IEC 60794-1-311

Edition 1.0 2024-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Optical fibre cables – Part 1-311: Generic specification – Basic optical cable test procedures – Cable element test methods – Tensile strength and elongation test for cable elements, Method G11A

Câbles à fibres optiques – Partie 1-311 : Spécification générique – Procédures fondamentales d'essai des câbles optiques – Méthodes d'essai des éléments de câble – Essai de résistance à la traction et d'allongement des éléments de câble, Méthode G11A

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IEC 60794-1-311 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

This document partially cancels and replaces IEC 60794-1-23:2019.

This edition includes the following significant technical changes with respect to IEC 60794-1-23:2019:

a) The information about dumb-bells is removed because this is not used for testing cable elements;
b) the parameters strain at yield and E modulus are added in 5.7.

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

Draft	Report on voting
86A/2394/FDIS	86A/2415/RVD

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. The main document types developed by IEC are described in greater detail at 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 in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This document contains method G11A of IEC 60794-1-23:2019, which will be withdrawn. The system for optical fibre test methods have been restructured and renumbered. The optical cable element test methods contained in IEC 60794-1-23:2019 will now be individually numbered in the IEC 60794-1-3xx 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.

OPTICAL FIBRE CABLES –

Part 1-311: Generic specification – Basic optical cable test procedures – Cable element test methods – Tensile strength and elongation test for cable elements, method G11A

1 Scope

This part of IEC 60794 describes test procedures to be used in establishing uniform requirements of optical fibre cable elements for the mechanical property – tensile strength and elongation at break.

This document 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.

Throughout the document, the wording "optical cable" can also include optical fibre units, microduct fibre units, etc.

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.

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures – General guidance*

IEC 60811-401, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 401: Miscellaneous tests – Thermal ageing methods – Ageing in an air oven*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

4 General requirements

IEC 60794-1-2 is the reference guide to test methods of all types. It shall be considered for general requirements and definitions.

5 Method G11A: Tensile strength and elongation of buffer tubes and micro tubes at break

5.1 Object

These tests are to determine the tensile strength and elongation at break of the buffer tubes of the cable and micro tubes in the condition as manufactured (i.e. without any ageing treatment) and, when required, after one or more accelerated ageing treatment(s), which are prescribed in the relevant cable standard.

For this test the procedure IEC 60811-501 shall be used. When the ageing treatment is to be carried out on prepared test pieces (in accordance with IEC 60811-401), the test pieces for the ageing treatment shall be from positions adjacent to the test pieces used for the test without ageing, and the tensile tests on the aged and unaged test pieces shall be made in immediate succession.

Where further increased test reliability is necessary, it is recommended that the tests on aged and unaged test pieces are performed by the same person using the same testing method and the same apparatus, in the same laboratory.

NOTE 1 In 5.2 to 5.5, descriptions for buffer tube also include micro tube.

5.2 Sample

5.2.1 General

One sample of each buffer tube to be tested shall be taken of sufficient size to provide a minimum of five test pieces each for the tensile tests without ageing and the tensile tests after each of the required ageing treatments, bearing in mind that a 100 mm length is needed for the preparation of each test piece.

Any sample that shows signs of mechanical damage shall not be used for the test.

5.2.2 Preparation and conditioning of test pieces

a) Conditioning of test pieces

1) Elevated temperature conditioning

NOTE 1 Elevated temperature conditioning is not an ageing treatment. It is used as a means of ensuring stable and consistent test pieces when required. It is used a) when called for in the relevant cable standard, or b) if there is a doubt or disagreement about a result and the test needs to be repeated. In either case, the conditioning applies only to the test piece as taken from the cable before any subsequent treatment (ageing, compatibility test, oil immersion, etc.).

Where conditioning at elevated temperature is used, such conditioning shall be carried out, for tubular test pieces, after removal of the fibre, and any filling compound, but before applying the reference marks, if any, for measurement of the extension.

Where the relevant cable standard calls for conditioning at elevated temperature, it shall be for the time and temperature given in that standard. Where, in case of doubt, the test has to be repeated, the conditioning shall be 24 h at 70 °C ± 2 °C, or a lower temperature corresponding to the maximum operating temperature of the cable.

2) Room temperature conditioning

Before determination of the cross-sectional area, all test pieces shall be protected from direct sunlight and maintained for at least 3 h at a temperature of 23 °C ± 5 °C.

b) Tubular test pieces

Tubular test pieces shall be used only when the dimensions of the buffer tube are such that it is not possible to prepare dumb-bell test pieces.

The samples of buffer tube shall be cut into pieces approximately 100 mm long and the fibre and any filling compound removed, care being taken not to damage the buffer tube. The tubes shall be marked to identify the sample from which they were prepared and their relative positions in the sample.

The central 20 mm shall be marked immediately before the tensile test.

NOTE 2 Where a contact extensometer is used, the pre set grips at the required spacing are deemed to constitute a mark.

5.2.3 Determination of cross-sectional area

In the middle of the sample being used to prepare the tubular test pieces, a piece shall be taken to determine the cross-sectional area, A, in square millimetres, of the test piece, using one of the following methods. In case of doubt, the methods 2) and 3) shall be used.

1) From the dimensions, using the formula:

$$A = \pi(D - \delta)\delta \quad (1)$$

where

δ is the mean value of the thickness of the buffer tube, in millimetres, rounded off to two decimal places;

D is the mean value of the outer diameter of the test piece, in millimetres, rounded off to two decimal places.

2) From the density, the mass and the length, using the formula:

$$A = \frac{1000 \times m}{d \times l} \quad (2)$$

where

m is the mass of the test piece, in grams, to three decimal places;

d is the density, in grams per cubic centimetre, to three decimal places;

l is the length, in millimetres, to one decimal place.

3) From the volume and the length, the volume being determined by means of immersion in, for example ethyl alcohol, using the formula:

$$A = \frac{V}{l} \quad (3)$$

where

V is the volume, in cubic millimetres, to two decimal places;

l is the length, in millimetres, to one decimal place.

Ensure there are no air bubbles in or on the surface of the test piece during immersion.

For test pieces which are to be aged, the cross-sectional area shall be determined before ageing treatment.