

# TECHNICAL REPORT



**Flexible display devices –  
Part 6-21: Mechanical test methods – Foldable durability test for foldable display  
set**

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## FLEXIBLE DISPLAY DEVICES –

**Part 6-21: Mechanical test methods –  
Foldable durability test for foldable display set**

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The text of this Technical Report is based on the following documents:

Draft	Report on voting
110/1426/DTR	110/1435A/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

A list of all parts in the IEC 62715 series, published under the general title *Flexible display devices*, 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- withdrawn,
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## FLEXIBLE DISPLAY DEVICES –

### Part 6-21: Mechanical test methods – Foldable durability test for foldable display set

#### 1 Scope

This part of IEC 62715, which is a technical report, provides information about various folding types and hinge structures of foldable products which can affect the durability of a foldable panel. This document focuses only on the issues concerning the foldable products and will not include product parts that do not affect display durability such as speakers, batteries, communication ports.

#### 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

##### **foldable panel**

flexible display panel which can be folded

##### 3.2

##### **foldable display set**

##### **foldable product**

device to which a foldable panel is applied

##### 3.3

##### **in-folding**

method used to fold the light emitting surface inward

##### 3.4

##### **out-folding**

method used to fold the light emitting surface outward

##### 3.5

##### **multi-folding**

method used to fold more than once in different positions

EXAMPLE The different folding positions can be in-out Z type or in-in G type.

##### 3.6

##### **in and out-folding**

method used to fold in both the inward and outward direction

**3.7*****R* value**

radius of curvature of the folding area

**3.8****folding area**

curved section of the panel due to folding

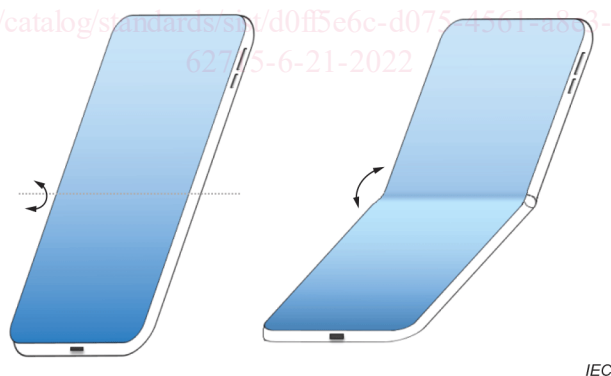
**4 Foldable devices technology****4.1 General**

The foldable product market has been growing steadily and the demand for foldable display panels is expected to increase in the future. The first foldable product was launched in 2019 and since then, various types of foldable products have been released during the past three years.

In 4.2, some of the techniques of the foldable product which affect the durability of the foldable panels are discussed.

**4.2 Classification of folding product****4.2.1 General**

The foldable product can be classified according to the folding method. The types of products released so far include in-folding and out-folding. Multi-folding (in-in folding, in-out folding) is expected in the future.

**4.2.2 In-folding products**

**Figure 1 – Example of in-folding product**

A foldable panel with the light emitting surface folded inward is called “in-folding” panel, and an “in-folding” product means a device to which the in-folding panel is applied. Figure 1 shows the most common type of the in-folding products. Such in-folding products have an advantage in that the panel surface can be protected in terms of durability because the panel is located inside the foldable product when folded.

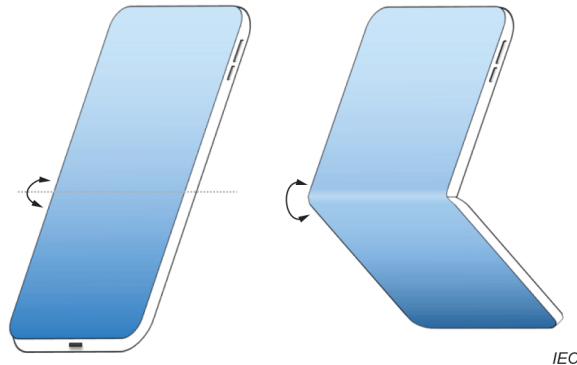
On the other hand, since the *R* value for in-folding is smaller, more sophisticated technology is needed to ensure device durability.

As the *R* value becomes smaller, the folding stress that the panel experiences increases. To mitigate this stress, the technology of the material, stack structure and module design will be optimized so that it can buffer against the folding stress.



### 4.2.3 Out-folding products

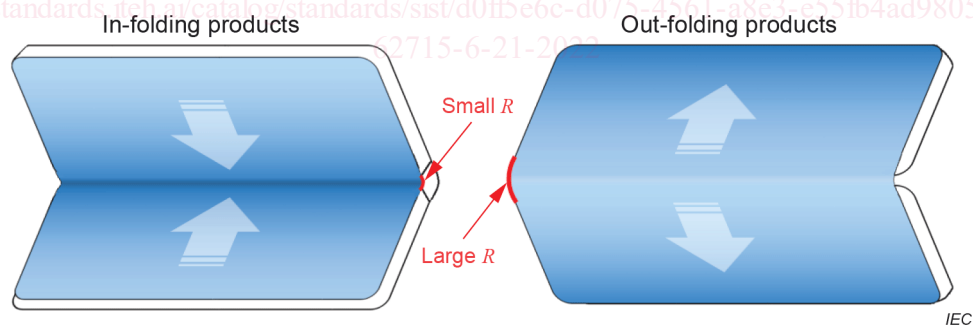
The “out-folding” panel has a light emitting surface on the outside of the panel when folded, and an “out-folding” product means the device to which the out-folding panel is applied as shown in Figure 2.



**Figure 2 – Example of out-folding product**

These out-folding products have a disadvantage with respect to durability because the surface of the foldable panel is exposed outward when folded so it is easily damaged. It is also more difficult to manage the flatness of the display surfaces when users configure the product in the unfolded state. This can cause distortion and bend of the display when viewed by the user. In addition, the screen can malfunction if it is unintentionally touched in the folded state.

On the other hand, compared to in-folding products, the  $R$  value for out-folding products is larger and results in a reduction of the folding stress. Figure 3 shows the  $R$  comparison between in-folding and out-folding products.



**Figure 3 –  $R$  comparison of in-folding versus out-folding**

### 4.2.4 Multi-folding products

Although they have not been released yet, it is expected that the multi-folding products that have a panel that can be folded several times will be launched in the near future.

Multi-folding products can fold the panel more than once. In terms of the types of product that can be folded twice, there is, for example, the in-out folding product of a Z-type that folds inward and outward once like a Z shape, as shown in Figure 4. Figure 5 shows the in-in folding product of a G-type which is folded inward twice.

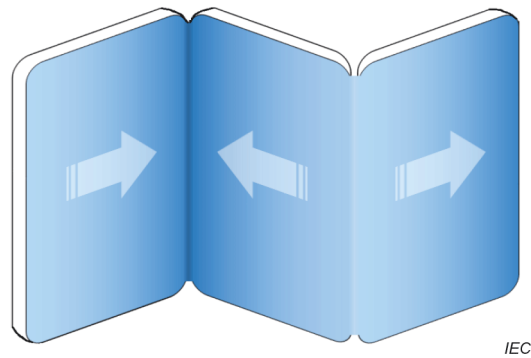


Figure 4 – Example of multi-folding Z-type product

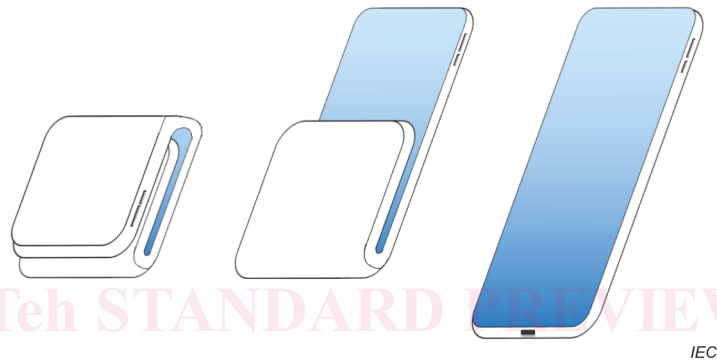


Figure 5 – Example of multi-folding G-type product

#### 4.2.5 In- and out-folding products

The foldable products released so far can be folded only in one fixed direction determined by the manufacturer, as described in 4.2.2 and 4.2.3. But it will also be possible to launch products in the future which can be folded not only inward but also outward so that a user can fold freely in both directions. Figure 6 shows the expected form of in and out-folding products.

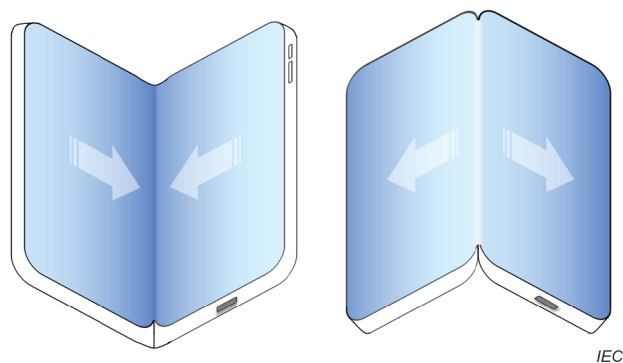


Figure 6 – In- and out-folding products

### 4.3 Hinge structure

#### 4.3.1 General

Subclause 4.3 describes the structure of the hinge that can affect the durability of the foldable display, especially the folding area.