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Date: 04 April 2014

Origin: European

Latest date for receipt of comments: 4 July 2014

Project No. 2009/01617

Responsible committee: ACE/6 - Aerospace avionic electrical and fibre optic technology

Interested committees:

Title: Draft BS EN 4706 Aerospace series - LED colour and brightness ranking

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Introduction

This draft standard is based on European discussions in which the UK has taken an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent British Standard. Comment is particularly welcome on national, legislative or similar deviations that may be necessary.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

ASD STANDARD NORME ASD ASD NORM Draft No: 11	prEN 4706:2014 Edition P1 2014-04-02
	PUBLISHED BY THE AEROSPACE AND DEFENCE INDUSTRIES ASSOCIATION OF EUROPE - STANDARDIZATION Rue Montoyer 10 - 1000 Brussels - Tel. + 32 2 775 8126 - Fax. + 32 2 775 8131 - www.asd-stan.org
ICS: Descriptors: ENGLISH VERSION Aerospace series — LED colour and brightness ranking Luft- und Raumfahrt — LED Farb- und Helligkeitsklassifizierung Série aérospatiale —	
Edition approved for publication	Comments should be sent within six months after the date of publication to ASD-STAN

[White page](#)

Contents

Page

Introduction.....	4
1 Scope	4
2 Normative references	4
3 Terms, definitions and abbreviations.....	4
4 Chromaticity classification.....	7
4.1 Colour coordinates of white LEDs.....	7
4.2 Colour coordinates of coloured LEDs.....	7
4.3 Colour distance	8
5 Brightness classification	10
6 Colour rendering classification	11
Annex A (normative) Colour coordinates of the standardized chromatics	12
A.1 Standardized Chromaticity S 6500	12
A.2 Standardized Chromaticity S 5700	13
A.3 Standardized Chromaticity S 5000	14
A.4 Standardized Chromaticity S 4500	15
A.5 Standardized Chromaticity S 4000	16
A.6 Standardized Chromaticity S 3500	17
A.7 Standardized Chromaticity S 3000	18
A.8 Standardized Chromaticity S 2700	19
Bibliography.....	20

Introduction

The chromaticities and brightness of LEDs of the same type have variations caused by the manufacturing process; this applies to white LEDs and coloured (monochrome) LEDs. Therefore LEDs have to be selected by the manufacturer into "Colour ranks". Also the brightness of LEDs has certain variations, therefore the LEDs are also selected into "Brightness Ranks".

The step width of these ranking systems depends on the manufacturer and the LED type. For certain applications, e.g. inside an aircraft cabin, a high quality light is demanded, so a manufacturer independent standardization is desirable.

The purpose of this standard is to provide a simple classification system to enable the end user to define lighting colour accuracy.

1 Scope

This standard defines selection ranks for LED Luminaires, and LEDs including OLEDs. The size of these ranks is defined by the use of grades. This standard is valid for photopic light levels only.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60081 Edition 5.1-2002, *Double-capped fluorescent lamps — Performance specifications*

DIN 5033-8, 1982-04, *Colorimetry; measuring conditions for light sources*

NEMA ANSLG C78.377-2008, *American National Standard for electric lamps — Specifications for the Chromaticity of Solid State Lighting Products*¹⁾

CIE 13.3-1995, *Method of measuring and specifying colour rendering properties of light sources*²⁾

D. L. MacAdam, *Specification of small chromaticity differences*³⁾

3 Terms, definitions and abbreviations

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

3.1

Light Emitting Diode

LED

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

1) Published by National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Suite 1752, Rosslyn, Virginia 22209, USA

2) Published by International Commission on Illumination (CIE), Kegelgasse 27, A-1030 Vienna, Austria

3) Published in the Journal of the Optical Society of America, vol 32, No. 5, May 1942, pp 247-274, and in vol 1, No. 1, Jan. 1943, pp 18-26

3.2

Organic Light Emitting Diode

OLED

an organic solid state device embodying a p-n junction, emitting optical radiation when excited by an electric current

3.3

Colour space

a description model to define 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)

3.4

LED luminaire

a device based on LEDs as light source including optics, electronics and cooling equipment enclosed in a housing

3.5

CIE 1931 colour space

a description of a two-dimensional colour space for light colours. In the CIE 1931 diagram the colour coordinates x and y describe the colour's position in the diagram.

NOTE For this standard the CIE 1931 2° observer shall be applicable.

3.6

Colour coordinates

Chromaticity

the two- or three-dimensional data representation of the colour in the corresponding colour space, e.g. x and y for the CIE 1931

3.7

MacAdam ellipses

an 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 (see D. L. MacAdam, 1943). The borderline of the ellipse represents the just noticeable colour difference.

NOTE Based on experimental data, originally 25 MacAdam ellipses were defined in the CIE 1931 colour space. The experiment was, that an observer had a given colour and was able to modify the chromaticity of a second colour. The colour coordinates, 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 colour coordinates of the given colour. The size and the orientation of the ellipses are different for different colours.

3.8

Standard deviation of colour matching

SDCM

a metric of the distance between light colours at photopic light level. It describes nearly the perceptual distance between two colour coordinates as a multiple of the MacAdam ellipses for these colour coordinates.

NOTE 1 n SDCM means that the distance between the two colour coordinates is n -times the radius of the appropriate MacAdam ellipse in that direction. The centre of the ellipse is given by the colour coordinates of one of the colours. Two colour coordinates on opposite points of the MacAdam ellipse have a distance of $(2 n)$ SDCM. The SDCM calculation between two colour coordinates may be non-linear, dependent on the selected colour space. Therefore distances shall be limited to less than 10 SDCM.

NOTE 2 For this document the calculated data from the Mac Adam ellipses has been used.