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Rigid cellular plastics— Determination of water vapour transmission properties

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from The Japan Plastics Industry Federation (JPIF)/Japanese Standards Association (JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

This Standard has been made based on **ISO 1663:1999** *Rigid cellular plastics—Determination of water vapour transmission properties* for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Rigid cellular plastics— Determination of water vapour transmission properties

Introduction This Japanese Industrial Standard has been prepared based on the second edition of **ISO 1663** *Rigid cellular plastics—Determination of water vapour transmission properties* published in 1999 with some modifications of the technical contents.

The portions underlined with dots are the matters modified from the original International Standard. A list of modifications with the explanations is given in Annex 1 (informative).

1 Scope This Standard specifies a method of determining the water vapour transmission rate, water vapour permeance, water vapour permeability and water vapour diffusion resistance index for rigid cellular plastics.

The scope of this method provides for the testing of rigid cellular materials that have thicknesses from 10 mm upwards and which may, as an integral part of the material, contain natural skins or adhered facings of some different material.

Three different sets of temperature and humidity conditions are provided, as follows:

- a) 38 °C and a relative-humidity gradient of 0 % to 88 %;
- b) 23 °C and a relative-humidity gradient of 0 % to 85 %;
- c) 23 °C and a relative-humidity gradient of 0 % to 50 %;

The results obtained by this method are suitable for design purposes and production control, and for inclusion in product specifications.

The method is suitable for materials which have water vapour transmission rates in the range 3 mg/(m²·s) to 200 mg/(m²·s).

Remarks: The International Standard corresponding to this Standard is as follows.

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

ISO 1663:1999 *Rigid cellular plastics—Determination of water vapour transmission properties* (MOD)

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 7100 *Plastics—Standard atmospheres for conditioning and testing*

JIS K 7248 *Cellular plastics and rubbers—Determination of linear dimensions*

Remarks : **ISO 1923**:1981 *Cellular plastics and rubbers—Determination of linear dimensions* is identical with the said standard.

3 Terms and definitions For the purposes of this Standard, the following terms and definitions apply.

3.1 water vapour transmission rate the quantity of water vapour transmitted through unit area of a test specimen in unit time under specified conditions of temperature, humidity and thickness

It is expressed in the unit $\mu\text{g}/(\text{m}^2 \cdot \text{s})$.

NOTE : The values obtained for water vapour transmission rate are specific to the thickness of the test specimen.

3.2 water vapour permeance the ratio of the water vapour transmission rate for a test specimen to the vapour pressure difference between the two specimen faces during the test

It is expressed in the unit $\text{ng}/(\text{m}^2 \cdot \text{s} \cdot \text{Pa})$.

NOTE : Water vapour permeance values are specific of the thickness at which the specimen was tested.

3.3 water vapour resistance the inverse of water vapour permeance

It is expressed in the unit $\text{m}^2 \cdot \text{s} \cdot \text{Pa}/\text{ng}$.

3.4 water vapour permeability the numerical value of the product of permeance and thickness

It is the quantity of water vapour transmitted per unit time through a given area of the material per unit vapour pressure difference between its faces for a unit thickness.

It is expressed in the unit $\text{ng}/(\text{m} \cdot \text{s} \cdot \text{Pa})$.

NOTE : For homogeneous materials, values obtained for water vapour permeability are a property of the material.

3.5 water vapour diffusion resistance index the ratio of the water vapour permeability of air to that of the material concerned

It indicates how much less permeable the material is than an equally thick layer of stationary air at the same temperature.

It is dimensionless.

NOTE : For homogeneous materials, values obtained for water vapour diffusion resistance index are a property of the material.

4 Principle The test specimen is sealed to the open mouth of a test dish containing a desiccant. The assembly is then placed in an atmosphere whose temperature and humidity are controlled. Periodic weighings of the assembly are made to determine the rate of water vapour transmission through the specimen into the desiccant.

5 Apparatus and materials

5.1 Test containers, with a circular opening, made of a material impermeable to water vapour, such a glass or metal, of 65 mm minimum diameter and with tops slightly belled out to admit a wax seal. See Annex A for typical assemblies and **5.3** for assemblies requiring a template.

5.2 Measuring instruments, capable of determining linear dimensions in accordance with the requirements of **JIS K 7248**.

5.3 Circular template (with edge tapered to facilitate removal after use), to duplicate the exposed area of the specimen to the nearest 10 mm^2 . The template shall have an area that is at least 90 % of the exposed surface of the specimen in order to reduce the edge effect due to a non-linear vapour seal.

5.4 Pot or dish, for melting the sealant wax (**5.7**).

5.5 Analytical balance, capable of weighing the test assembly to an accuracy of 0.1 mg.

5.6 Constant-temperature, constant-humidity chamber, capable of being maintained within $\pm 2 \%$ of the required relative humidity and within $\pm 1^\circ\text{C}$ of the required temperature, and with a provision for continuous monitoring of the temperature and humidity during the test period. The chamber may be a room. Alternatively, if the chamber corresponds to that shown in figure 1, then the air circulation shall be capable of being switched off to permit accurate weighings.

NOTE : If a conditioned room is used for the test, then it is not necessary to use the chamber shown in figure 1.

The following solutions can be used with non-injection-type humidity cabinets:

- a) For testing at 38°C and a relative-humidity gradient of 0 % to 88 %: saturated potassium nitrate solution containing a large excess of the undissolved salt at 38°C .
- b) For testing at 23°C and a relative-humidity gradient of 0 % to 85 %: saturated chloride solution containing a large excess of the undissolved salt at 23°C .

NOTE : For testing at 23°C and a relative-humidity gradient of 0 % to 50 %, there is no suitable salt which would meet the tolerance required by **8.1**.

5.7 Sealant wax, unaffected by the test conditions. The following are examples of suitable sealants:

5.7.1 A mixture of 90 % microcrystalline wax and 10 % of a plasticizer (for example low-molecular-mass polyisobutylene).

5.7.2 A mixture of 60 % microcrystalline wax and 40 % refined crystalline paraffin.

5.8 Anhydrous calcium chloride desiccant, with particles about 5 mm in diameter, free from fines, which would pass a No. 30 ($600 \mu\text{m}$) sieve.

5.9 Limiting ring, for use with thin specimens (see Annex A figure 1).

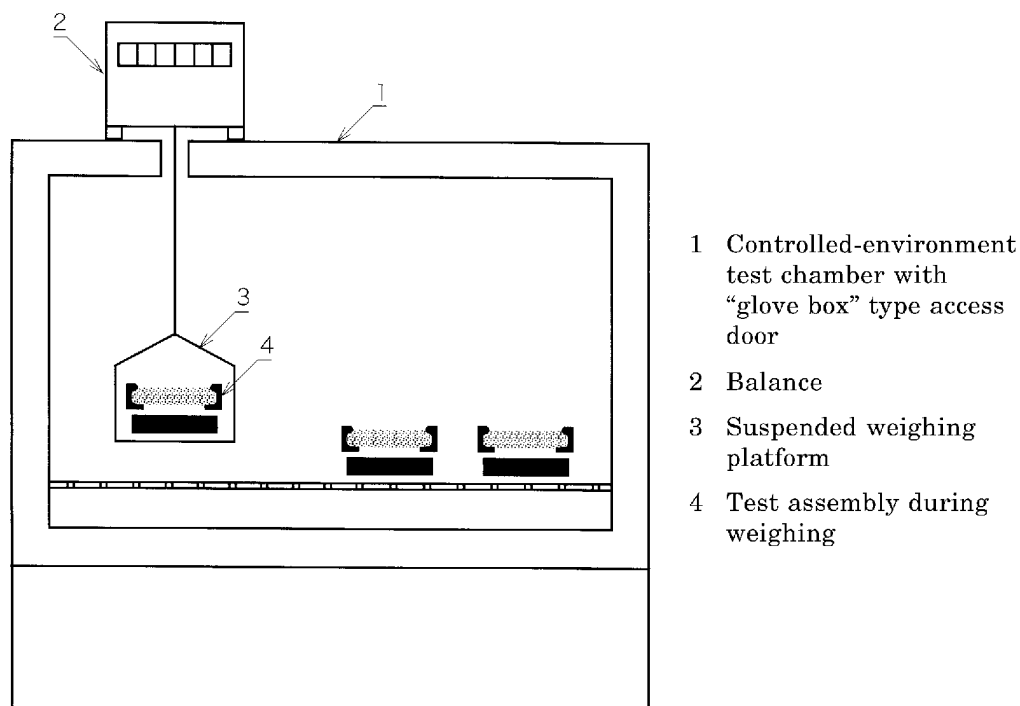


Figure 1 Recommended specimen exposure and measurement when operator cannot enter controlled environment

6 Sample The sample shall be representative of the material. It may contain the natural skin or facings adhered to it which constitute part of the material.

Some cellular plastics have skins of a density significantly different from that of the core material. If it is intended to determine the permeability of the material, the specimen shall be homogeneous and tested without the skin and facing.

7 Test specimens

7.1 Dimensions

7.1.1 Shape and fit Specimens shall be circular and cut to fit the dimensions of the test assembly in accordance with the appropriate drawing in Annex A figure 1.

7.1.2 Thickness The thickness of specimens shall not be less than 10 mm, except for materials produced thinner than 10 mm which shall be tested at the manufactured thickness. A specimen thickness of 25 mm is preferred.

7.1.3 Exposed area The minimum exposed area shall be 3 200 mm².

7.2 Number A minimum of five specimens shall be tested.

When the material to be tested is suspected of being anisotropic, the test specimens shall be cut such that the parallel faces are normal to the direction of vapour flow through the product in its intended use.