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**Abrasive grains — Determination of bulk  
density —**

Part 1:  
**Macrogrits**

*Grains abrasifs — Détermination de la masse volumique apparente —*

*Partie 1: Macrograins*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 9136-1 was prepared by Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 5, *Grinding wheels and abrasives*.

This first edition of ISO 9136-1 cancels and replaces ISO 9136:1989, the contents of which have been technically revised.

ISO 9136 consists of the following parts, under the general title *Abrasive grains — Determination of bulk density*:

- Part 1: *Macrogrits*
- Part 2: *Microgrits*

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# Abrasive grains — Determination of bulk density —

## Part 1: Macrogrits

### 1 Scope

This part of ISO 9136 specifies a test method for the determination of the bulk density of bonded and coated abrasive macrogrits.

### 2 Normative references

The following referenced documents are indispensable for the application 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 6344-1, *Coated abrasives — Grain size analysis — Part 1: Grain size distribution test*

ISO 8486-1, *Bonded abrasives — Determination and designation of grain size distribution — Part 1: Macrogrits F4 to F220*

ISO 9136-2, *Abrasive grains — Determination of bulk density — Part 2: Microgrits*

### 3 Definitions

For the purposes of this document, the definitions given in ISO 6344-1, ISO 8486-1 and ISO 9136-2 apply.

### 4 Apparatus

#### 4.1 General

The test apparatus is illustrated in Figure 1 and Annex A. It consists of the elements listed in 4.2 to 4.6.

#### 4.2 Stand

An exact description of the stand is not necessary. The only requirement is that it be capable of holding the funnel in a vertical position so that the dimension between the outlet of the funnel and the bottom of the measuring cylinder is  $138 \pm 1$  mm.

#### 4.3 Funnel

The slope of the funnel shall be such that fine grains will not adhere to the sides. By preference, the funnel shall be made of stainless steel with smooth inside seams. Its dimensional characteristics (see also Figure 1) shall be as follows:

- total height of funnel: 240 mm;
- diameter of top: 160 mm;
- inside diameter of the cylindrical outlet: 20 mm ± 0,5 mm;
- height of the cylindrical outlet area: 40 mm ± 1 mm.

#### 4.4 Funnel release valve

An exact description of the funnel release valve is not necessary. The only requirement is that quick opening of the valve be ensured. Figure 1 illustrates an example of a swinging stopper release valve.

#### 4.5 Measuring cylinder

The measuring cylinder is cylindrical with a polished inner surface and features a volume  $V$  of  $(200 \pm 0,5)$  cm<sup>3</sup>; this volume is determined by an inner diameter of 64 mm and an inner height of 62,2 mm. The measuring cylinder is placed centrally under the stream emanating from the vibration channel.

The height of fall of the macrogrits to be tested (from the upper edge of the channel bottom to the bottom of the measuring cylinder) shall be  $(138 \pm 1)$  mm.

#### 4.6 Overspill tray

The overspill tray with a flat bottom serves as a collector for overflowing macrogrits. The measuring beaker is placed in the drip tray.

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### 5 Calibration of the measuring cylinder

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Calibration of the measuring cylinder can be achieved by the following two methods.

The volume of the measuring cylinder shall be checked regularly.

#### Method A

The dry, empty measuring cylinder is weighed together with a flat glass plate. The measuring cylinder is filled with water and the glass plate placed on the cylinder in such a way that no air bubbles are present. The glass plate is held in this position, the surplus water removed and the total weight determined.

The volume is calculated as follows:

$$V = \frac{m_0}{\rho_{\text{H}_2\text{O}}} \quad (1)$$

where

$V$  is the volume of the measuring cylinder, in cubic centimetres;

$m_0$  is the mass of water, in grams;

$\rho_{\text{H}_2\text{O}}$  is the density of water, in grams per cubic centimetre, at the measuring temperature, see Table 1.

#### Method B

The volume is calculated by measuring the internal dimensions of the cylinder (margin of error 0,001 mm).

Table 1 — Density of purified water

Temperature °C	Density g/cm <sup>3</sup>	Temperature °C	Density g/cm <sup>3</sup>
18	0,998 593	26	0,996 780
20	0,998 201	28	0,996 230
22	0,997 767	30	0,995 643
24	0,997 293		

## 6 Method of measurement

### 6.1 Preparation of samples

For grain sizes F100 or P100 and finer, dry the abrasive grains at a temperature of 110 °C for 1 h and then, prior to measurement, cool them to room temperature.

Coarser grains shall be dry at room temperature.

### 6.2 Procedure

Fill a 250 ml beaker to the top with the abrasive grains to be tested. With the funnel outlet closed and the measuring cylinder centering under the outlet of the funnel, pour the grains into the funnel. Open the outlet of the funnel and allow the grains to fall freely until the funnel is empty. Avoid vibrations throughout this procedure.

The test material heaped above the rim of the measuring cylinder shall be removed using a straight blade with the leading edge at an angle of approximately 45° to the rim of the measuring beaker (see Figure 2).

Vibration shall be avoided throughout the measuring procedure (risk of compaction).

The measuring cylinder filled with macrogrits shall be weighed to within 0,01 g.

## 7 Expression of results

### 7.1 Method of calculation

Calculate the bulk density  $\rho_B$  as follows:

$$\rho_B = \frac{m_1}{V} \quad (2)$$

where

$\rho_B$  is the bulk density, in grams per cubic centimetre;

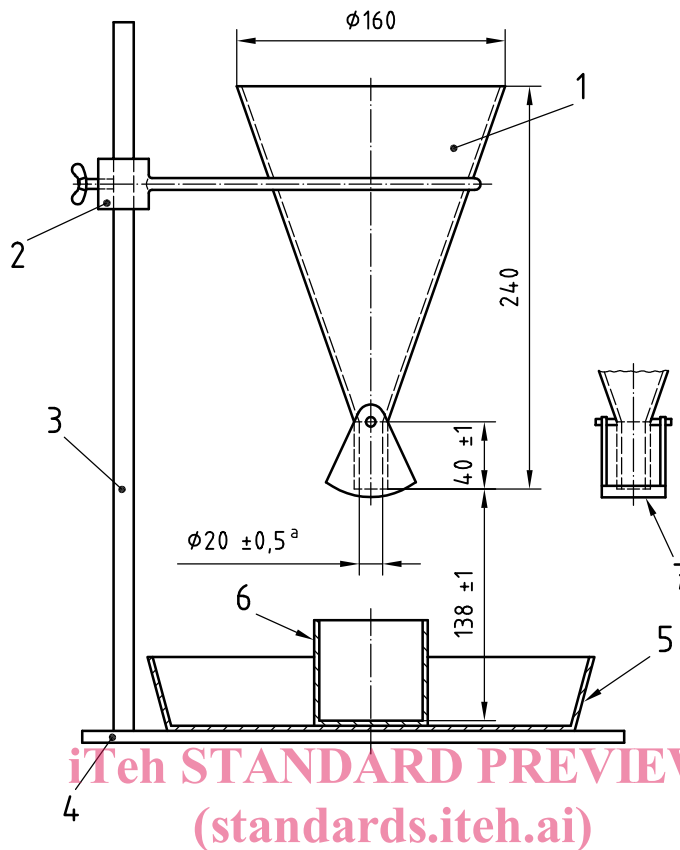
$m_1$  is the mass of grains contained in the measuring cylinder, in grams;

$V$  is the volume of the cylinder, in cubic centimetres.

### 7.2 Repeatability

Duplicate determinations by the same operator and apparatus shall not differ by more than  $\pm 0,02$  g/cm<sup>3</sup>.

Dimensions in millimetres



**Key**

- 1 funnel
- 2 funnel stand height adjustment
- 3 stand
- 4 bottom plate
- a Outlet diameter.

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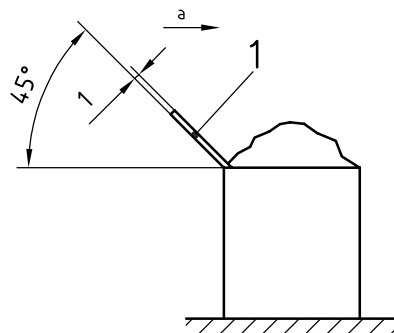
5 overflow dish

6 measuring cylinder

7 release valve (closed)

**Figure 1 — Apparatus for the determination of the bulk density of abrasive macrograins**

Dimensions in millimetres



**Key**

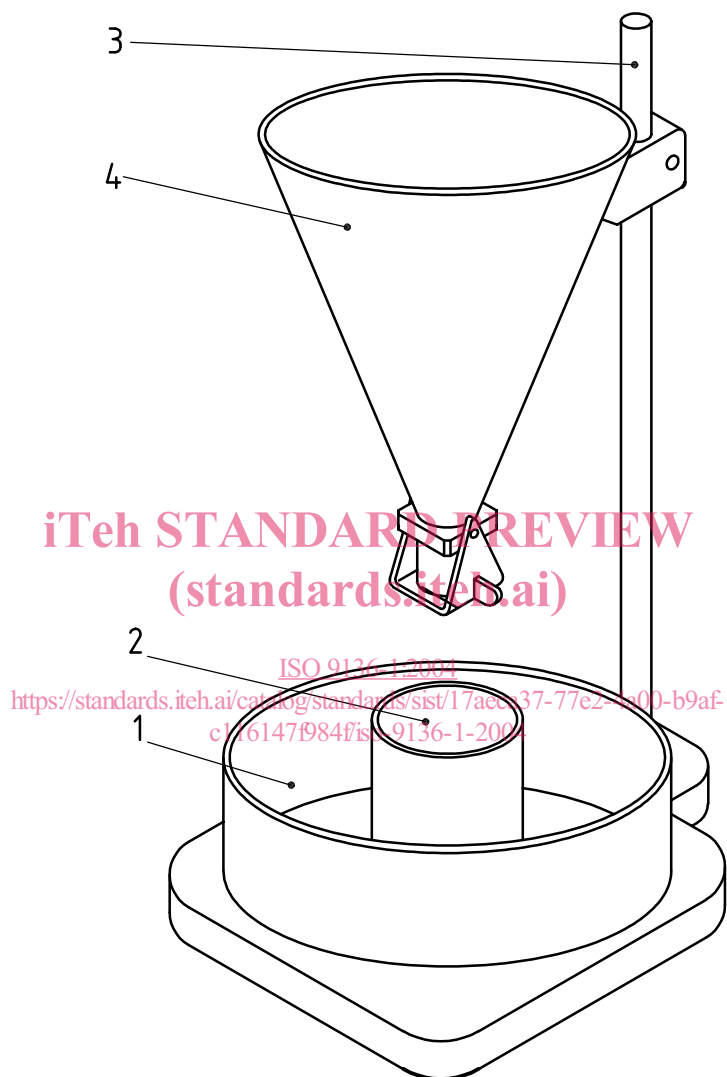
- 1 straight blade
- a Moving direction.

**Figure 2 — Procedure for removing the heaped material**



## Annex A (informative)

### Apparatus for the determination of the bulk density of macrogrits



#### Key

- 1 overspill tray
- 2 measuring cylinder
- 3 stand
- 4 funnel

Figure A.1 — Apparatus for the determination of the bulk density of macrogrits