

INTERNATIONAL STANDARD

IEC
61747-3

QC 720200

First edition
1998-02

**Liquid crystal and solid state display devices –
Part 3:
Sectional specification for liquid crystal
display (LCD) cells**

*Dispositifs d'affichage à cristaux liquides
et à semi-conducteurs –*

*Partie 3:
Spécification intermédiaire pour les cellules
pour dispositifs d'affichage à cristaux liquides*



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International Electrotechnical Commission
Telefax: +41 22 919 0300

3, rue de Varembe Geneva, Switzerland
e-mail: inmail@iec.ch IEC web site <http://www.iec.ch>



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**LIQUID CRYSTAL AND SOLID-STATE DISPLAY DEVICES –
Part 3: Sectional specification for liquid crystal display (LCD) cells**

FOREWORD

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International Standard IEC 61747-3 has been prepared by subcommittee 47C: Optoelectronic, display and imaging devices, of IEC technical committee 47: Semiconductor devices.

This part of IEC 61747 is a sectional specification for liquid crystal display cells. It should be read together with the generic specification to which it refers.

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

FDIS	Report on voting
47C/196/FDIS	47C/201/RVD

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

The QC number that appears on the front cover of this publication is the specification number in the IECQ Quality Assessment System for Electronic Components (IECQ).

LIQUID CRYSTAL AND SOLID-STATE DISPLAY DEVICES –

Part 3: Sectional specification for liquid crystal display (LCD) cells

1 Scope

This sectional specification applies to liquid crystal cells of the segment type monochrome liquid crystal display cells. It gives details of the quality assessment procedures, the 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, it is allowed to apply the capability approval procedure (see rules of procedure QC 001002, subclause 11.7, but at present capability approval procedure for the liquid crystal display cells is under consideration) for all products manufactured in a defined process.

All the requirements of this specification remain valid, unless modified by the requirements set out in 4.7.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of IEC 61747. At the time of publication, the edition indicated was 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 edition of the normative document indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

3 Definitions (related to manufacturing operations)

For the purpose of this part of IEC 61747, the following definitions apply.

3.1 production line

a single set of process operations including one or several of the following manufacturing phases:

- a) electrode patterning process;
- b) alignment treatment process;
- c) assembly process;
- d) liquid crystal material filling process;
- e) finishing process;
- f) inspection process.

NOTE – Quality assessment procedures are not included in these phases.

1) To be published.

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 Changes in manufacturing operations

3.3.1

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 (see 4.4.1 below). It is the responsibility of the chief inspector to decide whether the change is major or not

Any major change is only to be implemented with notification and demonstration by test evidence of quality to the National Supervising Inspectorate (NSI)

Examples of major changes are

- a) electrode patterning: complete different pattern;
- b) material of substrate: thickness of glass substrate;
- c) type of LC material: type of electro-optical effect, e.g. TN, STAN, etc.;
- d) pin assignment change.

NOTE – Not considered as a major change: equipment change without changing the technology.

4 Quality assessment procedure

Quality assessment procedure is defined as outlined below.

4.1 Primary stage of manufacture

For the purpose of this sectional specification, the primary stage of manufacture of liquid crystal display cells is the first process of the patterning of electrodes.

4.2 Manufacturing process

The manufacturing process of liquid crystal display cells is classified as given below.

a) Electrode patterning process

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

b) Alignment treatment process

This process is the set of manufacturing process operations to form the alignment layer onto the glass substrate and to treat the controlling of 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, and the marking.

f) Inspection process

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

4.3 Subcontracting

When the approved manufacturer invokes the rules of procedure 11.1.2 of IEC QC001002 concerning subcontracting, he shall ensure that the following conditions are satisfied:

- 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.

The NSI shall be satisfied that the chief inspector who is certifying the components under the IECQ system

- has been provided with the full quality assessment and inspection documentation of any operation outside the IECQ 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.

The chief inspector shall be provided and shall agree with the procedures for the transfer of the parts from the place of manufacture within the IECQ geographical area which is certifying the components. The NSI shall be informed and have access to the applicable documents.

Any changes in inspection requirements and manufacturing procedures shall be reported back to the chief inspector who is certifying the modules. The major changes shall be reported by an approved chief inspector to the NS (see 3.3.1 above).

The approved manufacturer shall perform the acceptance tests prescribed by the detail specification for the components he is certifying. He can perform the acceptance tests in a facility outside the IECQ geographical area, provided that this facility is supervised by the NSI.

Acceptance tests can be subcontracted to approved test laboratories within the IECQ geographical area.

4.4 Structural similarity procedures

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

4.4.1 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.

4.4.2 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.

Subclause 4.4.2 a) to 4.4.2 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 have within 150 % to 50 % 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 along 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, transfective, etc.)

g) Structure

Thickness of 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

4.5.1 Qualification approval tests

Qualification approval shall normally be granted when satisfactory results have been achieved on completion of method a) of the rules of procedure (11.3.1 of QC 001002), and 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 request, method b) of the rules of procedure (11.3.1 of QC 001002), may be used, with the sampling requirements in accordance with those stated in table 7 and table 8.

4.6 Quality conformance test

Quality conformance test is defined in 3.6 of IEC 61747-1/QC 720000.

4.6.1 Division into groups and subgroups

Division into groups and subgroups shall be in conformance with IEC 60747-10/QC 700000, subclause 3.7. 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 productions 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 productions 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.

4.6.2 Groups and categories

The groups shall be in accordance with table 3.

4.6.3 Group A – Lot-by-lot tests

These tests shall be prescribed in accordance with table 4.

4.6.4 Group B – Lot-by-lot tests

These tests shall be prescribed in accordance with table 5.

4.6.5 Group C – Periodic tests

These tests shall be prescribed in accordance with table 6.

4.6.6 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.

4.6.7 Dimensions to be checked

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.

4.6.8 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 the lot size 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. These tests shall be referred to in the detail specification when required.

Table 1 – Test dependent criteria for structural similarity

Test item	Substrate		Electrode patterning			Alignment treatment			Assembly			Liquid crystal material filling			Finishing				Ratings							
	4.4.2 a) Materials	4.4.2 g) Structure	4.4.2 a) Materials	4.4.2 c) Electrode construction	4.4.2 d) Process (common)	4.4.2 e) Production lines (common)	4.4.2 a) Materials	4.4.2 d) Process (common)	4.4.2 e) Production lines (common)	4.4.2 a) Materials	4.4.2 d) Process (common)	4.4.2 e) Production lines (common)	4.4.2 a) Materials	4.4.2 d) Process (common)	4.4.2 e) Production lines (common)	4.4.2 f) Methods and measures	4.4.2 a) Materials	4.4.2 b) Cell size	4.4.2 d) Process (common)	4.4.2 e) Production lines (common)	4.4.2 f) Methods and measures	4.4.2 h) Marking	4.4.2 i) Damp, temperature characteristics	4.4.2 j) Electrical characteristics	4.4.2 i) Optical characteristics	4.4.2 i) Mechanical characteristics
External visual examination	X	X																								
Display cosmetics			X		X	X	X	X	X	X	X	X	X	X	X	X	X									
Electrical characteristics at 25 °C																										
Electrical characteristics at T_{amb} max. and T_{amb} min.						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	
Optical characteristics at T_{amb} max. and T_{amb} min.							X	X	X	X	X	X	X	X			X					X		X		
Dimensions		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+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		
Light exposure													X	X												
Permanence of marking																	X		X			X				
Soldering ¹⁾																										
Resistance to soldering heat ¹⁾ and rapid change of temperature, followed by either – damp heat, cyclic or low air pressure – electrical and optical characteristics test																										
Mechanical shock or vibration, followed by – acceleration, steady state – electrical and optical characteristics test	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	Sub-group	Tests	IEC publication	Condition of tests	Category I		Category II		Category III		
					n	c	n	c	n	c	
0	0-1	External visual examination	61747-5 ¹⁾	Black spot and open, short	24	0	40	0	40	0	
	0-2	Visual defects									
	0-3A 0-3B	Electrical characteristics	61747-6 ¹⁾	To be specified in the detail specification							
	0-4	Optical characteristics at 25 °C									
1	1-1	Dimensions	61747-5		3	0	5	0	5	0	
	1-2	Robustness of terminations (D)	61747-5 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)			3	0	5	0	5	0	
	2-2	Shocks or vibration, followed by – acceleration, steady state – electrical and optical characteristics test (D)									
3	3-1	Electrical endurance or equivalent accelerated stress testing (D)		Condition to be specified in the detail specification	3	0	5	0	5	0	
	3-2	Storage (at high temperature) (D)									240 h for CAT.I 500 h for CAT.II 1 000 h for CAT.III
	3-3	Storage (at low temperature) (D)									240 h for CAT.I 500 h for CAT.II 1 000 h for CAT.III
	3-4	Light exposure (D)									To be specified in the detail specification
	3-5	Permanence of marking (D)									

NOTE 1 – In this table:

n = sample size

c = group acceptance criterion (permitted number of defectives per group or subgroup)

D = destructive

NOTE 2 – 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.

¹⁾ To be published.

Table 3 – Groups and categories of assessed quality

Group	Category I	Category II	Category III
Screening			X
A	X	X	X
B	X (NOTE)	X	X
C	X (NOTE)	X	X

NOTE – 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	61747-5 ¹⁾	To be specified
A2	Display cosmetics		
A3 A4	Electrical and optical characteristics	61747-6 ¹⁾	To be specified in accordance with the applicable methods

NOTE – 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)	61747-5 ¹⁾	In accordance with the drawing given in the detail specification
B4	Soldering (D)	61747-5 ¹⁾	To be specified
B5	Change of temperature (D)		To be specified (detection of intermittent failures)
B6	Acceleration, steady state (D)		To be specified, depending on encapsulation (if required by the blank detail specification)
B8	Electrical endurance (D)	–	168 h (method to be specified)
B9	Storage (at high temperature) (D)	61747-5 ¹⁾	168 h (at maximum storage temperature)
Subgroup CRRL	Certified record of released lots		Attributes information as specified in the blank detail specifications

NOTE – In case of category I, see 2.6 in the generic specification.
Those tests which are not specified in this specification shall be specified in the detail specification.
The item (D) means the destructive tests.

¹⁾ To be published.

Table 6 – Group C: Periodic tests

Subgroup	Tests	IEC publication	Details and conditions
C1	Dimensions	61747-5 ¹⁾	In accordance with the drawing given in the detail specification
C2a	Electrical and optical characteristics (design parameter)	61747-5 ¹⁾	To be specified in the detail specification
C2b	Electrical and optical characteristics (different condition)	61747-6 ¹⁾	To be specified, for example, measurements at temperature limits
C2c	Electrical and optical rating verification		
C3	Robustness of terminations (D)	61747-5 ¹⁾	To be specified in the detail specification
C4	Soldering		
C5	Resistance to soldering heat and rapid change of temperature, followed by – low air pressure – electrical and optical characteristics test (D)		
C6	Mechanical shock or vibration, followed by – acceleration, steady state – electrical and optical characteristics test (D)		
C7	Damp heat cyclic (D)		
C8	Electrical endurance or equivalent accelerated stress testing (D)		
C9a	Storage (at high temperature) (D)		
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
NOTE – Those tests which are not specified in this specification shall be specified in the detail specification. The item (D) means the destructive tests.			

¹⁾ To be published.

Table 7 – Sampling requirements for group A tests

Subgroup	Category I		Category II		Category III	
	<i>n</i>	<i>c</i>	<i>n</i>	<i>c</i>	<i>n</i>	<i>c</i>
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

NOTE – In this table:
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		
	<i>n</i>	<i>c</i>	<i>n</i>	<i>c</i>	<i>n</i>	<i>c</i>	
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

NOTE – In this table:
n = fixed sample size
c = group acceptance criterion

Table 9 – Screening test item and conditions

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

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Withdrawn



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- Both English/French text

17. Other comments:
.....
.....
.....
.....
.....

18. Please give us information about you and your company

name:

job title:.....

company:

address:.....

.....

.....

No. employees at your location:.....

turnover/sales:.....

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Withdrawn