

# Methods of test for dense shaped refractory products —

## Part 18: Determination of bulk density of granular materials by the water method with vacuum

The European Standard EN 993-18:2002 has the status of a  
British Standard

ICS 81.080

# National foreword

This British Standard is the official English language version of EN 993-18:2002.

The UK participation in its preparation was entrusted to Technical Committee RPI/1, Refractory products and materials, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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This British Standard, having been prepared under the direction of the Materials and Chemicals Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 12 September 2002

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English version

**Methods of test for dense shaped refractory products - Part 18:  
Determination of bulk density of granular materials by the water  
method with vacuum**

Méthodes d'essai pour produits réfractaires façonnés  
denses - Partie 18: Détermination de la masse volumique  
apparente des matériaux en grains par la méthode à l'eau  
sous vide

Prüfverfahren für dichte geformte feuerfeste Erzeugnisse -  
Teil 18: Bestimmung der Rohdichte an körnigem Gut nach  
dem Wasserverdrängungsverfahren unter Vakuum

This European Standard was approved by CEN on 5 July 2002.

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 Management Centre 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 Management Centre 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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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## Foreword

This document (EN 993-18:2002) 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 February 2003, and conflicting national standards shall be withdrawn at the latest by February 2003.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 993 'Methods of test for dense shaped refractory products' consists of 20 Parts:

- Part 1: *Determination of bulk density, apparent porosity and true 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 of rupture at ambient temperature.*
- Part 7: *Determination of modulus of rupture at 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).*
- Part 19: *Determination of resistance to thermal expansion.*
- Part 20: *Determination of resistance to abrasion at ambient temperature.*

## 1 Scope

This European Standard specifies a method based on water absorption with vacuum for the determination of the bulk density of granular refractory materials (grain bulk density) having a grain size greater than 2 mm.

NOTE 1 This method is proposed as an alternative to the method based on mercury displacement with vacuum described in EN 993-17 which is to be used as the reference method because of its reproducibility. However, mercury is known to be a hazardous substance and the method described in this European Standard is recommended for all routine purposes. Nevertheless, depending on the nature of the material tested, the two methods may give different results.

NOTE 2 For materials that are sensitive to contact with water, a suitable organic liquid should be used. The immersion liquid should not fractionate at a pressure above the absolute pressure attained in the test. For example, distilled paraffin can be used for hydratable materials.