INTERNATIONAL STANDARD

ISO 18549-1

First edition
2009-04-15

Metallic powders — Determination of apparent density and flow rate at elevated temperatures —

Part 1: Determination of apparent density at elevated temperatures

Poudres métalliques — Détermination de la masse volumique apparente et de la vitesse d'écoulement à températures élevées —

Partie 1: Détermination de la masse volumique apparente à températures élevées

Reference number
ISO 18549-1:2009(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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 18549-1 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 2, *Sampling and testing methods for powders (including powders for hardmetals)*.

ISO 18549 consists of the following parts, under the general title *Metallic powders — Determination of apparent density and flow rate at elevated temperatures*:

— *Part 1: Determination of apparent density at elevated temperatures*

— *Part 2: Determination of flow rate at elevated temperatures*

Metallic powders — Determination of apparent density and flow rate at elevated temperatures —

Part 1: Determination of apparent density at elevated temperatures

1 Scope

This part of ISO 18549 describes a method for the determination of apparent density at elevated temperatures for powder mixes, based on iron or steel powders and intended for warm compaction. The method is, to a large extent, based on the apparent density method (funnel method) standardized in ISO 3923-1, but either of the two funnels that are mentioned can be selected after agreement between the parties involved.

2 Apparatus

2.1 Thermally insulated enclosure, where the actual measurement shall take place.

2.2 Funnel with an orifice diameter of 2,5 mm or, alternatively, a **funnel with an orifice diameter of 5 mm**, see Figure 1 or 2, respectively.

2.3 Cylindrical cup, with a capacity of $25 \pm 0{,}03$ cm^3 and an internal diameter of $28 \pm 0{,}5$ mm. A cup with the same capacity and with an internal diameter of 30 ± 1 mm is also acceptable. However, $28 \pm 0{,}5$ mm is the first option when new equipment is manufactured.

The cup and funnel should be made of non-magnetic, corrosion-resistant, metallic material having sufficient wall thickness and hardness to avoid distortion and excessive wear. The inner surfaces of the funnel and cup should be polished.

2.4 Stand and horizontal vibration-free base to support the cup and funnel; the stand holding the orifice of the funnel 25 mm above the top surface of the cup and coaxially with it, see Figure 3.

2.5 Devices for heating the funnel, e.g. an electrical band heater, **and the cylindrical cup**, e.g. a cartridge heater, to the selected and agreed temperature for the powder mix within the range 60 °C to 180 °C, with a maximum allowed variation of $\pm$ 2,5 °C.

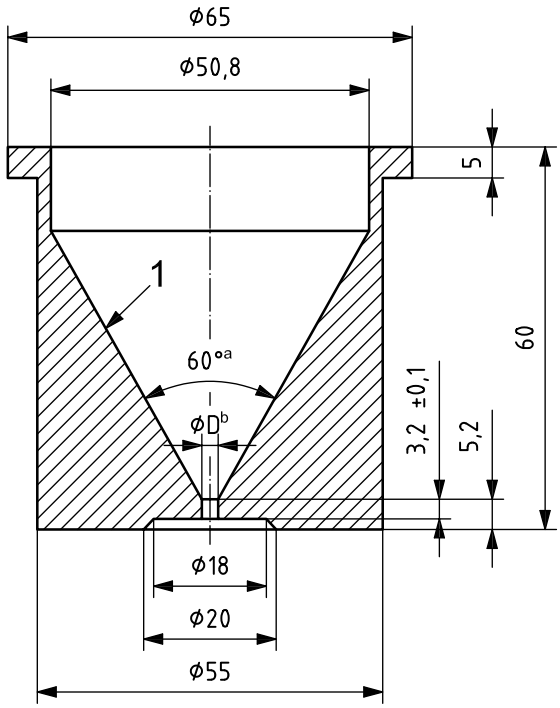
2.6 Laboratory furnace, for heating the powder sample to the selected and agreed temperature within the range 60 °C to 180 °C.

2.7 Thermocouples, sufficient to adjust and control the temperatures of the powder mix and the equipment within $\pm$ 2,5 °C of the selected temperature.

2.8 Balance, with a capacity of at least 200 g, capable of weighing the test sample to an accuracy of $\pm$ 0,01 g.

NOTE An example of the insulated enclosure containing the funnel, stand and cup is shown in Figure 4.

Dimensions in millimetres



Key

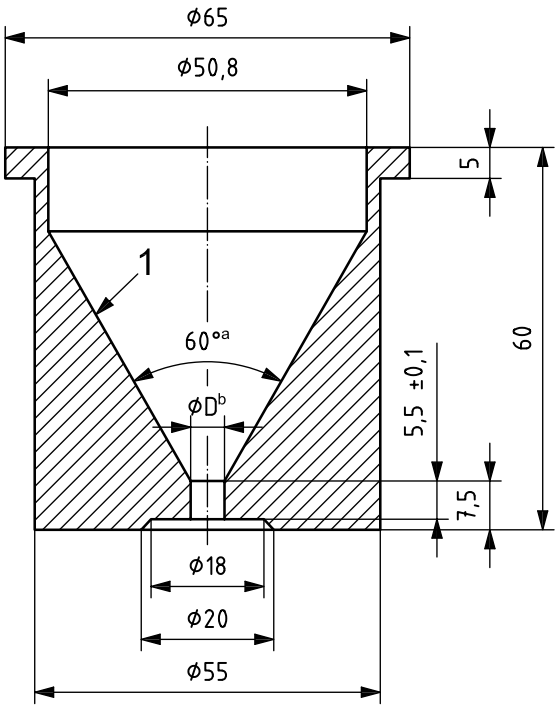
1 polished to $Ra \leqslant 0{,}4\ \mu m$

a this value is mandatory

b $D = 2{,}5^{+0{,}2}_{0}$

Figure 1 — Funnel with orifice diameter of 2,5 mm

Dimensions in millimetres



Key

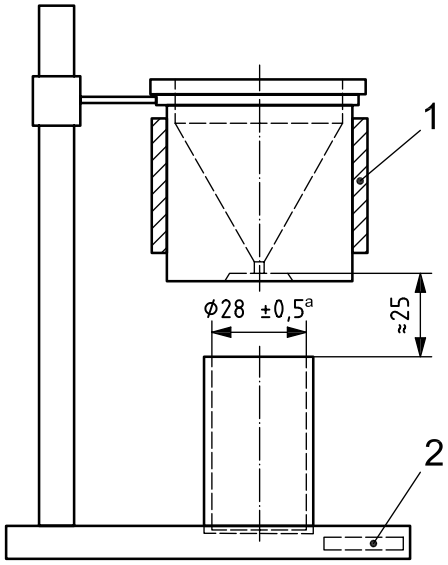
1 polished to $Ra \leqslant 0{,}4\ \mu m$

a this value is mandatory

b $D = 5^{+0{,}2}_{0}$

Figure 2 — Funnel with orifice diameter of 5 mm

Dimensions in millimetres



Key

1 heating device, e.g. band heater
2 heating device

a a cup with the same capacity and with an internal diameter of 30 mm ± 1 mm is also acceptable (see 2.3)

Figure 3 — Arrangement of the stand with funnel and cup, including heating devices

Figure 4 — Example of the insulated enclosure containing the funnel, stand and cup

3 Test sample

3.1 The test sample shall have a volume of at least 100 cm^3 to allow the determination of two or three test portions.

3.2 The test sample shall be heated in the laboratory furnace set at the selected temperature for the mix in question in the range 60 °C to 180 °C, to make sure that a homogeneous temperature of the powder can be kept within ± 2,5 °C.

4 Procedure

It is recommended to have the balance tared for the empty cylindrical cup before starting the determination.

4.1 Heat the test portion of the mix to the selected target temperature. Carefully load it into the flowmeter funnel as fast as possible to avoid cooling. Allow the powder to flow through the orifice into the density cup. Take care not to move the density cup.

4.2 When the powder completely fills and overflows the periphery of the density cup, rotate the funnel approximately 90° in a horizontal plane so that the remaining powder in the funnel falls away from the cup.

4.3 Level the powder with the top of the density cup using a non-magnetic spatula or straight-edge held perpendicular to the top of the cup. Take care to avoid jarring the apparatus at any time.

4.4 After the levelling operation, lightly tap the side of the density cup to settle the powder to avoid spilling the powder when moving the cup.

4.5 Weigh the filled density cup to the nearest 0,01 g.

It is very important to minimize heat losses. Therefore, the heated test portions must be transferred quickly to the thermally insulated enclosure.

WARNING — Both the powder and equipment are warm. The operation must therefore be carried out with care.

5 Result

The mass, in grams, of the powder in the levelled density cup shall be divided by the volume of the cup (25 cm^3).

Report the arithmetical mean of the two or three determinations to the nearest 0,01 g/cm^3.

6 Test report

The test report shall include the following information:

a) a reference to this part of ISO 18549;

b) all details necessary for the identification of the test sample;

c) the nominal diameter of the orifice;

d) the testing temperature used for the powder sample and funnel;

e) the result obtained, and how many determinations it is based on;

f) all operations not specified in this part of ISO 18549 or regarded as optional.

Bibliography

[1] ISO 3923-1:2008, *Metallic powders — Determination of apparent density — Part 1: Funnel method*

ICS 77.160

Price based on 5 pages