IEC 61747-40-4

Edition 1.0 2015-01

INTERNATIONAL STANDARD

Liquid crystal display devices – Part 40-4: Mechanical testing of display cover glass for mobile devices – Biaxial flexural strength (ring-on-ring)

IEC 61747-40-4:2015-01(en)

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
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 It also gives information on projects, replaced and withdrawn publications.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 also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
More than 60 000 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 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: csc@iec.ch.

IEC 61747-40-4

Edition 1.0 2015-01

INTERNATIONAL STANDARD

Liquid crystal display devices – Part 40-4: Mechanical testing of display cover glass for mobile devices – Biaxial flexural strength (ring-on-ring)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 31.120

ISBN 978-2-8322-2212-6

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

LIQUID CRYSTAL DISPLAY DEVICES –

Part 40-4: Mechanical testing of display cover glass for mobile devices – Biaxial flexural strength (ring-on-ring)

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.

International Standard IEC 61747-40-4 has been prepared by technical committee 110: Electronic display devices.

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

CDV	Report on voting
110/570/CDV	110/610A/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 parts in the IEC 61747 series, published under the general title *Liquid crystal display devices*, can be found on the IEC website.

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.

INTRODUCTION

Mobile electronic devices have become increasingly sophisticated and often include 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 standard is to provide mechanical testing procedures for cover glasses utilized in such applications. Such glasses can be strengthened, for example via an ion-exchange process, which acts to increase mechanical strength through the introduction of a surface compressive layer.

LIQUID CRYSTAL DISPLAY DEVICES –

Part 40-4: Mechanical testing of display cover glass for mobile devices – Biaxial flexural strength (ring-on-ring)

1 Scope

This part of IEC 61747-40 is a mechanical performance testing procedure for cover glass used in electronic flat panel displays in mobile devices. This standard is focused on the measurement of as-received surface fracture load via biaxial flexure generated by ring-on-ring.

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 61747-40-1, *Liquid crystal display devices – Part 40-1: Mechanical testing of display cover glass for mobile devices – Guidelines*

IEC 61649:2008, *Weibull analysis*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
specimen
individual piece of glass to be tested to failure

3.1.2
sample
group of specimens sharing a common pedigree (such as manufacturing process and period of production), for which failure statistics can be generated and reported

3.1.3

sample size
number of specimens in a sample

3.1.4
nominal value
value about which a tolerance range is specified

3.2 Abbreviations

PTFE polytetrafluoroethylene

4 General

This test measures surface fracture load by forcing a ring through a specimen that is supported by another, larger ring. The two rings shall be parallel and concentric and the applied force shall be perpendicular to the surface formed by the top of the support ring. The loads at fracture are measured. These loads are not normalized to strength using factors such as specimen dimensions and material properties because significant non-linearities may exist which render the classical formulas inaccurate.

The test is applied to a sample of several specimens. The sample statistics of the fracture load values are defined in Clause 7. The statistical values to be reported or specified are given in Clauses 8 and 9.

The specimens to be tested are typically 50 mm to 60 mm in width and 50 to 110 mm in length, with thickness ranging from 0,55 mm to 2,0 mm. The specimen is placed on the support ring so it is centered on the ring. Before the specimen is placed on the support ring, the surface that will contact the load ring is covered with a layer of polymeric adhesive tape to preserve the fracture surface and reduce the scattering of glass fragments upon breakage. The support ring is also covered with PTFE film to minimize contact damage and friction.

The general requirements of the apparatus are given in Clause 5. Apparatus dimensions can be affected by specimen dimensions. These relationships are outlined in 5.4.

Testing procedures are given in Clause 6.

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

5 Apparatus

5.1 Testing environment and pre-conditioning

The standard testing environment is specified in 61747-40-1. Specimens shall be stored in such an environment for at least four hours before testing.

5.2 Testing frame

The testing frame provides the aspects needed for the controlled vertical movement of some mechanical elements relative to a test fixture surface. It also includes a load cell to indicate the applied force of these mechanical elements against other mechanical elements that are attached to the test surface and detectors to indicate displacement from the start of motion. A controller is also required to coordinate the necessary motions. These may be driven by external commands or by load cell responses. Examples of motion directives include:

- Jog up or down.
- Slow manual up or down until the stop button is pushed.
- Return to a preset start of test.
- Traverse downward at a fixed rate until fracture is detected, then stop.
- Emergency stop.

In addition to providing motion control and measurement of load, the controller shall, at minimum, report the fracture load, allow the setting of the cross head traverse rate, and display the load as a function of time and/or deflection from the start of the test. Other features can include:

- Collection, organization, storage, and reporting of information entered for the sample, its specimens, failure load data, and statistical analysis results.

The main structural elements of the testing frame shall be made of steel with dimensions large enough so compliance is essentially zero with respect to the maximum force that will be applied. This maximum force depends on the specimens being tested, but should generally be less than 10 kN. These elements include:

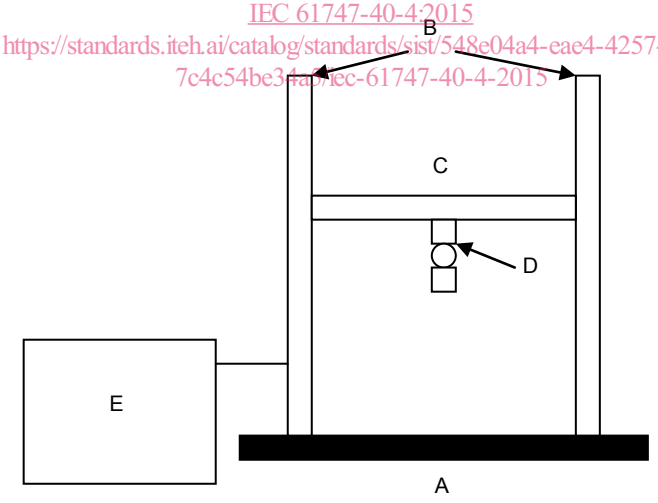
- the testing surface,
- vertical support columns,
- a cross head,
- motion tractors within the support columns,
- load cell assembly and attachment mechanisms.

The minimum and maximum rates of motion shall encompass the range of 0,001 mm/min and 1 000 mm/min.

The controller shall sample the load cell and displacement detectors at a minimum rate of 10 kHz.

The load cell shall be calibrated against a known weight, force gauge or load cell and be linear to within 1 % over the maximum applied force. The load cell shall be capable of being reset to zero after the attachment of mechanical elements to it before apparatus setup is complete. It shall also include an attaching mechanism.

Figure 1 illustrates some of the elements of the testing frame.



Key

A Testing surface
B Support columns
C Cross head (moves up and down)
D Load cell assembly
E Controller

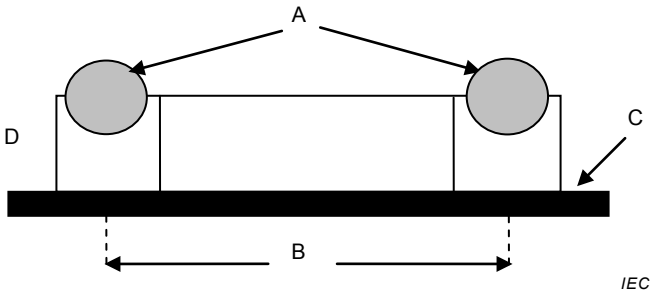
Figure 1 – Testing frame

5.3 Test fixture and setup

Subclause 5.3 outlines the generic test fixture elements and setup procedure. Subclause 5.4 identifies the requirements of the dimensional characteristics, which can depend on specimen characteristics.

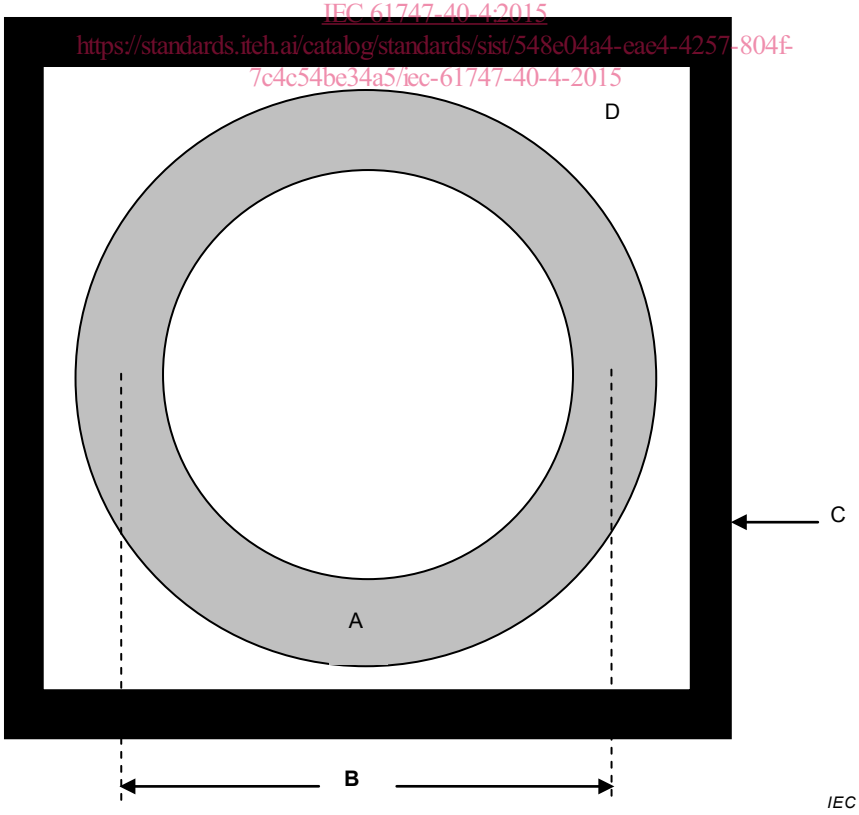
The primary test fixture elements are the support assembly and the load assembly. These are illustrated in from Figure 2 to Figure 5. Other test fixture elements include:

- Clamps used to fasten the support assembly to the test frame testing surface.
- Machined installation gage to align the support and load assemblies.
- Micrometer with flat anvil faces and resolution of 0,002 mm or better.



NOTE The key to the letters is provided in Figure 5.

Figure 2 – Support assembly (side view, cross-section)



NOTE The key to the letters is provided in Figure 5.

Figure 3 – Support assembly (top view)