

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1663

PLASTICS

DETERMINATION OF WATER VAPOUR TRANSMISSION RATE
OF RIGID CELLULAR PLASTICS

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BRIEF HISTORY

The ISO Recommendation R 1663, *Plastics – Determination of water vapour transmission rate of rigid cellular plastics*, was drawn up by Technical Committee ISO/TC 61, *Plastics*, the Secretariat of which is held by the American National Standards Institute (ANSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1663, which was circulated to all the ISO Member Bodies for enquiry in August 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Austria	India	South Africa, Rep. of
Belgium	Iran	Spain
Brazil	Israel	Sweden
Canada	Italy	Switzerland
Colombia	Japan	Turkey
Czechoslovakia	Korea, Rep. of	U.A.R.
France	Netherlands	United Kingdom
Germany	New Zealand	U.S.A.
Greece	Poland	U.S.S.R.
Hungary	Romania	

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

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PLASTICS

**DETERMINATION OF WATER VAPOUR TRANSMISSION RATE
OF RIGID CELLULAR PLASTICS**

1. SCOPE

This ISO Recommendation describes a method for determining the water vapour transmission rate through a rigid cellular plastics material under the following conditions :

- (a) at 38 °C and a relative humidity gradient of 0 to 88.5 % or
- (b) at 23 °C and a relative humidity gradient of 0 to 85 %.

The results obtained for different rigid cellular plastics with these test methods are only comparable if the results are determined at the same conditions of temperature and relative humidity and the same thickness of the examined sample.*

2. DEFINITION

The water vapour transmission rate of a flat slab of a material is defined as the mass of water in grammes transmitted through a square metre per 24 hours under specified conditions of temperature, humidity and thickness. It should be expressed in grammes per square metre per 24 hours [g/(m².24h)].

3. APPARATUS AND MATERIALS

- 3.1 *Beakers*, 250 ml, low-form, of glass or metal suitably resistant to calcium chloride, about 65 mm internal diameter, the tops being slightly belled out to admit the wax seal.
- 3.2 *Measuring instruments* capable of measuring linear dimensions to an accuracy of 0.5 mm.
- 3.3 *Circular metal template* of 65 ± 0.1 mm diameter.
- 3.4 *Small dish* for melting the wax.
- 3.5 *Balance* capable of weighing beakers to an accuracy of ± 1 mg.
- 3.6 *Constant temperature chamber* large enough to accommodate a desiccator containing at least five beakers and capable of being maintained at a temperature of 38 ± 1 °C, or 23 ± 1 °C.

Alternatively, a temperature and humidity controlled cabinet capable of maintaining the required test conditions.

* Attention is drawn to the fact that water vapour pressure across both sides of the test piece is different when tested at 23 °C or 38 °C. When cellular plastics with open cells are to be tested, the test at 38 °C and a relative humidity gradient of 0 to 88.5 % as well as the test at 23 °C with a relative humidity gradient of 0 to 85 % causes a rapid saturation of the calcium chloride absorbing agent. Therefore testing should not be carried out at values above 300 g/(m².24h).

- 3.7 *Plasticized paraffin wax.* A suitable composition consists of 90 % microcrystalline wax and 10 % plasticizer of a type unaffected by 85 % RH at 23 °C and 88.5 % RH at 38 °C; for example, low molecular weight polyisobutylene.
- 3.8 *Anhydrous calcium chloride, granulated.*
- 3.9 *Container,* such as a desiccator, in which the required relative humidity can be produced. This desiccator should be able to hold at least five beakers with their test pieces and be placed in a constant temperature chamber. ISO Recommendation R 483, *Plastics – Methods for maintaining constant relative humidity in small enclosures by means of aqueous solutions*, is a guide for the choice of the container. (It indicates, for example, that the height of the enclosure should not exceed the length of the smaller side of the surface of the solution).
- 3.10 *Solutions*
- (a) For testing at 38 °C at a relative humidity gradient of 0 to 88.5 % : a solution of potassium nitrate saturated at 38 °C which contains a large excess of undissolved potassium nitrate.*
- (b) For testing at 23 °C at a relative humidity gradient of 0 to 85 % : a solution of potassium chloride saturated at 23 °C which contains a large excess of undissolved potassium chloride.*

4. SAMPLE

The sample should be representative of the material. Any moulding skin should be removed from the test pieces. Their surfaces should be cut in such a way that the original structure is not damaged.

5. TEST PIECE

The test piece should be in the form of a cylinder 25 ± 0.5 mm high with a diameter cut to fit exactly (push fit) the beaker which is used. A minimum of five test pieces should be tested.

6. CONDITIONING

The test pieces should be conditioned in accordance with ISO Recommendation R 291, *Standard atmospheres for conditioning and testing*.

7. PROCEDURE

Place approximately 25 g of anhydrous calcium chloride in each beaker. Insert a test piece firmly into the opening of each beaker so that the top surface is just below the level of the edge of the beaker.*

Place the metal template (3.3) centrally on the top surface of the test piece and run in the melted paraffin wax (3.7) along its circumference in order to give a complete seal between the test piece and the wall of the beaker and in order to provide an accurate exposed area on the top surface of the test piece. After the paraffin wax has set, carefully remove the template. The Figure, page 8, illustrates the method of insertion of the specimen into the beaker.

For testing at 38 °C at a relative humidity gradient of 0 to 88.5 % weigh a minimum of five beakers each with a test piece in position, and then keep them in the desiccator (3.9) which contains the saturated solution of potassium nitrate (3.10). Keep the desiccator with the beakers for 24 hours in the constant temperature chamber (3.6) in which a temperature of 38 ± 1 °C is maintained. Alternatively, the five beakers may be placed in a temperature and humidity controlled cabinet maintained at the required test conditions.

* See ISO Recommendation R 483, *Plastics – Methods for maintaining constant relative humidity in small enclosures by means of aqueous solutions*.

** To ensure an effective seal between the test piece and the beaker, it is advisable to coat the circumference of the test piece with wax. Before inserting the test piece into the beaker, it is necessary to warm the beaker.