

# INTERNATIONAL STANDARD



Printed electronics – **STANDARD PREVIEW**  
Part 502-1: Quality assessment – Organic light emitting diode (OLED) elements –  
Mechanical stress testing of OLED elements formed on flexible substrates  
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# INTERNATIONAL STANDARD



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PRINTED ELECTRONICS –**

**Part 502-1: Quality assessment – Organic light emitting diode (OLED) elements – Mechanical stress testing of OLED elements formed on flexible substrates**

FOREWORD

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International Standard IEC 62899-502-1 has been prepared by IEC technical committee 119: Printed electronics.

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

FDIS	Report on voting
119/138/FDIS	119/148/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 62899 series, published under the general title *Printed electronics*, 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

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## INTRODUCTION

In contrast to existing lighting tiles formed on heavy and rigid substrates, printed flexible organic light emitting diodes (OLED) are expected to be thin and light-weight, and to be used as flexible lighting elements for emerging applications such as newly designed lighting for, architecture, automobile, aircraft and so on.

It is highly beneficial to standardize quality assessment methods of printed flexible OLED elements for both manufacturers and users at an early stage of the growing market for the devices. In addition, the standardization helps to settle the contents for the technological development. The standardization of testing conditions for mechanical stress is very much expected to evaluate the printed flexible OLED elements and to accelerate the expansion of the printed electronics (PE) market opportunities for flexible device applications.

This document defines testing conditions for mechanical stress, in the form of curving, rolling, and/or folding on printed flexible OLED elements. The mechanical stresses for the test are applied as specific forms under defined conditions, which depend on the specific applications including rigidly fixed lighting for the printed flexible OLED elements. This document also defines coexisting environmental conditions such as temperature, humidity and air pressure. This document includes evaluation methods of optical and electrical properties for the performance change induced by the stress test on the printed flexible OLED elements.

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## PRINTED ELECTRONICS –

### Part 502-1: Quality assessment – Organic light emitting diode (OLED) elements – Mechanical stress testing of OLED elements formed on flexible substrates

#### 1 Scope

This part of IEC 62899 specifies the quality assessment methods, especially the mechanical stress test methods, for reliability assessment.

This document is applicable to flexible OLED elements formed on flexible substrates by printed electronics technology *excluding those OLED products, which are intended to be used for lighting purposes.*

#### 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 of 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 62715-6-1, *Flexible display devices – Part 6-1: Mechanical stress test methods*

<https://standards.iteh.ai/catalog/standards/si/62715-6-1/iec-62899-502-1-2017>

IEC 62341-5:2009, *Organic light emitting diode (OLED) displays – Part 5: Environmental testing methods*

IEC 62341-6-1, *Organic light emitting diode (OLED) displays – Part 6-1: Measuring methods of optical and electro-optical parameters*

IEC 62595-2-1:2016, *Display lighting unit – Part 2-1: Electro-optical measurement methods of LED backlight unit*

IEC 62922, *Organic light emitting diode (OLED) panels for general lighting – Performance requirements*

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62922 and IEC 62715-6-1, and the following 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 General terms

#### 3.1.1

##### **OLED element**

light emitting element formed with at least one light emitting organic semiconductor film layered with an anode electrode and a cathode electrode and classified into two categories, lighting and display

Note 1 to entry: For display usage, printed OLED elements are applicable for back-lighting, etc.

#### 3.1.2

##### **printed OLED element**

light emitting element formed with at least one printed layer in OLED structure, where the printed layer is selected from an anode electrode, hole injection layer, hole transport layer, light emitting layer, electron transport layer, electron injection layer, charge generation layer, cathode electrode, passivation layer, smoothing layer, etc.

#### 3.1.3

##### **flexible substrate**

substrate with flexibility on which a flexible light emitting element is attached such as plastic film, thin glass, metal foil, paper, or cloth

#### 3.1.4

##### **flexibility**

mechanically bendable property upon stress, which is restored to its original state after removal of the stress and which is deformed from its initial state

#### 3.1.5

##### **flexible OLED element**

mechanically bendable element in at least one step among substrate handling, manufacturing storage, use, operation, shipping and relocation

### 3.2 Terms related to optical and electrical properties

#### 3.2.1

##### **IVL characteristics**

correlation between electric power, product of current (I) and voltage (V), applied to the OLED element with a defined electrical condition and light flux (L) emitted from the OLED element

#### 3.2.2

##### **luminous flux**

total flux from the light source

Note 1 to entry: This is expressed as lumen (lm).

#### 3.2.3

##### **maintenance of luminous flux**

changes in the luminous flux of the OLED element for driving and/or storage to the initial luminous flux

#### 3.2.4

##### **luminance uniformity**

qualifying value of the distribution of luminance on OLED element(s) luminance uniformity or non-uniformity of the OLED element is evaluated as defined in IEC 62595-2-1:2016

### 3.3 Terms related to mechanical stress test

#### 3.3.1

##### **bending test**

deformation caused by external stress in the perpendicular direction on the flat plane of the OLED element

#### 3.3.2

##### **rolling test**

deformation caused by external stress which forms a rolled shape from a flat shape, on at least one area of the front-side surface facing the back-side surface of the OLED element

#### 3.3.3

##### **torsion test**

deformation which twists the OLED element plane, pulling each edge in different directions

#### 3.3.4

##### **tension test**

pulling force applied to at least one direction of the OLED element along the plane

## 4 Standard atmospheric condition for measurements and tests

Standard atmospheric conditions defined in IEC 62341-5:2009, 5.3, shall apply.

## 5 Evaluation methods of optical and electrical properties

### 5.1 General

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Both before and after mechanical stress testing in Clause 6, the following measurements on the electrical and optical characteristics of OLED element(s) shall be performed in the standard environmental conditions defined in Clause 4. Measurement samples shall be prepared according to 5.2 before the measurement defined in 5.3 and 5.4. IEC 62922 and IEC 62341-6-1 apply for measuring the optical and electro-optical parameters.

- a) IVL characteristics (5.3)
- b) luminous flux (5.4)

Measurements of maintenance of luminous flux are important parameters for OLED elements however these measurements may cause degradation of OLED elements which will disturb the evaluation of mechanical stress on OLED elements. Since these measurements would be made as final products, these measurements shall be eliminated for evaluating the OLED elements both before and after mechanical stress testing.

### 5.2 Sample preparation of OLED element(s) for optical and electrical measurements

For the measurements both before and after mechanical stressing, the OLED(s) sample being test shall be aligned on an appropriate support that should be a flat surface. In addition, OLEDs element(s) for the measurement shall be appropriate form for mechanical stress testing. If some of the OLED element(s) are small or have a narrow edge where clamping for mechanical testing will not be possible, the OLED element(s) should be fixed on a bendable support substrate with a suited adhesive strip or glue. Both adhesive strip and glue should not influence the measurement. Flatness and size of the sample shall be determined between supplier and customer.

NOTE In some cases, the testing sample is small to clamp for the mechanical stress testing. Then it is possible to fix on a support substrate for the testing.

For precise optical measurements, it is very important to define the alignment of the measurement specimen because flexible printed OLED element(s) can be easily deformed by