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INTERNATIONAL STANDARD

Liquid crystal display devices –
Part 3: Liquid crystal display (LCD) cells – Sectional specification

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Part 3: Liquid crystal display (LCD) cells – Sectional specification

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIQUID CRYSTAL DISPLAY DEVICES –

Part 3: Liquid crystal display (LCD) cells – Sectional specification

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International Standard IEC 61747-3 has been prepared by IEC technical committee 110: Electronic display devices.

This International Standard is a sectional specification for liquid crystal display cells. It is be used in conjunction with IEC 61747-1-1:2014.

This third edition cancels and replaces the second edition, published in 2006. This edition constitutes a technical revision.

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

a) All the references to IECQ and QC were removed in accordance with ISO/IEC Directives Part 2, 6.7.1 and 6.7.2;

b) Updated normative references.

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

CDV	Report on voting
110/532/CDV	110/616/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 the parts in 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- withdrawn,
- replaced by a revised edition, or
- amended.

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

LIQUID CRYSTAL DISPLAY DEVICES –

Part 3: Liquid crystal display (LCD) cells – Sectional specification

1 Scope

This part of IEC 61747 applies to liquid crystal cells of the segment type monochrome. It gives details of the quality assessment procedures, inspection requirements, screening sequences, sampling requirements and test and measurement procedures required for the assessment of liquid crystal display cells.

Instead of the qualification approval procedure, the capability approval procedure can be applied for all products manufactured in a defined process.

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 61747-1-1:2014, *Liquid crystal display devices – Part 1-1: Generic – Generic specification*

IEC 61747-10-1, *Liquid crystal display devices – Part 10-1: Environmental, endurance and mechanical test methods – Mechanical*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
production line
arrangement of process operations in production permitting sequential occurrence at various stages of production

EXAMPLE Examples of processes:

a) electrode patterning process;

b) alignment treatment process;

c) assembly process;

d) liquid crystal material filling process;

e) finishing process;

f) inspection process.

Note 1 to entry: Quality assessment procedures are not included in these phases.

3.2
production lot
devices of the same type, manufactured in the same production lines and passing through the same nominated process, normally within one month

3.3
major changes
any change in the manufacturing process or technology which could affect the quality or performance of a product supplied to an approved specification, or which could require a product to be transferred from one similarity group to another group

EXAMPLE

Examples of major changes:

a) electrode patterning: completely different pattern;

b) material of substrate: thickness of glass substrate;

c) type of LC material: type of electro-optical effect, e.g. TN, STN, etc.;

d) pin assignment change.

Note 1 to entry: See 4.4 below.

Note 2 to entry: Equipment change without changing the technology is not considered as a major change.

Note 3 to entry: It is the responsibility of the designated management representative (DMR) to decide whether the change is major or not.

Note 4 to entry: Any major change is only to be implemented with notification and demonstration by test evidence of quality.

4 Quality assessment procedure

4.1 Primary stage of manufacture

The primary stage of manufacture of liquid crystal display cells is the first process of the patterning of electrodes.

4.2 Production process

The production process of liquid crystal display cells is classified as follows:

a) Electrode patterning process

This process is the set of manufacturing process operations from the primary stage to the last step for the patterning of the electrodes.

b) Alignment treatment process

This process is the set of manufacturing process operations to form the alignment layer on the glass substrate for controlling the liquid crystal molecular direction.

c) Assembly process

This process is the set of manufacturing process operations comprising the seal printing and the transfer plate assembling.

d) Liquid crystal material filling process

This process is the set of manufacturing process operations comprising the filling of liquid crystal material between the two parallel glass substrates, and the sealing.

e) Finishing process

This process is the final set of manufacturing process operations comprising the fitting of polarizer and reflector, as well as the marking.

f) Inspection process

This process is the final set of process operations before lot release, comprising visual inspection of dimensions and electrical and optical characteristics.

4.3 Subcontracting

The approved manufacturer shall ensure that the following conditions are satisfied:

a) The subcontracted manufacturing process may be either a part of, or a whole of, the cell and/or module manufacturing process, unconditionally, including screening steps which are incorporated in them. Screening operations applied after the assembly process may also be independently subcontracted.

b) It shall be ensured that the DMR that is certifying the components
   - has been provided with the full quality assessment and inspection documentation of any operation outside the specified geographical area. The documentation shall include the inspection records for each sample of the product which undergoes inspection;
   - regularly verifies that the quality assessment and inspection is applied in accordance with the agreed requirements.

c) The DMR shall be provided with, and shall agree with the procedures for the transfer of the parts from the place of manufacture within the specified geographical area which is certifying the components.

d) Any changes in inspection requirements and manufacturing procedures shall be reported back to the DMR that is certifying the modules.

e) The approved manufacturer shall perform the acceptance tests prescribed by the detail specification for the components it is certifying. It can perform the acceptance tests in a facility outside the specified geographical area.

f) Acceptance tests can be subcontracted to approved test laboratories within the specified geographical area.

4.4 Structural similarity procedures

4.4.1 General

Structural similarity procedures are intended to permit a reduction in the number of inspection lots for quality assessment that shall be tested.

Therefore, in case of reassessment by extension of approved types or change of the design, the testing data which was performed within the same grouping products may be used.

4.4.2 Structurally similar cells

Structurally similar cells are produced by one manufacturer, essentially to the same design, with the same material, manufacturing process and method.

The crucial criterion for the grouping of types of cells as structurally similar is that the differences between the various types have no influence on the results of the test for which the group has been formed.

4.4.3 Test-dependent criteria for structural similarity

The test-dependent criteria for structural similarity applicable to group B (lot-by-lot inspections), and group C (periodic tests), are given in Table 1.

Items a) to i) specify the interpretation of these criteria for structural similarity.

a) Materials

   Glass substrate: the material for glass substrate shall be the same.

Material of alignment layer: the material for alignment layer shall be the same.

Sealing material: the sealing material shall be the same.

Liquid crystal material: the liquid crystal material shall be the same.

Materials of polarizer and reflector: the materials of polarizer and reflector shall be the same.

b) Cell size

Where the cells are within ±50 % of the display area, they can be considered as structurally similar.

c) Electrode construction

The material and the basic design shall be the same.

d) Process (common)

The basic process and process materials shall be the same.

e) Production lines (common)

The cells shall be made on the same lines.

f) Methods and measures

Essential technical methods and measures used shall be the same, e.g. type of electro-optical effect (TN/STN, etc.), optical mode of operation (reflective, transflective, etc.).

g) Structure

The thickness of the glass substrate, gap of the cell, etc., shall be the same.

h) Marking

The same material shall be used for marking, and the essential process condition of marking shall be the same.

i) Rating

The rating values as specified on the detail specification shall be the same, except for the items dependent on the cell dimensions, such as current consumption, electrical capacitance, etc.

4.5 Qualification approval procedure

Qualification approval shall normally be granted when satisfactory results have been achieved on completion of the inspection requirements (including testing items, condition, final sampling size, etc.) to be used as specified in Table 2 of this specification.

However, in case of fixed sampling sizes, the sampling requirements in accordance with those stated in Table 7 and Table 8 may be used.

4.6 Quality conformance test

4.6.1 General

The quality conformance test is defined in IEC 61747-1-1:2014, 5.6.

4.6.2 Division into groups and subgroups

Division into groups and subgroups shall be in conformance with IEC 61747-1-1:2014, 5.6.2. In addition, the groups and subgroups shall satisfy the following conditions:

– Groups A and B: one test lot contains devices produced within a period of one month or four weeks as indicated by the used date code(s).

– Group C: samples from a production submitted for periodic testing shall have been manufactured within a period of three months as indicated by three consecutive month date codes or by 13 consecutive week date codes.

– Group D: samples from a production submitted for periodic testing shall have been manufactured within a period of 12 months as indicated by 12 consecutive month date codes or by 52 consecutive week date codes.

4.6.3 Groups and categories

The groups shall be in accordance with Table 3.

4.6.4 Group A – Lot-by-lot tests

These tests shall be prescribed in accordance with Table 4.

4.6.5 Group B – Lot-by-lot tests

These tests shall be prescribed in accordance with Table 5.

4.6.6 Group C – Periodic tests

These tests shall be prescribed in accordance with Table 6.

4.6.7 Group D – Periodic tests

These tests shall be performed for qualification approval, and thereafter annually where required only.

They shall be prescribed in the detail specification.

4.6.8 Dimensions to be checked

The dimensions to be checked as part of groups B and C shall be prescribed in the detail specification.

Also, where applicable, optical related dimensions and the group in which they are tested shall be given in the detail specifications.

4.6.9 Sampling requirements (fixed sampling sizes)

Table 7 gives sampling requirements for group A tests and Table 8 gives sampling requirements for group B and C tests, both for lot sizes between 501 and 3 200.

The other sampling sizes shall be specified in the blank detail specification (BDS) for different lot sizes.

4.7 Capability approval procedure

Under consideration.

4.8 Screening

When screening is specified in the detail specification or the order, it shall be applied to all devices in the production.

Screening is normally performed before group A, B and C tests. When screening is performed after meeting the requirements of group A and B on a lot-by-lot basis, and group C on a periodic basis, the soldering, sealing and group A tests shall be repeated.

Additional post-screening tests may be required as specified in the detail specification.

The test shall be prescribed in accordance with Table 9.

4.9 Delayed deliveries

Before delivery of lots which have been in store for more than one year, the lots or the quantities to be delivered shall undergo the specified group A tests and the soldering tests of group B. Once this has been done for the complete lot, no further retesting is required for one year.

5 Test and measurement procedures

The testing and measuring methods of electrical and optical characteristics for liquid crystal display cells shall be in conformance with IEC 61747-1-1. These tests shall be referred to in the detail specification, when required.

Table 1 – Test-dependent criteria for structural similarity

Test item \ Criteria	Substrate		Electrode patterning				Alignment treatment				Assembly				Liquid crystal material filling				Finishing						Ratings			
	4.4.3 a) Materials	4.4.3 g) Structure	4.4.3 a) Materials	4.4.3 c) Electrode construction	4.4.3 d) Process (common)	4.4.3 e) Production lines (common)	4.4.3 a) Materials	4.4.3 d) Process (common)	4.4.3 e) Production lines (common)	4.4.3 f) Methods and measures	4.4.3 a) Materials	4.4.3 d) Process (common)	4.4.3 e) Production lines (common)	4.4.3 g) Structure	4.4.3 a) Materials	4.4.3 d) Process (common)	4.4.3 e) Production lines (common)	4.4.3 f) Methods and measures	4.4.3 a) Materials	4.4.3 b) Cell size	4.4.3 d) Process (common)	4.4.3 e) Production lines (common)	4.4.3 f) Methods and measures	4.4.3 h) Marking	4.4.3 i) Damp, temperature characteristics	4.4.3 i) Electrical characteristics	4.4.3 i) Optical characteristics	4.4.3 i) Mechanical characteristics
External visual examination	X	X										X	X						X		X	X	X	X				X
Visual defects			X		X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X					
Electrical characteristics at 25 °C				X			X	X	X	X	X	X	X	X	X	X	X	X								X		
Electrical characteristics at $T_{amb\ max.}$ and $T_{amb\ min.}$							X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X		
Optical characteristics at 25 °C				X			X	X	X	X	X	X	X	X	X	X			X		X	X	X				X	
Optical characteristics at T_{amb} max. and $T_{amb\ min.}$							X	X	X	X	X	X	X	X	X	X			X		X	X	X		X		X	
Dimensions		X										X	X						X	X	X	X	X					X
Robustness (of terminations) [1]																			X		X							
Storage (at high temperature)											X	X	X	X	X	X	X	X	X		X	X	X		X			
Storage at low temperature											X	X	X	X	X	X	X	X	X		X	X	X		X			
Damp heat, cyclic (12-hour+12-hour cycle)											X	X	X	X	X	X	X	X	X		X	X	X		X			
Electrical endurance or equivalent accelerated stress testing							X	X			X	X			X	X										X		
Light exposure															X	X			X		X							
Permanence of marking																								X				
Soldering [1]																					X	X						
Resistance to soldering heat [1]																					X	X						
Shock or vibration	X	X									X	X	X	X					X		X							X

NOTE A cross (X) in the table denotes that the criterion is mandatory for the corresponding test.

[1] This item depends on the termination method.

Table 2 – Qualification approval tests

Group	Subgroup	Tests	IEC publication	Condition of tests	Category I		Category II		Category III	
					n	*c*	*n*	*c*	*n*	*c*
0	0-1	External visual examination	61747-1-1		24	0	40	0	40	0
	0-2	Visual defects		Black spot and open, short						
	0-3A 0-3B	Electrical characteristics	61747-1-1	To be specified in the detail specification						
	0-4	Optical characteristics at 25 °C								
1	1-1	Dimensions	61747-1-1		3	0	5	0	5	0
	1-2	Robustness of terminations (D)	61747-10-1							
	1-3	Soldering (D)								
2	2-1	Resistance to soldering heat and change of temperature, followed by either: – damp heat, cyclic or low air pressure – electrical and optical characteristics test (D)	61747-10-2		3	0	5	0	5	0
	2-2	Shock or vibration, followed by – acceleration, steady-state – electrical and optical characteristics test (D)	61747-10-1		3	0	5	0	5	0
3	3-1	Electrical endurance or equivalent accele-rated stress testing (D)		Condition to be specified in the detail specification	3	0	5	0	5	0
	3-2	Storage (at high temperature) (D)	61747-10-2	240 h for category I 500 h for category II 1 000 h for category III	3	0	5	0	5	0
	3-3	Storage (at low temperature) (D)		240 h for category I 500 h for category II 1 000 h for category III	3	0	5	0	5	0
	3-4	Light exposure (D)		To be specified in the detail specification	3	0	5	0	5	0
	3-5	Permanence of marking (D)			3	0	5	0	5	0

n = sample size
c = group acceptance criterion (permitted number of defectives per group or subgroup)
D = destructive

NOTE The following items are not applied to the panel without the terminal leads: 1-2, 1-3 and resistance to soldering heat of 2-1 and IEC 61747-10-2.

Table 3 – Groups and categories of assessed quality

Group	Category I	Category II	Category III
Screening			X
A	X	X	X
B	X [a]	X	X
C	X [a]	X	X
[a] Annually, one lot meets the B and C group inspection requirements.			

Table 4 – Group A – Lot-by-lot tests

Subgroup	Tests	IEC publication	Details and conditions
A1	External visual examination	61747-1-1	
A2	Display cosmetics		To be specified in the detail specification, if needed
A3 A4	Electrical and optical characteristics	61747-1-1	To be specified in accordance with the applicable methods
Those tests which are not specified in this specification shall be specified in the detail specification.			

Table 5 – Group B – Lot-by-lot tests

Subgroup	Tests	IEC publication	Details and conditions
B1	Dimensions (interchangeability)	61747-1-1	In accordance with the drawing given in the detail specification
In case of category I, see IEC61717-1-1:2014, 4.4. Those tests which are not specified in this specification shall be specified in the detail specification.			

Table 6 – Group C – Periodic tests

Subgroup	Tests	IEC publication	Details and conditions
C1	Dimensions	61747-1-1	In accordance with the drawing given in the detail specification
C2a	Electrical and optical characteristics (design parameter)	61747-1-1	To be specified in the detail specification
C2b	Electrical and optical characteristics (different condition)		To be specified, for example, measurements at temperature limits in the detail specification
C2c	Electrical and optical rating verification		To be specified in the detail specification
C3	Robustness of terminations (D)	61747-10-1	
C5	Resistance to soldering heat and rapid change of temperature, followed by – low air pressure – electrical and optical characteristics test (D)	61747-10-2	

Subgroup	Tests	IEC publication	Details and conditions
C6	Mechanical shock or vibration, followed by – acceleration, steady state – electrical and optical characteristics test (D)	61747-10-1	
C7	Damp heat cyclic (D)	61747-10-2	
C8	Electrical endurance or equivalent accelerated stress testing (D)	–	
C9a	Storage (at high temperature) (D)	61747-10-2	
C9b	Storage (at low temperature) (D)		
C11a	Light exposure (D)		
C11b	Permanence of marking (D)		
CRRL	Certified records of released lots		Attributes information as specified in the blank detail specifications
Item (D) refers to the destructive tests. Those tests which are not specified in this specification shall be specified in the detail specification.			

Table 7 – Sampling requirements for group A tests

Subgroup	Category I		Category II		Category III	
	n	*c*	*n*	*c*	*n*	*c*
A1	8	0	13	0	13	0
A2	8	0	13	0	13	0
A3	8	0	13	0	13	0
A4	8	0	13	0	13	0

n = fixed sample size

c = group acceptance criterion

Table 8 – Sampling requirements for group B and C tests

Subgroup		Category I		Category II		Category III	
		n	*c*	*n*	*c*	*n*	*c*
B1	C1	5	0	8	0	8	0
	C2a	5	0	8	0	8	0
	C2b	5	0	8	0	8	0
	C2c	5	0	8	0	8	0
	C3	5	0	8	0	8	0
B4	C4	5	0	8	0	8	0
	C5	5	0	8	0	8	0
B5		5	0	8	0	8	0
B6	C6	5	0	8	0	8	0
	C7	3	0	5	0	5	0
B8	C8	3	0	5	0	5	0
B9	C9a	3	0	5	0	5	0
	C9b	3	0	5	0	5	0
	C11a	3	0	5	0	5	0
	C11b	3	0	5	0	5	0

n = fixed sample size

c = group acceptance criterion

Table 9 – Screening test item and conditions

Item	Details and conditions
cxBurn in	Operation at specified maximum temperature for more than 6 h. Details to be specified in the specification.

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