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REDLINE VERSION

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colour inside

Organic light emitting diode (OLED) displays –
Part 5-2: Mechanical endurance test~~ing~~ methods

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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 liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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.

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ORGANIC LIGHT EMITTING DIODE (OLED) DISPLAYS –

Part 5-2: Mechanical endurance test~~ing~~ methods

1 Scope

This part of IEC 62341 defines test~~ing~~ 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~~ing~~ 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. ~~Vibration, shock,~~ Quasistatic strength, four-point bending ~~test~~ and peel strength tests are introduced here for usage environment, while vibration, shock and transportation drop tests ~~is~~ are applicable to the transportation environment. Mechanical endurance tests ~~may also~~ 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 ~~will be~~ are noted.

In case of contradiction between this document and a relevant specification, the latter will govern.

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
– 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~~:2007~~, *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 61747-5:1998, *Liquid crystal and solid-state display devices – Part 5: Environmental, endurance and mechanical test methods*~~

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 62341-1-2:2007, *Organic light emitting diode displays – Part 1-2: Terminology and letter symbols*~~

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

IEC 62341-6-1~~:2009~~, *Organic light emitting diode (OLED) displays – Part 6-1: Measuring methods of optical and electro-optical parameters*

IEC 62341-6-2:~~2012~~ 2015, *Organic light emitting diode (OLED) displays – Part 6-2: Measuring methods of visual quality and ambient performance*

ISO 2206~~:1987~~, *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 ~~given in IEC 62341-1-2 and the following~~ 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.

3.1
strength
stress at which a sample fails for a given loading condition

3.2
glass edge strength
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][1]
FEA	finite element analysis
FPCB	flexible printed circuit board
TSP	touch screen panel

[1] Numbers in square brackets refer to the Bibliography.

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 Evaluations

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 ~~prescribed~~ specified by the following ~~specification~~:

a) visual checks of damage to the exterior body of the specimen including marking, encapsulation and terminals shall be ~~examined as specified in IEC 61747-5:1998, 1.5~~ done as specified in IEC 61747-1-1:2014, 4.3;

b) dimensions given in the ~~customer's~~ 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:~~2012~~ 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.

7 Mechanical endurance test methods

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)

7.2.1 General

Test Fc, specified in IEC 60068-2-6 and ~~IEC 61747-5:1998, 2.3~~ IEC 61747-10-1:2013, 5.4 is applicable with the following specific conditions. In case of contradiction between these documents, ~~IEC 617475:1998, 2.3~~ IEC 61747-10-1:2013, 5.4, shall ~~govern~~ prevail.

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.

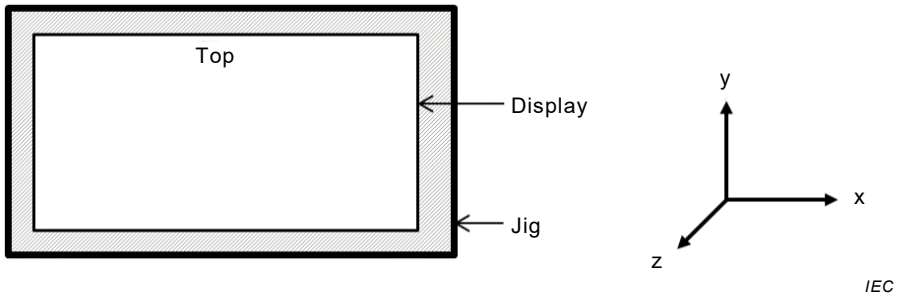
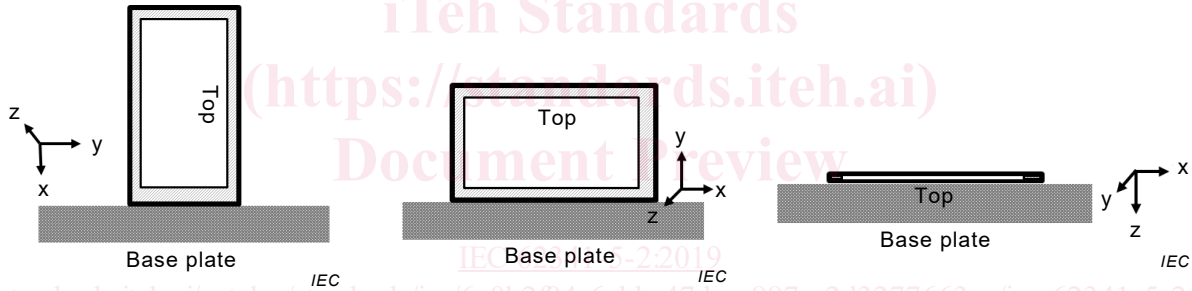


Figure 1 – Example of the specimen and jig

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.



a) x-axis **b) y-axis** **c) z-axis**

Figure 2 – Directions of vibration test

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 ~~may~~ can be important. If so, the relevant specification shall ~~prescribe~~ 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 %.

7.2.4.2.4 Vibration amplitude tolerance

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).

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.

Table 1 – Frequency 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.

Table 3 – Recommended frequency ranges

Recommended frequency ranges, from f_1 to f_2 (Hz)
5 to 100
5 to 200
5 to 500
10 to 55
10 to 200
10 to 300
10 to 500

7.2.4.3.3 Vibration amplitude

The vibration amplitude shall be stated in the relevant specification. Recommended vibration amplitudes with cross-over frequency are shown in Table 4.

Table 4 – Recommended vibration amplitudes

Displacement amplitude below the cross-over frequency	Acceleration amplitude above the cross-over frequency	
M_m	m/s^2	g_n
0,035	4,9	0,5
0,075	9,8	1,0
0,10	14,7	1,5
0,15	19,6	2,0
0,20	~~2,4~~ 29,4	3,0
NOTE 1 The values listed apply in Table 4 for cross-over frequencies between 57 Hz and 62 Hz.		
NOTE 2 Regardless of display size, the same amplitude is calculated and applied at per unit area.		

7.2.4.3.4 Duration of endurance

7.2.4.3.4.1 Endurance by sweeping

The duration of the endurance test in each axis shall be given as a number of sweep cycles chosen from the list given below:

1, 5, 10, 20, 30, 45, 60, 120

The sweeping shall be continuous and the frequency shall change exponentially with time. The endurance time associated with the number of sweep cycles or sweep rate in octaves/minute shall be specified. During the vibration response investigation, the specimen and the vibration response data shall be examined in order to determine critical frequencies.

7.2.4.3.4.2 Endurance at critical frequencies

The duration of the endurance test in each axis at the critical frequencies found during the vibration response investigation shall be chosen from the list given below. This test shall be repeated for the number of critical frequencies as specified by the relevant specification.

10 min, 15 min, 30 min, 90 min

7.2.5 Evaluation

After the test, visual, dimensional and functional checks shall be performed and compared as described in 6.1.

7.3 Shock

7.3.1 General

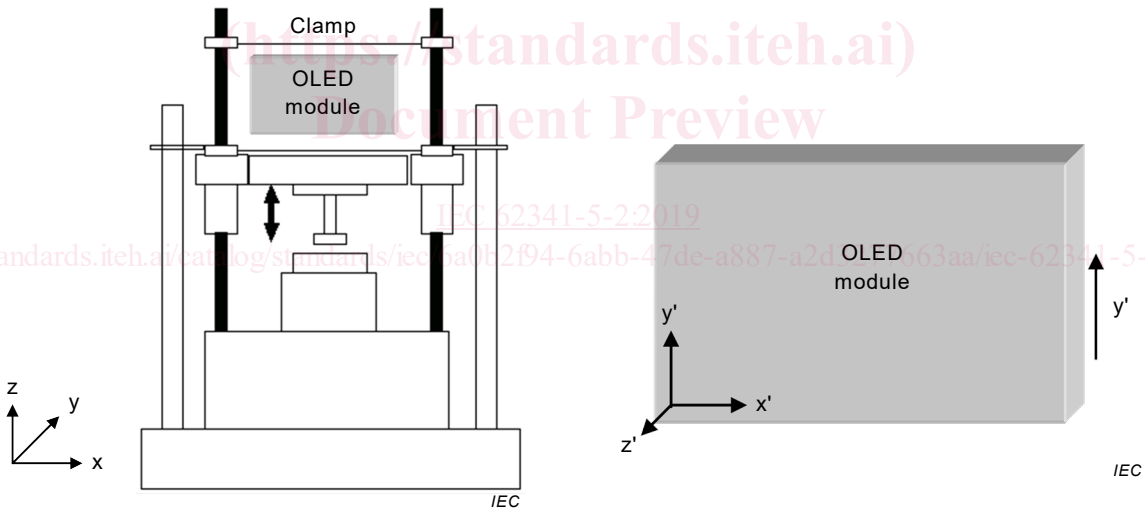
IEC 60068-2-27 and ~~61747-5:1998, 2.4~~ 61747-10-1:2013, 5.5, shall be applied with the following specific conditions. In case of contradiction between these documents, ~~IEC 61747-5:1998, 2.4~~ IEC 61747-10-1:2013, 5.5, shall ~~govern~~ prevail.

7.3.2 Purpose

This test aims to provide a standard procedure for determining the ability of an OLED panel or module to withstand specified severities of shock. During transportation or in use, an OLED panel or module ~~may~~ can be subjected to conditions involving relatively non-repetitive shocks.

7.3.3 Test apparatus

The body of the specimen shall be securely clamped during the test in the test direction and aligned with the z-axis of the test machine; for example, Figure 3 depicts the shock test along the y'-direction of the specimen. If the device has a specified method of installation, it shall be used to clamp the device.



a) Example of a shock test machine

b) test direction of a specimen

Figure 3 – Configuration of OLED shock test set-up

7.3.4 Test procedure

Test Ea, specified in IEC 60068-2-27, is applicable, with the following specific requirements. The conditions shall be selected from Table 5, taking into consideration the mass of the device and its internal construction.