BS EN 61747-5-2:2011

BSI Standards Publication

Liquid crystal display devices

Part 5-2: Environmental, endurance and mechanical test methods — Visual inspection of active matrix colour liquid crystal display modules

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National foreword

This British Standard is the UK implementation of EN 61747-5-2:2011. It is identical to IEC 61747-5-2:2011

The UK participation in its preparation was entrusted to Technical Committee EPL/47, Semiconductors.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Date	Text affected

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NORME EUROPÉENNE

EUROPÄISCHE NORM

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August 2011

ICS 31.120

English version

Liquid crystal display devices - Part 5-2: Environmental, endurance and mechanical test methods - Visual inspection of active matrix colour liquid crystal display modules

(IEC 61747-5-2:2011)

Dispositifs d'affichage à cristaux liquides - Partie 5-2: Méthodes d'essais d'environnement, d'endurance et mécaniques - Inspection visuelle des modules d'affichage à cristaux liquides couleurs à matrice active
(CEI 61747-5-2:2011)

Flüssigkristall-Anzeige-Bauelemente - Teil 5-2: Umwelt-, Lebensdauer- und mechanische Prüfverfahren - Sichtprüfung von Flüssigkristall-Anzeigemodulen mit Aktiv-Matrix Adressierung (Aktiv-Matrix LCDs)
(IEC 61747-5-2:2011)

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Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 110/287/FDIS, future edition 1 of IEC 61747-5-2, prepared by IEC TC 110, Flat panel display devices, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61747-5-2 on 2011-07-21.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

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)	2012-04-21
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-07-21

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61747-5-2:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61747-6:2004	NOTE	Harmonized as EN 61747-6:2004 (not modified).
ISO 13406-2:2001	NOTE	Harmonized as EN ISO 13406-2:2001 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 61747-1 + A1	1998 2003	Liquid crystal and solid-state display devices - Part 1: Generic specification	EN 61747-1 + A1	1999 2003
IEC 61747-5	1998	Liquid crystal and solid-state display devices - Part 5: Environmental, endurance and mechanical test methods	EN 61747-5	1998

CONTENTS

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LIQUID CRYSTAL DISPLAY DEVICES –

Part 5-2: Environmental, endurance and mechanical test methods – Visual inspection of active matrix colour liquid crystal display modules

FOREWORD

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

FDIS	Report on voting
110/287/FDIS	110/306/RVD

Full information on the voting for the approval on 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 of the IEC 61747 series, 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,
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INTRODUCTION

IEC 61747-5-2 facilitates subjective visual inspection of image defects of LCD modules by the human eye. Visual inspection is performed under specified conditions and criteria, and the objective measurement method of visual image defect by instrument will be studied and standardized.

LIQUID CRYSTAL DISPLAY DEVICES –

Part 5-2: Environmental, endurance and mechanical test methods – Visual inspection of active matrix colour liquid crystal display modules

1 Scope

This part of IEC 61747 gives the details of the quality assessment procedures and provides general rules for visual inspection of the active area of transmissive type active matrix colour liquid crystal display modules by the human eye. Furthermore, this standard includes defect definitions and the method for visual defect inspection.

NOTE 1 Mura is excluded from this standard because it was not clearly specified at the time this standard was developed.

NOTE 2 Restrictions on defect types, number, and sizes are specified in the quality contract (customer acceptance specification and incoming inspection specification) between panel and set makers.

2 Normative references

The following referenced documents are indispensable for the application 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 61747-1:2003, *Liquid crystal and solid-state display devices – Part 1: Generic specification*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61747-1, as well as the following, apply.

3.1
visual inspection
method by human eye for checking display defects that are difficult to objectively measure and characterize with an instrument

NOTE The limitation on display defects depends on supplier and customer. Therefore a limit sample, with well defined observation and operational conditions, can be used as a reference for the defect level.

3.2
defect
defined as any observable abnormal phenomena appearing in the active display area

NOTE It includes all kinds of defects such as one / more subpixel (dot) defect, line defect, scratch, foreign material and stain with unclear boundary larger than a pixel.

Figure 1 shows a classification of defects into two categories. The first category is classified as defects with a clear boundary, and the second category is classified as defects with an

unclear boundary. The latter category is not yet well defined, and hence difficult to evaluate. For this reason, defects in the second category are excluded from this standard.

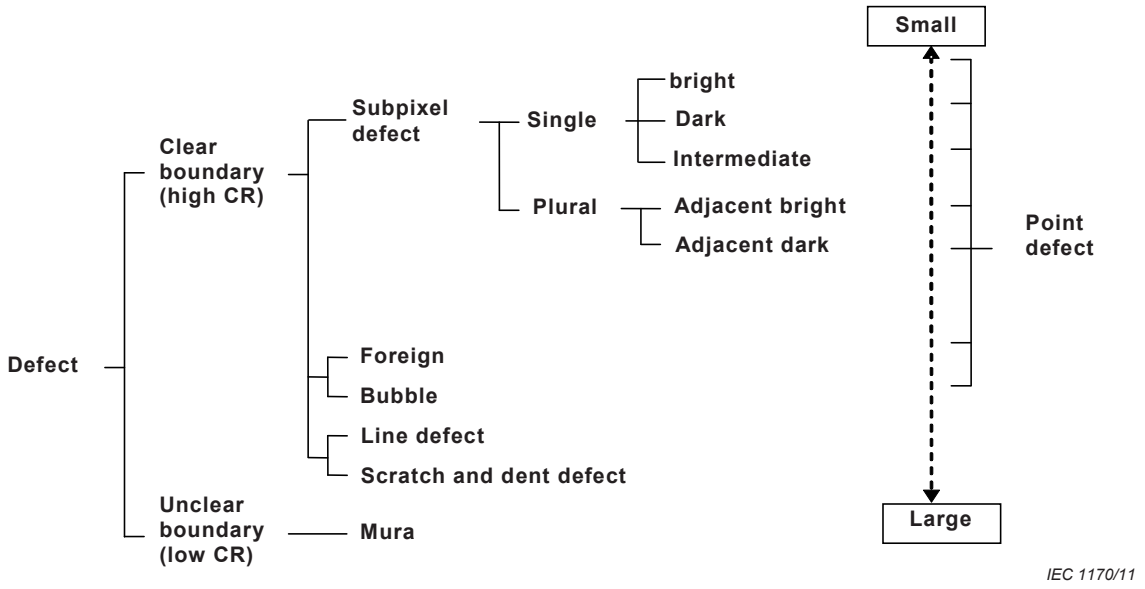
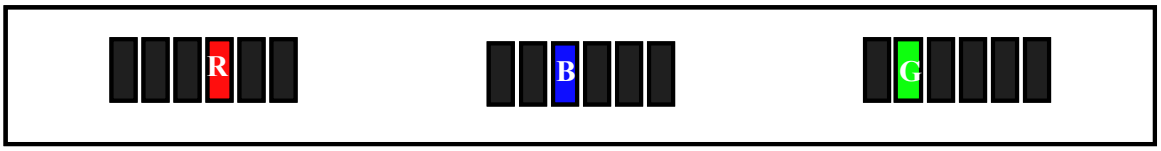


Figure 1 – Classification of defect by visual inspection

3.2.1
subpixel defect
defect in the smallest pixel element when it appears in a different than the intended state, for instance bright subpixels appear on the dark pattern, and dark subpixels appear on a bright pattern

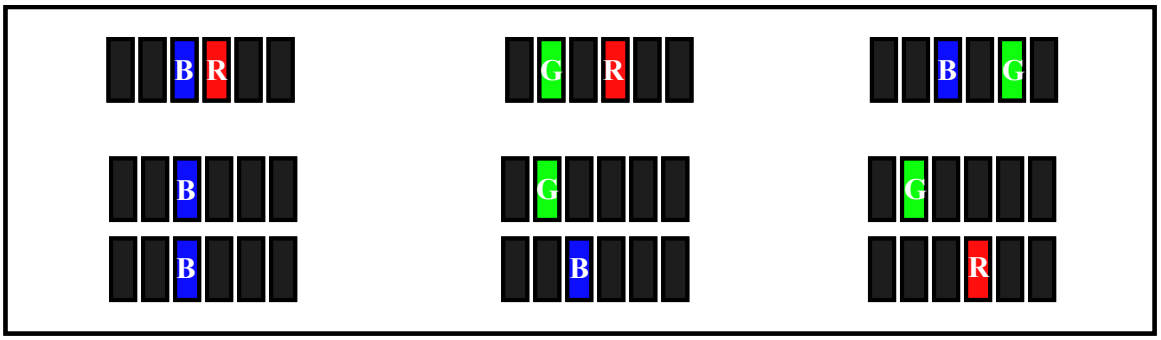
3.2.1.1
bright subpixel defects
defects which appear bright on the screen when a dark pattern is displayed

Figure 2a) shows a single subpixel bright defect of red, green, and blue respectively. And Figure 2b) shows two adjacent bright subpixel defects connected or disconnected in horizontal or (and) vertical one pixel area. Figure 2c) shows adjacent three bright subpixel defects connected in three horizontal or (and) vertical subpixel area.



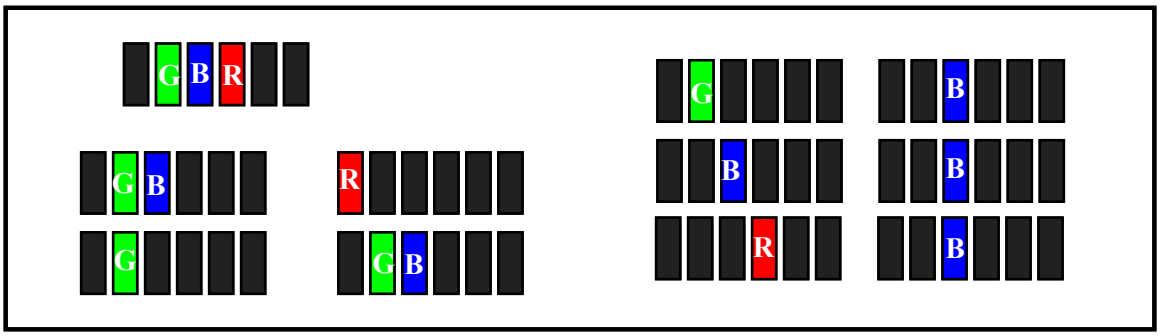
IEC 1171/11

Figure 2 a) – Examples of one bright subpixel defect



IEC 1172/11

Figure 2 b) – Examples of two adjacent bright subpixel defects



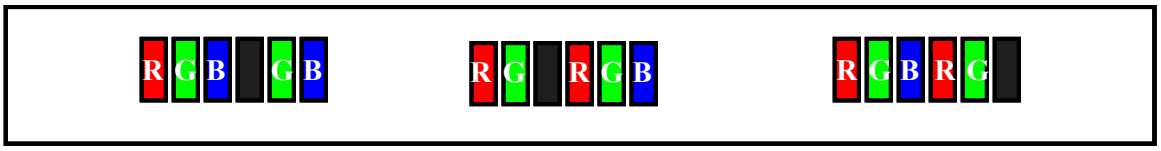
IEC 1173/11

Figure 2 c) – Examples of three adjacent bright subpixel defects

Figure 2 – Example of bright subpixel and adjacent subpixel defects in case of RGB primary colour display

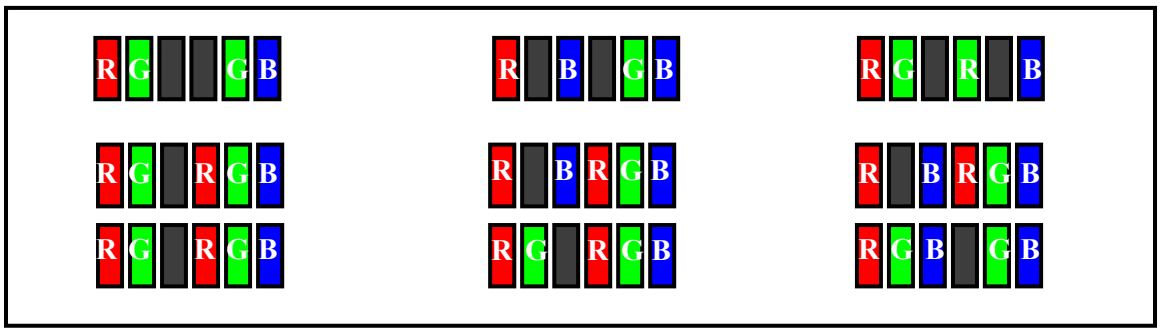
3.2.1.2
dark subpixel defects
defects which appear dark on the screen when a bright pattern is displayed

Figure 3 a) shows single subpixel defects of the dark-type of red, green, blue, respectively. Figure 3 b) shows two adjacent dark subpixel defects connected or disconnected in horizontal or(and) vertical one pixel area. Figure 3 c) shows adjacent three dark subpixel defects connected in three horizontal or(and) vertical subpixel area.



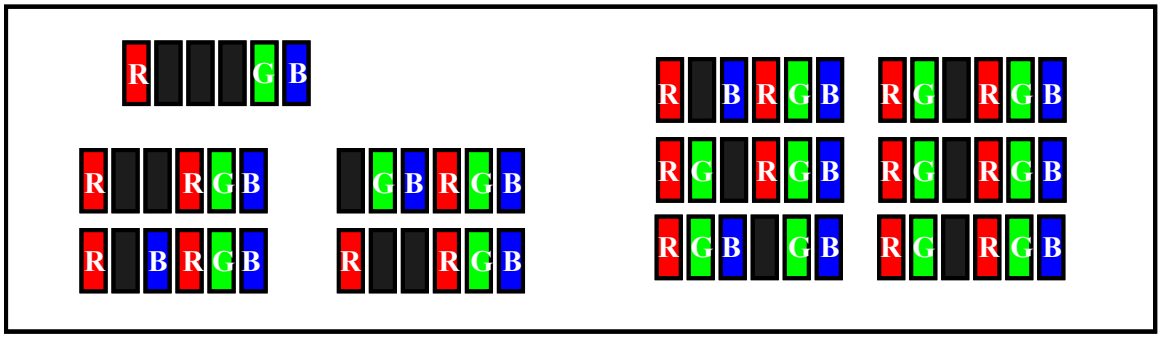
IEC 1174/11

Figure 3 a) – One dark subpixel defect



IEC 1175/11

Figure 3 b) – Two adjacent dark subpixel defects



IEC 1176/11

Figure 3 c) – Three adjacent dark subpixel defects

Figure 3 – Example of dark subpixel and adjacent subpixel defects in case of RGB primary colour display

3.2.1.3
intermediate subpixel defects
defects which appear with an intermediate level on the screen when a bright or dark pattern is displayed

3.2.1.4
cluster subpixel defects
defects clustered in a specified area or within a specified distance with many subpixel defects

Figures 4 a) and Figure 4 b) show an example of bright and dark cluster subpixel defects in which the minimum distance between the defects is specified.

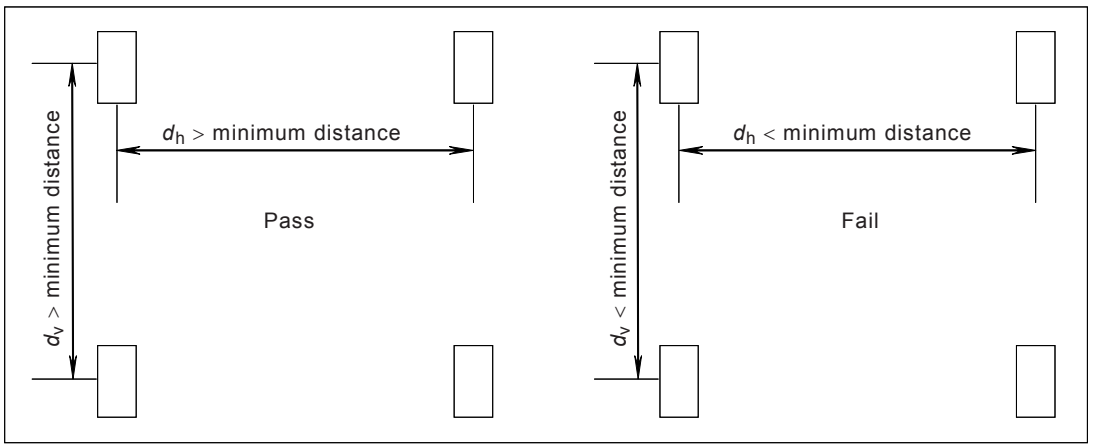


Figure 4a) – Bright subpixel defect to bright subpixel defect

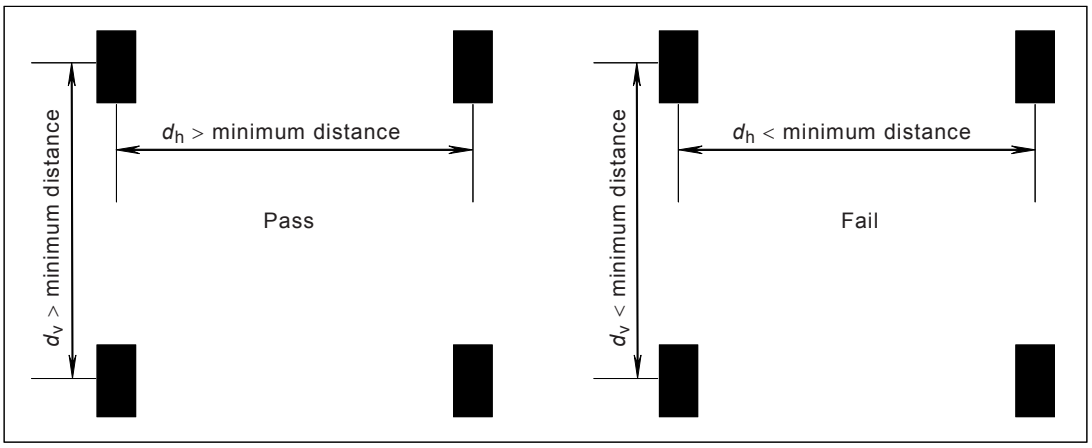


Figure 4 b) – Dark subpixel defect to dark subpixel defect

Figure 4 – Examples of minimum distance between subpixel defects

3.2.2
line defect
vertical or horizontal line which appears in the bright or dark state when a dark or bright pattern is displayed

3.2.2.1
bright line defect
line that appears bright on the screen when a dark pattern is displayed

3.2.2.2
dark line defect
line that appears dark on the screen when a bright pattern is displayed

3.2.3
scratch and dent defect
defects on top of or underneath the polarizer, or other optical components in the active display area

3.2.3.1
scratch defect
light(white) line that can be seen over a darker background and does not vary in size

3.2.3.2
dent defect
light (white) spot that can be seen over a darker background and does not vary in size

3.2.4
foreign material defect
defect that is located between panel and backlight unit

3.2.5
bubble defect
defect that is caused by a cavity or gas in the liquid crystal material in paste of polarizer / reflector

3.2.6
light leakage defect
light that is visible between top case (chassis) and outer black matrix in bezel open area

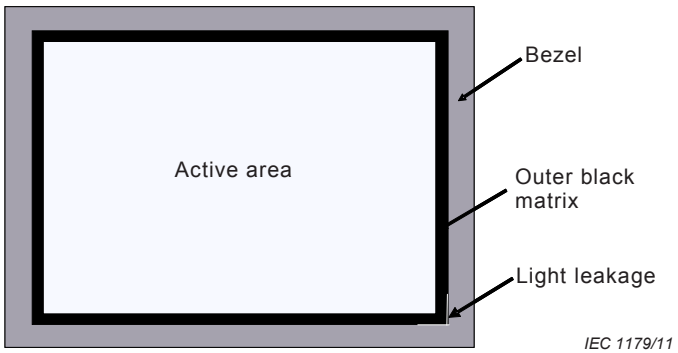


Figure 5 – Example of light leakage between top case and outer black matrix

3.2.7
mura
non-uniformity
visual imperfection in luminance or chromaticity

[definition 3.3.27 of IEC 61747-1:2003]

Under consideration.

4 Visual inspection method and criteria

4.1 Standard inspection conditions

4.1.1 Ambient conditions

4.1.1.1 Temperature

All visual inspection shall be carried out under specified temperature. Follow IEC 61747-5, 1.4.3 “Standard atmospheric conditions for measurements and tests”.

4.1.1.2 Humidity

All visual inspection shall be carried out under specified humidity. Follow IEC 61747-5, 1.4.3 “Standard atmospheric conditions for measurements and tests”.

4.1.1.3 Illuminance

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

4.1.2 Visual inspection conditions

4.1.2.1 Viewing angle range

The inspection shall be conducted within specified viewing angle range of liquid crystal display modules.

4.1.2.2 Viewing distance

The distance between device under test (DUT) and inspector’s eyes should be set at optimum distance. The optimum distance depends on pixel size, display size, application type, and defect size.

4.1.3 Electrical driving conditions

4.1.3.1 Driving supply voltage or current of DUT

Specified voltage and / or current shall be supplied to DUT.

4.1.3.2 Test pattern

Test patterns shall be specified in detail specification. For example, the test patterns for visual inspection are the full raster of white, gray, all primary colour patterns under the specified luminance range.

4.2 Standard inspection method

4.2.1 Setup of inspection equipment and liquid crystal display modules

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

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

4.2.2 Inspector and limit sample for visual inspection

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

4.2.3 Inspection and record of result

Inspector shall carry out the visual inspection based on specified procedure and record the result on recording sheets with specified inspection condition.

4.3 Criteria

4.3.1 Bright subpixel defects

The maximum number of bright defects shall be specified in specification.

– One subpixel---------- To be specified in detail specification
– Adjacent subpixels----------To be specified in detail specification
– Total amount of bright subpixels---------- To be specified in detail specification

4.3.2 Dark subpixel defects

The maximum number of dark defects shall be specified in specification.

– One subpixel---------- To be specified in detail specification
– Adjacent subpixels---------- To be specified in detail specification
– Total amount of dark subpixels----------To be specified in detail specification

4.3.3 Intermediate subpixel defects

The maximum number of intermediate defects shall be specified in specification:

– One subpixel---------- To be specified in detail specification
– Adjacent subpixels----------To be specified in detail specification
– Total amount of subpixels----------To be specified in detail specification

4.3.4 Cluster subpixel defects

The maximum number of cluster defects shall be specified in specification.

Also the minimum distance between subpixel defects (d_v and d_h, see Figure 4) shall be specified.

– Cluster subpixels---------- To be specified in detail specification

4.3.5 Bright line defect

All kinds of bright line defects such as vertical, horizontal or cross are not allowed.

4.3.6 Dark line defect

All kinds of dark line defects such as vertical, horizontal or cross are not allowed.

4.3.7 Scratch and dent defect

The criteria for scratch and dent defects are provided in Table 1 and Figure 6. The symbol of "*a*" and "*b*" indicates the major axis and minor axis of polarizer defect.

Extraneous substances which can be wiped out, like finger print, particles, are not considered as a defect. Scratches and dents located on the black matrix (outside of active area) are not considered as defects.

Table 1 – Criteria of scratch and dent defects

Item		Criteria
Scratches	Linear ($a>2b$)	Minimum ≤ width [mm] ≤ maximum, minimum ≤ length [mm] ≤ maximum, *N* (number of defect)≤ maximum
Dent	Circular ($a\leq 2b$)	Minimum ≤ average diameter, $(a+b)/2$ [mm] ≤ maximum, *N* (number of defect) ≤ maximum

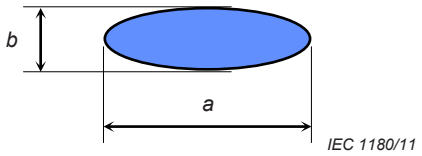


Figure 6 – Shape of scratch and dent defect

4.3.8 Foreign material and bubble defect

The criteria for foreign material, like dust, thread, etc, located inside of DUT, and bubbles, like air, gas, etc. are provided in Table 2 and Figure 7.

Table 2 – Criteria for foreign material and bubble defect

Item	Criteria
Foreign material	*N* (number of defect): maximum size of defect < max [*a*, *b*]
Bubble	*N* (number of defect): maximum size of defect < max [*a*, *b*]

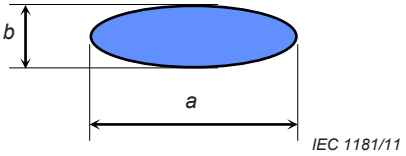


Figure 7 – Shape of foreign material and bubble defect

4.3.9 Light leakage defect

There shall be no visible light from backlight unit around the edges of the screen.

Bibliography

IEC 61747-6:2004, *Liquid crystal and solid-state display devices – Part 6: Measuring methods for liquid crystal modules – Transmissive Type*

ISO 13406-2:2001, *Ergonomic requirements for work with visual displays based on flat panels – Part 2: Ergonomic requirements for flat panel displays*

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