

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

Optical fibre cables –  
Part 1-211: Generic specification – Basic optical cable test procedures –  
Environmental test methods – Sheath shrinkage, method F11

Câbles à fibres optiques –  
Partie 1-211: Spécification générique – Procédures fondamentales d'essais des  
câbles optiques – Méthodes d'essais d'environnement – Rétraction de la gaine,  
méthode F11



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## OPTICAL FIBRE CABLES –

**Part 1-211: Generic specification –  
Basic optical cable test procedures –  
Environmental test methods – Sheath shrinkage, method F11**

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IEC 60794-1-211 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 60794-1-22:2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 60794-1-22:2017:

- a) method F11 (cables intended for patch cords) of IEC 60794-1-22:2017 was renumbered F11A and renamed as "sheath shrinkage (cables to be terminated with connectors)";
- b) a second method F11B is newly included that was adapted from ANSI/TIA-455-86-A;
- c) in method F11A, the thermal exposure from ambient to the specified temperature was replaced by temperature cycling between a low and high temperature according to IEC 60794-1-22, method F1;

- d) in method F11A, the continuing of the test cycles until the shrinkage exhibits a variation less than  $\pm 1$  mm was replaced with a fixed number of cycles specified by the detail specification;
- e) in method F11A, the average was changed to maximum sheath shrinkage that shall not exceed the value specified in the relevant detail specification;
- f) in both methods, the alternative that the sample may be cut to length and the length between the cut sheath ends measured is added.

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

Draft	Report on voting
86A/2074/FDIS	86A/2087/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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

A list of all parts in the 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## INTRODUCTION

This document defines two test methods to measure the shrinkage of the sheath due to thermal exposure of cables intended for termination with connectors and cables for general purpose.

This document cancels and replaces method F11 of IEC 60794-1-22:2017, which will be withdrawn. It includes an editorial revision, based on the new structure and numbering system for optical fibre cable test methods. Additionally, technical changes were implemented. The environmental tests contained in IEC 60794-1-22:2017 will be individually numbered in the IEC 60794-1-2xx 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.

This document includes a first method F11 of IEC 60794-1-22:2017 named "sheath shrinkage test for cables intended for patch cords". This method was renumbered as method F11A in this document. There are technical changes in method F11A. The thermal exposure from ambient to the specified temperature was replaced by temperature cycling according to IEC 60794-1-22, method F1. Also, the continuing of the test cycles until the shrinkage exhibits a variation less than  $\pm 1$  mm was replaced by a fixed number of cycles according to the detail specification.

This document includes a second method F11B for sheath shrinkage of cable for general purpose. This test procedure adapts the method in ANSI/TIA-455-86-A.

The numbering of these tests continues the F-series numbering sequence of IEC 60794-1-22:2017.

A test procedure other than method F11A and method F11B to measure the shrinkage exists. Method F17 according to IEC 60794-1-22 defines shrinkage testing on a cable sample with a minimum length of 10 m or longer by measuring the fibre protrusion and, indirectly, the buffered fibre or fibre tube protrusion at both ends.

For electric and optical fibre cables, a shrinkage test for sheaths according to IEC 60811-503 exists that uses a nominal sample length of 500 mm and exposes the sample over a specified temperature and time. Afterwards, the sample is allowed to cool in air to ambient temperature. Five such thermal cycles are carried out.

IEC TR 62959<sup>1</sup> provides information on cable shrinkage characterisation of optical fibre cables that consist of standard glass optical fibres for telecommunication applications. The characterisation is directed to the effects of cable shrinkage or cable element shrinkage on the termination of cables. Recommended test methods for the evaluation of cable shrinkage and classification by several grades are given.

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<sup>1</sup> Under preparation. Stage at the time of publication: IEC TR/TPUB 62959:2020.

## OPTICAL FIBRE CABLES –

### Part 1-211: Generic specification – Basic optical cable test procedures – Environmental test methods – Sheath shrinkage, method F11

## 1 Scope

This part of IEC 60794 defines test procedures to measure the shrinkage of the sheath due to thermal exposure of cables.

A first test method, F11A, is included for cables where the fibre or buffered fibre and the sheath of the cable are intended to be fully terminated into a connector at one or both cable ends.

A second test method, F11B, is included in this document for sheath shrinkage testing for general purpose.

See IEC 60794-1-2 for a reference guide to test methods of all types and for general requirements.

iTeh STANDARD PREVIEW

## 2 Normative references (standards.iteh.ai)

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 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General*

IEC 60794-1-22:2017, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods*

## 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 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 Method F11A – Sheath shrinkage (cables to be terminated with connectors)

### 4.1 Objective

The purpose of this test is to measure the shrinkage behaviour of the sheath due to thermal exposure of cables intended to be terminated with connectors.

This test is not intended for connectorised cable assemblies.



See Annex A for a comparison between method F11A and method F11B.

## 4.2 Sample

A 2 m length of cable shall be cut from the end of the cable and discarded in order to avoid end effects. The test sample lengths shall be cut from the adjoining cable. Five test samples of the length specified in the detail specification shall be cut from the cable.

- For test samples of a nominal 1 m length, cut  $1\,050\text{ mm} \pm 5\text{ mm}$ .
- For test samples of a nominal length of 150 mm, cut  $160\text{ mm} \pm 5\text{ mm}$ .

## 4.3 Apparatus

A horizontal surface where the test samples are placed that permit free movement of the sheath. For example, talc, paper or paper dusted with talc on the surface permits free movement of the sheath.

A temperature chamber of appropriate size and a temperature sensing device. The temperature chamber shall be able to accommodate the test samples and maintain the specified temperature within  $\pm 3\text{ }^{\circ}\text{C}$ .

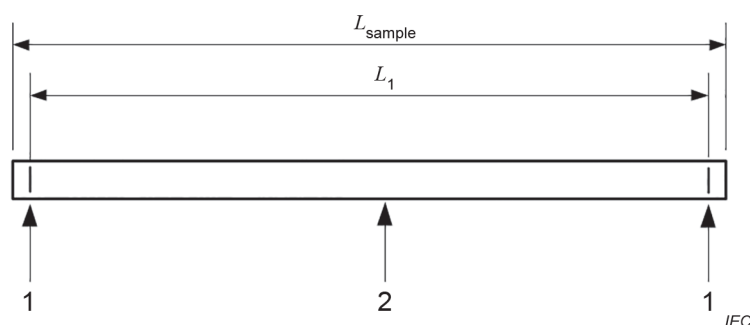
A length measuring device of sufficient length with a minimum resolution of 1 mm for a sample with a nominal 1 m length, or 0,15 mm for a sample with a nominal 150 mm length.

## 4.4 Procedure

The cable on the supply reel, or alternatively the cable coil, shall be conditioned for 24 h at ambient temperature before cutting the test samples.

Two marks separated by the distance of the nominal test length per the detail specification (e.g. 1 000 mm, 150 mm), with a deviation not greater than  $\pm 1\text{ mm}$ , shall be applied to each test sample, as shown in Figure 1.

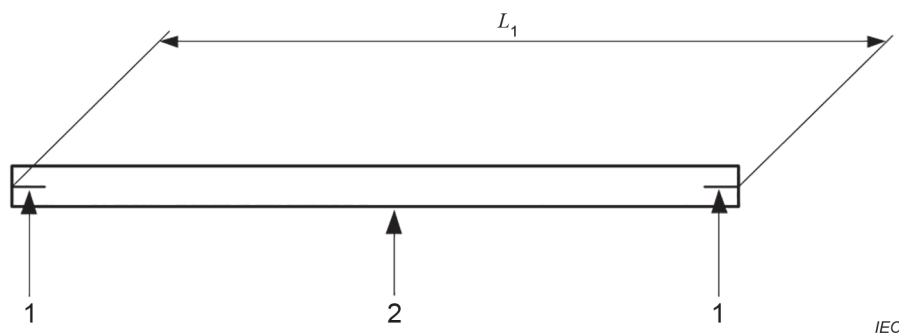
Alternatively, the sample ends may be cut to the measurement length,  $L_1$ , using a razor knife. This alternative is best suitable for a short sample length of 150 mm. Two marks longitudinally to the cable axis shall be applied to both ends of each test sample to indicate the measurement points, as shown in Figure 2.



### Key

- 1 mark on cable sheath
- 2 cable sample

**Figure 1 – Cable sample preparation**



#### Key

- 1 mark on cable sheath
- 2 cable sample

**Figure 2 – Alternative cable sample preparation (cut ends)**

The distance ( $L_1$ ) between the marks or cut ends on each test sample shall be measured and recorded.

The test samples are placed horizontally on a surface located in the temperature chamber in such a manner as to permit free movement of the sheath. When space allows, the samples should be placed into the chamber in a straight configuration. If the samples need to be coiled, the test samples shall be coiled with a radius of not less than 150 mm still allowing free movement of the sheath.

The cable samples shall be temperature cycled in accordance to IEC 60794-1-22, method F1. The parameters specified in the detail specification shall be used. For more information on cable shrinkage characterisation and guidance, see IEC TR 62959.

After the last cycle, allow the cable samples to recover for a minimum period of 1 h at ambient temperature, unless otherwise specified in the detail specification.

The distance ( $L_2$ ) between the marks or cut ends on each test sample shall be measured and recorded. If the samples have been coiled, straighten them for this measurement. When straightened, the test pieces should not be elongated. If the coiled samples cannot be effectively straightened for measurement, the test is rendered invalid.

The sheath shrinkage of each test sample is calculated as showed in Formula (1):

$$\Delta L_i = L_{1,i} - L_{2,i} \quad (1)$$

where

- $L_{1,i}$  is the initial distance measured between the marks or cut ends;
- $L_{2,i}$  is the final distance measured between the marks or cut ends;
- $i$  is the sample number ( $i = 1$  to 5).

#### 4.5 Requirements

The maximum sheath shrinkage value of all test samples shall not exceed the value specified in the relevant detail specification.

#### 4.6 Details to be specified

The detail specification shall include the following information:

- a) nominal test length of cable samples;
- b) low and high exposure temperature;
- c) soak time;
- d) number of cycles;
- e) maximum sheath shrinkage.

#### 4.7 Details to be reported

The test report shall include, beside the specified parameters in the detail specification (see 4.6), the following information, if applicable:

- a) method of marking and length measurement;
- b) sample configuration and arrangement on the surface;
- c) type and preparation of the surface;
- d) individual shrink values of all samples;
- e) any deviations from this test method.

### 5 Method F11B – Sheath shrinkage (general purpose)

#### 5.1 Objective

The purpose of this test method is to determine the linear dimensional changes in extruded plastic cable sheath due to exposure at elevated temperatures.

See Annex A for a comparison between method F11A and method F11B.

#### 5.2 Sample

A 2 m length of cable shall be cut from the end of the cable and discarded in order to avoid end effects. The cable sample(s) shall be whole-cable section(s), with all components, including the core, in place, unless otherwise specified. The number of samples specified shall be cut from the adjoining cable and shall be 150 mm long.

#### 5.3 Apparatus

A convection oven capable of maintaining a temperature within  $\pm 3$  °C at the specified exposure temperature.

A horizontal surface where the test sample(s) are placed that permit free movement of the sheath. For example, talc, paper or paper dusted with talc on the surface permits free movement of the sheath.

A linear scale or a precision calliper of sufficient length graduated in 0,15 mm or less divisions.

#### 5.4 Procedure

The cable length shall be conditioned for a minimum of 24 h at ambient temperature prior to the sample preparation.

Each sample shall be marked with reference marks along the longitudinal axis of the cable sample. The marks shall be made at convenient positions as close as practical to the ends of the sample. The marks shall not damage the cable sheath. Measure and record the initial distance  $L_1$  between the opposite edges of the sample(s) at the reference marks. Alternatively, the sample may be cut to length and the length between the cut sheath ends measured.

Place the sample(s) on a horizontal surface in the oven that permit free movement of the sheath.

Expose the sample(s) for the time period and at the temperature specified in the detail specification.

At the end of the oven exposure period, recondition the sample(s) at ambient temperature for minimum 1 h.

Measure and record the final distance  $L_2$  between the opposite edges of the sample(s) at the reference marks.

The (absolute) sheath shrinkage of each test sample is calculated as showed in Formula (2):

$$L_i = L_{1,i} - L_{2,i} \quad (2)$$

where

$L_{1,i}$  is the initial distance measured between the marks;

$L_{2,i}$  is the final distance measured between the marks;

$i$  is the sample number ( $i = 1$  to the number of test samples).

## 5.5 Requirements

Each sheath sample shrinkage ( $L_i$ ) shall not exceed the value specified in the relevant detail specification.

## 5.6 Details to be specified

The detail specification shall include the following information:

- a) number of cable samples;
- b) exposure temperature;
- c) time period;
- d) maximum allowable sheath shrinkage.

## 5.7 Details to be reported

The test report shall include, beside the specified parameters in the detail specification (see 5.6), the following information, if applicable:

- a) method of marking and length measurement;
- b) type and preparation of the surface;
- c) individual shrink values of all samples;
- d) any deviations from this test method.