



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS K 7129 : 2008

(JPIF/ JSA)

**Plastics — Film and sheeting —
Determination of water vapour
transmission rate — Instrumental
method**

ICS 83.140.10

Reference number : JIS K 7129 : 2008 (E)

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K 7129 : 2008

Date of Establishment: 1992-08-01
Date of Revision: 2008-03-20
Date of Public Notice in Official Gazette: 2008-03-21
Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Chemical Products

JIS K 7129 : 2008, First English edition published in 2008-10

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
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Contents

		Page
Introduction		1
1	Scope	1
2	Normative references	1
3	Terms and definitions	2
4	Principle	2
5	Test specimens	3
5.1	Shape of test specimen	3
5.2	Number of test specimens	3
5.3	Thickness measurement of test specimen	3
6	Conditioning	3
7	Test methods	3
8	Test result	4
9	Test report	4
Annex A (normative) Determination of water vapour transmission rate by humidity detection sensor method		5
Annex B (normative) Determination of water vapour transmission rate by infrared detection sensor method		9
Annex C (normative) Determination of water vapour transmission rate by gas chromatographic sensor method		13
Annex JA (informative) Comparison table between JIS and corresponding International Standards		19

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal of revision of Japanese Industrial Standard submitted by the Japan Plastics Industry Federation (JPIF)/ Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS K 7129** : 1992 is replaced with this Standard.

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Plastics—Film and sheeting—Determination of water vapour transmission rate—Instrumental method

Introduction

This Japanese Industrial Standard has been prepared based on the first editions of **ISO 15106-1** and **ISO 15106-2** published in 2003, and **ISO/DIS 15106-4** published in 2007 with some modifications of the technical contents.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standards have been modified. A list of modifications with explanations is given in Annex JA.

1 Scope

This Standard specifies an instrumental method for determining the water vapour transmission rate of plastic film, plastic sheeting and multi-layer structures including plastics, which have smooth surfaces without any embossed portions, using a humidity detection sensor, method, infrared detection sensor method and gas chromatographic sensor method.

NOTE : The corresponding International Standards and the symbol of degree of correspondence are as follows.

ISO 15106-1 : 2003 *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 1 : Humidity detection sensor method*

ISO 15106-2 : 2003 *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 2 : Infrared detection sensor method*

ISO/DIS 15106-4 : 2007 *Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 4 : Gas-chromatographic detection sensor method*

(Overall evaluation : MOD)

The symbols which denote the degree of correspondence in the contents between **JIS** and the relevant International Standards are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For the standards with the indication of year,

the edition of the indicated year shall be applied, and not any revisions (including amendments) made thereafter, and for those without, the most recent edition (including amendments) shall be applied.

JIS K 6900 *Plastics—Vocabulary*

JIS K 7130 : 1999 *Plastics — Film and sheeting—Determination of thickness*

NOTE : Corresponding International Standard : **ISO 4953** *Plastics—Film and sheeting—Determination of thickness by mechanical scanning (MOD)*

JIS K 8150 *Sodium chloride (Reagent)*

JIS K 8371 *Sodium acetate trihydrate (Reagent)*

JIS K 8953 *Zinc sulfate heptahydrate (Reagent)*

JIS K 9006 *Ammonium dihydrogenphosphate (Reagent)*

JIS Z 0208 *Testing methods for determination of the water vapour transmission rate of moisture-proof packaging materials (dish method)*

ISO 2528 *Sheet materials—Determination of water vapour transmission rate—Gravimetric (dish) method*

3 Terms and definitions

For the purposes of this document, the terms and definitions in JIS K 6900 and the following apply.

3.1 water vapour transmission rate (*WVTR*)

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

NOTE : Water vapour transmission rate is expressed in grams per square metre 24 hours [g/(m²·24 h)].

3.2 reference test specimen

a test specimen whose water vapour transmission rate is known, or one for which the water vapour transmission rate has been determined in accordance with JIS Z 0208 or **ISO 2528**

4 Principle

The dry chamber is separated from the wet chamber by a test specimen. The change in relative humidity in the dry chamber brought about by water vapour transmitted through the test specimen is detected (humidity detection sensor method and infrared detection sensor method) or the absolute amount of the transmitted water vapour is determined (gas chromatographic sensor method).

a) In humidity detection sensor method, the change in humidity in the dry chamber

caused by the water vapour transmitted through the test specimen is detected by the humidity sensor set in the dry chamber, and the time required for a specified change in relative humidity is measured. The water vapour transmission rate is calculated by the comparison of the result thus obtained with that of a reference test specimen (see Annex A).

- b) In infrared detection sensor method, the amount of water vapour transmitted to the dry chamber through the test specimen is detected by an infrared detection sensor, and by comparing the result with that obtained using a reference test specimen, the water vapour transmission rate is calculated (see Annex B).
- c) In gas chromatographic sensor method, the dry chamber is evacuated by a vacuum pump, and gas controlled to a specified relative humidity is introduced into a wet chamber. The water vapour transmitted through the test specimen is collected in a sampling loop for a specified duration, and the collected water vapour is measured by a gas chromatograph. The water vapour transmission rate is then calculated (see Annex C).

5 Test specimens

5.1 Shape of test specimen

The specimens shall be free from wrinkles, creases and pinholes, and have uniform thickness. Each specimen shall have a larger area than transmission area of the cell used for the test, and shall be hermetically mounted.

5.2 Number of test specimens

Three specimens at minimum shall be used unless otherwise specified or agreed between the interested parties.

5.3 Thickness measurement of test specimen

Determine the thickness of each specimen in accordance with method A of **JIS K 7130** at three points that are equally spaced.

6 Conditioning

Condition the specimens in accordance with 3.3.1 of JIS K 7130.

7 Test methods

The test methods to be applied shall be the humidity detection sensor method (Annex A), infrared detection sensor method (Annex B) and gas chromatographic sensor method (Annex C).

8 Test result

Calculate the test result as the arithmetic mean of the results obtained for each test specimen, rounding to the second place of decimals if the value is less than one, and to two significant figures if the value is greater than one.

NOTE : The precision of this test method is not known because inter-laboratory data are not available. When inter-laboratory data are obtained, a precision statement will be added at the following revision.

9 Test report

The test report shall include the following information :

- a) number of this Standard and the method used (humidity detection sensor method, infrared detection sensor method or gas-chromatographic sensor method) ;
- b) the test conditions (selected from among the conditions in table A.1, B.1 or C.1) ;
- c) apparatus used for measurement ;
- d) details of reference specimen, if used ;
- e) all details necessary for identification of the sample tested ;
- f) the method of preparation of the test specimens ;
- g) the side of the test specimen which faced the supply of water vapour, to be reported only in the case of multi-layer film, sheets, etc., the composition and construction of which are different between the front and rear surfaces.
- h) the transmission area of the test specimen ;
- i) the mean thickness of the test specimen ;
- j) the number of specimens tested ;
- k) if applicable in respective methods (see **A3.5**, **B3.5**, or **C4.7**) :
 - 1) in humidity detection sensor method, if applicable to adopted specimen, a statement that it was not possible to record two consecutive times within $\pm 5\%$;
 - 2) in infrared detection sensor method, if applicable to the adopted specimen, a statement that the output voltage from the infrared sensor was not constant to within $\pm 5\%$ (steady state) ;
 - 3) in gas chromatographic sensor method, if applicable to the adopted specimen, a statement that the water transmission amount (D_v) was not constant to within $\pm 5\%$ (steady state).
- l) the test result ;
- m) the date of the test.

Annex A (normative)

Determination of water vapour transmission rate by humidity detection sensor method

Introduction

This Annex specifies the method of determination of the water vapour transmission rate by a humidity sensor.

A.1 Apparatus

A.1.1 Example of apparatus

An example of a suitable apparatus is shown in figure A.1. The apparatus includes a transmission cell with two chambers, a lower (high-humidity i.e. wet) chamber and an upper (low-humidity i.e. dry) chamber between which a specimen is mounted, a humidity sensor for determining the relative humidity in the upper chamber, a pump for supplying air to the upper chamber, a drying tube, and a water reservoir.

A.1.2 Transmission cell

The wet chamber shall have been filled with water for testing. The dry chamber is designed to collect the water vapour which passes through the specimen from the high-humidity side, and the humidity sensor is mounted over this chamber. The temperature of the transmission cell shall be kept within ± 0.5 °C of the test temperature by means of a temperature controller. The transmission area shall be between 5 cm² and 100 cm². Furthermore, the surfaces of the transmission cell in contact with the specimen shall be smooth and flat so that gas leakage does not occur.

A.1.3 Humidity sensor

The humidity sensor shall be capable of detecting humidity changes of 0.05 % RH, and its response speed shall be no longer than 1 s. For each type of humidity sensor, the appropriate maintenance and calibration procedures shall be followed as specified by the manufacturer.

A.1.4 Water for test

The water reservoir shall contain distilled or deionized water.