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Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable element test methods

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

Part 1-23: Generic specification –
Basic optical cable test procedures –
Cable element test methods

FOREWORD

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International Standard IEC 60794-1-23 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This edition of IEC 60794-1-23 cancels and replaces the cable elements tests methods part of the second edition of IEC 60794-1-2 published in 2003. It constitutes a technical revision.

The main change with respect to the previous edition is that 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 & 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*

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

FDIS	Report on voting
86A/1451/FDIS	86A/1469/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.

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

A list of all the 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 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 standard may be issued at a later date.

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 FIBRE CABLES –

Part 1-23: Generic specification – Basic optical cable test procedures – Cable element 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 part of IEC 60794 is to define test procedures to be used in establishing uniform requirements for the geometrical, material, mechanical, environmental properties of optical fibre cable elements.

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

IEC 60794-3:2001, *Optical fibre cables – Part 3: Sectional specification – Outdoor cables*

3 Method G1: Bend test for cable elements

3.1 Object

The purpose of this test is to characterize cable elements for splicing purposes by determining the attenuation increase of an optical (fibre, ribbon, core tube, breakout unit, etc.) element when bent within a splice closure or similar device.

3.2 Sample

The length of the sample of optical element shall be sufficient to carry out the testing specified.

3.3 Apparatus

The apparatus consists of:

a) a mandrel having a smooth surface with diameter as stated in the detail specification;

b) an attenuation measuring apparatus (see IEC 60793-1-40).

3.4 Procedure

The element to be tested shall be loosely wound on the mandrel; the number of turns shall be stated in the detail specification.

In order to measure the attenuation increase caused by bending, allowance should be made for the intrinsic attenuation of the fibre.

3.5 Requirements

Any increase in attenuation shall comply with the limits shown in the detail specification.

3.6 Details to be specified

The detail specification shall include the following:

a) optical test wavelength;
b) diameter of the mandrel;
c) number of turns;
d) apparatus and attenuation measuring technique;
e) temperature.

4 Method G2: Ribbon dimensions and geometry – Visual method

4.1 Object

The purpose of this test is to determine the geometry of an optical fibre ribbon as defined by the parameters of width, height and fibre alignment, for the purpose of type testing to assume proper manufacturing process control. This test is not necessarily suitable for final product inspection and, unless otherwise specified, shall not be used for that purpose.

4.2 Sample

The number of samples to be tested shall be specified in the detail specification. The selected samples shall be statistically independent and representative of the ribbon population tested.

4.3 Apparatus

The apparatus consists of a microscope or profile projector with appropriate magnification.

4.4 Procedure

4.4.1 General

Either of the two following procedures may be used.

For the specified number of samples, all dimensions shall be measured as average as well as maximum and minimum values.

4.4.2 Method 1

The sample is prepared by cutting it perpendicular to the axis of the ribbon and placing it in a curable resin or in a tool which holds the ribbon. If necessary, the sample shall be ground and polished to prepare a smooth perpendicular end face. The prepared sample is secured with its end face perpendicular to the optical path and measured by means of a microscope or profile projector.

NOTE Care should be taken that the preparation of the sample does not change the structure of the fibre ribbon and represents an undisturbed image of the fibre cladding and ribbon cross-section.

4.4.3 Method 2

Place the ribbon in a ribbon fibre holder and remove 20 mm to 25 mm of the fibre coating and matrix material with the ribbon hot sheath stripping tool and wipe the stripped portion of the fibres clean with an alcohol-moistened pad. Adjust the position of the ribbon in the ribbon fibre holder and cleave the fibres at a distance of 250 μm to 500 μm from the stripped edge of the ribbon. Cut and polish the other end of the ribbon, and illuminate it with a collimated light source. Align and measure the cleaved end of the ribbon under microscope.

NOTE Care should be taken that the preparation of the sample does not change the structure of the fibre ribbon and represents an undisturbed image of the fibre cladding and ribbon cross-section.

4.5 Requirements

Unless otherwise specified in the detail specification, the width, height and fibre alignment shall be in accordance with IEC 60794-3:2001, Table 1.

4.6 Details to be specified

The detail specification shall include the following:

a) permissible maximum and minimum values;

b) average values;

c) number of samples tested.

4.7 Definitions of ribbon dimensions and geometry

4.7.1 General

The following definitions apply to a fibre ribbon cross-section as shown in Figure 1. The figure illustrates an example for a 4-fibre ribbon, where a is the diameter of a coloured fibre.

NOTE In consideration of the precision of fiber geometric attributes and the relatively larger precision of ribbon geometry requirements, it is acceptable for glass core/glass cladding fibres to use the edge of the cladding for the measurements of 4.7.3 and 4.7.4 in lieu of the fibre centres. In this case, the measurements shall be made on the same side of all fibres (e.g. top or bottom, left or right side).

4.7.2 Width and height

The width w and height h of the ribbon are the dimensions of the minimum rectangular area enclosing the ribbon cross-section.

4.7.3 Basis line

The basis line is given in the cross-section of an optical fibre ribbon as the straight line crossing the fibre centres of the first fibre (fibre 1) and the last fibre (fibre n) of the fibre ribbon.

4.7.4 Fibre alignment

4.7.4.1 Horizontal fibre separation

The horizontal separation of fibres is the distance of the orthogonal projection of two fibre centres on the basis line in the fibre ribbon cross-section.

Two horizontal separation parameters can be distinguished:

a) centre-centre distance d between adjacent fibres;

b) centre-centre distance b between the extreme fibres;

4.7.4.2 Planarity

The planarity p of the fibre ribbon structure is the sum of the maximum positive and absolute values of the maximum negative vertical separation of the fibres.

The vertical separation of the fibres is the orthogonal distance from the fibre centre to the basis line. The vertical separation is positive for fibres “above” the basis line and negative for fibres “below” the basis line.

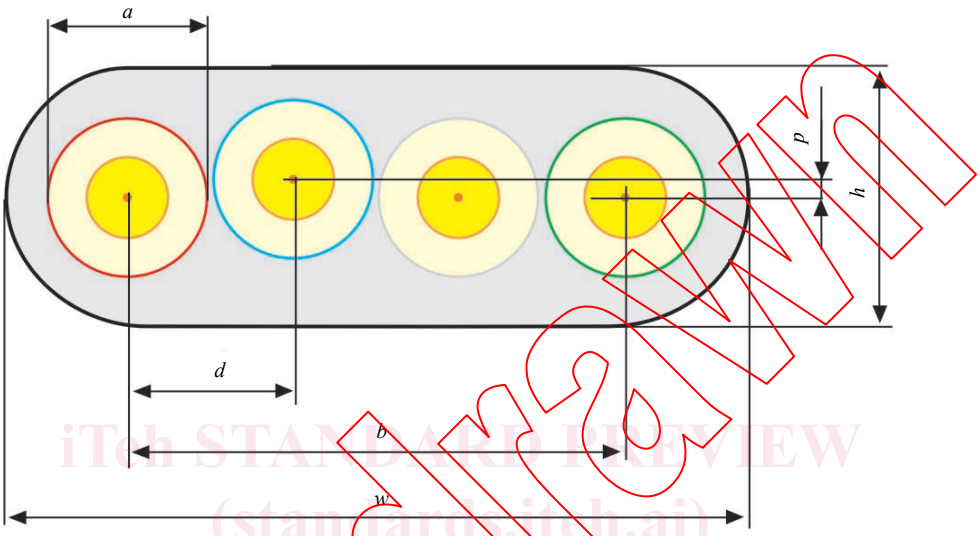

Figure 1 – Cross-sectional drawing illustrating fibre ribbon geometry

5 Method G3: Ribbon dimensions – Aperture gauge

5.1 Object

The purpose of this test is to verify the functional performance of a ribbon. In order to ensure functional performance, the dimensions of edge bonded ribbons may be controlled and verified for final inspection purposes with an aperture gauge. The intent is to verify that the end portion of a ribbon can be inserted into and would be reasonably aligned to the guide slots of commercial stripping tools. This method is under consideration for encapsulated ribbons.

5.2 Sample

Unless otherwise specified in the detail specification, five representative ribbon samples, each with a minimum length of 50 mm, shall be taken from the ribbon to be tested.

5.3 Apparatus

An aperture gauge, as shown in Figure 2, having an aperture based on the dimensions shown in IEC 60794-3:2001, Table 1, may be used to assess the overall dimensions of a ribbon.

5.4 Procedure

The ribbon sample to be tested is held in the middle and a 10 mm end portion is inserted through the aperture gauge.