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Durability test methods for electronic displays – Part 3-5: Mechanical tests – Surface durability

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FOREWORD

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International Standard IEC 63211-3-5 has been prepared by IEC technical committee 110: Electronic displays.

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

FDIS	Report on voting
110/1222/FDIS	110/1244/RVD

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.

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

A list of all parts in the IEC 63211 series, published under the general title *Durability test methods for electronic displays*, can be found on the IEC website.

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- withdrawn,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.

INTRODUCTION

This document relates to the common durability test methods applicable in the field of electronic displays, which may overlap with some of the parts of existing TC 110 documents that describe the durability test methods of the individual technologies, such as LCD, OLED, PDP and others. This document is intended to be used as the reference document in future standards and in revisions of existing. The existing standards will be revised in their maintenance time to refer to this document to the largest extent possible.

DURABILITY TEST METHODS FOR ELECTRONIC DISPLAYS –

Part 3-5: Mechanical tests – Surface durability

1 Scope

This part of IEC 63211 defines common procedures for surface durability mechanical test methods. This document generally describes the test equipment and procedures used for each method when applied on all levels, from parts (i.e. outermost surface parts of products, display panels and modules) to final products (i.e. finished displays or products).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements for this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62341-6-3, *Organic light emitting diode (OLED) displays – Part 6-3: Measuring methods of image quality*

IEC 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 62715-5-3, *Flexible display devices – Part 5-3: Visual assessment of image quality and defects*

IEC 62977-2-2, *Electronic displays – Part 2-2: Measurements of optical characteristics – Ambient performance*

ISO 15184, *Paints and varnishes – Determination of film hardness by pencil test*

ISO 19252, *Plastics – Determination of scratch properties*

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
scratch
mark or groove created by a sharp or pointed object cutting a surface in a single one-directional lateral movement of the object

3.2
abrasion
process of wearing away or deformation of a surface by repeatedly rubbing the surface

3.3
abrader
equipment for conducting abrasion tests

3.4
steel wool
special alloy steel which is processed into a thin and long fibrous form

Note 1 to entry: The cross section of the steel wool is polyhedral with edges.

Note 2 to entry: Steel wool is generally used as an abrasive.

4 Standard measuring conditions

4.1 Standard environmental measuring conditions

Mechanical and optical measurements shall be carried out under standard environmental conditions as follows:

- temperature: 25 °C ± 3 °C
- relative humidity: 50% ± 10%
- atmospheric pressure: 86 kPa to 106 kPa

When different environmental conditions are used, they shall be noted in the report.

4.2 Safety

All appropriate safety equipment shall be worn during testing. Guards shall be used to protect operators from being injured during testing. Specimen devices shall include safeguards in accordance with IEC 62368-1.

5 Mechanical test methods

5.1 Ball drop

5.1.1 General

This test evaluates the ability of the display surface to resist the point shock stresses that occur during impact when an object is dropped on it.

5.1.2 Test apparatus

5.1.2.1 Outline

The following components are important characteristics of the test apparatus (see Figure 1).

5.1.2.2 Height adjustment column

The height adjustment column shall be long enough to allow a drop height of at least 180 cm. An attached scale, or other measurement method, shall be used to measure the drop height to compensate for specimen thickness. Drop height is the distance from the test surface to the bottom of the ball when attached to the release mechanism.

5.1.2.3 Release mechanism

The release mechanism shall be attached to a beam that is perpendicular to the height adjustment column and be able to be repositioned on it. The release mechanism shall be powered by either an electromagnet, in the case of a steel ball, or a vacuum for any ball material. The release mechanism shall be actuated remotely via an electrical or pneumatic switch. The design shall allow free gravitational acceleration of the ball upon release.

5.1.2.4 Specimen holder

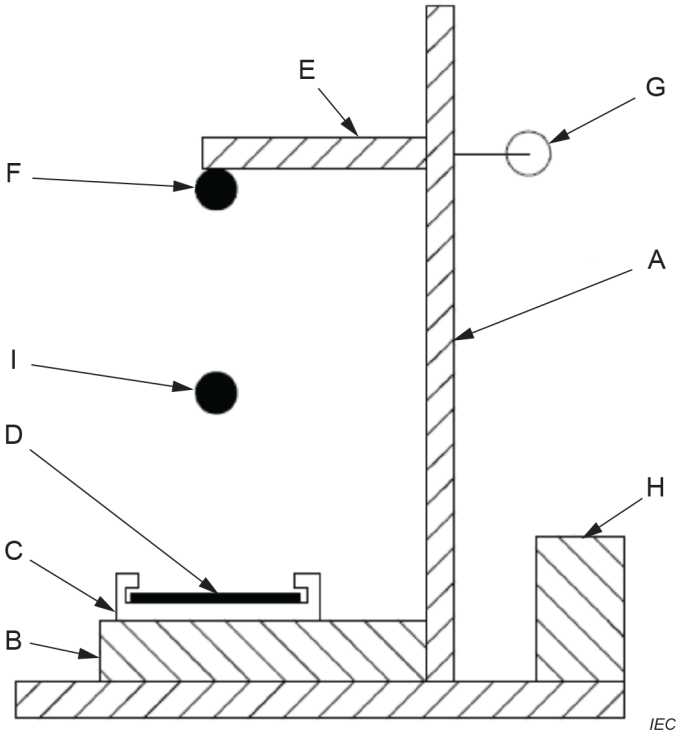
The specimen holder shall be made of a rigid material that minimizes damage to specimens when mounted in it. Flat or flexible specimens shall be allowed to rest securely in the specimen holder or can be secured using clamps. Specimens with curved backs will need custom specimen holders that stabilize them when secured to the base to prevent movement during testing. The use and purpose of other specialized specimen holders shall be stated in the results.

5.1.2.5 Base

The base shall be a dense rigid plate that is thick enough not to deform during testing and ensure minimal energy absorption. Steel or cast iron are ideal materials for the base, however, granite and other stone materials are also acceptable provided they are inspected prior to and after testing for chips or cracks and replaced if damage is found.

5.1.2.6 Ball

Ball materials shall be rigid materials that do not deform permanently or shatter on impact. A steel alloy with a hardness of C60 to C67 is the most common material. The diameter tolerance shall be no greater than ±0,05 mm from nominal, and the deviation from sphericity shall be no greater than 0,025 mm. The ball mass shall be within ±2,0 % of the specified value.



Key

A Height adjustment column
B Specimen base
C Specimen holder
D Specimen
E Ball release armature
F Ball release mechanism
G Armature height adjustment
H Ball release controller
I Ball (in freefall)

Figure 1 – Example of ball drop apparatus

5.1.3 Specimen preparation

The sample size shall be great enough to demonstrate repeatability of failure at the minimum height to induce damage as well as to determine the minimum height to induce damage via trial and error. Full display assembly specimens are also mounted on the display device. If damage is localized, multiple areas of a single specimen may be tested. Specimens with pre-existing damage shall either be excluded, or the damage shall be marked prior to testing if it will not influence further testing. All test point locations shall be included when reporting the data.

5.1.4 Test procedure

The test procedure shall be as follows:

a) Place the specimen in the specimen holder and align the impact zone with the test area of the specimen.
b) Secure the specimen holder to the base.
c) If required, clamp the specimen in place.
d) Set the ball release armature to the minimum drop height.
e) Load the ball.