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**Refractory materials — Determination  
of bulk density of granular materials  
(grain density)**

*Matériaux réfractaires — Détermination de la masse volumique  
apparente des matériaux en grains (masse volumique des grains)*



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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee 33, *Refractories*.

This second edition cancels and replaces the first edition (ISO 8840:1987), which has been technically revised.

The main changes compared to the previous edition are as follows:

- a new method according to ISO 5017 has been added. It is identical to the method given in EN 993-18 with a suggested improvement to avoid the most influencing factor of the operator.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Refractory materials — Determination of bulk density of granular materials (grain density)

## 1 Scope

This document specifies three methods for the determination of the bulk density of granular refractory materials (grain density) having a grain size larger than 2 mm:

- Method 1: mercury method with vacuum;
- Method 2: arrested water absorption method;
- Method 3: vacuum method with spin dryer option according to ISO 5017.

Method 1 is intended as the reference method.

**NOTE** Depending on the nature of the material tested, the three methods can give different results. Any statement of the value of a bulk density can therefore be accompanied by an indication of the method used or to be used in case of dispute.

The same method can be used for the determination of the volume of the sample, for selecting and preparing the sample, for calculating the bulk density and for presenting the test report.

## 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.

ISO 383, *Laboratory glassware — Interchangeable conical ground joints*

ISO 385-1, *Laboratory glassware — Burettes — Part 1: General requirements*

ISO 5017, *Dense shaped refractory products — Determination of bulk density, apparent porosity and true porosity*

ISO 8656, *Refractory products — Raw materials and unshaped products — Sampling*

## 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:

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

### 3.1

#### **grain density**

#### **bulk density of granular material**

ratio of the mass of a quantity of the material to the total volume of its grains, including the volume of any *closed pores* (3.2) within the grains