IEC 61747-10-1

Edition 1.0 2013-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Dispositifs d'affichage à cristaux liquides – Partie 10-1: Méthodes d'essais d'environnement, d'endurance et mécaniques – Essais mécaniques

IEC 61747-10-1:2013

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX M

ICS 31.120

ISBN 978-2-8322-0893-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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International Standard IEC 61747-10-1 has been prepared by IEC technical committee 110: Electronic display devices.

This first edition of IEC 61747-10-1 cancels and replaces Clauses 1 and 2 of the first edition of IEC 61747-5 published in 1998. This edition constitutes a technical revision.

NOTE It is intended that the other clauses of IEC 61747-5:1998 will be replaced by new parts in the IEC 61747 series. The details of the intended changes are given in Annex D of IEC 61747-30-1:2012.

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

CDV	Report on voting
110/395/CDV	110/454/RVC

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

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

A list of all parts in the IEC 61747 series, published under the general title *Liquid crystal display devices* can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

LIQUID CRYSTAL DISPLAY DEVICES –

Part 10-1: Environmental, endurance and mechanical test methods – Mechanical

1 Scope

This part of IEC 61747 lists test methods applicable to liquid crystal display devices. It takes into account, wherever possible, the mechanical robustness test methods as outlined in IEC 60068.

NOTE Devices include cells and modules.

The object of this standard is to establish uniform preferred test methods with preferred values for stress levels for judging the mechanical properties of liquid crystal display devices.

In case of contradiction between this standard and a relevant specification, it is the latter that should govern.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068 (all parts), *Environmental testing*

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

IEC 60068-2-7, *Basic environmental testing procedures – Part 2-7: Tests – Test Ga and guidance: Acceleration, steady state*

IEC 60068-2-20, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60068-2-21, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

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

IEC 60747 (all parts), *Semiconductor devices*

IEC 60748 (all parts), *Semiconductor devices – Integrated circuits*

IEC 60749-14, *Semiconductor devices – Mechanical and climatic test methods – Part 14: Robustness of terminations (lead integrity)*

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

3 Terms, definitions and letter symbols

For the purposes of this document, the terms, definitions and letter symbols given in IEC 60068, IEC 60747, IEC 60748 and IEC 61747-1 apply.

4 Standard atmospheric conditions for measurements and tests:

Unless otherwise specified, all tests and measurements shall be carried out under standard atmospheric conditions for testing:

Temperature: 15 °C to 35 °C

Relative humidity: 25 % to 85 % RH, where appropriate

Air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar)

The absolute humidity of the atmosphere shall not exceed 22 g/m^3.

5 Test methods

5.1 General

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

5.2 Robustness of terminations

5.2.1 Wire terminations, pins or connectors with pins

5.2.1.1 Test U

Test U, specified in IEC 60068-2-21, is applicable.

5.2.1.2 Tensile

This test shall be in accordance with test Ua1 of IEC 60068-2-21, with the following specific requirements.

After the test, examine under 3× to 10× magnification.

The device shall be rejected if there is breakage, loosening or relative motion between the lead or termination and the device body.

5.2.1.3 Bending

This test shall be in accordance with test Ub of IEC 60068-2-21.

5.2.1.4 Torsion

See IEC 60749-14.

Applied only for cells with pin.

5.2.1.5 Torque

See IEC 60749-14.

Applied only for cells with pin.

5.2.2 Flexible terminations

Under consideration.

5.3 Soldering

Test T, specified in IEC 60068-2-20, is applicable.

This test shall be in accordance with test Ta (methods 1, 2) (only methods 1 and 2 are referenced, these methods are solder bath and soldering iron).

5.4 Vibration (sinusoidal)

5.4.1 Test Fc

Test Fc, specified in IEC 60068-2-6, is applicable, with the following specific requirements.

5.4.2 Transverse motion

The maximum vibration amplitude at the check points in any perpendicular to the specified axis shall not exceed 25 %.

5.4.3 Distortion

Not exceeding 25 %.

5.4.4 Vibration amplitude tolerance

Reference point: ±15 %

Check point: ±25 %

5.4.5 Severities

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
1
5
10
55

Table 2 – Frequency range – Upper end

Upper frequency f_2 Hz
55
100
150
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
1 to 55
10 to 55
10 to 300
10 to 500
55 to 500

5.4.6 Vibration amplitude

The 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	
mm	m/s^2	g_n
0,035	4,9	0,5
0,075	9,8	1,0
0,15	19,6	2,0
0,35	49,0	5,0
0,75	98,0	10,0
NOTE The values listed apply in Table 4 for cross-over frequencies between 57 Hz and 62 Hz.		

5.4.7 Duration of endurance

5.4.7.1 Endurance by sweeping

The duration of the endurance in each axis shall be given as a number of sweep cycles given preference by the relevant specification from the list given below:

1, 2, 5, 10, 20.

5.4.7.2 Endurance at critical frequencies

The duration of the endurance in each appropriate axis at each critical frequency found during the vibration response investigation shall be given preference in the relevant specification from the list given below:

10 min ± 0,5 min

30 min ± 1 min

90 min ± 1 min

10 h ± 5 min

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.

5.5 Shock

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.

Table 5 – Conditions for shock test

Peak amplitude A	Corresponding duration D of the nominal pulse	Corresponding velocity change ΔV	
		Half-sine	Final-peak saw-tooth
m/s^2 (g_n)	ms	m/s	m/s
50 (5)	30	1,0	–
150 (15)	11	1,0	0,8
150 (15)	6	0,6	0,4
300 (30)	18	3,4	2,6
300 (30)	11	2,1	1,6
300 (30)	6	1,1	0,9
500 (50)	20	6,2	4,9
500 (50)	11	3,4	2,7
500 (50)	3	0,9	0,7
700 (70)	11	4,8	3,8
1 000 (100)	11	6,9	5,4
1 000 (100)	6	3,7	2,9
2 000 (200)	6	7,5	5,9
2 000 (200)	3	3,7	2,9

NOTE The preferred values are underlined.

The relevant specification shall state the wave form utilized.

The device shall be subjected to three successive shocks, in both directions of three mutually-perpendicular axes chosen so that faults are most likely to be revealed, i.e. a total of 18 shocks (see IEC 60068-2-27.) The preferred combinations are underlined.

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.

5.6 Acceleration, steady state

Test Ga, specified in IEC 60068-2-7, is applicable, with the following specific requirements.

The acceleration conditions shall be selected from Table 6.