SLOVENSKI STANDARD
SIST EN ISO 7783-2:1999

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Barve in laki - Premazna sredstva in premazni sistemi za obdelavo zunanjih zidov in betona - 2. del: Določ evanje in razvrstitev po prepustnosti za vodno paro (ISO 7783-2:1999)

Paints and varnishes - Coating materials and coating systems for exterior masonry and concrete - Part 2: Determination and classification of water-vapour transmission rate (permeability) (ISO 7783-2:1999)

Lacke und Anstrichstoffe - Beschichtungsstoffe und Beschichtungssysteme für mineralische Untergründe und Beton im Außenbereich - Teil 2: Bestimmung und Einteilung der Wasserdampf-Diffusionsstromdichte (Permeabilität) (ISO 7783-2:1999)

Peintures et vernis - Produits de peinture et systemes de revetement pour maçonnerie et béton extérieurs - Partie 2: Détermination et classification du taux de transmission de la vapeur d'eau (perméabilité) (ISO 7783-2:1999)

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87.040	Barve in laki	Paints and varnishes

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English version

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This European Standard was approved by CEN on 27 December 1998.

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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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

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Foreword

The text of EN ISO 7783-2:1999 has been prepared by Technical Committee CEN/TC 139 "Paints and varnishes", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 35 "Paints and varnishes".

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of an identical text or by endorsement, at the latest by September 1999, and conflicting national standards shall be withdrawn at the latest by September 1999.

EN 1062 consists of the following parts under the general title : Paints and varnishes - Coating materials and coating systems for exterior masonry and concrete

Part 1 : Classification
Part 2 : Determination and classification of water-vapour transmission rate (permeability) [1)]
Part 3 : Determination and classification of liquid-water transmission rate (permeability)
Part 6 : Determination of carbon dioxide permeability
Part 7 : Determination of crack-bridging properties - Test methods and classification
Part 11 : Methods for conditioning and testing

[1)] Published as EN ISO 7783-2

Due to the broad field of application of part 2 of this series of Standards, it was published as International Standard ISO 7783-2 and implemented as EN ISO 7783-2.

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.

Introduction

This European Standard deals with test methods for coating materials and coating systems for masonry and concrete. It should be read in conjunction with EN 1062-1.

1 Scope

This European Standard specifies a method for determining the water-vapour transmission rate of coatings, coating systems and related products, intended for exterior masonry and concrete.

The method is applicable to coatings and coating systems on porous substrates such as brick, concrete and renderings.

NOTE 1: The method is also applicable to the determination of the water-vapour transmission rate of coatings and coating systems intended for other substrates.

The procedure using a porous substrate is not applicable for coatings having dry film thicknesses less than 80 µm as determined by calculation.

NOTE 2: Some products, normally of low viscosity and/or very low solids content, that do not form films, or abnormally affect the porosity of porous substrates, should not be included when the water-vapour transmission rate of coating systems is determined. Their effect in practical situations should be agreed between the interested parties.

2 Normative references

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 any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1062-1	1996	Paints and varnishes – Coating materials and coating systems for exterior masonry and concrete – Part 1: Classification
EN 21512		Paints and varnishes – Sampling of products in liquid or paste form (ISO 1512 : 1991)
EN 23270		Paints and varnishes and their raw materials – Temperatures and humidities for conditioning and testing (ISO 3270 : 1984)
EN ISO 1513		Paints and varnishes - Examination and preparation of samples for testing (ISO 1513 : 1992)

ISO 7783-1 1996 Paints and varnishes – Determination of water-vapour transmission rate – Part 1: Dish method for free films

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 Water-vapour transmission rate V (of a coating): The mass of water vapour that is transmitted over a given period through a test piece of a given surface area under specified constant conditions of relative humidity at each face of the test piece.

NOTE: Water-vapour transmission rate is expressed in grams per square metre per day [g/(m² · d)] at the conditions of relative humidity defined at the two faces of the coatings

[ISO 7783-1 : 1996]

3.2 Diffusion-equivalent air layer thickness s_d**:** The thickness of a static air layer that possesses, under the same conditions, the same water-vapour transmission rate as the coating.

NOTE: Diffusion-equivalent air layer thickness is expressed in metres [m].

4 Principle

Exterior masonry coatings play an important role in regulating water-vapour exchange between substrate and external atmosphere. This property is evaluated using dishes containing a saturated solution of ammonium dihydrogen phosphate producing an atmosphere immediately above it of 93 % relative humidity, and closed by a film of the product or a porous substrate coated with the product to be tested. The dishes are placed in an enclosure at controlled temperature and relative humidity. They are weighed at suitable intervals of time and the water-vapour transmission rate is determined from the change in mass when this change has become directly proportional to the time interval.

5 Apparatus and materials

5.1 Dishes as specified in ISO 7783-1. Uncoated aluminium shall not be used.

5.2 Oven, capable of being maintained at a temperature of (50 ± 2) °C.

5.3 Balance, capable of weighing to the nearest 1 mg.

5.4 Ammonium dihydrogen phosphate, saturated solution, prepared by using deionized water or fresh tap water, to produce 93 % relative humidity.

6 Sampling

Take a representative sample of the product to be tested (or of each product in the case of a multi-coat system), as described in EN 21512.

Examine and prepare each sample for testing, as described in EN ISO 1513.

7 Test pieces

7.1 General

Select the technique for the preparation of the test pieces from table 1.

Table 1: Preparation of test pieces

Self-supporting coating	Reaction with substrate needed	Recommended dry film thickness µm	Technique
yes	no	-	free film
yes	yes	-	specific substrate
no	no	< 80	specific substrate
no	yes	-	specific substrate
no	no	> 80	porous substrate

7.2 Substrates for self-supporting coatings (free films)

To prepare free films chose a suitable substrate such as plastic film made of high-density polyethylene (PE-HD), polytetrafluorethylene (PTFE) or poly(ethylene terephthalate) (PET), free from surface defects, from which the test coating can be easily detached when dried in accordance with the specifications of the manufacturer of the coating material. The surface area of the free film shall be at least 60 cm^2.

7.3 Substrates for non-self-supporting coatings

If the water-vapour transmission rate cannot be measured on free films because these would be too weak or too brittle, the determination shall be carried out using a substrate with a high water-vapour transmission rate.

– For coatings not requiring a reaction with the substrate, any substrate is suitable which has a water-vapour transmission rate of more than 240 g/(m^2 · d), for instance glass frits, unglazed ceramic tiles. The area shall be at least 60 cm^2 for one side.

– For coatings reacting with the substrate, pieces of the specific substrate can be used which do not necessarily fulfill the above transmission rate characteristic. In this case, the results shall be expressed in accordance with 9.1.2. In any case the area shall be at least 60 m^2 for one side.

Sealing material: A wax material complying with the requirements of D.1.3 of ISO 7783-1 : 1996 or two-component adhesives have been found suitable.

A suitable material is a wax material that adheres strongly to both the dish used as the test cell, and the test piece, and is not brittle at the test temperature, not hygroscopic and not susceptible to oxidation.

7.4 Preparation and coating

The substrate shall be clean and dry.

Coat the substrate by applying the coating or coating system to be tested at the specified thickness in accordance with the recommendations of the manufacturer of the coating material(s). When using porous substrates, coat only one side of the substrate. The coating shall be free of visible defects.

7.5 Drying and conditioning

7.5.1 Drying

Unless otherwise agreed, dry the test pieces for 28 days with free circulation of air at (23 ± 2) °C and (50 ± 5) % relative humidity (see also EN 23270).

7.5.2 Conditioning

The water-vapour transmission rate is influenced by the volatile and/or water-soluble components of the coating. Since in practice these components can evaporate from the coating during outdoor exposure or be washed out by water (rain), the coating is to be aged prior to the determination of the water-vapour transmission rate.Subject the test specimens to 3 cycles comprising the following conditions:

– 24 h storage in water (potable water) of (23 ± 2) °C;

– 24 h drying at (50 ± 2) °C.

If the coatings are thermoplastic at 50 °C, the test pieces shall be suspended and/or suitably placed in the oven, ensuring that they do not adhere to the parts of the oven and/or to each other.

During weekends, or interruption of the conditioning for other reasons, store the test specimens in the standard atmosphere as defined in EN 23270 [(23 ± 2) °C and (50 ± 5) % relative humidity].

Afterwards, condition the test specimens in the standard atmosphere as defined in EN 23270 [(23 ± 2) °C and (50 ± 5) % relative humidity] for at least 24 h and no longer than 3 days before carrying out the test.

7.5.3 Dry film thickness

Determine the average dry film thickness of individual coats by calculating it from the consumption and the non-volatile matter content in accordance with 5.3 of EN 1062-1 : 1996 or by other suitable methods.

8 Procedure

Carry out the determination in triplicate at (23 ± 2) °C, unless otherwise agreed.

When using free films, carry out the determination in accordance with ISO 7783-1. The relative humidity at 23 °C on one side of the film shall be 93 % and 50 % on the other side. A relative humidity of 93 % inside the dish shall be maintained by using a saturated solution of ammonium dihydrogen phosphate (see 5.4). The determination shall be carried out in a place where the air speed is below 0,3 m/s.

For both free films and supported films, unless otherwise agreed, the face of the coating or coating system intended to be the external side shall face the lower relative humidity, i.e. (50 ± 5) %.

Determine the mass loss at appropriate time intervals, for example once a day, and carry out at least three determinations on three successive intervals as soon as a steady state has been reached.

9 Expression of results

9.1 Calculate the test results using one of the following methods.

9.1.1 For each test specimen determine the total mass after definite intervals and represent graphically as a function of time. The test is completed when three of four points lie on a straight line, showing a constant rate of passage of water vapour.

Calculate for each test specimen the water-vapour transmission Δm_i, in milligrams per hour, from the total change in mass for each time interval, using equation (1):

$$\Delta m_i = \frac{(m_1 - m_2)}{(t_2 - t_1)} \quad (1)$$

Calculate the water-vapour transmission rate V, in grams per square metre per day, for each test specimen from Δm_i, using equation (2):

$$V = \frac{240 \times \Delta m_i}{A_i} \quad (2)$$

where:

m_1, m_2 is the total mass, in milligrams, at the time t_1, t_2;

t_1, t_2 is the time, in hours;

A_i is the area, in square centimetres, of the test piece i.

9.1.2 For supported films applied on porous substrates, calculate the water-vapour transmission rate of the coating system using equation (3):

$$\frac{1}{V_{cs}} = \frac{1}{V_s} + \frac{1}{V}$$

$$\therefore V = \frac{V_{cs} \times V_s}{V_s - V_{cs}} \quad (3)$$

where:

V is the water-vapour transmission rate, in grams per square metre per day, of the coating system;

V_{cs} is the water-vapour transmission rate, in grams per square metre per day, of the porous substrate coated with the coating material or coating system (index cs for "coated substrate");

V_s is the water-vapour transmission rate, in grams per square metre per day, of the porous substrate.

The water-vapour permeation coefficient δ, in grams per metre per day per Pascal, of the coating is:

$$\delta = \frac{V \times d}{\Delta p} \quad (4)$$

where:

V is the water-vapour transmission rate, in grams per square metre per day, of the coating;

d is the film thickness, in metres;

Δp is the difference of water-vapour pressure, in Pascal, of the two sides of the coating;

The water-vapour permeation coeffcient of the air, δ_L, is:

$$\delta_L = \frac{0{,}083 \times p_0 \times T^{1,81}}{R_v \times T \times p \times 273^{1,81}} \quad (5)$$

where:

T is the temperature, in Kelvin, during the measurement;

p_0 is the normal atmospheric pressure, 1013,25 hPa;

R_v is the gas constant of water vapour, 462 Nm kg^{-1} K^{-1};

p is the atmospheric pressure, in hecto Pascal, during the measurement.

Determine the diffusion-equivalent air layer thickness s_D from the water-vapour transmission rate V.

The diffusion-equivalent air layer thickness s_d, in metres, is:

$$s_d = \frac{\delta_L}{\delta} \quad (6)$$

For T = 23 °C and $p_0 = p$ = 1013,25 hPa, Δp = 1207 Pa (which is equivalent to a water-vapour pressure difference from 93 % relative humidity to 50 % relative humidity, under the above conditions) the conversion factor for V, in grams per square metre per day, to s_d, in metres, is:

$$s_d = \frac{21}{V} \quad (7)$$

10 Precision

10.1 Repeatability (r)

The value below which the absolute difference between two single test results, each the mean of triplicates, obtained on identical material by one operator in one laboratory within a short interval of time using the standardized test method, may be expected to lie with a 95 % probability, is 20 % (relative to the mean of the two test results).

10.2 Reproducibility (R)

The value below which the absolute difference between two single test results, each the mean of triplicates, obtained on identical material by operators in different laboratories using the standardized test method, may be expected to lie with a 95 % probability, is 28 % (relative to the mean of the two test results).