
**Adhesives for organic electronic
devices — Determination of water
vapour transmission rate —**

**Part 2:
Edge seal methods**

*Adhésifs pour dispositifs électroniques organiques — Détermination
du taux de transmission de vapeur d'eau —*

Partie 2: Méthodes de l'étanchéité de bord



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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

A list of all parts in the ISO 21760 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning 4 Principle and 5 Test specimens given in structure of a water permeation cell.

ISO takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has ensured the ISO that he/she is willing to negotiate licenses either free of charge or under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from:

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Adhesives for organic electronic devices — Determination of water vapour transmission rate —

Part 2: Edge seal methods

1 Scope

This document specifies four methods for determining the water vapour transmission rate through the cross-section of an adhesive for edge seal in organic electronic devices, such as organic light emitting diodes and organic photovoltaic cells.

The methods provide rapid measurement over a wide range of water vapour transmission rates.

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.

ISO 15106-3, *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 3: Electrolytic detection sensor method*

ISO 15106-5, *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 5: Pressure sensor method*

ISO 15106-6, *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 6: Atmospheric pressure ionization mass spectrometer method*

ISO 15106-7, *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 7: Calcium corrosion method*

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:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

water vapour transmission rate

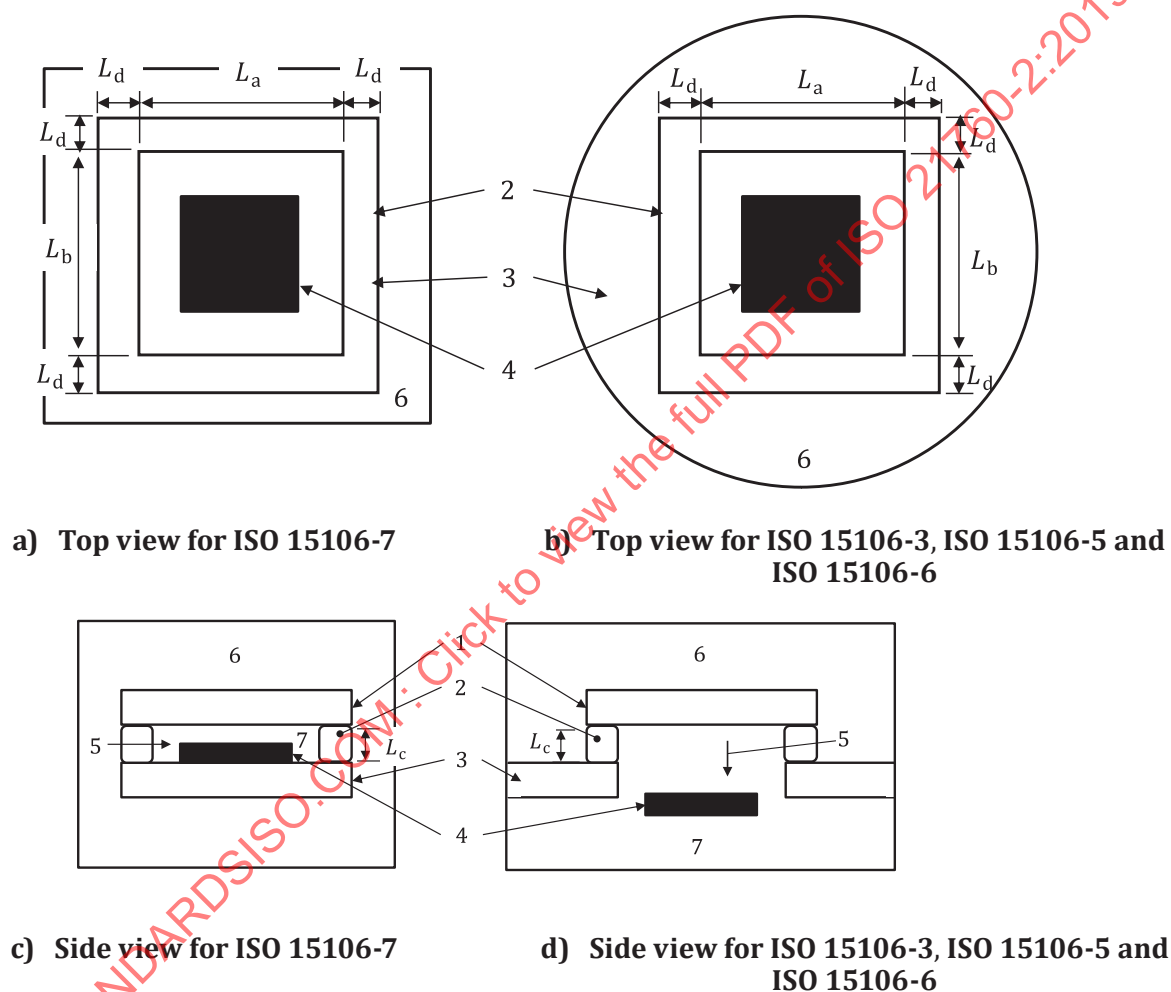
amount of water vapour transmitted through unit area of test specimen per unit time under specified conditions

Note 1 to entry: Water vapour transmission rate is expressed in grams per square metre per 24 h [$\text{g}/(\text{m}^2 \times 24 \text{ h})$].

4 Principle

Materials such as an organic layer and metal layer in the flexible organic electronic device are degraded by the penetration of a very small amount of water vapour. The hermetic lid and adhesive seal around

the edges of the lid are required to have high barrier properties. The method for determining the water vapour transmission rate of adhesive is specified in accordance with one of the following: ISO 15106-3, ISO 15106-5, ISO 15106-6, or ISO 15106-7. A water transmission cell is composed of a lid (upper substrate), a base plate (bottom substrate) and a test specimen bonding these substrates. Feed side and permeation side of water vapour are divided by the substrates with the test specimen (see [Figure 1](#)). A detector is placed on the permeation side where the space is evacuated by vacuum pump or filled with inert gas. Water vapour is introduced into the feed side, permeates the test specimen, and reaches the detector. The amount of water vapour which permeates through the cross-section of the test specimen is determined by an increase in optical transmission, in electrical resistivity of the calcium film deposited on the base plate (see [Figure 1](#) a and c), in intensity of H₂O mass-number, in pressure or in electric charge (see [Figure 1](#) b and d).



Key

1	lid (upper substrate)	6	feed side
2	test specimen	7	permeation side
3	base plate (bottom substrate)	L_a and L_b	inside size of test specimen
4	detector	L_c	thickness of test specimen
5	water vapour flow	L_d	width of test specimen

Figure 1 — Structure example of a water transmission cell

5 Test specimens

5.1 A base plate is made as follows, depending on the selected method for the water vapour transmission rate.

In the case of ISO 15106-3, ISO 15106-5 and ISO 15106-6, the shape of the base plate is circular, and its diameter should typically be 30 mm to 200 mm. The centre of the base plate is cut into a square or a rectangle with sides L_a and L_b .

In the case of ISO 15106-7, the water vapour transmission cell shall be prepared in an inert atmosphere. The base plate shall be optically transparent, the shape of the base plate shall be a square or a rectangle and the length of each side of the base plate should typically range from 20 mm to 100 mm.

NOTE The sample preparation in an inert atmosphere minimizes the influence of trace moisture on the calcium degradation before the water vapour transmission rate measurement according to ISO 15106-7.

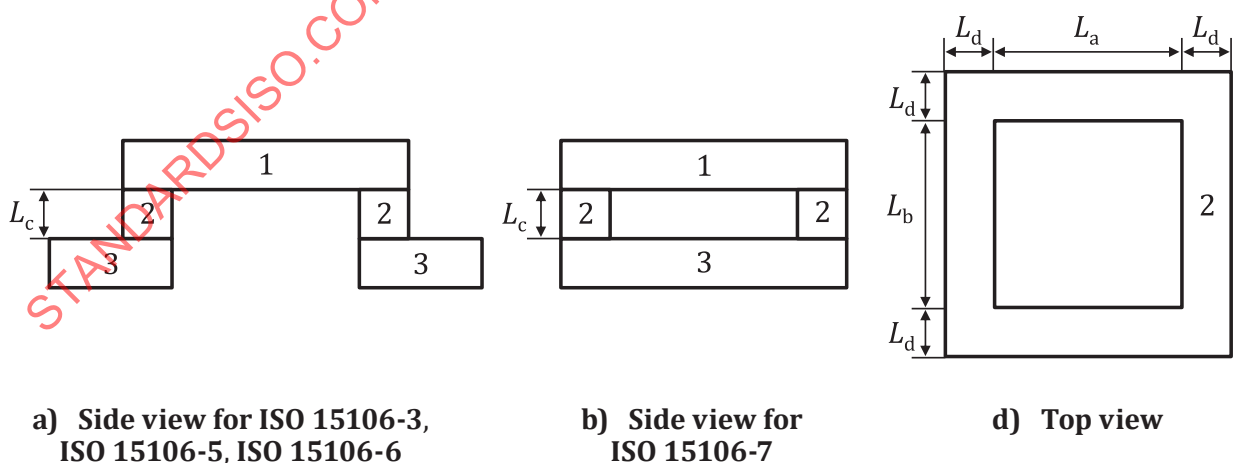
5.2 The length of each side of the lid shall be equal to or greater than the length of each side of the outer periphery part of the test specimen ($2L_d + L_a$ and $2L_d + L_b$). In the case of ISO 15106-7, the lid shall be transparent.

5.3 The test specimen is applied to the upper face of the peripheral edge of the opening of the base plate (bottom substrate) for ISO 15106-3, ISO 15106-5 and ISO 15106-6 or the peripheral edge of the base plate for ISO 15106-7. The lid (upper substrate) is then pressed onto the base plate (as shown in [Figure 2](#)).

The thickness (L_c) and width (L_d) of the test specimen is controlled by loading of spacers and weight when the lid is pressed onto the base plate. The width (L_d) and thickness (L_c) of the test specimen should typically range from 3 mm to 10 mm and from 0,01 mm to 0,1 mm, respectively.

Finally, the specimen is cured by UV irradiation or heated to bind the base plate and the lid. The temperature of the transmission cell shall be kept within $\pm 0,5$ °C of the test temperature by means of a temperature controller.

The size of substrates and a specimen other than these shall be agreed upon by the interested parties.



Key

1	lid (upper substrate)	L_a and L_b	inside size of test specimen
2	test specimen	L_c	thickness of test specimen
3	base plate (bottom substrate)	L_d	width of test specimen

Figure 2 — Example of a test specimen structure

5.4 The test specimen shall be representative of the material, free from cracks and air bubbles, and have uniform thickness.

5.5 Three test specimens shall be tested unless otherwise specified or agreed between the interested parties.

NOTE In some cases, testing more than three test specimens gives a more representative result.

6 Conditioning

Condition the test specimens in vacuum or inert atmosphere. The period of conditioning shall be as stated in the relevant specification for the material.

NOTE In some cases, heating the test specimen is effective for rapid conditioning.

7 Test method

One of four methods is used for measuring the amount of water vapour permeating through a specimen according to ISO 15106-3, ISO 15106-5, ISO 15106-6 or ISO 15106-7.

Fragile specimens are difficult to measure according to ISO 15106-5. Measurement according to ISO 15106-7:2015, Annex A requires non-opaque substrates. Measurement according to ISO 15106-7:2015, Annex B requires non-conductive substrates.

8 Procedure

Measure the water vapour transmission rate using a method selected from ISO 15106-3, ISO 15106-5, ISO 15106-6, ISO 15106-7.

9 Calculation

The water vapour transmission rate is calculated using $2L_c(L_a + L_b)$ instead of the transmission area and corrosion area defined in ISO 15106-3, ISO 15106-5, ISO 15106-6 or ISO 15106-7.

10 Test conditions

The test conditions shall preferably be chosen from those given in [Table 1](#).

Table 1 — Choice of test conditions

Test conditions	Temperature °C	Relative humidity %
1	25 ± 0,5	90 ± 3
2	40 ± 0,5	90 ± 3
3	60 ± 0,5	90 ± 3
4	85 ± 0,5	85 ± 3

Test conditions other than these shall be agreed upon by the interested parties.

11 Test result

Calculate the test result as the arithmetic mean of the results obtained for each test specimen, rounding to two significant figures.

12 Precision

The precision of this test method is not known because interlaboratory data are not available at the time of publication.

13 Test report

The test report shall include the following information:

- a) a reference to this document, i.e. ISO 21760-2:2019;
- b) the name of the apparatus and the part or the annex of the relevant part of ISO 15106;
- c) the test conditions;
- d) all details necessary for identification of the sample tested, including the adhesive type;
- e) the method of preparation of the test specimens;
- f) the length (L_a and L_b), thickness (L_c) and width (L_d) of the test specimens;
- g) transmission area [$2L_c(L_a + L_b)$];
- h) the material of the lid and the base plate;
- i) the number of specimens tested;
- j) details of specimen conditioning;
- k) the test result;
- l) the date of the test (or the period of the test).