



Edition 2.0 2019-03

# INTERNATIONAL STANDARD



### Organic light emitting diode (OLED) displays PREVIEW Part 5-2: Mechanical endurance test methods (Standards.iteh.ai)

<u>IEC 62341-5-2:2019</u> https://standards.iteh.ai/catalog/standards/sist/6a0b2f94-6abb-47de-a887a2d3277663aa/iec-62341-5-2-2019





### THIS PUBLICATION IS COPYRIGHT PROTECTED Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

**IEC Central Office** 3, rue de Varembé CH-1211 Geneva 20 Switzerland

Tel.: +41 22 919 02 11 info@iec.ch www.iec.ch

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

### IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email. I I en 

IEC Customer Service Centre - webstore iec ch/csc If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch. IEC 62341-5-2:2019

### Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

### IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

https://standards.iteh.ai/catalog/standards/sist/6a0b2f94-6abb-47de-a887

a2d3277663aa/iec-62341-5-2-2019





Edition 2.0 2019-03

# INTERNATIONAL STANDARD



# Organic light emitting diode (OLED) displays PREVIEW Part 5-2: Mechanical endurance test methods h.ai)

<u>IEC 62341-5-2:2019</u> https://standards.iteh.ai/catalog/standards/sist/6a0b2f94-6abb-47de-a887a2d3277663aa/iec-62341-5-2-2019

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 31.260

ISBN 978-2-8322-6603-8

Warning! Make sure that you obtained this publication from an authorized distributor.

### CONTENTS

FC	REWO	RD	4
1	Scop	e	6
2	Norm	ative references	6
3	Term	s and definitions	7
4	Abbre	eviated terms	7
5	Stand	dard atmospheric conditions	7
6	Evalu	iation	7
0		Visual eventiantian and varification of dimensiona	7
	0.1 6.2	Penerting	1
7	0.2 Moch	Reporting	0 0
'			0
	7.1	Vibration (sinuscidal)	ð
	7.2	Coporal	0 0
	7.2.1		0 م
	723	Test annaratus	0 8
	724	Test procedure	0 8
	725	Evaluation	12
	7.2.0	Shock IIeh STANDARD PREVIEW	12
	7.3.1	General (standards iteh ai)	12
	7.3.2	Purpose	12
	7.3.3	Test apparatus	12
	7.3.4	Testprocedurels.iteh.ai/catalog/standards/sist/6a0b2f94-6abb-47de-a887-	12
	7.3.5	Evaluation	13
	7.4	Quasistatic strength	13
	7.4.1	General	13
	7.4.2	Purpose	13
	7.4.3	Specimen	14
	7.4.4	Test apparatus	14
	7.4.5	Test procedure	14
	7.4.6	Evaluation	15
	7.5	Four-point bending test	15
	7.5.1	General	15
	7.5.2	Purpose	15
	7.5.3	Specimen	15
	7.5.4	Test apparatus	16
	7.5.5	lest procedure	17
	7.5.6	Post-testing analysis	17
	7.5.7	Evaluation	18
	7.0		10
	1.0.1 760		10 10
	1.0.2	ruipuse Test sample	10
	7.0.3 7.6.4	Test procedure	10 19
	7.0.4	Evaluation	10
	7 7	Peel strength test	19
	771	Purpose	19
		1	

7.7.2	Test procedure	19
7.7.3	Evaluation	20
7.8	Shock test for large size display	20
7.8.1	Purpose	20
7.8.2	Test procedure	20
Annex A (	informative) Example of raw test data reduction for four-point bending tes	t21
A.1	Purpose	21
A.2	Sample test results	21
A.3	Finite element analysis	22
A.4	Use of conversion factor	26
A.5	Evaluation	27
Bibliograp	hy	29
Figure 1 -	- Example of the specimen and jig	9
Figure 2 -	- Directions of vibration test	9
Figure 3 -	- Configuration of OLED shock test set-up	12
Figure 4 -	- Schematic of quasistatic strength measurement apparatus example	14
		10

Figure 5 – Schematics of test apparatus and pinned bearing edges	16
Figure 6 – Specimen configuration under four-point bending test	16
Figure 7 – Order of transportation package drop. PREVIEW	19
Figure 8 – Example of peeling strength test role. it ch. ai	20
Figure A.1 – Specimen dimensions used for sample test	21
Figure A.2 – Examples of test results: Load-displacement curves	22
Figure A.3 – Finite element model of test speciment	23
Figure A.4 – Displacement contour map after moving the loading bar down by 2 mm	24
Figure A.5 – Contour map of maximum principal stress distribution	24
Figure A.6 – Maximum principal stress and maximum stress along the edge	25
Figure A.7 – Final relationship between panel strength and failure load	25
Figure A.8 – Extraction of conversion factor by linear fitting	26
Figure A.9 – Example of Weibull distribution of strength data and statistical outputs	28
Figure A.10 – Fitted failure probability distribution of strength data and $B_{10}$ strength	28

Table 1 – Frequency range – Lower end	10
Table 2 – Frequency range – Upper end	10
Table 3 – Recommended frequency ranges	11
Table 4 – Recommended vibration amplitudes	11
Table 5 – Conditions for shock test	13
Table 6 – Examples of test parameter combinations	17
Table 7 – Example of package drop sequence	19
Table A.1 – Results of raw test data	22
Table A.2 – Example of conversion factor ( $t = 0,4$ mm, test span = 20mm/40mm)	26
Table A.3 – Failure load and converted strength data	27

– 4 –

### INTERNATIONAL ELECTROTECHNICAL COMMISSION

### **ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS -**

### Part 5-2: Mechanical endurance test methods

### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity. EC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter. IEC 62341-5-2:2019
- 5) IEC itself does not provide any attestation of conformity. The pendent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62341-5-2 has been prepared by IEC technical committee 110: Electronic display devices.

This second edition replaces the first edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Vibration and shock tests for large displays (for example, TVs and monitors) are added.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
110/1069/FDIS	110/1083/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 62341 series, under the general title Organic light emitting diode (OLED) displays, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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.

A bilingual version of this publication may be issued at a later date. (standards.iteh.ai)

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

### ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS -

### Part 5-2: Mechanical endurance test methods

### 1 Scope

This part of IEC 62341 defines test methods for evaluating the mechanical endurance quality of organic light emitting diode (OLED) display panels and modules or their packaged form for transportation. It takes into account, wherever possible, the environmental test methods outlined in IEC 60068 (all parts). The object of this document is to establish uniform preferred test methods for judging the mechanical endurance properties of OLED display devices.

There are generally two categories of mechanical endurance tests: those relating to the product usage environment and those relating to the transportation environment in packaged form. Quasistatic strength, four-point bending and peel strength tests are introduced here for usage environment, while vibration, shock and transportation drop tests are applicable to the transportation environment. Mechanical endurance tests can be categorized into mobile applications, notebook computer or monitor applications and large size TV applications. Special considerations or limitations of test methods according to the size or application of the specimen are noted.

## iTeh STANDARD PREVIEW

In case of contradiction between this document and a relevant specification, the latter will govern. (standards.iteh.ai)

NOTE This document is established separately from IEC 61747-5-3, because the technology of organic light emitting diodes is considerably different from that of liquid crystal devices in such matters as:

used materials and structure

a2d3277663aa/iec-62341-5-2-2019

- operation principles
- measuring methods

### 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.

IEC 60068-2-6, Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)

IEC 60068-2-27:2008, Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock

IEC 61747-1-1:2014, Liquid crystal and solid-state display devices – Part 1-1: Generic – Generic specification

IEC 61747-5-3:2009, Liquid crystal display devices – Part 5-3: Environmental, endurance and mechanical test methods – Glass strength and reliability

IEC 61747-10-1:2013, Liquid crystal display devices – Part 10-1: Environmental, endurance and mechanical test methods – Mechanical

IEC 62341-5:2009, Organic light emitting diode (OLED) displays – Part 5: Environmental testing methods

IEC 62341-6-1, Organic light emitting diode (OLED) displays – Part 6-1: Measuring methods of optical and electro-optical parameters

- 7 -

IEC 62341-6-2:2015, Organic light emitting diode (OLED) displays – Part 6-2: Measuring methods of visual quality and ambient performance

ISO 2206, Packaging – Complete, filled transport packages – Identification of parts when testing

ISO 2248:1985, Packaging – Complete, filled transport packages – Vertical impact test by dropping

### 3 Terms and definitions

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

NOTE Most of the definitions used comply with IEC 62341-1-2 PREVIEW

# 3.1 strength (standards.iteh.ai)

stress at which a sample fails for a given loading condition

IEC 62341-5-2:2019

3.2 https://standards.iteh.ai/catalog/standards/sist/6a0b2f94-6abb-47de-a887-

glass edge strength a2d3277663aa/iec-62341-5-2-2019

measured stress at failure where the failure origin is known to have occurred at an edge

### 4 Abbreviated terms

- $B_{10}$  the value at the lower 10 % position in the Weibull distribution [1]<sup>1</sup>
- FEA finite element analysis
- FPCB flexible printed circuit board

TSP touch screen panel

### 5 Standard atmospheric conditions

The standard atmospheric conditions in IEC 62341-5:2009, 5.3, shall apply unless otherwise specifically agreed between customer and supplier.

### 6 Evaluation

### 6.1 Visual examination and verification of dimensions

The specimen shall be submitted to the visual and dimensional checks in non-operation conditions and functional checks in operational conditions specified by the following:

<sup>1</sup> Numbers in square brackets refer to the Bibliography.

a) visual checks of damage to the exterior body of the specimen including marking, encapsulation and terminals shall be done as specified in IEC 61747-1-1:2014, 4.3;

- 8 -

- b) dimensions given in the relevant specification shall be verified;
- c) visual and optical performance shall be checked as specified in IEC 62341-6-1.

Unless otherwise specified, visual inspection shall be performed under the conditions and methods specified in IEC 62341-6-2:2015, 6.2.

#### 6.2 Reporting

For the main results in each test, generally the minimum and averaged values or  $B_{10}$  value instead of the minimum value shall be reported over the number of specimens depending on the test purposes. The relevant specification shall provide the criteria upon which the acceptance or rejection of the specimen is to be based.

#### Mechanical endurance test methods 7

#### 7.1 General

Choice of the appropriate tests depends on the type of devices. The relevant specification shall state which tests are applicable.

### 7.2

# Vibration (sinusoidal) iTeh STANDARD PREVIEW

### 7.2.1

Test Fc, specified in IEC 60068-2-6 and IEC 61747-10-1:2013, 5.4, is applicable with the following specific conditions. In case of contradiction between these documents, IEC 61747-10-1:2013, 5.4, shall prevail <u>IEC 62341-5-2:2019</u>

https://standards.iteh.ai/catalog/standards/sist/6a0b2f94-6abb-47de-a887a2d3277663aa/iec-62341-5-2-2019

#### 7.2.2 Purpose

The purpose of this test is to investigate the behaviour of the specimen in a vibration environment such as transportation or in actual use.

#### 7.2.3 Test apparatus

The equipment shall be capable of maintaining the test conditions specified in 7.2.4.1. The vibration testing table should not resonate within the test condition vibration frequency range. The required characteristics apply to the complete vibration system, which includes the power amplifier, vibrator, test fixture, specimen and control system when loaded for testing. The body of the device shall be securely clamped during the test. If the device has a specified method of installation, it shall be used to clamp the device. The specimen shall be tested under the non-operational condition.

#### 7.2.4 **Test procedure**

#### 7.2.4.1 General

The test specimen should be hooked up to the jig as shown in Figure 1 for a large size display.



-9-

Figure 1 – Example of the specimen and jig

During this test for the large size display, the specimen should be turned off and the test based on the specific time; the specimen quality is checked. The jig is on the base plate, which should be fixed at the plate. The conditions for fixation of the specimen are depicted in Figure 2 according to the different axes.



To start, the condition should be as in Figure 2a), and the vibration frequency and the duration time should be reported. After testing the x-axis condition, the specimen should be set as in Figure 2b). The test with the specified vibration frequency and the duration time should be operated. Finally, the test with the z-axis should be done. The test shall be performed as described in 7.2.4.2.

NOTE The large size is defined for TVs. The size would be over 40 in.

### 7.2.4.2 Test conditions

### 7.2.4.2.1 Basic motion

The basic motion shall be a sinusoidal function of time and such that the fixing points of the specimen move substantially in phase and in straight parallel lines.

### 7.2.4.2.2 Spurious motion

The maximum amplitude of spurious transverse motion at the check points in any perpendicular area to the specified axis shall not exceed 25 %. In the case of large size or high mass specimens, the occurrence of spurious rotational motion of the vibration table can be important. If so, the relevant specification shall specify a tolerance level.

### 7.2.4.2.3 Signal tolerance

Unless otherwise stated in the relevant specification, acceleration signal tolerance measurements shall be performed and signal tolerance shall not exceed 5 %.

#### Vibration amplitude tolerance 7.2.4.2.4

Reference point: ±15 %.

Check point: ±25 %.

#### 7.2.4.2.5 **Frequency tolerances**

#### 7.2.4.2.5.1 Endurance by sweeping

±1 Hz from 5 Hz to 50 Hz.

±2 % above 50 Hz.

#### 7.2.4.2.5.2 Endurance at critical frequencies

±2 %.

#### 7.2.4.3 **Severities**

#### 7.2.4.3.1 General

A vibration severity is defined by the combination of three parameters: frequency range, vibration amplitude and duration of endurance (in sweep cycles or time).

- 10 -

### iTeh STANDARD PREVIEW 7.2.4.3.2

## **Frequency range**

The frequency range shall be given in the relevant specification by selecting a lower frequency from Table 1 and an upper frequency from Table 2.

# https://standards.iteh.ai/catalog/standards/sist/6a0b2f94-6abb-47de-a887-Table 12752reguency\_range\_-Lower end

Lower frequency $f_1$ (Hz)
5
10
20

### Table 2 – Frequency range – Upper end

Upper frequency $f_2$ (Hz)
55
100
200
300
500

The recommended ranges are shown in Table 3.