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Fukt- och värmetekniska egenskaper hos byggmaterial och byggprodukter – Bestämning av fuktutvidgnings-koefficient

Hygrothermal performance of building materials and products – Determination of hygric expansion coefficient

Europastandarden EN 13009:2000 gäller som svensk standard. Detta dokument innehåller den engelska språkversion av EN 13009:2000.

EN 13009 har tagits fram inom CEN/TC 89, Thermal performance of buildings and building components.

I standarden beskrivs en metod för att bestämma fuktutvidgningskoefficienten som en funktion av fuktinnehållet. Denna koefficient kan användas i beräkningar av materialdeformationer eller spänningar orsakade av variationer i fuktinnehållet. Metoden är relevant för material och fuktinnehåll där man kan förutsätta reversibla svällnings/krympningsprocesser.

Motsvarigheten och aktualiteten i svensk standard till de publikationer som omnämns i denna standard framgår av ”Katalog över svensk standard”, som årligen ges ut av SIS. I katalogen redovisas internationella och europeiska standarder som fastställts som svenska standarder och övriga gällande svenska standarder.

ICS 91.100.01

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English version

Hygrothermal performance of building materials and products - Determination of hygric expansion coefficient

Performance hygrothermique des matériaux et produits pour le bâtiment - Détermination du coefficient d'expansion hydrique

Wärme- und feuchtetechnisches Verhalten von Baustoffen und Bauprodukten - Bestimmung des hygrischen Dehnkoeffizienten

This European Standard was approved by CEN on 26 November 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 89 "Thermal performance of buildings and building components", the secretariat of which is held by SIS.

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 July 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 document is one of a series of standards on general test methods for the thermal and moisture related properties of building materials and products.

Introduction

Many building materials exhibit expansion/contraction characteristics resulting from changes in moisture content.

This standard specifies a method of measuring the hygric expansion coefficient as a function of moisture content. This coefficient can be used in calculations of material deformations or stresses due to changes in moisture content.

Material specifications may impose additional requirements related to the test, e.g. dimensions or numbers of test specimens.

This standard is intended to be used as the reference by harmonised product specifications, as far as products do not have properties which make application of this standard difficult.

1 Scope

This standard specifies a procedure for determining the hygric expansion or contraction behaviour of building materials as a function of moisture content. It is applicable for mineral, porous hygroscopic materials. For other materials showing moisture-induced deformations, the procedure described can be applied in a suitable way taking into account their specific moisture behaviour.

This standard is relevant to material states when reversible expansion/contraction processes may be assumed, but not to states governed by irreversible processes such as shrinkage after material production or after initial drying.

2 Normative references

This 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 below. For dated references, subsequent amendments to or revisions of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN ISO 9346 Thermal insulation - Mass transfer - Physical quantities and definitions (ISO 9346:1987)

EN ISO 12570 Hygrothermal performance of building materials and products - Determination of moisture content by drying at elevated temperature (ISO/FDIS 12570:1999)

EN ISO 12571 Hygrothermal performance of building materials and products - Determination of hygroscopic sorption properties (ISO/FDIS 12571:1999)

prEN ISO 12572:2000 Hygrothermal performance of building materials and products - Determination of water vapour transmission properties (ISO/DIS 12572:1997)

3 Definitions, symbols and units

3.1 Definitions

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

3.1.1
free water saturation
maximum water uptake under normal pressure conditions (without overpressure or vacuum)

3.1.2
reference length
the length of the specimen, between measuring points, in the dry state

3.1.3
hygric strain
ratio of measured length change to the reference length as a function of moisture content

3.1.4
hygric expansion coefficient
ratio of difference in hygric strain to difference in moisture content as a function of moisture content.

3.2 Symbols and units

Symbol	Quantity	Unit
l	length dimension of specimen along the measuring axis	M
l_0	Reference length of the dry specimen	M
Δl	length change of specimen caused by a change in moisture content	M
u	moisture content, mass by mass	kg/kg
Δu	Difference in moisture content between two successive states	kg/kg
u_f	free water saturation	kg/kg
ε_h	hygric strain	-
α_h	hygric expansion coefficient	-

4 Principle

The hygric expansion coefficient is calculated by relating the measured length change of a specimen, caused by a defined change in moisture content, to the length of the specimen in the dry state and to the difference in moisture content. The length change measurement is carried out continuously in the direction of the largest dimension of a prismatic specimen starting and ending in a state of equilibrium. The wetting or drying process is carried out in several steps of controlled moisture content change, in order to obtain the hygric expansion coefficient as a function of moisture content. Measurements are carried out under isothermal conditions to avoid superimposed temperature induced deformations.

5 Apparatus

The test apparatus shall include the following.

a) Measuring instruments for determining specimen dimensions to an accuracy of ± 0,1 mm.

b) Measuring devices for length change measurements which do not obstruct free hygric dilatation and are not sensitive to temperature and humidity changes. These shall include length change measuring sensors with an accuracy of ± 0,001 mm, with continuous data logging during the recording of positive and negative length changes along the measuring axis of the specimen. The sensors shall be either:

- capable of maintaining defined and reproducible contact with a gauge plug attached to the end of the test specimen; or

- attached to one or two long sides of the specimen parallel to the measuring axis such that the measuring tips of the sensor are in permanent contact with the specimen over a distance between the tips (the reference length) of nearly the specimen length.

NOTE Suitable length change measuring systems include inductive movement sensors, mechanical dial gauges, optical systems with a measuring magnifier and laser optical systems (interferometry).

Systems having mechanical contact with the specimen, e.g. via plugs on the specimen, shall have good reproducibility (spherical/point contact, suitable contact force, non-corrosive plugs, etc.).

c) Measuring chamber (climatic chamber or test box or similar) capable of providing variable steps in relative humidity between about 10 % relative humidity and about 95 % relative humidity at constant temperature (e.g. 20 °C or 23 °C), maintaining constant conditions in each step within ± 2 % relative humidity and ± 1 K. If test boxes or desiccators with saturated aqueous solutions are used (see EN ISO 12571), they should be placed in a constant-temperature chamber with the specified temperature conditions.

d) Balance capable of weighing test specimens and water supply equipment to an accuracy of ± 0,01 % of their mass.

e) Ventilated oven for specimen drying at elevated temperatures with specifications according to EN ISO 12570.

f) Desiccator with desiccant so that dried specimens may be cooled down to test temperature while maintaining dry conditions (desiccants according to prEN ISO 12572:2000).

g) Suitable and regularly calibrated sensors for temperature and humidity control within the measuring chamber, possibly with a continuous recording system.

h) Hypodermic syringe of suitable volume for water supply.

6 Test specimens

6.1 General

Test specimens shall be representative of the material, taking account of any guidance given in material standards. If the material to be tested is suspected of being anisotropic, two sets of test specimens shall be cut so that measurements can be made in different anisotropic directions.