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Optical fibres –
Part 1-31: Measurement methods and test procedures – Tensile strength

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FOREWORD

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International Standard IEC 60793-1-31 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

The main change with respect to the previous edition is the addition of comprehensive details, such as examples of fibre clamping as given in Annexes A, B and C.

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

CDV	Report on voting
86A/1285/CDV	86A/1308/RVC

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

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

A list of all parts of the IEC 60793-1series, published under the general title *Optical fibres – Measurement methods and test procedures*, can be found on the IEC website.

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

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Failure stress distributions can be used to predict fibre reliability in different conditions. IEC/TR 62048 shows mathematically how this can be done. To complete a given reliability projection, the tests used to characterize a distribution shall be controlled for the following:

- Population of fibre, e.g., coating, manufacturing period, diameter
- Gauge length, i.e., length of section that is tested
- Stress or strain rates
- Testing environment
- Preconditioning or aging treatments
- Sample size

This method measures the strength of optical fibre at a specified constant strain rate. It is a destructive test, and is not a substitute for prooftesting.

This method is used for those *typical* optical fibres for which the median fracture stress is greater than 3,1 GPa (450 kpsi) in 0,5 m gauge lengths at the highest specified strain rate of 25 %/min. For fibres with lower median fracture stress, the conditions herein have not demonstrated sufficient precision.

Typical testing is conducted on “short lengths”, up to 1 m, or on “long lengths”, from 10 m to 20 m with sample size ranging from 15 to 30.

The test environment and any preconditioning or aging is critical to the outcome of this test. There is no agreed upon model for extrapolating the results for one environment to another environment. For failure stress at a given stress or strain rate, however, as the relative humidity increases, failure stress decreases. Both increases and decreases in the measured strength distribution parameters have been observed as the result of preconditioning at elevated temperature and humidity for even a day or two.

This test is based on the theory of fracture mechanics of brittle materials and on the power-law description of flaw growth (see IEC TR 62048). Although other theories have been described elsewhere, the fracture mechanics/power-law theory is the most generally accepted.

A typical population consists of fibre that has not been deliberately damaged or environmentally aged. A typical fibre has a nominal diameter of 125 μm, with a 250 μm or less nominal diameter acrylate coating. Default conditions are given for such typical populations. Atypical populations might include alternative coatings, environmentally aged fibre, or deliberately damaged or abraded fibre. Guidance for atypical populations is also provided.

OPTICAL FIBRES –

Part 1-31: Measurement methods and test procedures – Tensile strength

1 Scope

This part of IEC 60793 provides values of the tensile strength of optical fibre samples and establishes uniform requirements for the mechanical characteristic – tensile strength. The method tests individual lengths of uncabled and unbundled glass optical fibre. Sections of fibre are broken with controlled increasing stress or strain that is uniform over the entire fibre length and cross section. The stress or strain is increased at a nominally constant rate until breakage occurs.

The distribution of the tensile strength values of a given fibre strongly depends on the sample length, loading velocity and environmental conditions. The test can be used for inspection where statistical data on fibre strength is required. Results are reported by means of statistical quality control distribution. Normally the test is carried out after temperature and humidity conditioning of the sample. However, in some cases, it may be sufficient to measure the values at ambient temperature and humidity conditions

This method is applicable to types A1, A2, A3, B and C optical fibres.

Warning – This test involves stretching sections of optical fibre until breakage occurs. Upon breakage, glass fragments can be distributed in the test area. Protective screens are recommended. Safety glasses should be worn at all times in the testing area.

2 Normative references

The following referenced documents are indispensable for the application of this document.

For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60793-1-20, *Optical fibres – Part 1-20: Measurement methods and test procedures – Fibre geometry*

IEC 60793-1-21, *Optical fibres – Part 1-21: Measurement methods and test procedures – Coating geometry*