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Edition 1.0 2015-02

INTERNATIONAL STANDARD

Liquid crystal display devices –
Part 20-1: Visual inspection – Monochrome liquid crystal display cells (excluding all active matrix liquid crystal display cells)

IEC 61747-20-1:2015-02(en)

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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LIQUID CRYSTAL DISPLAY DEVICES –

Part 20-1: Visual inspection – Monochrome liquid crystal display cells (excluding all active matrix liquid crystal display cells)

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International Standard IEC 61747-20-1 has been prepared by IEC technical committee 110: Electronic display devices.

This first edition cancels and replaces Clause 6 of the first edition of IEC 61747-5 published in 1998. This edition constitutes a technical revision.

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

a) The editorial modifications were done in accordance with the ISO/IEC Directives, Part 2, Ed. 6.0:2011.

b) The document number was changed to align with the new numbering structure of the IEC 61747 series.

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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
110/522/CDV	110/558A/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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

This part of IEC 61747 facilitates the visual inspection of image defects of monochrome LCD cells by human eyes subjectively. Visual inspection is performed at specified conditions and criteria. The objective measurement method of visual image defect with an instrument will be studied and standardized.

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LIQUID CRYSTAL DISPLAY DEVICES –

Part 20-1: Visual inspection – Monochrome liquid crystal display cells (excluding all active matrix liquid crystal display cells)

1 Scope

This part of IEC 61747 gives the details of testing and provides general rules for visual inspection of the non-active and active area of monochrome liquid crystal display cells by the human eye, if necessary, through an optical microscope. Furthermore this standard includes defect definitions and the methods for visual defect inspection.

NOTE Restrictions on defect types, number, and sizes are specified in the quality contract (customer acceptance specification and incoming inspection specification).

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 61747-1-2:2014, *Liquid crystal display devices – Part 1-2: Generic – Terminology and letter symbols*

IEC 61747-10-2:2014, *Liquid crystal display devices – Part 10-2: Environmental, endurance and mechanical test methods – Environmental and endurance*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms, definitions and letter symbols given in IEC 61747-1-2 and IEC 61747-10-2 apply.

3.2 Abbreviations

DUT Device under test

4 Visual inspection method and criteria

4.1 Standard inspection conditions and methods

4.1.1 Ambient conditions

4.1.1.1 Temperature

All visual inspection shall be carried out under specified temperature. Refer to IEC 61747-10-2:2014, Clause 4.

4.1.1.2 Humidity

All visual inspection shall be carried-out under specified humidity. Refer to IEC 61747-10-2:2014, Clause 4.

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4.1.1.3 Illuminance

All visual inspection shall be carried out under illumination levels as specified in the detail specification. The illumination level shall be adjusted in such a way that it allows for an accurate visual inspection.

4.1.2 Inspection equipment and liquid crystal display cells

The DUT will be installed on a rotatable fixture to enable changes in the horizontal and vertical viewing direction range. Alternatively, the inspector moves around and the DUT is fixed.

Turn on the direct current power supply and pattern generator and warm up for stabilization. Supply the driving voltage and pattern to the DUT. The warm-up time of the DUT shall be sufficiently long to obtain a stable signal, necessary for the visual inspection.

4.1.3 Inspector and limit sample for visual inspection

The inspector shall have a (corrected-to) normal vision, a normal colour vision and shall be periodically trained with specified limit samples in order to accurately carry out the visual examination.

4.1.4 Inspection and record of result

The inspector shall carry out the visual inspection based on the specified procedure and record the results on recording sheets with the specified inspection conditions.

4.2 Visual inspection of display

4.2.1 Display not activated

4.2.1.1 Test conditions to be specified in the detail specification

The test conditions to be specified in the detail specification are:

The test conditions of the visual inspection shall be described for the following conditions:

– the viewing direction range;
– the illumination from above or through the device (depending on the application);
– the duration;
– the viewing distance.

4.2.1.2 Procedure

Devices shall be inspected for the following visual defects in Table 1.

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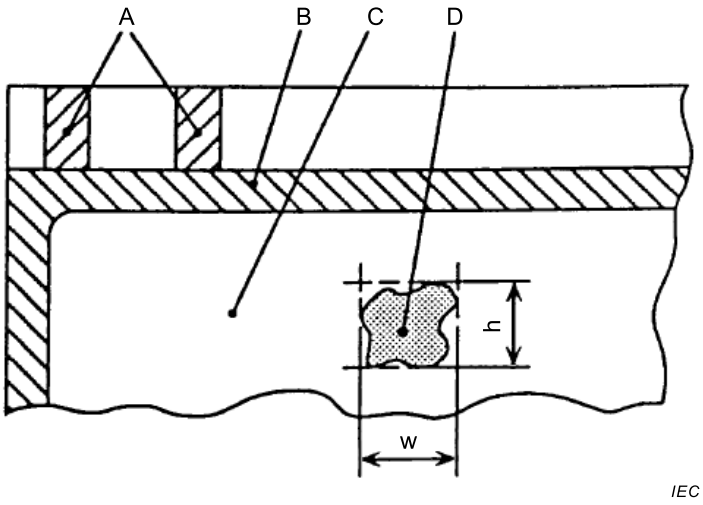
Table 1 – Visual defects to be inspected

Spots (see Figure 1), bubbles, foreign particles	To be specified in the detail specification
Light/dark stains on light background	To be specified in the detail specification
Light/dark stains on dark background	To be specified in the detail specification
Scratches on the liquid crystal cell and on the polarizer within the specified viewing direction range	To be specified in the detail specification
Mechanical damage outside of viewing area (see Figures 5 and 6)	To be specified in detail specification
Accumulation of the above-listed visible defects	Reference samples
Visible structure of the electrodes within the viewing area	Reference samples
Non-uniformity of luminance and colours within the viewing area of the display and within the specified viewing direction range	Reference samples
Dirt on surface, e.g. finger prints, adhesive residue	Reference samples



Key

A = contact pads
B = sealing area
C = viewing area
D = defect
h = height
w = width

Figure 1 – Defects within the viewing area

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4.2.2 Display activated

4.2.2.1 Overall geometrical aspect of the display

4.2.2.1.1 General

The deviations and defects of the displays are shown in Figure 2 and Figure 3.

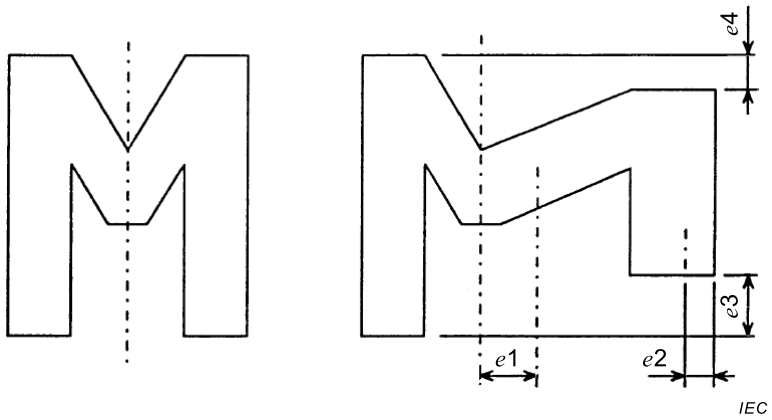
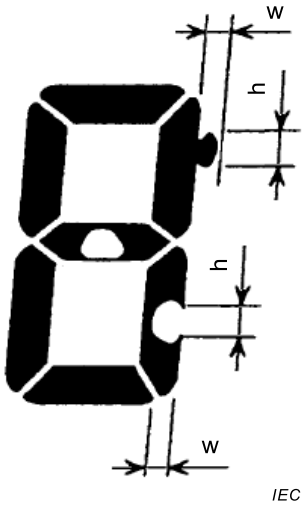


Figure 2 – Deviations of dimensions and shape *e*1 to *e*4



Key

h = height w = width

Figure 3 – Defects within segments

4.2.2.1.2 Test conditions to be specified in the detail specification

The test conditions of the visual inspection shall be described for the following conditions:

– the electrical driving conditions;
– the illumination;
– the ambient temperature.

4.2.2.1.3 Procedure

Devices shall be inspected to be in conformity with the detail specification in Table 2 and Table 3.

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Table 2 – Properties of display area to be inspected

Property	Rejection criteria
Dimension of the picture elements	Not in conformity with the detail specification
Shape of the picture elements	Not in conformity with the detail specification

Table 3 – Defects of display area to be inspected

Defect	Rejection criteria
Missing picture elements	Not in conformity with the detail specification
Unwanted picture elements	Not in conformity with the detail specification
Seal edge within viewing area	Not in conformity with the detail specification

4.2.2.2 Visible defect of the viewing area

4.2.2.2.1 Test conditions to be specified in the detail specification

The test conditions of the visual inspection shall be described for the following conditions:

– the electrical driving conditions;
– the viewing direction range;
– the illumination from above or through the devices (depending on the application);
– the duration;
– the viewing distance;
– the ambient temperature.

4.2.2.2.2 Procedure

Devices shall be inspected for the following visual defects in Table 4.

Table 4 – Defects of viewing area to be inspected

Defect	Rejection criteria
A pin-hole within the picture element	To be specified in the detail specification
Accumulation of pin-holes whose size is smaller than specified above	Reference samples
Pin-holes within the non-activated surrounding area of the picture elements	To be specified in the detail specification
Difference of contrast ratio between different picture elements	To be specified in the detail specification
Uniformity of luminance within the viewing area	To be specified in the detail specification
Uniformity of contrast within the viewing area	To be specified in the detail specification
Non-uniformity of luminance and colours within the viewing area and within the specified viewing direction range	Reference samples

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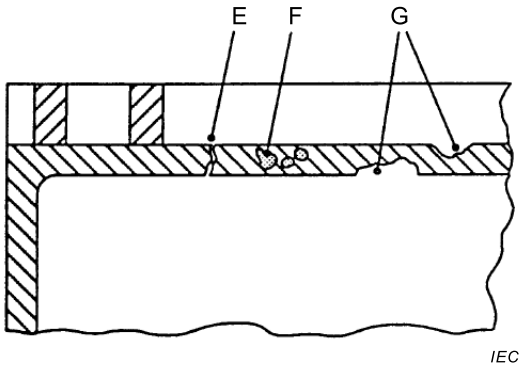
4.2.3 Seal inspection

4.2.3.1 General

The defects within the sealing area are shown in Figure 4.



Key

E = crack

F = inclusions or hole

G = different seal widths

Figure 4 – Defects within the sealing area

4.2.3.2 Test conditions

The test condition of visual inspection shall be described for the following conditions:

– optical magnification (e.g. 10 x);

– illumination (e.g. vertical illumination).

4.2.3.3 Procedure

The seal shall be inspected for the following defects in Table 5.

Table 5 – Defects of sealing area to be inspected

Defect	Rejection criteria
Cracks	To be specified in the detail specification
Inclusions (e.g. bubbles, foreign particles)	To be specified in the detail specification
Differences of seal width	To be specified in the detail specification

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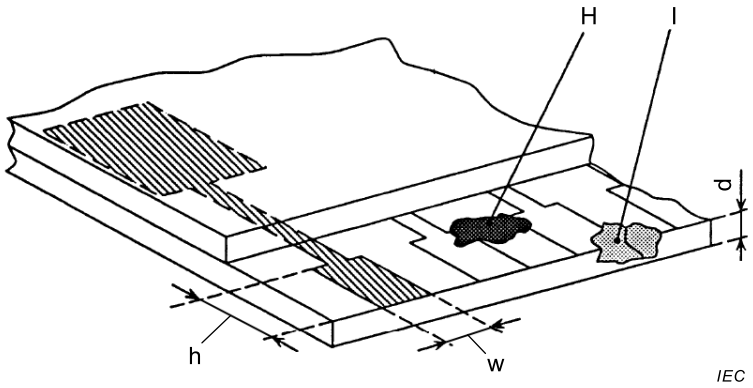
4.2.4 Contact pad area

4.2.4.1 General

The defects of the contact pad area are shown in Figure 5.



Key

h = height w = width

H = residue d = depth

I = damage

Figure 5 – Defects of contact pad area

4.2.4.2 Test conditions to be specified in the detail specification

The test condition of visual inspection shall be described for the following conditions:

– the viewing direction;
– the illumination from above or through the devices (depending on the application);
– the viewing distance.

4.2.4.3 Procedure

4.2.4.3.1 General

The contact pads and flexible shields shall be inspected for the following defects in Table 6, Table 7 and Table 8.

4.2.4.3.2 Contact pads

Table 6 – Visual defects of contact pad area to be inspected

Defect	Rejection criteria
Dirt on contact pad area, for example residue of liquid crystal material or adhesive	Not allowed
Cracks	a) Complete breaks not allowed b) Reference samples for partial breaks
Damage to contact pad area	To be specified in the detail specification

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Table 7 – Defects of pin to be inspected

Defect	Rejection criteria
Dirt on pins	To be specified in the detail specification
Missing pins	Not allowed
Bent pins	To be specified in the detail specification

4.2.4.3.3 Flexible leads

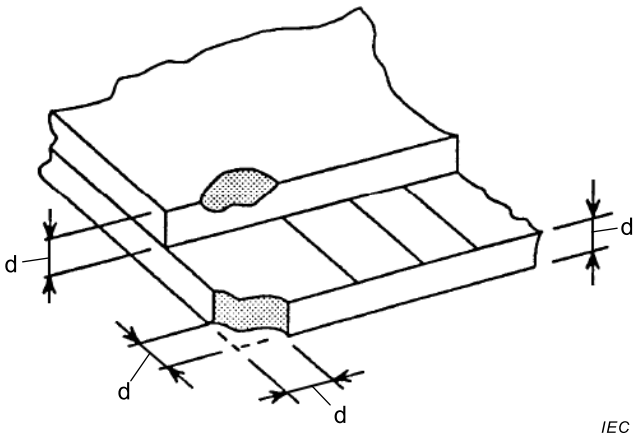
Table 8 – Defects of lead to be inspected

Defect	Rejection criteria
Missing electrical contact	Not allowed

4.2.5 Chipped material at the borders and edges of support plates of cells

4.2.5.1 General

The damages of support plates are shown in Figure 5 and Figure 6.



Key

d = depth

Figure 6 – Damage of a corner and an edge

4.2.5.2 Procedure

The support plates shall be inspected for mechanical damage at the border and edge described in Table 9.

Table 9 – Defects of support plate to be inspected

Defect	Rejection criteria
Damage to the support	To be specified in the detail specification

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[1] IEC 61747-20-2, *Liquid crystal display devices - Part 20-2: Visual inspection - Monochrome matrix liquid crystal display modules (excluding all active matrix liquid liquid crystal display modules)*

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[4] ISO 9241-307, *Ergonomics of human-system interaction- Part 307:Analysis and compliance test methods for electronic visual displays*

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[1] Under consideration.

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3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch

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