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colour inside

Optical fibres –
Part 1-32: Measurement methods and test procedures – Coating strippability

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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FOREWORD

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International Standard IEC 60793-1-32 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition: expansion of the range of coating dimensions applicable to the procedure detailed in this document to accommodate optical fibres with a 200 µm coating dimension.

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

FDIS	Report on voting
86A/1890/FDIS	86A/1899/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60793 series, published under the general title *Optical fibres*, 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- withdrawn,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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

OPTICAL FIBRES –

Part 1-32: Measurement methods and test procedures – Coating strippability

1 Scope

This part of IEC 60793 is intended primarily for testing either fibres as produced by a fibre manufacturer or subsequently overcoated (tight buffered) using various polymers. The test can be performed either on fibres as produced, or after exposure to various environments.

This test applies to A1, A2, A3, B and C fibres with a nominal glass dimension of 125 µm.

The object of this document is to establish uniform requirements for the mechanical characteristic – coating strippability. This test quantifies the force required to mechanically remove the protective coating from optical fibres along their longitudinal axis.

This test is not intended as a means to maximize fibre strength after the coating is removed nor is it intended to specify the best conditions for field stripping of optical fibres.

This test is designed for optical fibres having polymeric coatings with nominal outer diameters in the range of 200 µm to 900 µm. ~~Application of this method to fibres with outer coating diameters outside the range of 230 µm to 930 µm is not recommended.~~

~~Warning – Fibres can fracture while being stripped and pierce skin and eyes. Use of protective eyewear is recommended.~~

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 60793-1 (all parts), *Optical fibres – Measurement methods and test procedures*~~

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

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

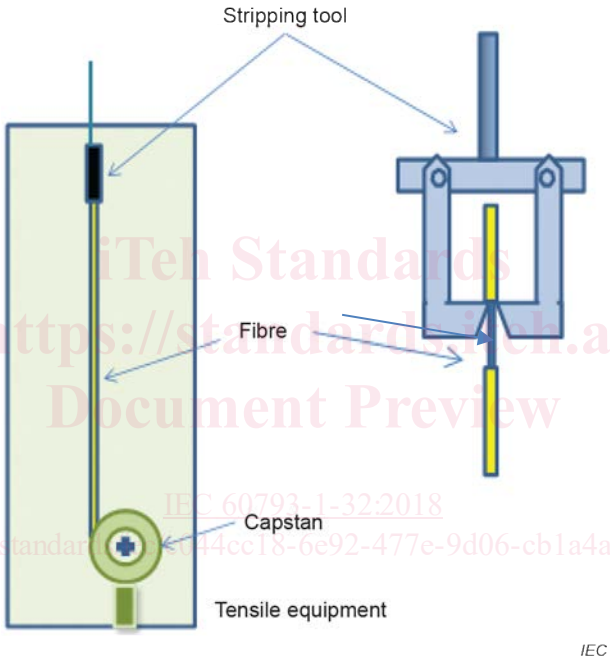
4 Apparatus

4.1 Tensile equipment

Use a suitable device, for example a vertical tensile tester, which provides relative motion between the test fibre and a stripping tool and is capable of imparting constant motion at the velocity found in 6.2, without jerking the fibre under test or the stripping tool.

Use a device capable of providing relative motion in two directions to allow resetting. Provide suitable means for clamping and maintaining the stripping tool blades perpendicular to the fibre axis or in a position that prevents fibre bending, and for securing one end of the test fibre. To prevent fibre breakage, secure the fibre at the clamping point without stressing the fibre excessively.

Examples of test arrangements are shown in Figure 1.



NOTE Either the stripping tool or the capstan is fixed.

Figure 1 – Example of test arrangement

4.2 Load cell

Use any appropriate device that is capable of sensing the force imparted to the fibre during the removal of the fibre coating.

4.3 Transducer amplifier

This device receives signals from the load cell and indicates the tensile force on the test fibre up to the point when the coating is stripped off. The transducer shall acquire the force data at a rate greater than 100 Hz. The transducer and/or measurement system shall have the ability to plot the test data on a continuous chart, such as a strip chart or line chart. It shall also have the capability of capturing sufficient information to calculate the maximum and average forces, along with the amplitude and frequencies of any oscillations in the force during the stripping process.

The accuracy of the force measurement shall be stated in the detail specification.

4.4 Stripping tool

4.4.1 Because the results from this test are strongly dependent upon the design of tool used, it is important that the following tool design guidelines be observed.

a) Unless otherwise specified in the detail specification, use tool blades with the diameter of the hole greater than the nominal cladding diameter of the fibre to be stripped in order not to damage the cladding surface. The recommended stripping tool ~~shall~~ should be constructed such that the blades form a circular aperture. Other blade configurations may be used as long as it can be shown that the results correlate to ones with a circular aperture [1][1]. A practical example is a hole which is 15 µm larger that the nominal cladding diameter; for 125 µm cladding diameter fibres, this results in a 140 µm circular hole.

b) The stripping tool blades shall be constructed such that the blades do not cause fibre bending. Stripping tools in which the blades butt together in the same plane are preferred in this test.

4.4.2 Mount the stripping tool on the test fixture and provide a means to hold it closed around the fibre using suitable clamps. Ensure the fibre is pulled in a direction normal to the plane of the blades.

4.4.3 Replace the stripping tools at intervals as dictated by a documented quality schedule, when the blades become dull or damaged, or whenever wear appears sufficient to affect the test results.

NOTE Tool wear can affect any or all of the following:

- fibre breakage;
- the amount of residue left on the glass surface;
- the way in which the coating is removed from the fibre;
- the force required to remove the coatings.

4.5 Fibre guide

A fibre guide shall be provided to support the fibre that extends past the stripping tool blade (if not already designed into the tool) and which meets the following requirements:

a) the guide shall support the fibre to prevent sagging due to the weight of the fibre;

b) the guide shall prevent bending of the fibre caused by buckling of the fibre coating as it is removed;

c) the guide shall be located as close to the stripping tool as possible without interfering with the stripping operation;

d) the guide shall allow for easy insertion into the test set-up and for easy cleaning, and shall provide freedom from interference if the coating buckles.

5 Specimen preparation

5.1 Representative sample

The sampling ~~should~~ shall consist of a minimum of 10 specimens assumed to be representative of the population of fibres under evaluation. The specimens ~~should~~ shall be tested and their results will be averaged.

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1 Numbers in square brackets refer to the Bibliography.

5.2 Strip length

The length of fibre stripped on a particular piece can affect the strip force. However, for ~~245 µm nominal~~ 200 µm and 250 µm coating diameter fibres, the length of fibre stripped has minimal effect on the strip force. The length of fibre stripped shall be specified in the detail specification. For ~~245 µm nominal~~ 200 µm and 250 µm coating diameter fibres, a preferred value is 30 mm. For larger coating diameter, shorter stripping lengths are preferred, for example 15 mm.

To perform the measurement, a specimen of fibre ~~must~~ shall be provided that is longer than just the specified length to be stripped. The total specimen length consists of the fibre required to secure itself to the capstan, the fibre between the capstan and the stripping tool (see Figure 1) and the fibre length to be stripped that extends past the stripping tool (see Figure 2). The total specimen length shall be sufficiently long to meet this deployment. The test results are not dependent on the total sample length. The test results are, in part, dependent on the length of fibre to be stripped.

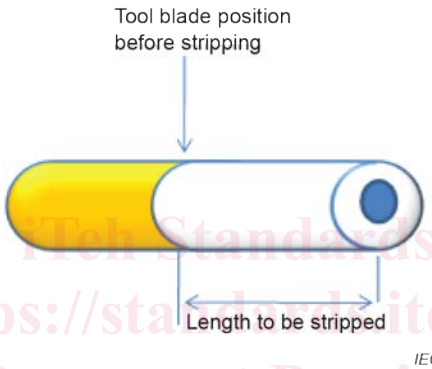

Figure 2 – Length of fibre to be stripped

6 Procedure

6.1 ~~Introduction~~ General

This procedure involves

a) severing the coating at the prescribed distance from the end of the fibre, and then

b) removing the coating from the fibre while measuring the force required to accomplish this removal.

Use of protective eyewear is recommended as fibres can fracture while being stripped and pierce skin and eyes.

6.2 Stripping rate

The force required to remove coatings from fibre is dependent, in part, on the stripping rate. If results of different tests are to be comparable, the same stripping rate ~~should~~ shall be used. Set up the test equipment so as to impart a relative motion between the fibre and the stripping tool at the rate specified in the detail specification. A preferred value for ~~245 µm nominal~~ 200 µm and 250 µm coating diameter is 500 mm/min. For fibres with larger ~~nominal~~ coating diameter, a lower value is preferred, for example 10 mm/min to 25 mm/min.

6.3 Preconditioning

Unless otherwise specified, pre-condition the test samples for a minimum of 2 h at the standard test conditions given in IEC 60793-1-1 ~~series~~.

6.4 Calibrating the transducer amplifier

Calibrate the transducer and load cell before each series of tests or as dictated by a documented calibration schedule.

6.5 Loading the test specimen

Ensure the area around both blades of the stripping tool is free of debris and/or build-up from any previous use before loading the fibre.

Secure one end of the test fibre to the test fixture so that it will not slip under load (e.g. wrap one end of the fibre three times around an 80-mm diameter capstan). Thread the other end through the stripping tool and insert it through the fibre guide/support.

6.6 Stripping the coating

Start the test apparatus to provide a constant relative motion between the fibre and the stripping tool.

Observe and record the force required to remove the coating from the glass fibre. Exclude data from fibres that break during the test.

The test is complete when the coating has been completely removed from the fibre.

~~NOTE~~ Any remaining coating residue visible to the naked eye ~~should~~ shall be easy to remove by gently wiping the fibre with a laboratory tissue.

7 Calculations

7.1 Calculation for the value of a ~~piece~~ specimen

7.1.1 General

There are two approaches to measuring strip force. Both incorporate the same experimental technique but each emphasizes a different focal point for the strip force.

7.1.2 Approach 1 – Average strip force

Start the test apparatus to provide a constant relative motion between fibre and stripping tool. Observe and record the force required to remove the coating from the glass fibre. Exclude data from fibres that break during the test. The average strip force is then calculated, excluding the initial 20 % of the strip length data. The average of the sampling strip force values is then reported as "average strip force".

7.1.3 Approach 2 – Peak strip force

Start the test apparatus to provide a constant relative motion between the fibre and stripping tool. Observe and record the force required to remove the coating from the glass fibre. The peak strip force is then recorded. Exclude data from fibres which break during the test. The average of the sampling peak strip force values is then reported as "peak strip force".

7.2 Calculation of the reported value ~~for a specimen~~

Calculate the average and standard deviation of the sampling.