



National Standards Authority of Ireland

IRISH STANDARD

I.S. EN 993-5:1999

ICS 81.080

**METHODS OF TEST FOR DENSE SHAPED  
REFRACTORY PRODUCTS - PART 5:  
DETERMINATION OF COLD CRUSHING  
STRENGTH**

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English version

## Methods of test for dense shaped refractory products - Part 5: Determination of cold crushing strength

Méthodes d'essai pour produits réfractaires façonnés  
denses - Partie 5: Détermination de la résistance à  
l'écrasement à température ambiante

Prüfverfahren für dichte geformte feuerfeste Erzeugnisse -  
Teil 5: Bestimmung der Kaltdruckfestigkeit

This European Standard was approved by CEN on 4 September 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.



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## Foreword

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of an identical text or by endorsement, at the latest by March 1999, and conflicting national standards shall be withdrawn at the latest by March 1999.

It is closely based on the corresponding International Standard ISO 10059-1: 1992 "Dense, shaped refractory products- Determination of cold compressive strength - Part 1: Referee test without packing."

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

EN 993 "Methods of testing dense shaped refractory products" consists of 18 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 temperatures
- 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 (refractoriness)
- Part 13 : Specification for pyrometric reference cones for laboratory use
- Part 14 : Determination of thermal conductivity by the hot-wire (cross-array) method
- Part 15 : Determination of thermal conductivity by the hot-wire (parallel) method
- Part 16 : Determination of resistance to sulphuric acids
- Part 17 : Determination of bulk density of granular materials by the mercury method with vacuum
- Part 18 : Determination of bulk density of granular materials by the water method with vacuum
- Part 19 : Determination of resistance to thermal expansion
- Part 20 : Determination of resistance to abrasion at ambient temperature

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.

## 1 Scope

This European standard specifies a method of determination of the cold crushing strength of dense shaped refractory products.

## 2 Normative references

This European standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in the text and in 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 993-1      Methods of test for dense shaped refractory products - Part 1 : Determination of bulk density, apparent porosity and true porosity.

ISO 3599      Vernier callipers reading to 0,1 and 0,05 mm.

## 3 Definitions

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

**3.1 Cold crushing strength.** The maximum load per unit area, applied under specified conditions at room temperature, that a refractory product will withstand before failure occurs.

**3.2 Dense shaped refractory product.** A product having a true porosity of less than 45 % (V/V), when measured in accordance with EN 993-1.

## 4 Principle

A test piece of known dimensions is subjected under specified conditions to a steadily increasing compressive load until its failure, when it cannot support a further increase in load. The cold crushing strength is calculated from the maximum load indicated at failure and the mean cross-sectional area over which the load is applied.

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