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colour inside

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

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

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

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LIQUID CRYSTAL DISPLAY DEVICES –

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FOREWORD

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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- withdrawn,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.

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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)

4 Mechanical performance testing guidelines

4.1 General

The appropriate attribute(s) and test method(s) shall be selected based on the detail specification or depending on the purpose of the evaluation.

The standard environment for testing shall be as follows:

– temperature: 23 °C ± 3 °C

– relative humidity: 50 % ± 5 %

unless otherwise specified in the detail specification. These standard requirements are established to control fatigue effects when performing mechanical testing on glass. If environmental conditions differ from the standard environment, the conditions shall be reported with the test data.

4.2 Mechanical testing guidelines for display cover glass for mobile devices

~~The mechanical attributes and measurement methods are given in Table 1.~~

~~Table 1 – Mechanical attributes and measurement methods~~

~~Category~~	~~Attributes~~	~~Unit~~	~~Test method~~
~~Strength (as-received)~~	~~Edge strength~~	~~MPa~~	~~Uniaxial flexural strength (4-point bend)~~
~~Strength (as-received)~~	~~Surface strength~~	~~N~~	~~Biaxial flexural strength (ring-on-ring)~~
~~Impact resistance~~	~~Surface energy-to-failure~~	~~Joules~~	~~Biaxial flexural energy-to-failure (ball drop)~~
~~Surface damage resistance~~	~~Scratch performance~~	~~gF N~~	~~Scratch lateral crack visibility/retained strength~~
~~Surface damage resistance~~	~~Retained surface strength~~	~~N~~	~~Abraded biaxial flexural strength (ring-on-ring)~~
~~Surface damage resistance~~	~~Resistance to indentation cracking~~	~~gF N~~	~~Visual median radial crack resistance/retained strength~~

A comprehensive list of all cover glass test methods and failure mechanisms is given in Table 1.