INTERNATIONAL STANDARD

ISO 20393

First edition
2007-06-15

Thermal-insulating materials — Determination of long-term water absorption by diffusion

Matériaux d'isolation thermique — Détermination de l'absorption d'eau à long terme par diffusion

Reference number
ISO 20393:2007(E)

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Published in Switzerland

Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 20393 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

Thermal-insulating materials — Determination of long-term water absorption by diffusion

1 Scope

This International Standard specifies equipment and procedures for determining the long-term water absorption of test specimens by diffusion. It is intended for use with thermal-insulation products. It is designed to simulate the absorption of water by products subjected for a long period of time not only to high relative humidity, approximating to 100 %, on both sides, but also to a water vapour pressure gradient, as experienced by e.g. inverted roof or unprotected ground insulation.

The test is not applicable to all types of thermal-insulation product. The product standard should normally state whether this test is applicable to a particular product.

NOTE For unprotected ground insulation, a lower temperature might, when more data is available, replace the test temperature of 50 °C currently specified in this International Standard.

2 Normative references

The following referenced documents are indispensable for the application 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 472, *Plastics — Vocabulary*

ISO 1923, *Cellular plastics and rubbers — Determination of linear dimensions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 apply.

4 Principle

The long-term water absorption by diffusion is determined by measuring the increase in mass of a test specimen when it is subjected to a water vapour pressure difference and temperature gradient between its upper and lower surfaces for a period of 28 days.

5 Apparatus and materials

5.1 Balance, capable of determining the mass of the test specimen to within 0,1 g.

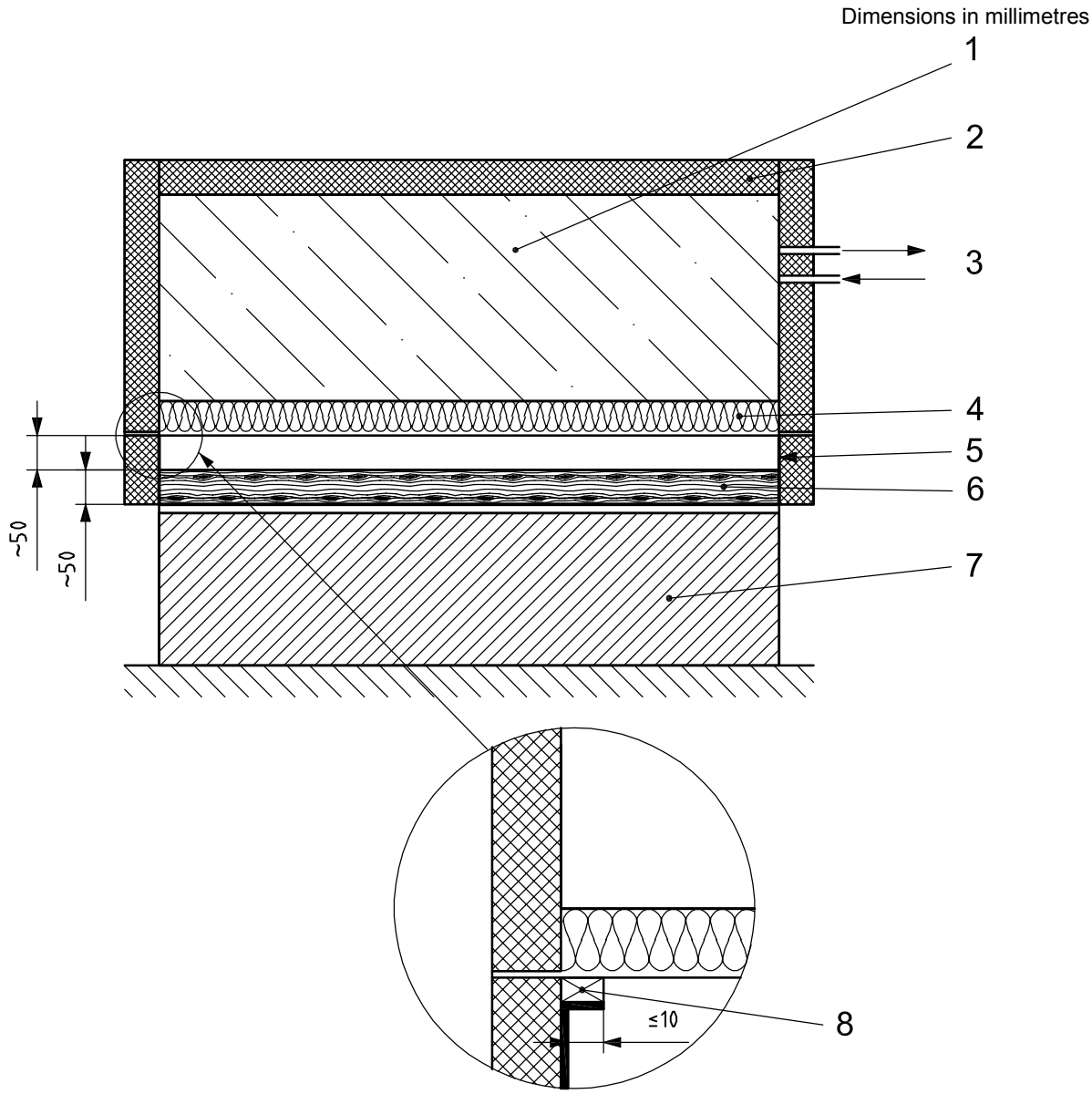
5.2 Corrosion-resistant container, with a frame supporting the test specimen.

5.3 Heating device, with a thermostat capable of controlling the water temperature at (50 ± 1) °C.

5.4 Cooling plate, thermally insulated on the outside, operating at a temperature of (1 ± 0,5) °C.

5.5 Tap water, kept at a temperature of (50 ± 1) °C.

The basic principles of the apparatus are illustrated in Figure 1.



Key

1 cooling plate
2 thermal insulation for cooling plate and container
3 coolant inlet and outlet
4 test specimen
5 corrosion-resistant container with a frame supporting the test specimen
6 tap water
7 heating device with thermostat
8 seal

Figure 1 — Example of apparatus for determining water absorption by diffusion

6 Test specimens

6.1 Dimensions

The thickness of the test specimens shall be the original product thickness.

The test specimens shall be squares, with squarely cut edges, having sides of length (500 ± 1) mm. If the product is not large enough to permit this size of test specimen, the test specimen size shall be reduced accordingly. Test specimens shall contain no joints.

6.2 Number

The number of test specimens shall be at least two.

6.3 Preparation

The test specimens shall be cut so that they do not include original product edges.

Test specimens shall be prepared by methods that do not substantially change the original structure of the product. Any facings, skins and/or coatings shall be retained.

NOTE Special methods of preparation, when needed, are given in the relevant product standard.

6.4 Conditioning

The test specimens shall be conditioned for at least 6 h at

(23 ± 2) °C and (50 ± 10) % relative humidity

or

(23 ± 5) °C and 50^{+20}_{-10} % relative humidity

or

(27 ± 5) °C and 65^{+20}_{-10} % relative humidity.

In cases of dispute, they shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity for the time stated in the relevant product standard, but in any case for a minimum of 6 h.

7 Procedure

Measure the dimensions of the test specimens in accordance with ISO 1923.

Weigh the test specimen to the nearest 0,1 g to determine its initial mass, m_0.

Place the test specimen on the frame of the container. If the product is faced on one side, begin the test with the facing uppermost. Seal the bottom edge of the test specimen to the container. The width of the seal shall be $\leqslant$ 10 mm (see Figure 1). Place the insulated cooling plate on top of the test specimen.

Subject the test specimen to a temperature and water vapour pressure difference for 28 days, maintaining the tap water at a temperature of (50 ± 1) °C and the cooling plate on the other side at a temperature of (1 ± 0,5) °C.

Turn the test specimen over every 7 days.

After 28 days, remove the test specimen and wipe off any surface water. Weigh the test specimen again to determine its mass, m_D.

8 Calculation and expression of results

For each test specimen, calculate the long-term water absorption by diffusion, W_{dP} or W_{dV}, in kilograms per square metre or in percent by volume, using Equation (1) or (2), respectively:

$$W_{dP} = \frac{m_D - m_0}{A_p} \quad (1)$$

$$W_{dV} = \frac{m_D - m_0}{A_p \times d} \times \frac{100}{\rho_W} \quad (2)$$

where

m_0 is the initial mass of the test specimen, in kilograms;

m_D is the mass of the test specimen after being subjected to a temperature and water vapour pressure difference for 28 days, in kilograms;

A_p is the area of the lower surface of the test specimen, in square metres;

d is the thickness of the test specimen, in metres;

ρ_W is the density of water, assumed to be 1 000 kg/m^3.

The test result shall be taken as the mean value of the individual values, rounded to the nearest 0,01 kg/m^2 in the case of W_{dP} and to the nearest 0,1 % by volume in the case of W_{dV}.

Results shall not be extrapolated to other thicknesses.

9 Precision

It has not been possible to include a statement on the precision of the measurements in this edition of this International Standard, but it is intended to include such a statement when the standard is next revised.

10 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) product identification:

   1) the name of the product, the factory where it was manufactured and the manufacturer or supplier,

   2) the production code number,

   3) the type of product,

   4) the type of packaging,

   5) the form in which the product arrived at the laboratory,

   6) any other information as appropriate, e.g. nominal thickness, nominal density;

c) test procedure:

   1) details of pre-test history and sampling, e.g. who sampled and where,

   2) details of conditioning,

   3) details of any deviations from the requirements specified in Clauses 6 and 7,

   4) the dates of testing,

   5) the dimensions of the test specimens and the number tested,

   6) general information relating to the test,

   7) details of any events which may have affected the results;

d) results: record all the individual values and the mean value.

Information about the apparatus and the identity of the technician should be available in the laboratory, but need not be recorded in the test report.

ICS 83.100

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