IEC 61189-2-501

Edition 1.0 2022-02

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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## Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 2-501: Test methods for materials for interconnection structures – Measurement of resilience strength and resilience strength retention factor of flexible dielectric materials



## Méthodes d'essai pour les matériaux électriques, les cartes imprimées et autres structures d'interconnexion et ensembles – Partie 2-501: Méthodes d'essai des matériaux pour structures d'interconnexion – Mesure de la puissance élastique et du facteur de rétention de la puissance élastique des matériaux diélectriques flexibles

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# TEST METHODS FOR ELECTRICAL MATERIALS, PRINTED BOARDS AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

# Part 2-501: Test methods for materials for interconnection structures – Measurement of resilience strength and resilience strength retention factor of flexible dielectric materials

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IEC 61189-2-501 has been prepared by IEC technical committee TC 91: Electronics assembly technology. It is an International Standard.

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

| Draft | Report on voting |
|---|---|
| 91/1765/FDIS | 91/1774/RVD |

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 International Standard 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. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61189 series, published under the general title *Test methods for electrical materials, printed boards and other interconnection structures and assemblies*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

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- amended.

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# TEST METHODS FOR ELECTRICAL MATERIALS, PRINTED BOARDS AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

# Part 2-501: Test methods for materials for interconnection structures – Measurement of resilience strength and resilience strength retention factor of flexible dielectric materials

## 1 Scope

This part of IEC 61189 establishes a method suitable for testing the softness of FCCL (Flexible Copper Clad Laminate) products and related materials. This method determines the resilience under specified conditions. The test is performed on the sample as manufactured and without conditioning. The test does not apply to the resilience force lower than 10 mN.

## 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**
**softness**
property of little resistance to pressure

Note 1 to entry: This property enables easy molding.

**3.2**
**resilience force**
force produced by the deformation of an object under a force, which is opposite to the direction of the applied force

**3.3**
**maximum resilience force**
$L_{max}$
resilience force when compressed to the final distance, expressed in millinewtons (mN)

**3.4**
**resilience strength**
$F_{max}$
resilience force per unit width, expressed in millinewtons per millimetres (mN/mm)

**3.5**
**resilience force at the end of holding pressure**
$L_{end}$
resilience force after compression to the final distance and held for a specified time, expressed in millinewtons (mN)

**3.6**
**resilience strength at the end of holding pressure**
$F_{end}$
resilience force per unit width at the end of holding pressure, expressed in millinewtons per millimetres (mN/mm)

**3.7**
**resilience strength retention factor**
$K_{Rf}$
ratio of the resilience strength at the end of holding pressure to the maximum resilience strength at the final distance, reflecting the ability of the material to continue to retain the resilience after the compression is completed

**3.8**
**MD**
machine direction
direction of flexible dielectric materials passing through an assembly line viewed from the operator side



**3.9**
**TD**
transverse direction
direction perpendicular to the machine direction



**3.10**
**initial distance**
distance between the clamps before compression, expressed in millimetres (mm)

**3.11**
**clamp distance**
distance between the clamps, expressed in millimetres (mm)

**3.12**
**test equipment**
calibrated test equipment equipped with a load cell, capable of measuring to the nearest 0,001 N, and capable of a feed rate of (50 ± 1) mm per minutes

Note 1 to entry: The clamp jaws must cover the width of specimens.

**3.13**
**test fixture**
apparatus for compressing the test specimens

SEE: Figure 2

Note 1 to entry: See Annex A for additional information.

## 4 Test apparatus and materials

The test apparatus and materials are the following:

– micrometer: apparatus with 0,001 mm resolution for measuring the thickness of the test specimens;

– calliper: apparatus with 0,01 mm resolution for measuring the width of the test specimens;

– ruler: apparatus with 0,1 mm resolution for measuring the length of the test specimens;

– sample cutter: apparatus for cutting the test specimens;

– marking pen: apparatus for drawing a straight line on test specimens as shown in Figure 1 with a clearly readable colour, in contrast to the colour of the test specimen.

The marking should be durable through the whole test procedure.

## 5 Test specimens

Test specimens should be cut of unclad material. The size of each specimen should be (120 ± 2,0) mm × (15 ± 0,1) mm, described in Figure 1. Each specimen should be marked as described in Figure 1. The test specimen should be free of incisions, twists, wrinkles and burrs.






**Figure 1 – Test specimen**

## 6 Procedure

The procedure is as follows:

a) determine the thickness ($h$) and width ($W_S$) of each prepared specimen;

b) initial distance is set to (30 ± 0,05) mm;

c) set the distance of the clamps after compression according to Table 1; the distance between the clamps after compression is set according to the sample thickness, accurate to ± 0,05 mm, as shown in Table 1;

Dimensions in millimetres

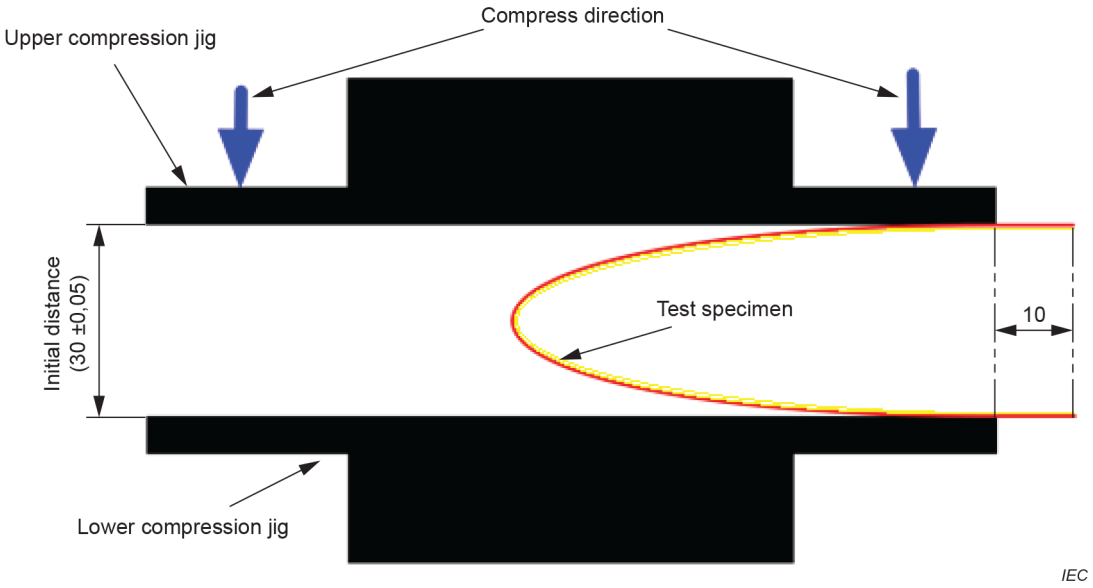


**Figure 2 – Schematic of compression jig with test specimen**



**Table 1 – Settings of distance between the clamps after compression**

| Specimen thickness, h | Clamps distance after compression |
|---|---|
| h < 0,1 mm | (1 ± 0,05) mm |
| 0,1 mm ≤ h < 0,2 mm | (2 ± 0,05) mm |
| 0,2 mm ≤ h < 0,3 mm | (3 ± 0,05) mm |
| 0,3 mm ≤ h < 0,4 mm | (4 ± 0,05) mm |
| Or user-defined | |



d) compression rate is set to (50 ± 1) mm/min;

e) pressure holding time after compression is set to (30 ± 0,5) s;

f) clamp the test specimen vertically in the upper and lower compression jigs to ensure that the marked lines at both end are parallel with the edge of the jigs;

g) test Single-side adhesive specimens in a manner of adhesive-side inward bending, and double-side asymmetric adhesive specimens in a manner of thicker adhesive-side inward bending;

h) set the force of test equipment to zero and start the compression process according to the above settings, and record the test process. The force curve is as shown in Figure 3;

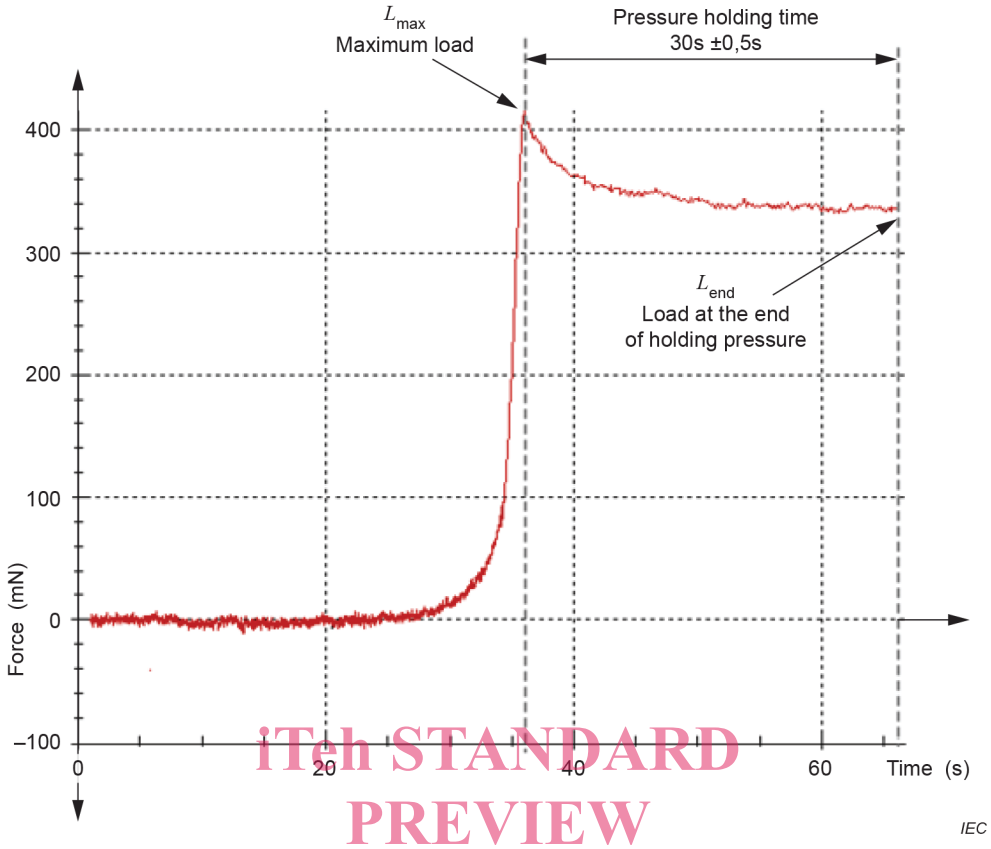


**Figure 3 – Force curve**



i) record the maximum load value $L_{max}$ and Load at the end of holding pressure value $L_{end}$ of each specimen.



## 7 Calculation

a) Calculate the maximum resilience strength per Formula (1):

$$F_{max} = \frac{L_{max}}{W_S} \quad (1)$$

where

$F_{max}$ is the maximum resilience strength, expressed in millinewtons per millimetres (mN/mm);

$L_{max}$ is the maximum load, expressed in millinewtons (mN);

$W_S$ is the measured width of the specimen, expressed in millimetres (mm).

b) Calculate the resilience strength at the end of holding pressure as per the Formula (2):

$$F_{end} = \frac{L_{end}}{W_S} \quad (2)$$

where

$F_{end}$ is the resilience strength at the end of holding pressure, expressed in millinewtons per millimetres (mN/mm);

$L_{end}$ is the resilience force at the end of holding pressure, expressed in millinewtons (mN);