BS EN 993-1:2018

BSI Standards Publication

Methods of test for dense shaped refractory products

Part 1: Determination of bulk density, apparent porosity and true porosity

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National foreword

This British Standard is the UK implementation of EN 993-1:2018. It supersedes BS EN 993-1:1995, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RPI/1, Refractory products and materials.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Methods of test for dense shaped refractory products - Part 1: Determination of bulk density, apparent porosity and true porosity

Méthodes d'essai pour produits réfractaires façonnés denses - Partie 1 : Détermination de la masse volumique apparente, de la porosité ouverte et de la porosité totale

Prüfverfahren für dichte geformte feuerfeste Erzeugnisse - Teil 1: Bestimmung der Rohdichte, offenen Porosität und Gesamtporosität

This European Standard was approved by CEN on 5 October 2018.

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

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European foreword

This document (EN 993-1:2018) has been prepared by Technical Committee CEN/TC 187 “Refractory products and materials”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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

This document supersedes EN 993-1:1995.

It is closely based on the corresponding International Standard, ISO 5017 “Dense shaped refractory products - Determination of bulk density, apparent porosity and true porosity”.

Reproducibility and repeatability data are available only for a limited number of testing methods and materials, but may be complemented in subsequent edition.

The series of standards EN 993 'Methods of test for dense shaped refractory products' consists of 20 Parts, some of which have been withdrawn and replaced by equivalent standards:

— *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 of rupture, elevated temperatures*

— *Part 8 Determination of refractoriness under load* – withdrawn – replaced by EN ISO 1893

— *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)* – withdrawn – replaced by EN ISO 8894-1

— *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)*

— *Part 19: Determination of thermal expansion by a differential method*

— *Part 20: Determination of resistance to abrasion at ambient temperature* – withdrawn – replaced by EN ISO 16282

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document specifies a method for the determination of the bulk density, apparent porosity and true porosity of dense shaped refractory products.

NOTE For shaped insulating refractory products, the bulk density and true porosity are determined in accordance with EN 1094-4.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 993-2, *Methods of test for dense shaped refractory products — Part 2: Determination of true density*

ISO 5022, *Shaped refractory products - Sampling and acceptance testing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
bulk density
ρ_b
ratio of the mass of the dry material of a porous body to its bulk volume, expressed in grams per cubic centimetre or in kilograms per cubic metre

3.2
bulk volume
V_b
sum of the volumes of the solid material, the open pores and the closed pores in a porous body

NOTE The roughness of the surface limits the accuracy of definition of the bulk volume and, in consequence, of the bulk density. Also, the concept of bulk density becomes less precise when the volume of the test piece diminishes below certain limits or when its texture (size of pores and grains) is too coarse.

3.3
true density
ρ_t
ratio of the mass of the solid material of a porous body to its true volume, expressed in grams per cubic centimetre or in kilograms per cubic metre

3.4
true volume
volume of the solid material in a porous body

3.5
open pores
pores that are penetrated by the immersion liquid in the current test

NOTE These pores are, in principle, all those that are connected with the atmosphere, either directly or via one another. Here also the roughness of the surface imposes a limit to the accuracy of the definition of the volume of the open pores.