SLOVENSKI STANDARD
SIST EN 3745-302:2004

01-maj-2004

Aerospace series - Fibres and cables, optical, aircraft use - Test methods - Part 302: Numerical aperture

Aerospace series - Fibres and cables, optical, aircraft use - Test methods - Part 302: Numerical aperture

Luft- und Raumfahrt - Faseroptische Leitungen für Luftfahrzeuge - Prüfverfahren - Teil 302: Numerische Apertur

Série aérospatiale - Fibres et câbles optiques à usage aéronautique - Méthodes d'essais - Partie 302: Ouverture numérique

Ta slovenski standard je istoveten z: EN 3745-302:2002

ICS:

49.060	Letalska in vesoljska elektriļ na oprema in sistemi	Aerospace electric equipment and systems

SIST EN 3745-302:2004 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 3745-302

June 2002

ICS 49.060

English version

Aerospace series - Fibres and cables, optical, aircraft use - Test methods - Part 302: Numerical aperture

Série aérospatiale - Fibres et câbles optiques à usage aéronautique - Méthodes d'essais - Partie 302: Ouverture numérique

Luft- und Raumfahrt - Faseroptische Leitungen für Luftfahrzeuge - Prüfverfahren - Teil 302: Numerische Apertur

This European Standard was approved by CEN on 1 March 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 3745-302:2002 E

Foreword

This document (EN 3745-302:2002) has been prepared by the European Association of Aerospace Manufacturers (AECMA).

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 AECMA, 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 December 2002, and conflicting national standards shall be withdrawn at the latest by December 2002.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard specifies a method of determining the effective numerical aperture of an optical cable or fibre used in aerospace applications.

2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 2591-100 Aerospace series – Elements of electrical and optical connection – Test methods – Part 100: General [1)]

EN 3745-100 Aerospace series – Fibres and cables, optical, aircraft use – Test methods – Part 100: General [2)]

3 Preparation of specimens

3.1 The specimens shall be prepared in accordance with EN 2591-100, 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.

3.2 Unless specified in the technical specification, the following details shall be stated:

– type of cable or fibre and length if different from 2 m;

– acceptable radius of curvature during measurement.

4 Apparatus

The apparatus shall comprise:

– a Light Launch System (LLS) as defined in EN 2591-100;

– a mechanical chopper H;

– detection systems depending on the selected method.

1) Published as AECMA Prestandard at the date of publication of this standard

2) In preparation at the date of publication of this standard

4.1 Apparatus for method A (see figure 1):

– for the "far field rotating arm method", the specimen is fixed, the detector is attached to a rotating arm; distance between detector and fibre $> 2\,\phi_{CR}^2 / \lambda$;

– a goniometer;

– a classical detector with a small aperture.

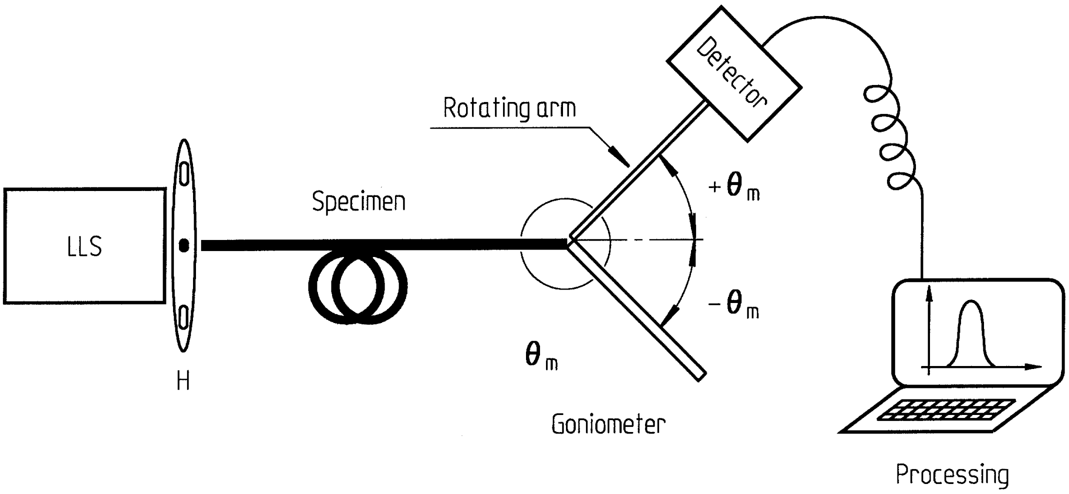

Figure 1

4.2 Apparatus for method B (see figure 2):

– for the "Charge Coupled Device (CCD) camera method", everything is fixed (specimen and detector), required apparatus is only a CCD camera, placed at a distance from the optical fibre $> 2\,\phi_{CR}^2 / \lambda$.

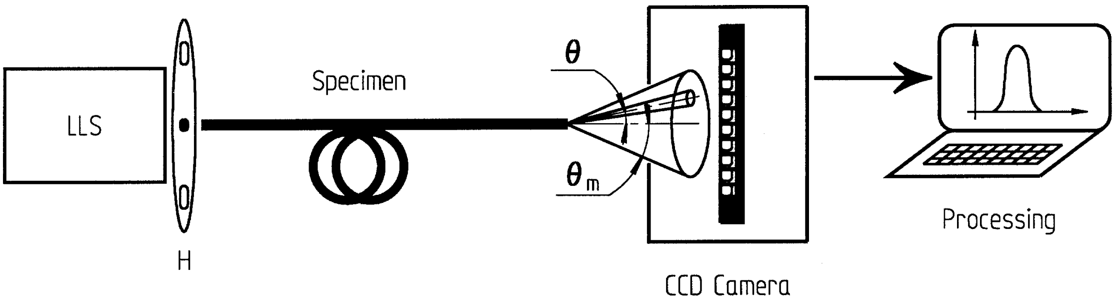

Figure 2

5 Method

5.1 Method description

Adjust the launch condition parameters to the following values:

– $NA = 110\ \%\ NA_{nom}$

– $\phi_{CR} = 100\ \%\ \phi_{CR\ nom}$

Connect the specimen to LLS and to the required detector following selected method.

5.2 Method A (see figure 1)

The principle consists in measuring the variation in the radiant intensity emitted by the fibre versus the angular position of the detector that is: $i = f(\theta)$ (θ being the emission angle with respect to a line normal to the source).

Install the arm supporting the detector on a goniometer driven by a step motor connected to a computer.

Rotate the rotating arm at regular rotation angle intervals e.g. $\alpha \leq 1°$. If the optical axis of the fibre is taken as being the origin, the arm will describe sector: – 60°, 0°, 60°.

Process the modulated optical signal received by the detector at each measurement step (synchronous detector amplifier).

Average this signal over the measurement intervals, store it and then plot the radiation intensity diagram.

NOTE The resolution tg corresponds to the following ratio:

$$tg = \frac{\text{detector aperture diameter}}{\text{fibre detector distance}}$$

5.3 Method B (see figure 2)

The principle consists in analysing the output light of the fibre by means of a CCD camera. The intensity profile is given by the processing of the intensity delivered by each pixel of the CCD output.

Adjust the CCD camera illumination level and acquire the output signal emerging from the optical fibre. A corrective factor ($\cos\theta$) shall be applied to the received signal to take into account the angle between CCD plane and unit output beam.

Store it and then plot the radiation intensity diagram.

For each numerical aperture determination, three curves will be plotted allowing an average of the calculated value to be determined with a related standard deviation.

NOTE An angle measurement determined at $\theta_c \pm 0{,}5°$, corresponds typically to a numerical aperture accuracy of ± 0,01.

5.4 Final measurements and requirements

Following the radiation diagram $i = f(\theta)$, the numerical aperture corresponds to:
NA = $\sin\theta_m$ at 5 % of $I_{max.}$ (see figure 3).

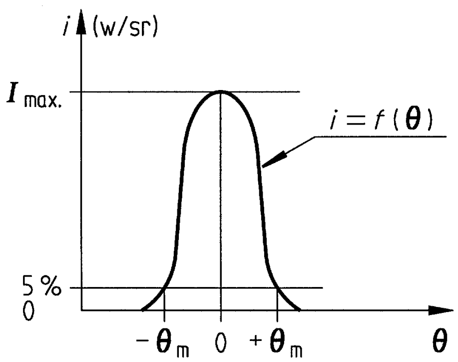

Figure 3

5.5 Special precautions

Care will be taken not to modify curvature bend radius of specimen during the various measurement steps.