SLOVENSKI STANDARD
SIST EN 4705:2020

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Aeronavtika - Merilne metode v zvezi z obnašanjem svetlobnih enot v njihovi življenjski dobi v standardiziranem letalskem okolju

Aerospace series - Measurement methods regarding the lifetime behaviour of light units in a standardized aircraft-related environment

Luft- und Raumfahrt - Messverfahren zur Bestimmung der Lebenszeit von Leuchten in einem standardisierten luftfahrzeugnahen Umfeld

Série aérospatiale - Méthodes de mesure du comportement lié à la durée de vie des systèmes d'éclairage dans un environnement normalisé destiné aux aéronefs

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49.095	Oprema za potnike in oprema kabin	Passenger and cabin equipment
91.160.01	Razsvetljava na splošno	Lighting in general

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

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European foreword

This document (EN 4705:2020) 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of an identical text or by endorsement, at the latest by August 2020, and conflicting national standards shall be withdrawn at the latest by August 2020.

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Introduction

The light output of all light sources decreases over time and also the chromaticity coordinates may change. Because of a longer lifetime of modern light sources, like LEDs, a brightness decrease or a chromaticity locus shift can be expected more often than a complete failure of the light source.

This document is applicable to all kind of aircraft cabin light sources including those with means for ageing compensation.

1 Scope

This document describes the measurement method for the lifetime behaviour of aircraft cabin light units in a standardized aircraft-related environment.

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 4706, *Aerospace series — LED colour and brightness ranking*[1]

EN 13032-4, *Light and lighting — Measurement and presentation of photometric data of lamps and luminaires — Part 4: LED lamps, modules and luminaires*

IES LM-80-08, Approved Method: Measuring Lumen Maintenance of LED Light Sources[2]

3 Terms, definitions and abbreviations

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

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

3.1
light-emitting diode
LED
solid state device embodying a p-n junction, emitting optical radiation when excited by an electric current

3.2
luminance
photometric measure of the luminous intensity per unit area of light travelling in a given direction

Note 1 to entry: The unit is cd/m^2.

3.3
illuminance
photometric measure of the total luminous flux incident on a surface, per unit area

Note 1 to entry: The unit is lx.

3.4
colour space
description model to define light colours in a two-dimensional (colour without intensity, e.g. *xy* space CIE 1931) or three-dimensional space, (colour and intensity, e.g. *Yxy* CIE 1931)

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1 Published as ASD-STAN Prestandard at the date of publication of this standard by AeroSpace and Defence Industries Association of Europe – Standardization (ASD-STAN) (www.asd-stan.org).

2 Published by Illumination Engineering Society (IES), 120 Wall Street, Floor 17, New York NY 10005-4001, USA

3.5
CIE 1931 colour space
description of a two-dimensional colour space for light colours

Note 1 to entry: In the CIE 1931 diagram the colour coordinates *x* and *y* describe the chromaticity locus in the diagram. For this document the CIE 1931 2° observer is applicable.

3.6
chromaticity coordinate
two-dimensional data representation of the colour in the corresponding colour space, e.g. *x* and *y* for the CIE 1931

3.7
MacAdam ellipse
area in the corresponding colour space (e.g. CIE 1931) in which all colours have the same visual impression to an observer as the colour in the centre of this area

Note 1 to entry: The borderline of the ellipse represents the just noticeable colour difference. Based on experimental data, originally 25 MacAdam ellipses were defined in the CIE 1931 colour space. In the experiment an observer had a given colour and was able to modify the chromaticity locus of a second colour. The chromaticity loci, where the observer determined a difference between the two colours were recorded. When all these points were plotted in the CIE 1931 diagram, they created an ellipse around the chromaticity locus of the given colour. The size and the orientation of the ellipses are different for different colours.

[SOURCE: D. L. MacAdam]

3.8
Standard Deviation of Colour Matching
SDCM

for a given target chromaticity locus, the metric of the distance between light colours at photopic light level, that describes approximately the perceptual distance between two chromaticity loci as a multiple of the MacAdam ellipses for these chromaticity loci

Note 1 to entry: *n* SDCM means that the distance between the two chromaticity loci is *n*-times the radius of the appropriate MacAdam ellipse in that direction. The centre of the ellipse is given by the chromaticity locus of the specified colour. Two chromaticity loci on opposite points of the MacAdam ellipse have a distance of (2 *n*) SDCM. The SDCM calculation between two chromaticity loci may be non-linear, dependent on the selected colour space. Therefore distances are limited to less than 10 SDCM.

Note 2 to entry: For this document the calculated data from the MacAdam ellipses has been used.

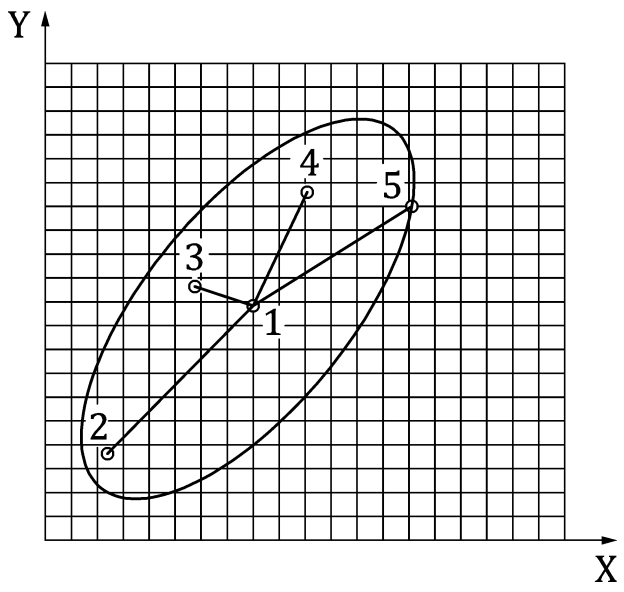
3.9
chromaticity coordinate distance
R
perceived chromaticity coordinate distance between any chromaticity loci and the target chromaticity locus in the corresponding colour space which is expressed in SDCM values

Note 1 to entry: The maximum chromaticity coordinate distance between any two chromaticity loci is the full diameter 2 × *R* of the corresponding *n*-times scaled MacAdam ellipse:

R is the function which describes the radius of an *n*-times scaled MacAdam ellipse:

$$R = n \cdot \mathrm{SDCM}$$

Figure 1 shows the chromaticity coordinate distance in a *n* SDCM ellipse.



Key

1 Target chromaticity locus
2 Colour 1
3 Colour 2
4 Colour 3
5 Limit $R = n \times$ SDCM
X Chromaticity coordinate x
Y Chromaticity coordinate y

Figure 1 — Chromaticity coordinate distance in a *n* SDCM ellipse

4 Definition of lifetime

4.1 General

In this document the light unit lifetime shall be considered as limited by the following possible incidents:

a) light unit fails;

b) the brightness falls below a defined limit;

c) the chromaticity is out of a defined limit.

If at least one of the incidents occurs the end of the lifetime is reached, although the light source may still emit light.

4.2 Light unit fails

A sudden complete or partial loss of function beyond specification requirements is considered as failure.