SLOVENSKI STANDARD
oSIST prEN 3745-100:2025

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Aeronavtika - Optična vlakna in kabli za uporabo v zračnih plovilih - Preskusne metode - 100. del: Splošno

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

Luft- und Raumfahrt - Faseroptische Leitungen für Luftfahrzeuge - Prüfverfahren - Teil 100: Allgemeines

Série aérospatiale - Fibres et câbles optiques à usage aéronautique - Méthodes d'essais - Partie 100 : Généralités

Ta slovenski standard je istoveten z: **prEN 3745-100**

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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English Version

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

Série aérospatiale - Fibres et câbles optiques à usage aéronautique - Méthodes d'essais - Partie 100 : Généralités

Luft- und Raumfahrt - Faseroptische Leitungen für Luftfahrzeuge - Prüfverfahren - Teil 100: Allgemeines

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

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European foreword

This document (prEN 3745-100:2024) has been prepared by ASD-STAN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 3745-100:2008.

This document includes the following significant technical changes with respect to EN 3745-100:2008:

— integration of all the latest EN 3745 series documents, including their disposal of comments in the prEN 3745-100 document;

— integration in the document of the revisions of current tests –306, –412, –510 et –801;

— integration of NWP proposal on tests –516 and –603.

1 Scope

This document defines terms, definition and all test methods for optical fibres and cable.

In this document test methods items have been kept according to the historical references.

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 2591-100:2024, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 100: General*

EN 2591-601:2001, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 601: Optical elements - Insertion loss*

EN 2591-602:2001, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 602: Optical elements - Variation of attenuation and optical discontinuity*

EN 3475-601, *Aerospace series - Cables, electrical, aircraft use - Test methods - Part 601: Smoke density*

EN 3475-602, *Aerospace series - Cables, electrical, aircraft use - Test methods - Part 602: Toxicity*

EN 4056-003, *Aerospace series - Cable ties for harnesses - Part 003: Plastic cable ties - Operating temperatures - 65 °C to 105 °C and - 65 °C to 150 °C - Product standard*

EN 4533-004, *Aerospace series - Fibre optic systems - Handbook - Part 004: Repair, maintenance, cleaning and inspection*

EN IEC 60793-1-40:2019, *Optical fibres - Part 1-40: Attenuation measurement methods (IEC 60793-1-40)*

EN IEC 60793-1-41, *Optical fibres - Part 1-41: Measurement methods and test procedures - Bandwidth (IEC 60793-1-41)*

EN IEC 60793-2, *Optical fibres - Part 2: Product specifications – General (IEC 60793-2)*

EN 60794 (all parts), *Optical fibre cables*

EN 61754-20, *Fibre optic interconnecting devices and passive components - Fibre optic connector interfaces - Part 20: Type LC connector family*

IEC 61300-3-47, *Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 3-47: Examinations and measurements — End face geometry of PC/APC spherically polished ferrules using interferometry*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 4046, *Paper, board, pulp and related terms — Vocabulary*

ISO 7724-1, *Paints and varnishes — Colorimetry — Part 1: Principles*

AMS 1476C, *Deodorant, Aircraft Toilet*

ASTM-D740,[1] *Standard Specification for Methyl Ethyl Ketone*

ASTM-D3032,[1] **Error! Bookmark not defined.** *Standard Test Methods for Hookup Wire Insulation*

CIE 015,[2] *Colorimetry*

MIL-PRF-87937,[3] *Performance specification: Cleaning compound, aerospace equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
optical fibre
dielectric waveguide whose core consists of optically transparent material of low attenuation and whose cladding consists of optical transparent material of lower refractive index than that of the core (see Figure 1)

Note 1 to entry: In general the optical fibre is furnished with a primary coating (see Figure 1).

3.2
core
central region of an optical fibre through which most of the optical power is transmitted (see Figure 1)

3.3
cladding
dielectric material surrounding the core of the optical fibre (see Figure 1)

3.4
fibre coating
first protective coating directly applied to the fibre during its manufacture (see Figure 1)

Note 1 to entry: Its purpose is to maintain original optical performance of the fibre and to provide minimum mechanical properties.

3.5
optical cable
assembly consisting of optical fibre, inner sheath and where applicable strength members and jacket (see Figure 1)

3.6
multiple fibre cable
construction in which a number of fibres are placed together in a cable

1 Published by American Society for Testing and Materials (ASTM International), available at: https://www.astm.org/.

2 Published by CIE Central Bureau - Kegelgasse 27 - A-1030 Wien - Austria.

3 Published by Department of Defense (DoD), available at: https://assist.dla.mil/online/start/.

3.7
buffer
material which surrounds and is immediately adjacent to a primary coating and provides mechanical protection (see Figure 1)

3.8
strength members
protective envelope added to the inner sheath when necessary to improve the properties of mechanical resistance (see Figure 1)

3.9
jacket
external protective covering (see Figure 1)

3.10
refractive index profile
distribution of the refractive index along the diameter of an optical fibre

Note 1 to entry: The refractive index profile for simple structures can be approximated by:

$$n(r) = n_1\sqrt{1-2\Delta(r/a)^g} \quad \text{for } r < a$$

$$n(r) = n_2 = n_1\sqrt{1-2\Delta} \quad \text{for } r \geq a$$

$$\text{with } \Delta = \left(n_1^2 - n_2^2\right) / 2\,n_1^2$$

where

r is the radial distance from the centre of fibre;

n_1 is the maximum refractive index value of the core material;

n_2 is the refractive index value of the cladding material;

a is the core radius;

g is the profile parameter which defines the form of the profile:
$10 \leq g < \propto$ → step index profile
$1 \leq g < 3$ → graded index profile
$3 \leq g < 10$ → quasi step index profile.

3.11
core diameter
⌀ cr
diameter of the circle which best fits the core area

Note 1 to entry: For a cross section of an optical fibre, the core area is that within which the refractive index everywhere (excluding any index dip) exceeds that of the innermost homogeneous cladding by a given fraction of the difference between the maximum of the refractive index of the core (n_1) and the refractive index of the innermost homogeneous cladding (n_2).

Note 2 to entry: It is contained within the focus of points where the refractive index n_3 is given by:

$$n_3 = n_2 + k\,(n_1 - n_2)$$

where

n_1 = maximum refractive index value of core;

n_2 = refractive index value of the innermost homogeneous cladding;

k = a constant (unless otherwise specified a k value of 0,05 is assumed).

3.12
cladding diameter
⌀ *cd*
physical diameter of the optical fibre

3.13
concentricity error core/cladding
distance between the centre point of the core and the centre point of the cladding divided by the core diameter

3.14
non circularity of core
difference between the longest and the shortest chords passing through the core centre, divided by the core diameter

3.15
non circularity of cladding
difference between the longest and the shortest chords passing through the cladding centre, divided by the cladding diameter

3.16
attenuation
attenuation A at the wavelength lambda between two cross sections 1 (input) and 2 (output) separated by the distance L of the fibre is defined by:

$$A = 10 \log_{10} (P_1/P_2)\ \text{(dB)}$$

P_1 = optical power traversing the cross section 1

P_2 = optical power traversing the cross section 2

Attenuation coefficient:

α (alpha) = A/L (dB/unit length)

Note 1 to entry: For practical use, generally, these parameters are given under modal equilibrium conditions (this is not normally the case in avionic applications where lengths are short).

3.17
numerical aperture
NA
maximum theoretical numerical aperture defined by:

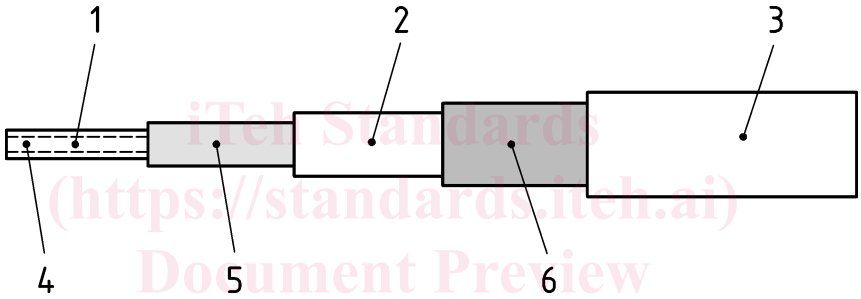
$$\mathrm{NA} = \sqrt{n_1^2 - n_2^2}$$

where

n_1 = maximum of the refractive index value of the core;

n_2 = the refractive index value of the innermost homogeneous cladding

3.18
bandwidth
value numerically equal to the lowest frequency at which the magnitude of the baseband transfer function of an optical fibre decreases to a specified fraction, generally to one half (3 dB), of the zero frequency value



Key

1 cladding
2 buffer (if present)
3 jacket
4 core
5 fibre coating
6 strength members (if present)

} optical fibre

Figure 1 — Optical cable

3.19
contrast
ratio of reflecting light (here: reflecting light of cable identification marking and cable surface)

3.20
illuminance
reflection of visible light

3.21
measuring range
maximum effective range of measurement

4 Test conditions

Unless stated otherwise in the test methods, the technical specification or the product standard the test conditions shall be:

— temperature: (20 ± 5) °C;

— atmospheric pressure: 86 KPa to 106 KPa;

— relative humidity: 45 % to 75 %.

The temperature and humidity shall remain constant during a series of measurement.

5 List of test methods

Table 1 — General designation

EN 3745 part	Test designation
Subclause 6.1	Test 201: Visual examination
Subclause 6.2	Test 202: Fibre dimensions
Subclause 6.3	Test 203: Cable dimensions
Subclause 6.4	Test 205: Cable longitudinal dimensional stability

Table 2 — Optical tests

EN 3745 part	Test designation
Subclause 7.1	Test 301: Attenuation
Subclause 7.2	Test 302: Numerical aperture
Subclause 7.3	Test 303: Bandwidth
Subclause 7.4	Test 305: Immunity to ambient light coupling
Subclause 7.5	Test 306: Variation of attenuation during temperature cycling

Table 3 — Environmental tests

EN 3745 part	Test designation
Subclause 8.1	Test 401: Accelerated ageing
Subclause 8.2	Test 402: Temperature cycling
Subclause 8.3	Test 404: Thermal shock
Subclause 8.4	Test 405: Low/High temperature bend test
Subclause 8.5	Test 406: Cold bend test
Subclause 8.6	Test 407: Flammability
Subclause 8.7	Test 410: Thermal life
Subclause 8.8	Test 411: Resistance to fluids
Subclause 8.9	Test 412: Humidity resistance

Table 4 — Mechanical tests

EN 3745 part	Test designation
Subclause 9.1	Test 501: Optical fibre proof test
Subclause 9.2	Test 502: Tensile strength for short length of optical fibres
Subclause 9.3	Test 503: Scrape abrasion
Subclause 9.4	Test 504: Micro bending test
Subclause 9.5	Test 505: Cable tensile strength
Subclause 9.6	Test 506: Impact resistance
Subclause 9.7	Test 507: Cut-through
Subclause 9.8	Test 508: Torsion
Subclause 9.9	Test 509: Kink test
Subclause 9.10	Test 510: Bending test
Subclause 9.11	Test 511: Cable to cable abrasion
Subclause 9.12	Test 512: Flexure endurance
Subclause 9.13	Test 513: Crush resistance
Subclause 9.14	Test 514: Cable twist bend
Subclause 9.15	Test 515: Remove buffer
Subclause 9.16	Test 516: “Severe” cable bend test
Subclause 9.17	Test 517: Cable tie clamping test

Table 5 — Sundry tests

EN 3745 part	Test designation
Subclause 10.1	Test 601: Smoke density
Subclause 10.2	Test 602: Toxicity
Subclause 10.3	Test 603: Nuclear radiation

Table 6 — Cable implementation tests

EN 3745 part	Test designation
Subclause 11.1	Test 701: Strippability
Subclause 11.2	Test 703: Durability of manufacturer’s marking
Subclause 11.3	Test 705: Contrast measurement
Subclause 11.4	Test 801: Fibre movement under compression

6 Serie 2xx: General designation

6.1 General

Test series −20x corresponds to test methods allowing to measure general fibre and cable characteristics.

6.2 Test 201: Visual inspection of optical fibres and optical cables

6.2.1 General

This clause a method for the visual inspection of optical fibres and optical cables.

6.2.2 Test 201: Characteristics to be examined

6.2.2.1 Test 201: General

The type and length of cable/fibre from which the specimen is taken shall be as specified in the product specification.

6.2.2.2 Test 201: Optical fibre

6.1.1.2.1 The fibre shall have the correct identification colour coating if specified in the product standard.

6.1.1.2.2 The coating shall be continuous and free of visible defects such as lumps, abrasions, cracks, splits, or blisters.

6.2.2.3 Test 201: Optical cable

6.1.1.3.1 The cable shall have the correct identification colour if specified in the product standard.

6.1.1.3.2 The cable shall be marked in accordance with the product standard.

6.1.1.3.3 The cable shall be free from discoloration due to overheating or foreign materials such as dust, grease, or oil.

6.1.1.3.4 The cable jacket (sheath) and/or coating shall not be scorched.

6.1.1.3.5 The cable jacket and/or coatings shall be free from delaminations and voids.

6.1.1.3.6 The cable shall be free from deformities in the jacket that increase, or decrease, the cable diameter in excess of the specified maximum or minimum outside diameter.

6.1.1.3.7 The cable shall be free from metallic or gritty particles in the jacket and/or coating.

6.1.1.3.8 The cable shall show no cracking or crazing.

6.2.3 Test 201: Apparatus

A lamp which can provide an illumination of 500 lx to 700 lx on a flat workbench shall be used.

A 10x magnifying lens or microscope shall be used.

6.2.4 Test 201: Method A

Unless otherwise stated in the product standard, visual examination shall be made by the following methods:

— by a 10x magnifying lens for the inspection of optical fibres;

— by a naked eye of normal vision, or normally corrected, for the inspection of optical cables.

The test specimen shall be placed flat on the workbench. The test specimen shall be visually examined at a distance of not more than 0,3 m, if not using a magnifying device.