



SLOVENSKI STANDARD
SIST EN 993-2:1998

01-april-1998

**Metode za preskušanje gostih oblikovanih ognjevzdržnih izdelkov - 2. del:
Ugotavljanje gostote**

Methods of test for dense shaped refractory products - Part 2: Determination of true density

Prüfverfahren für dichte geformte feuerfeste Erzeugnisse - Teil 2: Bestimmung der Dichte

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Méthodes d'essai pour produits réfractaires façonnés denses - Partie 2: Détermination de la masse volumique absolue

[SIST EN 993-2:1998](https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-1b54557658e8/sist-en-993-2-1998)

[https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-](https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-1b54557658e8/sist-en-993-2-1998)

[1b54557658e8/sist-en-993-2-1998](https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-1b54557658e8/sist-en-993-2-1998)

Ta slovenski standard je istoveten z: EN 993-2:1995

ICS:

81.080

Ognjevzdržni materiali

Refractories

SIST EN 993-2:1998

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 993-2:1998](#)

<https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-1b54557658e8/sist-en-993-2-1998>

EUROPEAN STANDARD

EN 993-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 1995

ICS 81.080

Descriptors: Refractory materials, dense shaped refractory products, shaped insulating refractory products, raw materials, tests, determination, density, testing conditions

English version

Methods of test for dense shaped refractory products - Part 2 : Determination of true density

Méthodes d'essai pour produits réfractaires
façonnés denses - Partie 2: Détermination de la
masse volumique absolue

Prüfverfahren für dichte geformte feuerfeste
Erzeugnisse - Teil 2: Bestimmung der Dichte

STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 993-2:1998

<https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-1b54557658e8/sist-en-993-2-1998>

This European Standard was approved by CEN on 1995-02-15. 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.

The European Standards exist 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

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

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

© 1995

All rights of reproduction and communication in any form and by any means reserved in all countries to CEN and its members.

Ref. No. EN 993-2:1995 E

Contents

	Page
Foreword	3
1 Scope	4
2 Normative reference	4
3 Definitions	4
4 Principle	4
5 Apparatus	4
6 Test material	5
7 Procedure	6
8 Expression of results	8
9 Test report	8
Annex	9
A (Normative) Alternative procedure	9

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 993-2:1998

<https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-1b54557658e8/sist-en-993-2-1998>

Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 187 "Refractory products and materials", the secretariat of which is held by BSI.

It is closely based on the corresponding International Standard, ISO 5018 "Refractory materials - Determination of true density", published by the International Organization for Standardization (ISO).

Reproducibility and repeatability data are not available, but may be given in a subsequent edition.

EN 993 'Methods of test for dense shaped refractory products' consists of 18 Parts:

- Part 1 : Determination of bulk density and porosity
- Part 2 : Determination of true density
- Part 3 : Test methods for carbon-containing refractories
- Part 4 : Determination of permeability to gases
- Part 5 : Determination of cold crushing strength
- Part 6 : Determination of modulus rupture, ambient temperatures
- Part 7 : Determination of modulus rupture, elevated temperatures
- Part 8 : Determination of refractoriness-under-load
- Part 9 : Determination of creep in compression
- Part 10 : Determination of permanent change in dimensions on heating
- Part 11 : Determination of resistance to thermal shock (ENV)
- Part 12 : Determination of pyrometric cone equivalent
- Part 13 : Specification for pyrometric cones
- Part 14 : Determination of thermal conductivity (hot wire, cross-array)
- Part 15 : Determination of thermal conductivity (hot wire, parallel)
- Part 16 : Determination of resistance to acids
- Part 17 : Determination of bulk density of granular material (mercury method)
- Part 18 : Determination of bulk density of granular material (water method)

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 August 1995, and conflicting national standards shall be withdrawn at the latest by August 1995.

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

1 Scope

This Part of EN 993 specifies a method for measuring the true density of refractory and raw materials.

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 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.

ISO 565 Test sieves - Woven metal wire cloth and perforated plates - Nominal sizes of aperture.

3 Definitions

For the purpose of this Part of EN 993, the following definitions apply.

3.1 true density: The ratio of the mass of a quantity of dried material to its true volume.

3.2 true volume: The volume of the solid material in a porous body.

SIST EN 993-2:1998

4 Principle

<https://standards.iteh.ai/catalog/standards/sist/8ec90450-8a43-4b58-8f2e-1b54557658e8/sist-en-993-2-1998>

The true density is determined by measuring the dry mass and the true volume of a sample of the material after it has been crushed and ground to such a particle size that as far as possible no closed pores remain. The volume of the ground material is determined using a pycnometer and a liquid of known density, the temperature of the liquid being controlled or carefully measured.

Unfired refractory products and basic products may require pre-treatment, the conditions of which are agreed between the parties concerned.

5 Apparatus

5.1 Pycnometer, of capacity from 25, 50 or 100 mL, fitted with a ground stopper having a capillary bore.

5.2 Balance, with an accuracy of $\pm 0,1$ mg.

5.3 Evacuating equipment, capable of reducing the pressure to a value not greater than 2500 Pa, and a means of measuring the pressure used.

5.4 Thermostatically controlled bath, capable of being maintained at a temperature from 2 °C to 5 °C above the ambient temperature, $\pm 0,2$ °C

NOTE : This accuracy of temperature control is necessary because the method is very sensitive to variations in temperature. Because of the different coefficients of thermal expansion of the vessel and of the liquid, significant errors arise if there are variations in the temperature.

5.5 Test sieve, 63 μm aperture, complying with the requirements of ISO 565.

5.6 Drying oven, capable of being controlled at (110 ± 5) °C.

5.7 Desiccator.

6 Test material

6.1 In the case of a shaped refractory product, the number of test pieces to be tested per item (brick, shape, nozzle) shall be agreed between the parties and shall be stated in the test report. The same number of test pieces shall be taken from each item, in order to facilitate statistical analysis.

6.2 The test material (test piece) shall be crushed and ground to pass completely through the test sieve (see 5.5).

NOTE : In some materials grinding the sample to pass 63 μm will still leave some closed pores.

6.3 Care shall be taken that the crushing and grinding operations do not introduce foreign matter or moisture into the material.

6.4 Before the test, the materials to be tested shall be dried at (110 ± 5) °C to constant mass, that is to say until two successive weighings made before and after at least 2 h in the drying oven (see 5.6) do not differ by more than 0,1 % of the mass of the test material. Before each weighing, the test material shall be placed in the desiccator (see 5.7) until it has cooled to room temperature.

6.5 Care shall be taken during the preparation of basic refractory materials to prevent any hydration. It is permissible that these materials should be dried at 500 °C; if this is done, the fact shall be stated in the test report.

7 Procedure

7.1 Determination of the initial mass of test material (m_1)

7.1.1 Clean the empty pycnometer (see 5.1) and ensure that it is perfectly dry. It is recommended that leather fingers be used to manipulate the pycnometer. Allow it to come to a temperature near to the ambient temperature.

7.1.2 Weigh the cleaned and empty pycnometer with its stopper in position to the nearest 0,0002 g.

7.1.3 Introduce into the pycnometer a quantity of the dry test material equal to approximately 1/3 of the volume of the pycnometer. When the pycnometer and its contents have again come to the ambient temperature, weight it to the nearest 0,0002 g. The difference in the two weighings is the initial mass of the test material (m_1).

Annex A gives an alternative procedure which may be used if the test material is difficult to wet with the liquid; use of this procedure shall be reported.

7.2 Determination of the mass of the pycnometer filled with a quantity of the test material and with test liquid (m_2)

7.2.1 Add to the pycnometer (weighed in accordance with 7.1.3) a quantity of deaerated boiled water (see table 1) or another liquid of known density, so that the pycnometer is filled to 1/2 or 2/3 capacity. Place the pycnometer in a desiccator and expose it to a vacuum (see 5.3) whose pressure is no greater than 2500 Pa, until no more air bubbles are seen to rise. The pycnometer may be shaken by means of a shaking device mounted in the desiccator, or by some other method, to ensure complete wetting. When a liquid other than water is used, it should not boil under the pressure used.

7.2.2 Fill the pycnometer almost completely with water or with the other chosen liquid and allow its contents to settle until the supernatant liquid is only slightly cloudy (it is normally sufficient to allow the contents to settle overnight).

7.2.3 Carefully fill the pycnometer, insert the glass stopper and carefully eliminate the liquid that overflows. Put the pycnometer into the thermostatically controlled bath (see 5.4) and raise its temperature to between 2 °C and 5 °C above the ambient temperature (this temperature is the temperature of the test to which the whole determination is related). Maintain the temperature constant to within $\pm 0,2$ °C.

7.2.4 As the temperature rises, a little liquid will escape from the capillary bore of the stopper. Carefully remove this overflowing liquid by absorbing it with filter paper. The pycnometer has attained the test temperature when no more liquid comes from the capillary bore. Take the pycnometer from the thermostatically controlled bath and take precautions that heat from the hand does not warm the pycnometer and cause any further escape of liquid (such warming can be prevented by plunging the completely filled pycnometer into cold water for a few seconds, avoiding wetting the top of the neck or the stopper). Carefully wipe and dry the outside the pycnometer and weigh it to the nearest 0,0002 g (mass m_2).

7.3 Determination of the mass of the pycnometer filled with the liquid used (m_3)

7.3.1 Empty and clean the pycnometer and fill it almost completely with water or with the other chosen liquid.

7.3.2 Repeat the procedure detailed in 7.2.3 and 7.2.4 so as to ascertain the mass of the pycnometer filled with the liquid used (mass m_3).

Table 1. Density of water as a function of temperature between 15 and 30 °C

Temperature °C	Density . g/cm ³
15	0,9991
16	0,9989
17	0,9988
18	0,9986
19	0,9984
20	0,9982
21	0,9980
22	0,9978
23	0,9975
24	0,9973
25	0,9970
26	0,9968
27	0,9965
28	0,9962
29	0,9959
30	0,9956