SLOVENSKI STANDARD
SIST EN 3745-202:2019

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Nadomešča:
SIST EN 3745-202:2006

Aeronavtika - Optična vlakna in kabli za uporabo v zračnih plovilih - Preskusne metode - 202. del: Mere vlaken

Aerospace series - Fibres and cables, optical, aircraft use - Test methods - Part 202: Fibre dimensions

Luft- und Raumfahrt - Faseroptische Leitungen für Luftfahrzeuge - Prüfverfahren - Teil 202: Faserabmessungen

Série aérospatiale - Fibres et câbles optiques à usage aéronautique - Méthodes d'essais - Partie 202: Dimensions de la fibre

Ta slovenski standard je istoveten z: **EN 3745-202:2018**

ICS:

33.180.10	(Optična) vlakna in kabli	Fibres and cables
49.060	Letalska in vesoljska električna oprema in sistemi	Aerospace electric equipment and systems

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EUROPEAN STANDARD

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English Version

Aerospace series - Fibres and cables, optical, aircraft use - Test methods - Part 202: Fibre dimensions

Série aérospatiale - Fibres et câbles optiques à usage aéronautique - Méthodes d'essais - Partie 202: Dimensions de la fibre

Luft- und Raumfahrt - Faseroptische Leitungen für Luftfahrzeuge - Prüfverfahren - Teil 202: Faserabmessungen

This European Standard was approved by CEN on 12 June 2017.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 3745-202:2018) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2019, and conflicting national standards shall be withdrawn at the latest by April 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 3745-202:2005.

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1 Scope

This European Standard specifies several methods for measuring the diameter of an optical fibre or cable, the non-circularity and the concentricity of the fibre core/cladding on an optical fibre.

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.

EN 2591-100, *Aerospace series — Elements of electrical and optical connection — Test methods — Part 100: General*

EN 3745-100, *Aerospace series — Fibres and cables, optical, aircraft use — Test methods — Part 100: General*

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 Preparation of specimens

4.1 The specimen shall comprise a length of the optical fibre or cable to be measured. The fibre ends shall be prepared in accordance with EN 2591-100. The length of specimen shall be (3 ± 0,5) m unless otherwise specified in the product standard.

If not yet at standard test conditions, the specimens shall be subjected to standard test conditions and stabilized at these conditions for 24 h as defined in EN 3745-100.

4.2 The following detail shall be specified if not already included in the product standard:

- type of fibre/cable from which the specimen was taken.

5 Apparatus

For method B, the Light Launch System used shall be as specified in EN 2591-100 with an angular size > 110 % of the fibre numerical aperture and a spot size > 110 % of fibre core diameter.

6 Method

6.1 Method A: Refracted near field

6.1.1 Object

The refracted near-field measurement is straightforward, accurate and measures directly the refractive index variation the fibre (core and cladding). The measurement is capable of good resolution and can be calibrated to give absolute values of refractive indexes. It can be used to obtain profiles of both single-mode and multimode fibre.

6.1.2 Test apparatus

A schematic diagram of the test apparatus is shown in Figure 1 and Figure 2.

6.1.2.1 Source

A stable laser giving a few milliwatts of power in the TEM00 mode is required.

A HeNe laser, which has a wavelength of 633 nm, may be used, but a correction factor must be applied to the results for extrapolation at different wavelengths. It shall be noted that measurement at 633 nm may not give complete information at longer wavelengths; in particular non-uniform fibre doping can affect the correction.

A quarter-wave plate is introduced to change the beam from linear to circular polarization because the reflectivity of light at an air-glass interface is strongly angle and polarization dependent.

A pinhole placed at the focus of lens 1 acts as a spatial filter.

6.1.2.2 Launch optics

The launch optics, which are arranged to overfill the NA of the fibre, brings a beam of light to a focus on the flat end of the fibre. The optical axis of the beam of light should be within 1° of the axis of the fibre. The resolution of the equipment is determined by the size of the focused spot, which should be as small as possible in order to maximize the resolution, for example less than 1,5 μm. The equipment enables to focused spot to be scanned across the fibre diameter.

6.1.2.3 Liquid cell

The liquid in the liquid cell shall have a refractive index slightly higher than that of the fibre cladding.

6.1.2.4 Sensing

The refracted light is collected and brought to the detector in any convenient manner provided that all the refracted light is collected. By calculation, the required size of disc and its position along the central axis can be determined.

6.1.3 Sample preparation

A length of fibre of about 1 m is required.

All fibre coating shall be removed from the section of fibre immersed in the liquid cell.

The fibre ends shall be clean, smooth and perpendicular to the fibre axis.

6.1.4 Procedure

Refer to the schematic diagram of the test apparatus (Figure 2).

6.1.4.1 Fibre index profile plot

The launch end of the fibre to be measured is immersed in a liquid cell hose refractive index is slightly higher than that of the fibre cladding. The fibre is back illuminated by light from a tungsten lamp. Lenses 2 and 3 produce a focused image of the fibre.

The position of lens 3 is adjusted to centre and focus the fibre image, and the laser beam is simultaneously centred and focused on the fibre.

The disc is centred on the output cone. For multimode fibre, the disc is positioned on the optical axis to just block the leaky mode. For single-mode fibre, the disc is positioned to give optimum resolution.

Refracted modes passing the disc are collected and focused onto a photodiode. The focused laser spot is traversed across the fibre end and a plot of fibre refractive index variation is directly obtained.

6.1.4.2 Equipment calibration

The equipment is calibrated with the fibre removed from the liquid cell. During the measurement the angle of the cone of light varies according to the refractive index seen at the entry point to the fibre (hence the change of power passing the disc). With the fibre removed and the liquid index and cell thickness known, this change in angle can be simulated by translating the disc along the optic axis. By moving the disc to a number of predetermined positions the profile can be scaled is terms of relative index. Absolute indices, i.e. n_1 and n_2, can only be found in the cladding index or the liquid index, at the measurement wavelength and temperature is known accurately.

6.1.4.3 Results

The following details shall be presented:

- test arrangement and wavelength correction procedure;
- relative humidity and ambient temperature;
- fibre identification. Depending on specification requirement:
  - profile through core and cladding centres calibrated for a given wavelength;
  - profile along the core major and minor axes calibrated for a given wavelength;
  - profiles along the cladding major and minor axes calibrated for a given wavelength.

By the raster scan of the cross-section of the profile, the following quantities may be calculated:

- diameter of core;
- diameter of cladding;
- concentricity error core/cladding;
- non-circularity of core;

- non-circularity of cladding;
- maximum theoretical numerical aperture;
- index difference;
- relative index difference;
- indication of accuracy and reproducibility.

6.2 Method B: Near field light distribution

6.2.1 Object

The following test is for incoming and/or outgoing inspection. Imaging is made on a cross section at the end of the fibre under test.

The image is magnified by an output optics, for example microscope and various kinds of sensors can be used (direct examination, photographic camera, digital video analyzer, scanning detector, etc.).

6.2.2 Sample preparation

The sample shall be a short length of the optical fibre to be measured. This length shall be noted. The fibre ends shall be clean, smooth and perpendicular to the fibre axis.

6.2.3 Apparatus

6.2.3.1 Light source

The core illumination source shall be incoherent, adjustable in intensity and the type shall be noted. A second light source can be used to illuminate the fibre for cladding measurement purposes. The light source selected shall be stable for the required period of measurement.

6.2.3.2 Detection systems

Different detection systems can be used depending on the type of measurement to be done (visual inspection, photography, calculation on the complete pattern).

6.2.3.2.1 Microscope

An inverted metallurgical microscope or a biological microscope with a resolution near the diffraction limit shall be used (for example it should have a calibrated magnification of up to 600 x and be equipped with the filar micrometre).

6.2.3.2.2 Microscope with a photographic camera

The microscope described in 6.2.3.2.1 may be equipped with a camera for micro photography. A suitable scale shall be used to calibrate the dimensions in the photograph.

6.2.3.2.3 Video analyzer

The microscope described in 6.2.3.2.1 may be equipped with a TV camera. The output signal of the camera can be sent to a TV monitor for visual inspection or to a video analyzer in order to record the complete output near of the fibre.