IEC 62922

Edition 1.0 2021-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Organic light emitting diode (OLED) panels for general lighting – Performance requirements

Panneaux à diodes électroluminescentes organiques (OLED) destinés à l'éclairage général – Exigences de performance

IEC 62922:2016-11/AMD1:2021-08(en-fr)

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Organic light emitting diode (OLED) panels for general lighting – Performance requirements

Panneaux à diodes électroluminescentes organiques (OLED) destinés à l'éclairage général – Exigences de performance

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 29.140.99

ISBN 978-2-8322-1013-9

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ORGANIC LIGHT EMITTING DIODE (OLED) PANELS FOR GENERAL LIGHTING – PERFORMANCE REQUIREMENTS

AMENDMENT 1

FOREWORD

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Amendment 1 to IEC 62922:2016 has been prepared by subcommittee 34A: Electric light sources, of IEC technical committee 34: Lighting.

The text of this amendment is based on the following documents:

FDIS	Report on voting
34A/2241/FDIS	34A/2252/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Amendment is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications/.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

2 Normative references

Delete the reference to IEC TR 62732.

Replace "ISO 11664-5/CIE S 014-5/E:2009" *with* "ISO 11664-5/CIE S 014-5/E:2016".

3 Terms and definitions

Add, at the end of 3.5, the following new entries 3.6, 3.7 and 3.8:

3.6
median useful life
L_x
<of OLED tiles and panels> length of operating time during which a total of 50 % of a population of operating OLED tiles or panels of the same type have flux degraded to the luminous flux maintenance factor x

Note 1 to entry: The median useful life includes operating OLED tiles and panels only.

Note 2 to entry: By convention, the expression "life of OLED tiles" or "life of OLED panels" without any modifiers is understood to be the median useful life.

3.7
maintained operating voltage

<of OLED tiles and panels> operating voltage measured at an operational time, the OLED tiles or panels operating under specified conditions

Note 1 to entry: Specified conditions are described either in this document or the manufacturer's document.

3.8
maintained chromaticity coordinate
<of OLED tiles and panels> chromaticity coordinate measured at an operational time, the OLED tiles or panels operating under specified conditions

Note 1 to entry: Specified conditions are described either in this document, or the manufacturer's document.

Note 2 to entry: Details are given in 8.2.2.

5 Marking

5.1 Contents and location

Table 1

Delete the row "Photometric code" *and add four new rows before the NOTE, as follows:*

Table 1 – Contents and location of marking

Parameters	Location
Rated luminous flux (lm)	Mandatory on packaging or product information
Average luminance (cd/m^2)	Mandatory on packaging or product information
~~Photometric code (according to IEC TR 62732)~~	~~Mandatory on packaging or product information~~
Rated chromaticity coordinates (in u'v' coordinates) and chromaticity coordinate range (expressed by Δu'v', a u'v' circle or a u'v' quadrangle)	Mandatory on packaging or product information
Correlated colour temperature (K)	Mandatory on packaging or product information
Rated colour rendering index	Mandatory on packaging or product information
Operating temperature range (°C)	Mandatory on packaging or product information
Rated luminous efficacy (lm/W)	Mandatory on packaging or product information
Luminance uniformity (%)	Mandatory on packaging or product information
Luminous intensity distribution[a]	Mandatory on packaging or product information
Surface chromaticity uniformity and location of measurement spots (if applicable)	Mandatory on packaging or product information
Angular chromaticity uniformity	Mandatory on packaging or product information
Rated location and dimensions of the light output surface	Mandatory on packaging or product information
Rated median useful life (h)	Mandatory on packaging or product information
Luminous flux maintenance (%)	Mandatory on packaging or product information
Maintained operating voltage (V)	Mandatory on packaging or product information
Maintained chromaticity coordinate	Mandatory on packaging or product information
NOTE The operating temperature range specifies maximum and minimum temperatures of the OLED panel at which the OLED panel will function as intended. The operating temperatures are measured according to Annex F.	
[a] This requirement is fulfilled if the data file is made available electronically.	

7.4 Chromaticity coordinates

Replace the existing text with the following new text:

The chromaticity coordinates shall be determined from the spectral distribution obtained from the measurement specified in 7.2, in accordance with ISO 11664-5/CIE S 014-5/E:2016.

7.7 Luminance uniformity

Replace the existing title of 7.7 with the following new title:

7.7 Luminance

7.7.1 Average luminance (L_{av})

Replace the existing subclauses 7.7.1.1 to 7.7.1.3 with the following new text:

The initial average luminance is measured in accordance with Annex G.

Compliance:

The initial average luminance shall not deviate from the rated average luminance by more than 10 %.

8 Maintained photometric characteristics

Replace the existing text with the following new Subclauses 8.1 to 8.3:

8.1 Luminous flux maintenance

The luminous flux maintenance factor is obtained from the value at rated life expressed as a percentage of the initial value.

For the measurement method of luminous flux, Annex C applies.

Information on lifetime estimation is given in Annex H.

An accelerated life test can be used to estimate the lifetime of an OLED light source. If an accelerated life test is used to estimate the lifetime, then the estimation method with detailed measurement conditions shall be provided by the manufacturer.

NOTE 1 The luminous flux at the rated life can be evaluated by the direct measurement or estimation.

NOTE 2 For general guidance on LED product lifetime metrics, see Annex C of IEC 62717:2014 and Annex C of IEC 62717:2014/AMD2:2019.

Compliance:

The evaluated luminous flux maintenance factor at rated life time shall not be less than 90 % of the rated luminous flux maintenance factor.

8.2 Maintained operating voltage

The manufacturer shall declare the maintained operating voltage values for 2 000 h and the maximum operating voltage value for OLED light sources during their lifetime.

An OLED panel shall not exceed the maintained operating voltage rise, which is defined by its manufacturer.

Compliance:

The maintained operating voltage of the OLED panels measured at 2 000 h shall not exceed the declared value.

8.3 Maintained chromaticity coordinates

The initial chromaticity coordinates of the OLED panel and the chromaticity coordinates at 2 000 h are measured.

NOTE The maintained chromaticity coordinate shift can be expressed by Δ(u',v').

Compliance:

The OLED panel shall not exceed the rated maintained chromaticity coordinate shift.

9.2 High temperature – high humidity storage

Replace the existing text with the following new text:

An OLED panel shall be kept in a humidity cabinet having a relative humidity of (90 ± 5) % for 500 h. The temperature of internal air shall be maintained at (60 ± 2) °C. The OLED panel shall be placed in the humidity cabinet where humidity and temperature are maintained without supplying electricity. The test shall be conducted so that no condensation or water droplets appear on any part of the OLED panel. After the high temperature – high humidity storage test, the luminous flux and chromaticity of the OLED panel are measured in accordance with 7.2 and 7.4 respectively. The mounting position shall be declared in the test report.

10 Information for controlgear design

Replace the existing text with the following new text:

Information for controlgear design is given in Annex E. This should be followed for proper operation of OLED panels.

At the end of Annex F, add the following new Annex G and Annex H:

Annex G
(normative)

Measuring method for average luminance

G.1 General

Measurement of the average luminance of an OLED panel shall use one of the two methods described below.

1) imaging luminance measuring device (ILMD) method;
2) spot luminance meter method.

The actual method used for measurement shall be recorded in the test report.

G.2 Setting

Depending on the method adopted, it may be necessary to install the panel vertically to keep an adequate distance between the panel and the instrument. In this case, the vertical mounting position shall be recorded in the test report.

G.3 Imaging luminance measuring device (ILMD) method

The average luminance shall be calculated from an image of the entire light output surface with a maximum exclusion zone of 3 mm from the edge.

G.4 Spot luminance meter method

The measurement of average luminance (L_{av}) shall be carried out in perpendicular direction to the light output surface of an OLED panel. The distance from the edge of the light output surface to the closest measurement spot perimeter shall be a maximum of 3 mm.

The remaining lighting area shall then be subdivided into quadrilateral areas with a side length corresponding to a viewing angle of not more than 1° at a viewing distance of 1 m. The spot size shall fit into the quadrilateral area with a clearance of at least 1 mm.

EXAMPLE For a 1° viewing angle, the side length l of a subdivision is given by l = tan (0,5°) × 2 × 1 m = 0,017 m = 1,7 cm. So a 10 cm × 10 cm lighting area would have to be divided into 10/1,7 ≈ 5,8, i. e. 5 × 5 segments.

The arithmetic average of all luminance values of the measured areas is taken as the initial average luminance.

Annex H
(informative)

Information on lifetime estimation

H.1 General

A direct measurement of the median useful life, L_x, of an OLED light source operating at rated electrical conditions can take tens of thousands of hours. Therefore, accelerated life tests are used to reduce the necessary testing time for an estimation of the median useful life.

The physical mechanisms for luminous flux degradation differ substantially between OLED products from different designs and manufacturing processes. Thus, a single standardized mathematical model for the luminous flux degradation is not known or expected for OLED technology today.

This annex gives guidance on various tests for OLED lifetime estimation that do not require testing to the full median useful life.

H.2 Extrapolation through the deterioration curve fitting

The objective of this method is to use degradation measurements taken under the rated electrical conditions and before reaching L_x to determine the functional parameters.

The majority part of the degradation curve of OLED panels can be expressed in a Weibull degradation mode (Equation (H.1)).

The luminous flux maintenance can be represented over elapsed time t by the Weibull reliability function, $R(t)$,

$$R(t) = \exp(-(t/t_0)^{\beta}) \tag{H.1}$$

where t_0 is the time scaling factor and β is the shape factor.

Some of the degradation curves of OLED panels can be expressed with the combination of the initial degradation (first term) and the normal degradation (second term).

$$R(t) = a \cdot \exp(-(t/t_1)) + (1 - a)\exp(-(t/t_0)^{\beta}) \tag{H.2}$$

$$0 \leqq a < 1$$

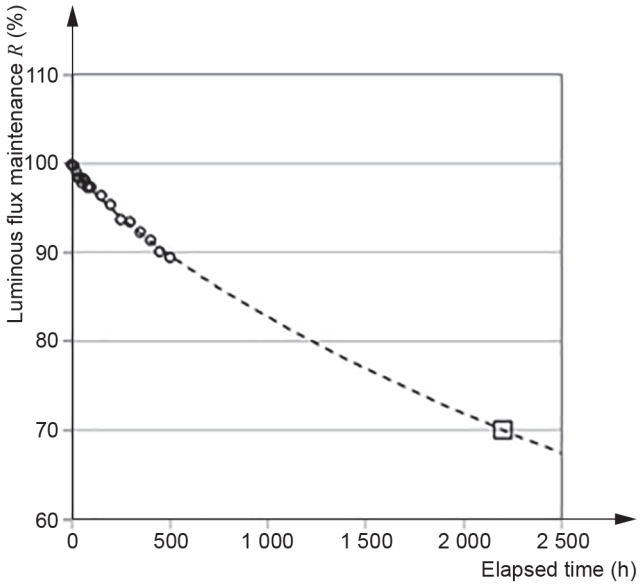
where t_1 is the time scaling factor of the initial degradation and a is the proportion factor of the initial degradation.

NOTE In 2014, the group who proposed this Annex H (Chemical Materials Evaluation and Research Base) reported that about 3 % of data cannot be fitted by stretched-exponential decay (SED) function (Weibull reliability function) (Equation (1)) [T. Yoshioka et al. SID Symposium Digest, **45**, 642 (2014)]. And there is a document which expresses that stretched-exponential decay (SED) function does not have a reaction kinetics meaning and is expressed by several Arrhenius equations [T. Yoshioka et al. SID Symposium Digest, **46**, 1650 (2015)]. Therefore, the fitting equations are not restricted to one form in order to express OLED degradation data in the current situation.

Most OLED panels are fitted by Equation (H.1). Some panels with fair initial degradation are fitted by Equation (H.2).

EXAMPLE

In this example degradation data was collected frequently over a period of 500 h. The data was fitted using Equation (H.1). A best fit to the parameters was obtained for β = 0,8 and t_0 = 8 000 h. An estimation of the median useful life for 70 % luminous flux maintenance is calculated using the fitted function as 2 200 h (see Figure H.1).



NOTE The extrapolation value (□) of L_{70} is obtained by using the deterioration curve data (○) and the extrapolation curve (dashed line). The time is 2 200 h when the luminous flux maintenance ratio becomes 70 % (L_{70}).

Figure H.1 – Typical degradation curve of acceleration test

The estimation accuracy of the median useful life, L_x, improves considerably as more data is taken over a longer period.

H.3 Lifetime estimation using accelerated testing

The time required for lifetime estimation may be shortened by conducting an accelerated test, which speeds up the degradation process of an OLED product by subjecting it to higher stress conditions of temperature or drive current or both. Extrapolation to normal operating conditions of temperature and drive current is used to estimate the median useful life.

Test samples for an accelerated test should be selected from a population of OLED products having the same degradation characteristics. Normally this will be from a normal manufacturing production run. At least three test samples should be tested for each selected stress condition.

The accelerated test should be designed so as to avoid changing the failure or degradation mode at all levels of stress conditions, especially high temperature and high drive current for OLED panels. A lack of fit to the same degradation function at all stress levels may be evidence of a changing degradation physics. Test samples should maintain uniform current density at all stress levels. Heating characteristics may differ due to self-heating either by conduction (joule heating) or radiation from the test piece resulting in a non-uniform current density distribution. If evidence of an altered degradation mode is observed, either by visual inspection of test samples or by lack of fit analysis, then the results should not be used to estimate the median useful life.

The time required for significant degradation of the test samples subjected to the lowest stress level will normally be longer than for the higher stress levels. However, estimates of the median useful life are possible as soon as the data fits the accelerated life test model reasonably well.