INTERNATIONAL STANDARD

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Hygrothermal performance of building materials and products — Determination of hygroscopic sorption properties

Performance hygrothermique des matériaux et produits pour le bâtiment — Détermination des propriétés de sorption hygroscopique

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12571 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 163, *Thermal insulation*, Subcommittee SC 1, *Test and measurement methods*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

Annexes A to D of this International Standard are for information only.

Contents

Foreword

The text of EN ISO 12571:2000 has been prepared by Technical Committee CEN/TC 89 "Thermal performance of buildings and building components", the secretariat of which is held by SIS, in collaboration with Technical Committee ISO/TC 163 "Thermal insulation".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2000, and conflicting national standards shall be withdrawn at the latest by December 2001**.**

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard is one of a series of standards, which specify test methods for the thermal and moisture related properties of building materials and products.

1 Scope

This standard specifies two alternative methods for determining hygroscopic sorption properties of porous building materials and products:

a) using desiccators and weighing cups (desiccator method);
b) using a climatic chamber (climatic chamber method).

The desiccator method is the reference method.

The standard does not specify the method for sampling.

The methods specified in this standard can be used to determine the moisture content of a sample in equilibrium with air at a specific temperature and humidity.

2 Normative reference

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, latest edition of the publication referred to applies.

EN ISO 9346	Thermal insulation - Mass transfer - Physical quantities and definitions (ISO 9346)
EN ISO 12570	Hygrothermal performance of building materials and products - Determination of moisture content by drying at elevated temperature (ISO 12570)

3 Definitions, symbols and units

3.1 Definitions

For the purposes of this standard, the definitions given in EN ISO 9346 and the following apply:

3.1.1 hygroscopic sorption
exchange of water vapour between ambient air and a porous material until the point of equilibrium is reached

3.1.2 moisture content mass by mass
mass of evaporable water divided by mass of dry material

3.1.3 moisture content volume by volume
volume of evaporable water divided by volume of dry material

3.1.4 moisture content mass by volume
mass of evaporable water divided by volume of dry material

NOTE The mass of water is determined by weighing the specimen before and after drying at the appropriate drying temperature until constant mass is reached.

3.1.5 sorption curve
curve that establishes a relationship between the moisture content of a material at equilibrium with the environment and the relative humidity of the ambient air, at a specified temperature

3.1.6 adsorption curve
sorption curve established at a series of increasing equilibrium relative humidities

3.1.7 desorption curve
sorption curve established at a series of decreasing equilibrium relative humidities

3.2 Symbols and units

Symbol	Quantity	Unit
m	mass of test specimen	kg
m_0	mass of dried test specimen	kg
u	moisture content mass by mass	kg/kg
ψ	moisture content volume by volume	m^3/m^3
w	moisture content mass by volume	kg/m^3

4 Principle

4.1 Adsorption curve

The specimen is dried to constant mass. Whilst maintaining a constant temperature, the specimen is placed consecutively in a series of test environments, with relative humidity increasing in stages. The moisture content is determined when equilibrium with each environment is reached. Equilibrium with the environment is established by weighing the specimen until constant mass is reached. A minimum of four test atmospheres shall be selected in the humidity range under consideration.

After establishing the moisture content at each relative humidity the adsorption curve can be drawn.

4.2 Desorption curve

The starting point for desorption is a relative humidity of at least 95 %. This might be the last point of the adsorption curve or might be reached by adsorption from a dried test specimen. Whilst maintaining a constant temperature, the specimen is placed consecutively in a series of test environments, with relative humidity decreasing in stages. The moisture content is determined when equilibrium with each environment is reached. Equilibrium with the environment is established by weighing the specimen until constant mass is reached. A minimum of four test atmospheres shall be selected in the humidity range under consideration. Finally, the specimen is dried to constant mass.

After establishing the moisture content at each relative humidity the desorption curve can be drawn.

NOTE A defined starting point for desorption has been chosen for better reproducibility.

5 Apparatus

5.1 Desiccator method

The test apparatus shall include:

a) weighing cups which do not absorb water and with tight-fitting lids;

b) balance, capable of weighing to an accuracy of ± 0,01 % of the mass of the test specimen;

NOTE If larger weighing cups are used, the weighing accuracy can be determined with respect to the total mass and the required accuracy of the test results.

c) drying oven, in accordance with EN ISO 12570;

d) desiccator, capable of maintaining the relative humidity within ± 2 % relative humidity;

e) constant-temperature chamber, capable of maintaining the specified test temperature to an accuracy of ± 0,5 K.

5.2 Climatic chamber method

The test apparatus shall include:

a) weighing cups which do not absorb water;

b) balance, capable of weighing to an accuracy of ± 0,01 % of the mass of the test specimen;

NOTE If larger weighing cups are used, the weighing accuracy can be determined with respect to the total mass and the required accuracy of the test results.

c) drying oven, in accordance with EN ISO 12570;

d) climatic chamber capable of maintaining the relative humidity within ± 5 % relative humidity and the temperature within ± 2 K over the whole test area.

6 Test specimens

6.1 Specification of the test specimens

A test specimen shall be representative of the product and have a mass of at least 10 g. Specimens of materials with a dry density less than 300 kg/m^3 shall have an area of at least 100 mm × 100 mm.

If it can be demonstrated from other references that the result will not be affected, a test specimen can be cut or crushed into smaller pieces to reduce the time to reach equilibrium with the environment.

6.2 Number of test specimens

A minimum of three specimens shall be tested. The procedure in clause 7 shall be applied to each specimen.

7 Procedure

7.1 Test conditions

Reference sorption curves shall be established at a temperature of (23 ± 0,5) °C. If agreed between the parties, sorption curves can be established at other temperatures for specific applications.

7.2 Desiccator method

7.2.1 General

Make up the appropriate saturated aqueous solution to achieve the necessary relative humidity in the desiccator.

NOTE Annex A gives the relative air humidities of various saturated solutions in equilibrium, and annex B describes the preparation of various solutions.

Place the desiccator in the constant-temperature chamber.

7.2.2 Adsorption curve

Weigh the weighing cup and lid when empty and dry.

Put the test specimen into the weighing cup without the lid and dry it until constant mass in the drying oven at the temperature specified in EN ISO 12570.

Constant mass is reached if the change of mass between three consecutive weighings, each made at least 24 h apart, is less than 0,1 % of the total mass.

Put the test specimen in the weighing cup, with the lid beside it, into the desiccator containing the salt solution needed to give the appropriate relative humidity.

Periodically weigh the specimen until it is in equilibrium with the environment (constant mass). Immediately after removing the lid of the desiccator, put on the lid of the weighing cup, and move the weighing cup to the balance. After weighing the cup, return it to the desiccator with the lid beside it.

NOTE 1 Annex C gives an example of a detailed weighing procedure.

Repeat the procedure for increasing humidities. A minimum of four approximately evenly spaced humidities in increasing order shall be selected in the range of 30 % to 95 % relative humidity.

NOTE 2 It is possible that mould and mildew grow on specimens of wood based materials in atmospheres with relative humidities over 80 %. This might invalidate the test and can be prevented by adding a few drops of an appropriate fungicide to the solution.

7.2.3 Desorption curve

The starting point for desorption is a relative humidity of at least 95 %. This might be the last point of the adsorption curve or might be reached by adsorption from dried test specimen.

Put the test specimen in the weighing cup, with the lid beside it, into the desiccator containing the solution needed to give the appropriate relative humidity.

Periodically weigh the specimen until it is in equilibrium with the environment (constant mass). Immediately after removing the lid of the desiccator, put on the lid of the weighing cup, and move the weighing cup to the balance. After weighing the cup, return it to the desiccator with the lid beside it. Constant mass is reached if the change of mass between three consecutive weighings, each made at least 24 h apart, is less than 0,1 % of the total mass.

NOTE Annex C gives an example of a detailed weighing procedure.

Repeat the procedure for decreasing humidities. A minimum of four approximately evenly spaced humidities in decreasing order shall be selected in the range of 95 % to 30 % relative humidity.

7.3 Climatic chamber method

7.3.1 Adsorption curve

Put the test specimen, if necessary in the weighing cup, in the drying oven and dry it until constant mass at the temperature specified in EN ISO 12570. Constant mass is reached if the change of mass between three consecutive weighings, each made at least 24 h apart, is less than 0,1 % of the total mass.