SLOVENSKI STANDARD
SIST ENV 1094-7:1998

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Toplotnoizolacijski ognjevzdrġni izdelki - 7. del: Metode za preskuġanje izdelkov iz keramiļ nih vlaken

Insulating refractory products - Part 7: Methods of test for ceramic fibre products

Feuerfeste Erzeugnisse für Isolationszwecke - Teil 7: Prüfverfahren für Erzeugnisse aus keramischer Faser

Produits réfractaires isolants - Partie 7: Méthodes d'essai des produits de fibres céramiques

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English version

Insulating refractory products - Part 7: Methods of test for ceramic fibre products

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Contents

Foreword

This European Pre-standard has been prepared by CEN/TC187 'Refractory products and materials', the secretariat of which is held by BSI.

Reproducibility and repeatability data are not available at present but may be included in a subsequent edition.

EN 1094 'Insulating refractory products' consists of 7 Parts:

Part 1 : Terminology for ceramic fibre products
Part 2 : Classification of shaped products
Part 3 : Classification of ceramic fibre products
Part 4 : Determination of bulk density and true porosity of shaped products
Part 5 : Determination of cold crushing strength of shaped products
Part 6 : Determination of permanent change in dimensions on heating of shaped products
Part 7 : Methods of test for ceramic fibre products (ENV)

In accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to announce this European Pre-standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK.

1 Scope

This European Pre-standard specifies methods for determining the thickness, bulk density, resilience, permanent linear change, thermal conductivity, tensile strength and shot content of ceramic fibre products. It applies to ceramic fibre bulk, blankets, felts, mats, boards, pre-formed shapes and papers, with the exception of products delivered in a wet state.

The application of the individual test methods is given in table 1, with reference to the type of products.

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 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 1094-1	Insulating refractory products Part 1 : Terminology for ceramic fibre products
EN 10002-2	Metallic materials - Tensile testing Part 2 : Verification of the force measuring system of the tensile testing machine.
ISO 565 : 1990	Test sieves : Woven metal wire cloth perforated plate, and electroformed sheets, nominal sizes of apertures.

3 Preparation of test pieces

The number of items to be tested shall be determined by agreement between the parties. The number of test pieces per item shall be determined in accordance with table 1.

When the material to be tested is wound, any compressed material at the extreme ends shall be excluded. A strip shall be cut perpendicular to the length across the full material width, of sufficient size for the different tests planned.

From the strip, cut the required number of test pieces of required dimensions, using a template, a sharp knife, a saw, or other method which will not damage the sample. Avoid excess pressure as this may crush the fibre.

Table 1 : Summary of test methods and designations, applicability to product types and number of test pieces per item required

clause	Test	Material	Number of test pieces
4	Thickness: 725 Pa method or 350 Pa method	Blanket, Felt, Mat, Board	3
	50 kPa method	Paper	3
5	Bulk density	Blanket, Felt, Mat, Board, Paper	3
6	Resilience	Blanket, Felt, Mat	3
7	Permanent linear change on heating by the: Slow heat method or the Hot furnace method	Blanket, Felt, Mat, Board, Paper, Pre-formed shapes	3
8	Thermal conductivity: Calorimetric method up to hot face temperature of 1300 °C	Blanket, Felt, Mat, Board, Pre-formed shapes	1
9	Tensile strength	Blanket, Felt, Paper	5
10	Shot content	Bulk fibre, Blanket, Felt, Mat, Board, Paper	3

4 Determination of the thickness

4.1 Principle

Determination of the thickness of a product subjected to a compressive stress which depends on its nominal bulk density. There are two methods, of which the dial gauge comparator method (4.3.1) is the referee method and is the only method applicable to ceramic fibre paper.

4.2 Test piece dimensions:

The size of the test piece shall be such that the disc entirely rests on it, and shall be at least 100 mm x 100 mm.

4.3 Methods

4.3.1 *The dial gauge comparator method*

4.3.1.1 *Apparatus*, consisting of a machined reference plate, a dial gauge comparator and its base and a metallic disc, 75 mm in diameter. The apparatus is capable of applying a 350 Pa ± 7 Pa compressive stress to products with a nominal bulk density less than 96 kg/m^3 and a 725 Pa ± 15 Pa compressive stress to products with a nominal bulk density equal to or higher than 96 kg/m^3. For ceramic fibre papers, the measurement shall be carried out under a compressive stress of 50 kPa ± 1 kPa with a disc of 12,5 mm in diameter.

4.3.1.2 *Procedure.* Put the test piece on the reference plate and let the disc rest on the product, care being taken not to induce parasitic pressure. Measure the thickness at the disc centre with respect to the reference plate and to an accuracy of ± 0,1 mm.

4.3.2 *The needle method*

4.3.2.1 *Apparatus*, consisting of a machined reference plate, and a measuring device made up of a needle 150 mm ± 1 mm in length and 3 mm in diameter, and a metallic disc 75 mm in diameter which slides along the needle and is capable of being secured in position, with a dial gauge comparator and a thickness gauge.

The stress determined by the mass of the disc and of its securing device shall not exceed 350 Pa ± 7 Pa for products with a nominal bulk density less than 96 kg/m^3 and 725 Pa ± 15 Pa for products with a nominal bulk density equal to or higher than 96 kg/m^3.

4.3.2.2 *Procedure.* Put the product to be measured on the reference plate, punch it with the needle and remove the needle. For the measurement, bring back the needle point in contact with the reference plate and lower the disc on to the surface of the product, care being taken not to induce parasitic pressure. Secure the disc in position, remove the whole device and measure the distance between the needle point and the disc to an accuracy of ± 0,1 mm.

4.4 Test report

Report the data required by clause 11, the dimensions of each test piece, the individual values for each test piece and the mean value for each item.

5 Determination of the bulk density

5.1 Principle

Determination of the bulk density by calculation of the ratio between the mass of the product and its volume geometrically determined, thickness having been first determined according to clause 4.

5.2 Apparatus

a) Thickness measurement device, as in 4.3.1 or 4.3.2:

b) Steel rule, reading to 0,5 mm, possibly with a square angle at the readings origin, or alternatively, callipers;

c) Ventilated oven at (110 ± 5) °C;

d) Balance, of 2 kg capacity, accurate to ± 0,1 g.

5.3 Test pieces

The dimensions of the test pieces shall be in accordance with 4.2.

Dry the test pieces at (110 ± 5) °C to constant mass. Constant mass can be considered as achieved when the mass variation between two weighings carried out within a one hour interval does not exceed 0,1 %.

Reject any test piece where the loss of mass exceeds 5 % after drying.

5.4 Procedure

Measure the two other dimensions of the test piece with the steel rule or the callipers to an accuracy of 0,5 mm, and calculate its area, the thickness being determined according to clause 4.

Carry out the measurements along the middle of each face of the test piece.
Carry out the weighings with an accuracy of ± 0,1 g.

5.5 Expression of results

Calculate the bulk volume V_b of the test-piece (in m^3) using the following equation :

$$V_b = S \times t$$

where:

S is the area in m^2
t is the thickness in m

Calculate the bulk density ρ of the test piece (in kg/m^3) using the equation:

$$\rho = \frac{m}{V_b} \qquad (1)$$

where :

m is the dry mass in kg determined in 5.4.
V_b is the bulk volume in m^3.

5.6 Test report

Report the data required by clause 11, the mass and dimensions of each test piece, reference to the method for thickness, and the individual values for each test piece and a mean for each item.

6 Determination of resilience

6.1 Definition

Resilience is the ability of ceramic fibres to spring back after compression to 50 % of thickness. It is the ratio of the thickness of a product after the application and relaxation of a compressive force which reduces the original thickness to 50 % of its original value, to its original thickness.

6.2 Principle

Calculation of the ratio, expressed in %, of the thickness of a product to its initial thickness, after application of a compressive stress sufficient to reduce the initial thickness to 50 % for a given time.

6.3 Apparatus, consisting of:

a) thickness gauge;
b) compression testing machine capable of applying the compressive stress at a given rate and provided with means for measuring the test piece deformation;
c) balance, accurate to ± 0,1 g.
d) ventilated oven, set at (110 ± 5) °C.

6.4 Test pieces

6.4.1 *Dimensions*

Cut out test pieces of dimensions 100 mm x 100 mm x (nominal thickness). Do not compress the test pieces when cutting out.

6.4.2 *Drying*

See 5.3.2

6.5 Procedure

Determine the thickness according to clause 4. Set the compression testing machine to give a constant deformation rate of 2 mm/min.

Place the test piece in the compression tester and compress at the given rate until the test piece thickness has been reduced by 50 %.

NOTE : If a record of compressive stress versus thickness is required, record the compressive stress at regular % reductions of the original thickness).

Keep the test piece at 50 % of its initial thickness for 5 min and then remove the majority of the pressure applied by the testing machine but just maintaining a nominal pressure, of either 350 Pa for products with a bulk density less than 96 kg/m^3, or 725 Pa for products with a bulk density equal to or higher than 96 kg/m^3. After 5 min, determine the thickness according to clause 4.

NOTE : Other values for reduction of the thickness can be chosen by agreement between the parties. The same procedure shall be used.

6.6 Expression of the results

Calculate resilience, in %, from the following equation:

$$\text{Resilience} = \frac{\text{thickness after testing} \times 100}{\text{initial thickness}} \qquad (2)$$

Calculate permanent deformation, in %, from the following equation:

$$\text{Permanent deformation} = 100 \left[1 - \frac{\text{thickness after testing}}{\text{initial thickness}} \right] \qquad (3)$$

6.7 Test report

Report the data required by clause 11, the dimensions of the test pieces and the thickness method, also any value for reduction of the thickness, if different from 50 %, individual values of permanent deformation/resilience, and the mean values of permanent deformation/resilience.