
**Fine ceramics (advanced ceramics,
advanced technical ceramics) —
Determination of bulk density of ceramic
powders —**

**Part 1:
Tap density**

*Céramiques techniques — Détermination de la masse volumique des
poudres céramiques —*

Partie 1: Masse volumique après tassement



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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 23145-1 was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

ISO 23145 consists of the following parts, under the general title *Fine ceramics (advanced ceramics, advanced technical ceramics)* — *Determination of bulk density of ceramic powders*:

- *Part 1: Tap density*
- *Part 2: Untapped density*

Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of bulk density of ceramic powders —

Part 1: Tap density

1 Scope

This part of ISO 23145 specifies a procedure to determine the tap density of granulated or ungranulated ceramic powders by a constant-volume measuring method.

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 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

3 Principle

The mass of a known volume of the powder is determined after allowing it to fall freely into a stationary container, and then tapping it under specified conditions until saturation of packing is reached. The mass of the powder divided by its volume after the test gives its tap density.

4 Apparatus

4.1 Cylindrical container, of stainless steel (see Figure 1) with a volume of 100 cm³ and a diameter-to-height ratio of approximately 1.

4.2 Sieve, as specified in ISO 565, with an aperture size of 0,71 mm.

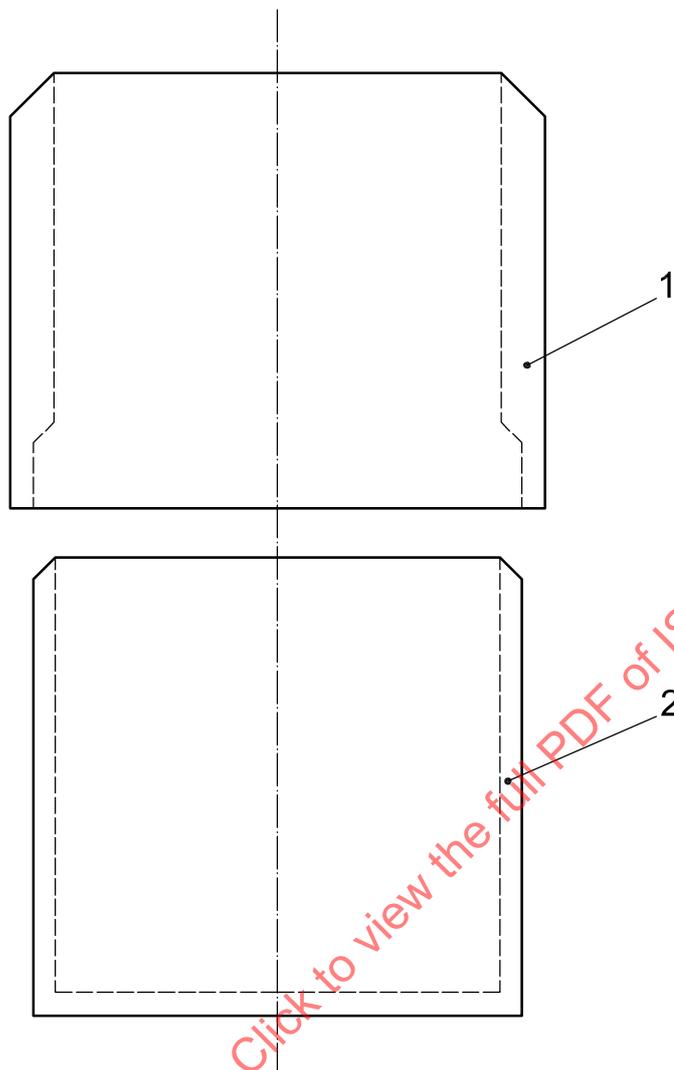
4.3 Balance, with a precision of 0,1 g or 0,01 g.

A balance with a precision of 0,01 g should be used for very fluffy powders, such as aerosil.

4.4 Ring (see Figure 1), which can be fitted to the top of the cylindrical container to increase its height.

4.5 Tapping apparatus, which permits the tapping of the ceramic powder in the cylindrical container and its ring. The tapping stroke should be (10 ± 1) mm and the tapping frequency should be less than 180 taps/min. An example of the tapping apparatus is shown in Figure 2.

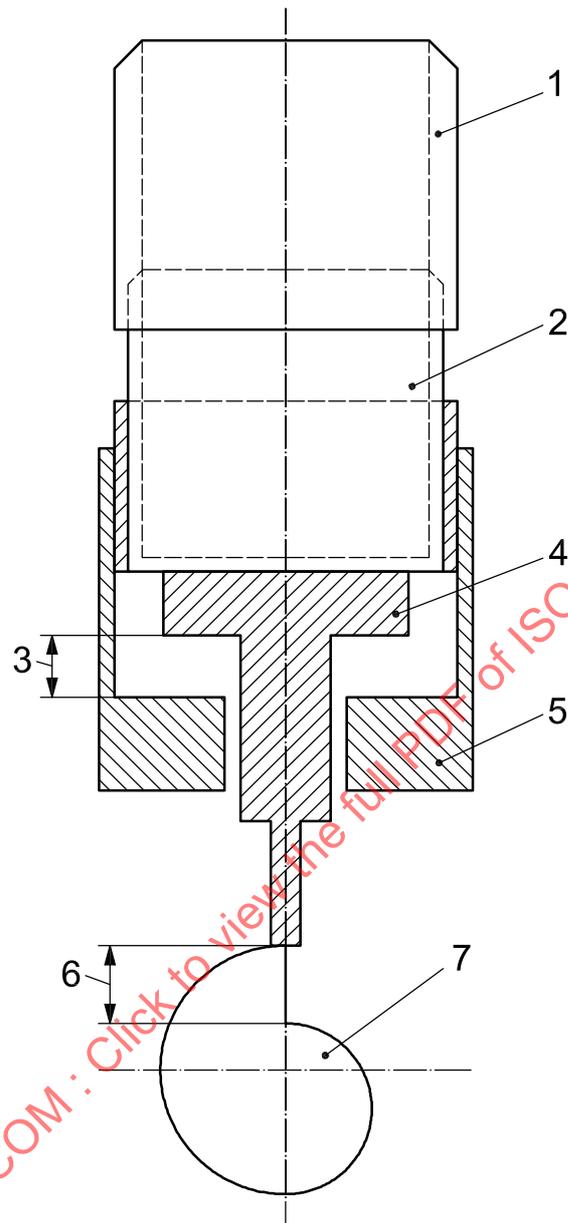
The cylindrical container shall not be tilted when it is tapped.



Key

- 1 ring, height 50 mm
- 2 cylindrical container, diameter 50 mm, height 51 mm

Figure 1 — Example of cylindrical container and ring

**Key**

- 1 ring
- 2 cylindrical container
- 3 tapping stroke, (10 ± 1) mm
- 4 piston
- 5 guide bearing
- 6 (10 ± 1) mm
- 7 cam

Figure 2 — Example of tapping apparatus

5 Sampling

5.1 In general, the powder should be tested in the as-received condition. In certain instances, the powder may be dried. If the powder is required to be dried, it should be dried at $(110 \pm 10)^\circ\text{C}$ for at least 1 h and cooled to room temperature in a desiccator. If the powder contains volatile substances, it shall not be dried.

NOTE If the powder is required to be dried, it is desirable that the powder be dried until below the weight loss rate of 0,1 %/30 min.

5.2 Should there be any treatment (e.g. drying) of the powder before measurement, it shall be recorded in the test report.

5.3 The test shall be carried out on three test portions.

6 Procedure

6.1 Weigh the empty cylindrical container.

6.2 Place the ring on the top of the cylindrical container.

6.3 Pour the powder, which passed through the sieve, into the cylindrical container with the ring.

6.4 Place the cylindrical container with the ring, filled with the powder, on the tapping apparatus and tap it 1 000 times. During tapping, pour the powder into the cylindrical container with the ring, to keep the surplus powder (20 to 30) mm higher than the height of the cylindrical container.

6.5 Remove the cylindrical container with the ring from the tapping apparatus, without any vibration.

6.6 Carefully remove the ring from the cylindrical container.

6.7 Remove the cone of surplus powder by gently drawing a straight-edge (see Figure 3) across the top rim of the cylindrical container.

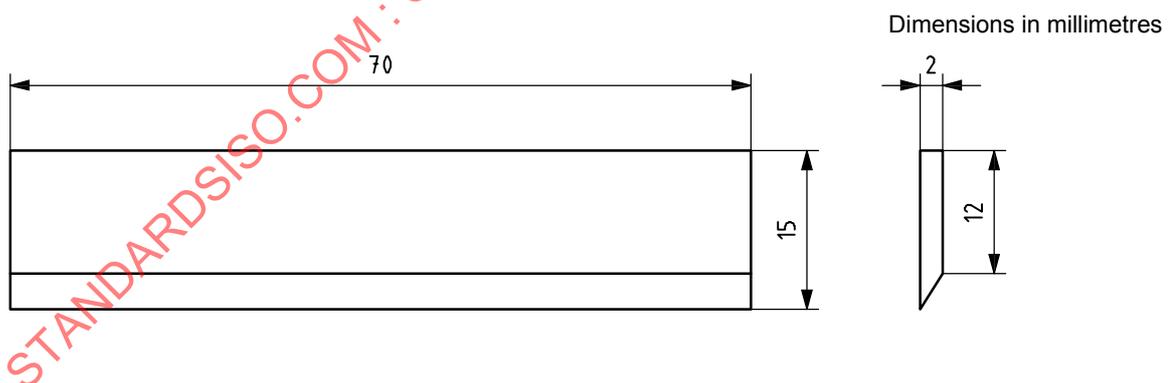


Figure 3 — Example of a straight-edge

6.8 Weigh the cylindrical container and its contents.

6.9 Place the ring on the top of the cylindrical container and pour the powder into the cylindrical container with the ring. Tap the container filled with the powder 100 times using the tapping apparatus.

6.10 Remove the ring from the cylindrical container and remove the cone of surplus powder by gently drawing a straight-edge across the top rim of the cylindrical container. Weigh the cylindrical container and its contents.

6.11 Calculate the deviation between the mass of powder weighed in 6.8 and that in 6.10.

If the deviation is more than 0,3 %, repeat steps 6.9 to 6.11 until it becomes less than 0,3 %.

6.12 Repeat steps 6.1 to 6.11 with two additional portions, and average the results.

7 Calculation

Calculate the tap density from the mass of the powder which is weighed in 6.10 divided by the volume of the cylindrical container.

$$p_t = \frac{m_1 - m_0}{V}$$

where

p_t is the tap density, in grams per cubic centimetre, of the ceramic powder;

m_0 is the mass, in grams, of the empty cylindrical container;

m_1 is the mass, in grams, of the cylindrical container full of the powder after tapping;

V is the volume, in cubic centimetres, of the cylindrical container (100 cm³).

8 Test report

The test report shall include the following information:

- a) the name of the testing establishment;
- b) date of the test, report identification and number, operator, signatory;
- c) a reference to this part of ISO 23145;
- d) a description of the powder (material type, manufacturer, batch or code number);
- e) any pretreatment of the powder, such as drying;
- f) the result obtained: tap density (kg/m³ or g/cm³);
- g) any unusual features noted during the determination;
- h) comments about the test or test results.