

# Liquid crystal and solid-state display devices —

## Part 5: Environmental, endurance and mechanical test methods

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# National foreword

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The UK participation in its preparation was entrusted by Technical Committee EPL/47, Semiconductor devices, to Subcommittee EPL/47/3, Optoelectronic display and imaging devices, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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Attention is drawn to the fact that CEN and CENELEC standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 34 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 November 1998

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ISBN 0 580 30410 8

### Amendments issued since publication

| Amd. No. | Date | Comments |
|----------|------|----------|
|          |      |          |
|          |      |          |
|          |      |          |
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English version

Liquid crystal and solid-state display devices  
Part 5: Environmental, endurance and mechanical  
test methods

(IEC 61747-5:1998)

Dispositifs d'affichage à cristaux  
liquides et à semiconducteurs  
Partie 5: Méthodes d'essais  
d'environnement, d'endurance et mécaniques  
(CEI 61747-5:1998)

Flüssigkristall- und  
Halbleiter- Anzeige-Bauelemente  
Teil 5: Umwelt-, Lebensdauer- und  
mechanische Prüfverfahren  
(IEC 61747-5:1998)

This European Standard was approved by CENELEC on 1998-08-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

## CENELEC

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B-1050 Brussels**

## Foreword

The text of document 47C/203/FDIS, future edition 1 of IEC 61747-5, prepared by SC 47C, Optoelectronic, display and imaging devices, of IEC TC 47, Semiconductor devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61747-5 on 1998-08-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-05-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2001-05-01

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, Annex ZA is normative and Annex A is informative.

Annex ZA has been added by CENELEC.

## Endorsement notice

The text of the International Standard IEC 61747-5:1998 was approved by CENELEC as a European Standard without any modification.

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## 1 General

### 1.1 Scope and object

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

It also includes visual inspection for both liquid crystal display cells and modules.

NOTE 1 This standard is established separately from IEC 60749, because the technology of liquid crystal display devices is completely different from that of semiconductor devices in such matters as

- shape and size;
- used materials and structure;
- function;
- measuring methods;
- operation principles.

NOTE 2 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 environmental properties of liquid crystal display devices.

In case of contradiction between this standard and a relevant specification, the latter shall govern.

### 1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61747. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61747 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60068, *Environmental testing*.

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance*.

IEC 60068-2-1:1990, *Environmental testing — Part 2: Tests — Test A: Cold*.

IEC 60068-2-2:1974, *Environmental testing — Part 2: Tests — Test B: Dry heat*.

IEC 60068-2-3:1969, *Environmental testing — Part 2: Tests — Test Ca: Damp heat, steady state*.

IEC 60068-2-5:1975, *Environmental testing — Part 2: Tests — Test Sa: Simulated solar radiation at ground level*.

IEC 60068-2-6:1995, *Environmental testing — Part 2: Tests — Test Fc: Vibration (sinusoidal)*.

IEC 60068-2-7:1983, *Environmental testing — Part 2: Tests — Test Ga: Acceleration, steady state*.

IEC 60068-2-13:1983, *Environmental testing — Part 2: Tests — Test M: Low air pressure*.

IEC 60068-2-14:1984, *Environmental testing — Part 2: Tests — Test N: Change of temperature*.

IEC 60068-2-20:1979, *Environmental testing — Part 2: Tests — Test T: Soldering*.

IEC 60068-2-21:1983, *Environmental testing — Part 2: Tests — Test U: Robustness of terminations and integral mounting devices*.

IEC 60068-2-27:1987, *Environmental testing — Part 2: Tests — Test Ea and guidance: Shock*.

IEC 60068-2-30:1980, *Environmental testing — Part 2: Tests — Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*.

IEC 60068-2-38:1974, *Environmental testing — Part 2: Tests — Test Z/AD: Composite temperature/humidity cyclic test*.

IEC 60068-2-45:1980, *Environmental testing — Part 2: Tests — Test XA and guidance: Immersion in cleaning solvents*.

IEC 60747, *Semiconductor devices*.

IEC 60747-1:1983, *Semiconductor devices — Discrete devices — Part 1 — General*.

Amendment 1 (1991)

Amendment 2 (1993)

Amendment 3 (1996)

IEC 60747-5:1984, *Semiconductor devices — Part 5: Optoelectronic devices*.

Amendment 1 (1994)

Amendment 2 (1995)

IEC 60748-1:1984, *Semiconductor devices — Integrated circuits — Part 1: General*.

IEC 60749:1996, *Semiconductor devices — Mechanical and climatic test methods*.

IEC 61747:1998, *Liquid crystal and solid-state display devices*.

### 1.3 Terms, definitions and letter symbols

For the purpose of this standard, the definitions and letter symbols of IEC 60068, IEC 60747, IEC 60748 and IEC 61747-1 apply.

### 1.4 Standard atmospheric conditions

The atmospheric conditions specified in IEC 60068-1 apply.

#### 1.4.1 Standard reference atmosphere

Temperature: 25 °C

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

#### 1.4.2 Standard atmosphere for referee measurements and tests

If the parameters of liquid crystal display devices to be measured depend on temperature, pressure, and humidity and the law of dependence is unknown, the atmospheres to be specified shall be selected from the following:

| Temperature<br>°C                                                                 | Relative humidity<br>% RH | Air pressure<br>kPa |
|-----------------------------------------------------------------------------------|---------------------------|---------------------|
| 20 ± 1                                                                            | 45 to 75                  | 86 to 106           |
| 25 ± 1                                                                            | 45 to 75                  | 86 to 106           |
| 30 ± 1                                                                            | 45 to 75                  | 86 to 106           |
| 35 ± 1                                                                            | 45 to 75                  | 86 to 106           |
| NOTE Atmospheric conditions for initial and final measurements shall be the same. |                           |                     |

#### 1.4.3 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<sup>3</sup>.

#### 1.4.4 Recovery conditions

After the conditioning period and before making the final measurements, the specimens should be allowed to stabilize at the ambient temperature, the temperature at which the measurements shall be made.

The “controlled recovery conditions” (see 1.4.4.1) shall be applied if the electrical parameters to be measured are affected by absorbed humidity or by the surface conditions of the specimens, and change rapidly, for example if the insulation resistance rises considerably within approximately 2 h after removal of the specimens from the humidity chamber.

If the electrical parameters of the specimens affected by absorbed humidity or surface conditions do not vary rapidly, recovery may be carried out in the conditions specified in 1.4.3.

#### 1.4.4.1 *Controlled recovery conditions*

Unless otherwise specified, all recovery shall be carried out under controlled atmospheric conditions:

Temperature: actual laboratory temperature  $\pm 1$  °C, provided that it is within the limits fixed in 1.4.3, that is between 15 °C to 35 °C.

Relative humidity: 73 % to 77 %, where appropriate

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

Before the measurements are made, the devices shall be stored until temperature equilibrium is reached. The ambient temperature during the measurements shall be stated in the test report.

During measurements, the devices shall not be exposed to draught, illumination or other influences likely to cause error. The environment shall be controlled to avoid error.

If recovery and measurements are performed in separate chambers, the combination of temperature and humidity conditions shall be such that condensation on the surface of the devices does not occur when the device is transferred to the measurement chamber.

#### 1.4.4.2 *Recovery procedure*

The device shall be placed in the recovery chamber within 10 min of completing of conditioning. Where the relevant specification requires measurements to be made immediately after the recovery period, these measurements shall be completed within 30 min of the specimen being removed from the recovery chamber. Those characteristics which are expected to change most rapidly after the device is removed from the recovery chamber shall be measured first.

#### 1.4.5 *Standard atmospheric conditions for assisted drying*

Where assisted drying is required before commencing a series of measurements, the conditions listed below shall be used on the specimen for 6 h, unless otherwise prescribed by the relevant specification.

Temperature:  $(55 \pm 2)$  °C

Relative humidity: not exceeding 20 %

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

When the specified temperature for the dry heat test is lower than 55 °C, assisted drying shall be carried out at that lower temperature.

### 1.5 *Visual examination and verification of dimensions*

Clauses 5 and 6 are applicable.

#### 1.5.1 *Visual examination shall include*

- a) the conformance and permanence of the marking;
- b) damage to the encapsulation, including terminals;
- c) workmanship of the encapsulation, including terminals.

#### 1.5.2 *Dimensions given in the relevant specification shall be verified.*

1.5.3 Unless otherwise specified, visual inspection shall be performed under normal factory lighting and under normal visual conditions.

### 1.6 *Electrical and optical measurements*

1.6.1 For environmental testing, the characteristics to be checked shall be selected from the relevant part of IEC 61747.

1.6.2 Measurement conditions shall comply with the table "Conditions for the endurance tests" in the relevant part of IEC 61747.

#### 1.6.3 *Initial measurements*

If only upper specification limit and/or lower specification limit criteria are required, it is left to the discretion of the manufacturer whether initial measurements are made or not. Initial measurements shall be made where individual values for an individual device are a criterion.

#### 1.6.4 Measurements monitored during environmental testing

To be stated, where appropriate.

#### 1.6.5 Final measurements

When the test is called for in the relevant specification as part of a sequence (subgroup) of tests, measurements are required only at the end of the sequence. For certain tests, such as solderability or lead fatigue, electrically or optically defective devices may be used.

### 1.7 Electrical operating conditions

Electrical operating conditions shall be defined in the relevant specifications.

## 2 Mechanical test methods

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

### 2.1 Robustness of terminations

#### 2.1.1 Wire terminations, pins or connectors with pins

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

##### 2.1.1.1 *Tensile*

This test shall be in accordance with test Ua1, with the following specific requirements.

After test, examine under  $3 \times$  to  $10 \times$  magnification.

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

##### 2.1.1.2 *Bending*

This test shall be in accordance with test Ub.

##### 2.1.1.3 *Torsion*

See IEC 60749, chapter II, subclause 1.3.

Applied only for cells with pin.

##### 2.1.1.4 *Torque*

See IEC 60749, chapter II, subclause 1.4.2.

Applied only for cells with pin.

#### 2.1.2 Flexible terminations

Under consideration.

### 2.2 Soldering

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

This test shall be in accordance with test Ta (methods 1, 2 and 3).

### 2.3 Vibration (sinusoidal)

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

#### 2.3.1 Transverse motion

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

#### 2.3.2 Distortion

Not exceeding 25 %.