedures – General and definitions*

IEC 60794-1-22:2012, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods*

IEC TR 62691, *Guide to the installation of optical fibre cables*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

### 3 Method E1: Tensile performance

#### 3.1 Object

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

#### 3.2 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.

[IEC 60794-1-21:2015](https://standards.iteh.ai/catalog/standards/sist/53f54def-f62e-402a-a2b0-39f06d8ae133/iec-60794-1-21-2015)

<https://standards.iteh.ai/catalog/standards/sist/53f54def-f62e-402a-a2b0-39f06d8ae133/iec-60794-1-21-2015>

#### 3.3 Apparatus

The apparatus consists of

- an attenuation measuring apparatus for the determination of attenuation changes (see IEC 60793-1-40), and/or a fibre elongation strain measuring apparatus (see IEC 60793\_1\_22:2001, Method C: Fibre elongation);
- a tensile strength measuring apparatus which is able to accommodate the minimum length to be tested. Transfer devices may 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; typically 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 typically 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.

#### 3.4 Procedure

##### 3.4.1 General requirements

- Unless otherwise specified, the conditions for testing shall be in accordance with the expanded test conditions as defined in IEC 60794-1-20.

- 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, including fibres, 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.

For aerial cable types, if required by the detail specification, the fixing of the cable may 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 may 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 60793-1-22:2001, 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) The change of attenuation and/or fibre strain shall be recorded, 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 (typically one) shall be agreed between manufacturer and customer.
- h) The readings taken at the end of the time periods stated in 3.4.2 should be stable (i.e. within measurement uncertainty) before the loads are changed or the test completed. If the readings are still fluctuating then the load holding period should be extended until they are stable.

#### 3.4.2 Procedure

<https://standards.iteh.ai/catalog/standards/sist/53f54def-f62e-402a-a2b0-39f06d8ae133/iec-60794-1-21-2015>

Measure the optical attenuation and/or determine the fibre strain before the start of the test as a baseline:

- a) apply the short-term load to the cable;
- b) hold this load for 10 min;
- c) determine fibre strain, if required;
- d) if required, change the applied load to the long term load
- hold this load for 10 min,
  - measure the attenuation and/or determine the fibre strain;
- e) remove the load;
- f) allow the cable to rest for 5 min;
- g) measure the attenuation and/or determine the fibre strain.

Different steps and load levels can be used if agreed between customer and supplier.

#### 3.5 Requirements

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

#### 3.6 Details to be specified

The relevant specification shall include the following:

- length under tension if different from this method;