

INTERNATIONAL STANDARD



**Liquid crystal display devices –
Part 40-1: Mechanical testing of display cover glass for mobile devices –
Guidelines**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

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

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.



IEC 61747-40-1

Edition 2.0 2019-04
REDLINE VERSION

INTERNATIONAL STANDARD



**Liquid crystal display devices –
Part 40-1: Mechanical testing of display cover glass for mobile devices –
Guidelines**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.120

ISBN 978-2-8322-6854-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Mechanical performance testing guidelines.....	8
4.1 General.....	8
4.2 Mechanical testing guidelines for display cover glass for mobile devices	8
5 Brief overview of mechanical test methods	10
5.1 Edge strength	10
5.2 Surface impact resistance (energy-to-failure).....	10
5.3 Surface strength	10
5.4 Resistance against sharp contact surface damage and propagation under rigid support (energy-to-failure).....	11
5.5 Retained surface strength	11
Bibliography.....	12
Table 1 – Mechanical attributes and measurement methods	9
Table 1 – Comprehensive list of cover glass testing methods.....	9
Table 2 – Matrix of cover glass test methods and glass condition	10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIQUID CRYSTAL DISPLAY DEVICES –

**Part 40-1: Mechanical testing of display cover glass
for mobile devices – Guidelines**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 61747-40-1 has been prepared by IEC technical committee 110: Electronic displays.

This second edition cancels and replaces the first edition published in 2013. This edition constitutes a technical revision.

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

- a) withdrawal of test methods unsuitable for mobile display cover,
- b) revision of test methods based on newly developed market relevance,
- c) addition of test method for abraded strength,
- d) addition of explanations about the relevance between the test methods and the fracture mode, and
- e) revision of terms and definitions.

The text of this International Standard is based on the following documents:

CDV	Report on voting
110/1040/CDV	110/1093/RVC

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

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.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

Mobile electronic devices have become increasingly sophisticated and often incorporate displays for the purposes of user interface and viewing. Such displays commonly incorporate a transparent cover glass which aids in protecting the display against the introduction of damage through routine device transport and use, as well as occasional or accidental misuse.

The purpose of this document is to provide mechanical testing guidelines for cover glasses ~~utilized~~ used in such applications. Such glasses ~~may or may not~~ can be strengthened or not, for example via an ion-exchange process, which acts to increase mechanical strength through the introduction of a surface compressive layer.

It is assumed that all measurements – described in detail in individual test method standards – are performed by personnel skilled in the general art of mechanical property measurements. Furthermore, it ~~should be assured~~ is recommended that all equipment is suitably calibrated as is known to skilled personnel and that records of the calibration data and traceability are kept.

LIQUID CRYSTAL DISPLAY DEVICES –

Part 40-1: Mechanical testing of display cover glass for mobile devices – Guidelines

1 Scope

This part of IEC 61747 ~~is a~~ provides mechanical performance testing guidelines for cover glass used in electronic flat panel displays in mobile devices. This document focuses on key mechanical testing performance parameters and covers mainly strength and damage resistance attributes. The test methods ~~will~~ focus on the cover glass level testing only.

NOTE The glass used for cover glasses for electronic mobile devices can be chemically strengthened by an ion-exchange process. This ion exchange process increases the mechanical strength of the glass.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

abraded

subjected to a defined process which introduces mechanical abrasive damage to a portion of the specimen to be placed under tension during subsequent flexural strength testing

EXAMPLE Biaxial flexure via ring-on-ring.

3.2

as-received

representative of standard sample preparation and handling practices, and therefore free of intentional mechanical damage such as abrasion, scratching, or indentation

Note 1 to entry: The strength of glass is not an intrinsic material property, and like other brittle elastic materials, is highly dependent upon the surface flaw population. The term “as-received” is meant to represent the surface condition upon specimen receipt and ~~should be~~ is distinguished from a condition where damage has been intentionally introduced prior to testing.

3.3

central tension

CT

tensile stress generated within the interior of a glass article which serves to counteract (i.e., force balance) compressive stress acting at or near the article surface

~~Note 1 to entry: This note applies to the French language only.~~

3.4**chemically strengthened**

subjected to a molten salt bath containing alkali ions typically larger than those residing in the glass, resulting in the generation of residual compressive stress (3.5) and central tension (3.3)

3.5**compressive stress****CS**

maximum residual stress in compression measured near the glass surface

~~Note 1 to entry: This note applies to the French language only.~~

3.6**cover glass**~~cover lens~~

glass that typically protects an optical component such as a display from damage

3.7**damage resistance**

ability to resist certain potential damage-inducing events such as abrasion, ~~indentation or scratching~~

~~**2.8**~~~~**depth of layer**~~~~**DOL**~~

~~distance from the surface of a strengthened glass to the depth of zero stress or the depth of transition from compressive to tensile stress~~

~~Note 1 to entry: The ability to approximate this depth is dependent upon the measurement methodology chosen.~~

~~Note 2 to entry: This note applies to the French language only.~~

3.8**edge strength**

measured stress at failure in the case where failure is known to have originated from a specimen edge

3.9**mobile device**

electronic device that includes a battery and is designed to be carried about by consumers

3.10**retained surface strength**~~**abraded surface strength**~~

measured stress (or measured load or impact energy when stress cannot be measured) at failure in the case where failure is known to have originated from a specimen surface which has experienced a ~~prescribed~~ specified abrasion or mechanical damage event

3.11**strength**

stress, load, or impact energy at which a specimen fails for a given loading condition

3.12**thermally strengthened**

subjected to fast cooling of the glass exterior relative to the glass interior, resulting in the generation of residual compressive stress (3.5) and central tension (3.3)