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(JTETC)

Testing methods for water vapour
permeability of textiles

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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 for revision of Japanese Industrial Standard submitted by Japan Textile Evaluation Technology Council (JTETC) 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 L 1099**: 1993 is replaced with this Standard.

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Testing methods for water vapour permeability of textiles

1 Scope This Japanese Industrial Standard specifies the testing methods for water vapour permeability of textiles.

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS K 8125 *Calcium chloride (for U-tube)*

JIS K 8363 *Potassium acetate*

JIS L 0105 *General principles of physical testing methods for textiles*

3 Term and definition For the purpose of this Standard, the following term and definition applies:

- a) **water vapour permeability** the mass (g) of water vapour that has permeated a textile at a specified temperature and under a specified humidity is converted to the value per 1 m² of its textile and 1 h

4 Place of testing The testing shall be carried out at a place simulating, as far as practical, the standard condition specified in **5.1** of **JIS L 0105** and the temperature and relative humidity at the time of testing shall be mentioned in the test report.

5 Sampling and preparation of sample and test specimen The sample and test specimen shall be sampled and prepared in accordance with **6.3** or **6.4** of **JIS L 0105**. The test specimen shall be three pieces of the size in table 1 respectively.

6 Kind of test and size of test specimen The test shall be in accordance with any one of table 1.

Table 1 Kind of test and size of test specimen

Kind of test			Size of test specimen
Method A	Method A-1	Calcium chloride method	Approx. 7 cm in diameter
	Method A-2	Water method	
Method B	Method B-1	Potassium acetate method	Approx. 20 cm × 20 cm
	Method B-2	Alternative method of potassium acetate method	

NOTE : Potassium acetate method can not be applied to the sample permeated by water at the time of testing. The sample permeated by water shall be measured by the alternative method of potassium acetate method.

7 Testing methods

7.1 Method A

7.1.1 Method A-1 (calcium chloride method)

a) **Apparatus and materials** The apparatus and materials shall be as follows.

- 1) **Thermohygrostat**, capable of regulating at the specified temperature and humidity, and of circulating the air in the inside of the apparatus.
- 2) **Wind speed indicator**, capable of measuring the wind speed in the inside of the thermohygrostat to the nearest 0.1 m/s.
- 3) **Chemical balance**, capable of weighing the mass of specimen to the nearest 1 mg.
- 4) **Disk plate**, in flat form, made of synthetic resin and 60 mm in diameter and 3 mm in thickness
- 5) **Permeable cup**, as shown in figure 1, whose material is not permeated by water vapour. It shall be free from corrosion or change of the water permeability area when it is subjected to the test procedure.
- 6) **Desiccant**, specified in **JIS K 8125**.

Unit: mm

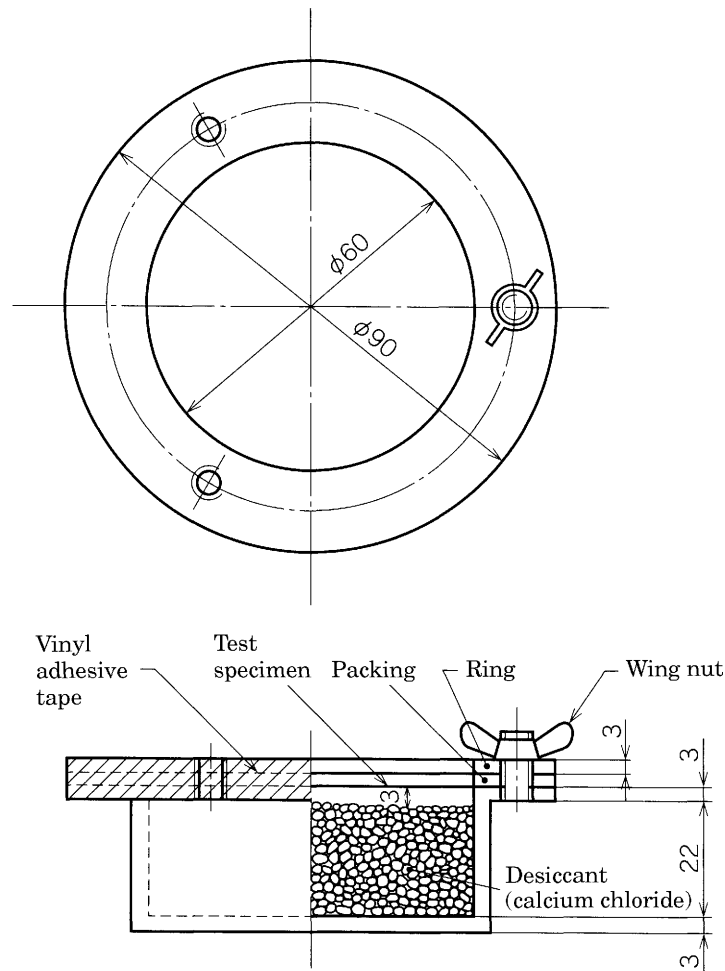


Figure 1 Permeable cup Method A-1 (calcium chloride method)

- b) **Operation** Put approximately 33 g of desiccant in a permeable cup warmed at approximately 40 °C beforehand, make it uniform by vibrating the cup, then smoothen the surface by medical spoon and make the distance between the desiccant and the lower surface of test specimen to be 3 mm by using a disk plate.

As shown in figure 1, place the test specimen on the cup so that its front surface faces the desiccant and it is concentric with the cup, and then put the packing and the ring in place and fix them with the wing nut. Seal the side periphery of the packing and the ring with vinyl adhesive tape to make it the test specimen.

Place this specimen in the position where the wind speed does not exceed 0.8 m/s at approximately 1 cm above the upper part of test specimen in a thermohygrostat maintained at 40 °C ± 2 °C temperature and under (90 ± 5) %RH⁽¹⁾ humidity.

Take out the specimen after 1 h and immediately weigh its mass (a_1) to the nearest 1 mg. After measuring, place the specimen again at the same position of the thermohygrostat. After 1 h, take out the specimen and immediately weigh the mass (a_2) to the nearest 1 mg.

Note (1) As occasion demands, the conditions of temperature and humidity may be altered. In any case, the temperature and humidity shall be mentioned in the test report.

- c) **Calculation** The water vapour permeability shall be calculated in accordance with the following formula and the test result shall be expressed by the mean value of three tests (up to an integer place).

$$P_{A1} = \frac{10 \times (a_2 - a_1)}{S_{A1}}$$

where, P_{A1} : water vapour permeability ($\text{g/m}^2 \cdot \text{h}$)
 $a_2 - a_1$: quantity of mass change of specimen per hour (mg/h)
 S_{A1} : permeated area (cm^2)

7.1.2 Method A-2 (water method)

- a) **Apparatus and materials** The apparatus and materials shall be as follows.

- 1) **Thermohygrostat**, specified in 7.1.1 a) 1).
- 2) **Wind speed indicator**, specified in 7.1.1 a) 2).
- 3) **Chemical balance**, specified in 7.1.1 a) 3).
- 4) **Permeable cup**, specified in 7.1.1 a) 5).

- b) **Operation** Pour 42 ml of water⁽²⁾ of a temperature approximately 40 °C in a permeable cup warmed to approximately 40 °C beforehand, and make the distance between the water and the lower surface of test specimen 10 mm.

Place the test piece so that its rear surface faces the water and that it is concentric with the cup and put the packing and the ring in place and fix them with the wing nut. Seal the side periphery of the packing and the ring with an adhesive tape and make it the test specimen.

Place this specimen on the position where the wind speed at approximately 1 cm above the upper part of test specimen does not exceed 0.8 m/s in a thermohygrostat maintained at 40 °C $\pm$ 2 °C temperature and under (50 $\pm$ 5) %RH⁽¹⁾ humidity.

After 1 h, take out the specimen and immediately weigh the mass (a_3) to the nearest 1 mg. After measuring, place the specimen again on the same position of the thermohygrostat. After 1 h, take out the specimen and immediately weigh the mass (a_4) to the nearest 1 mg.

Moreover, care shall be sufficiently taken in handling the specimen so as not to wet the test specimen by the water in permeable cup.

Note (2) It shall be distilled water or ion-exchanged water.

- c) **Calculation** The water vapour permeability shall be calculated in accordance with the following formula and the test result shall be expressed by the mean value of three tests (up to an integer place).

$$P_{A2} = \frac{10 \times (a_3 - a_4)}{S_{A2}}$$

where, P_{A2} : water vapour permeability ($\text{g/m}^2 \cdot \text{h}$)
 $a_3 - a_4$: quantity of mass change of specimen per hour
(mg/h)
 S_{A2} : permeated area (cm^2)

7.2 Method B

7.2.1 Method B-1 (potassium acetate method)

a) **Apparatus and materials** The apparatus and materials shall be as follows.

- 1) **Thermostat**, capable of regulating at the specified temperature.
- 2) **Chemical balance**, specified in 7.1.1 a) 3).
- 3) **Permeable cup**, as shown in figure 2, whose material is not permeated by water vapour. It shall be free from corrosion and change of permeated area during test operation.
- 4) **Test specimen supporting frame**, of synthetic resin of a approximately 80 mm inside diameter, approximately 50 mm height and 3 mm thickness in cylindrical form.
- 5) **Water tank**, capable of being housed in the thermostat and having the structure capable of fixing the test specimen supporting frame.
- 6) **Auxiliary film for measuring water vapour permeability**, being poly-tetrafluoroethylene film of approximately 25 μm thickness having the micro porous structure of approximately 80 % porosity⁽³⁾.
Note (3) The porosity means the rate of space to volume.
- 7) **Desiccant**, in the deposition state of crystal prepared by adding 100 ml of water to 300 g of potassium acetate specified in **JIS K 8363** and leaving to stand for a whole day and night.

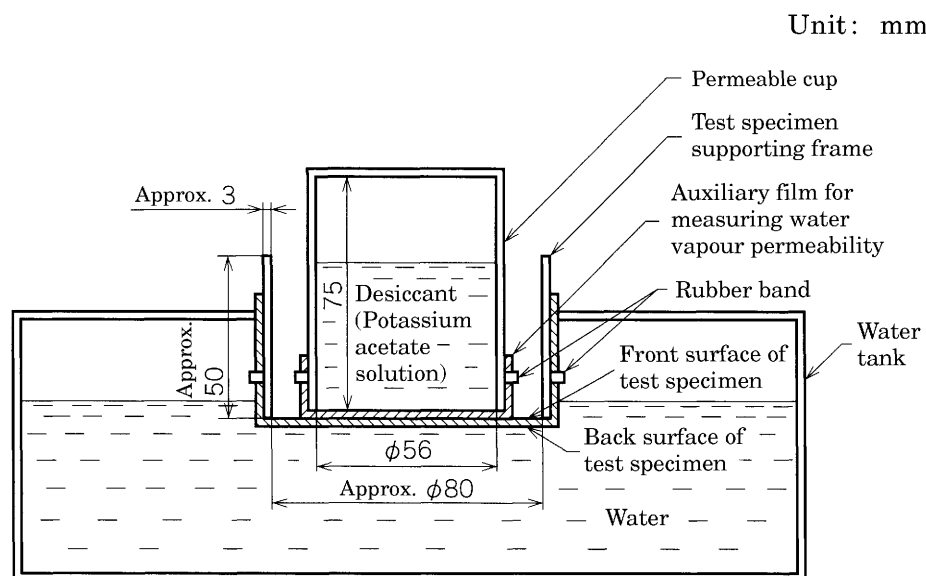


Figure 2 Permeable cup Method B-1 (potassium acetate method)

- b) **Operation** Fit the test specimen to the test specimen supporting frame by using rubber band so that the back surface of test specimen faces the outside of the supporting frame as shown in figure 2. Fix this test specimen supporting frame at the position (approximately 10 mm in water depth) where the test specimen is sufficiently immersed as shown in figure 2 in the water tank containing water maintained at approximately 23 °C placed in the thermostat, and leave it to stand for 15 min or longer.

The air maintained at the temperature of 30 °C ± 2 °C is circulated in this thermostat.

Then, put the desiccant maintained at an approximately temperature of 23 °C in the permeable cup up to approximately two thirds of the volume of permeable cup, fit the auxiliary film for measuring water vapour permeability approximately 10 cm × 10 cm in size by rubber band and take it as the specimen. Weigh the mass (a_5) of this specimen to the nearest 1 mg so as to make the fit side of film upside. After measuring, immediately make the specimen to stand reversely and put it on the test specimen supporting frame fixed to the water tank. Take out the specimen after 15 min, turn it over and weigh the mass (a_6) to the nearest 1 mg.

- c) **Calculation** The water vapour permeability shall be calculated in accordance with the following formula and the test result shall be expressed by the mean value of three tests (up to an integer place).

$$P_{B1} = \frac{40 \times (a_6 - a_5)}{S_{B1}}$$

where, P_{B1} : water vapour permeability (g/m² · h)

$a_6 - a_5$: quantity of mass change of specimen per 15 min (mg/min)

S_{B1} : permeated area (cm²)

7.2.2 Method B-2 (alternative method of potassium acetate method)

- a) **Apparatus and materials** The apparatus and materials specified in 7.2.1 a) shall be used.
- b) **Operation** Cover the back surface of the test specimen by using the auxiliary film for measuring water vapour permeability approximately 20 cm × 20 cm in size and fit it by rubber band so that the auxiliary film for measuring water vapour permeability faces the outside of the supporting frame as shown in figure 3. Fix this test specimen supporting frame to the position (approximately 10 mm in water depth) where the test specimen is sufficiently immersed as shown in figure 3 in the water tank containing water approximately at 23 °C in temperature placed in the thermostat, and leave it to stand for 15 min or longer.

Moreover, the air maintained at the temperature of $30\text{ °C} \pm 2\text{ °C}$ is circulated in this thermostat.

Then, put the desiccant maintained at an approximate temperature of 23 °C in the permeable cup up to approximately two thirds of the volume of the permeable cup, fit the auxiliary film for measuring water vapour permeability approximately 10 cm × 10 cm in size by rubber band and take it as the specimen. Weigh the mass (a_7) of this specimen to the nearest 1 mg so as to make the fit side of film upside. After measuring, immediately make the specimen to stand reversely and put it on the test specimen supporting frame fixed to the water tank. Take out the specimen after 15 min, turn over it and weigh the mass (a_8) to the nearest to 1 mg.

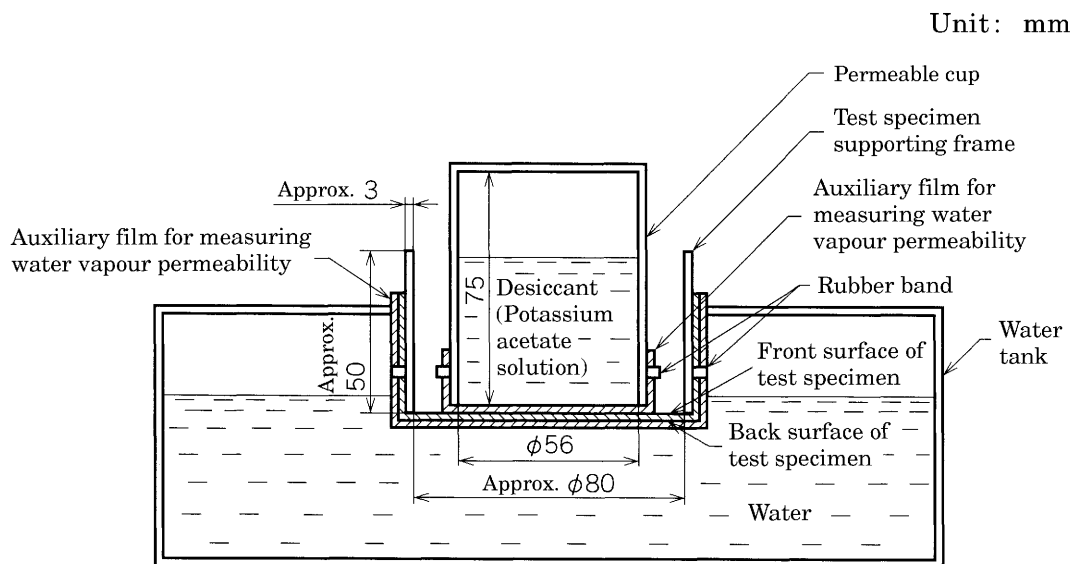


Figure 3 Permeable cup Method B-2 (alternative method of potassium acetate method)

- c) **Calculation** The water vapour permeability shall be calculated in accordance with the following formula and the test result shall be expressed by the mean value of three tests (up to an integer place).

$$P_{B2} = \frac{40 \times (a_8 - a_7)}{S_{B2}}$$

where, P_{B2} : water vapour permeability ($\text{g/m}^2 \cdot \text{h}$)
 $a_8 - a_7$: quantity of mass change of specimen per 15 min
(mg/min)
 S_{B2} : permeated area (cm^2)

8 Test report The test report shall mention the following information.

- a) Date
- b) Number of standard
- c) Testing method
- d) Test conditions (temperature and humidity at place of testing)
- e) Test results

Example 1 Date, **JIS L 1099, Method A-1** (calcium chloride method),
Inside of apparatus 40 °C 90 %RH, 20 °C 65 %RH, 200 $\text{g/m}^2 \cdot \text{h}$

Example 2 Date, **JIS L 1099, Method A-1** (calcium chloride method),
Inside of apparatus 35 °C 90 %RH, 25 °C 75 %RH, 200 $\text{g/m}^2 \cdot \text{h}$

Related standards:

JIS K 6549 *Testing method for water vapour permeability of leather*

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

ISO 2528:1974 *Sheet materials—Determination of water vapour transmission rate—Dish method*

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association, and also provided to subscribers of JIS (English edition) in *Monthly Information*.

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Standards Promotion Department, Japanese Standards Association

4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

TEL. 03-3583-8002 FAX. 03-3583-0462