



Metallic powders — Determination of apparent density — Part 1 : Funnel method

Poudres métalliques — Détermination de la masse volumique apparente — Partie 1 : Méthode de l'entonnoir

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3923/1 was developed by Technical Committee ISO/TC 119, *Powder metallurgy*.

This second edition was submitted directly to the ISO Council, in accordance with clause 5.10.1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 3923-1977), which had been approved by the member bodies of the following countries :

Australia	Germany, F. R.	Spain
Brazil	Italy	Sweden
Bulgaria	Japan	Turkey
Canada	Mexico	United Kingdom
Czechoslovakia	Poland	USA
Egypt, Arab Rep. of	Portugal	USSR
France	Romania	Yugoslavia

No member body had expressed disapproval of the document.

Metallic powders — Determination of apparent density — Part 1 : Funnel method

1 Scope and field of application

This part of ISO 3923 specifies the funnel method for the determination of the apparent density of metallic powders under standardized conditions.

The method is intended for metallic powders that flow freely through a 2,5 mm diameter orifice. It may, however, be used for powders that flow with difficulty through a 2,5 mm diameter orifice but flow freely through a 5 mm diameter orifice.

Methods for the determination of the apparent density of powders that will not flow through a 5 mm diameter orifice are specified in Parts 2 and 3 of this International Standard.

2 References

ISO 3923/2, *Metallic powders — Determination of apparent density — Part 2 : Scott volumeter method.*¹⁾

ISO 3923/3, *Metallic powders — Determination of apparent density — Part 3 : Oscillating funnel method.*¹⁾

3 Principle

Measurement of the mass of a certain quantity of powder, which in a loose condition exactly fills a cup of known volume.

The loose condition is obtained by using, when filling the cup, a funnel placed at a determined distance above the cup.

The ratio between the mass and the volume represents the apparent density.

4 Symbols and designations

Symbol	Designation	Unit
ρ_a	Apparent density of metallic powders (General term)	g/cm ³
ρ_{ac}	Apparent density obtained by the funnel method	g/cm ³
m	Mass of the powder	g
V	Volume of the cup	cm ³

5 Apparatus

5.1 Funnels, one having an orifice of diameter $2,5 + 0,2$ mm and the other an orifice of diameter $5 + 0,2$ mm; see figure 1.

5.2 Cylindrical cup, having a capacity of $25 \pm 0,05$ cm³ and an internal diameter of 30 ± 1 mm.

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

5.3 Balance, of sufficient capacity, capable of weighing the test sample to an accuracy of $\pm 0,05$ g.

5.4 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 2.

6 Sampling

6.1 The test sample shall be of at least 100 cm³ volume to allow the determination to be carried out on three test portions.

1) At present at the stage of draft.

6.2 In general the powder should be tested in the as-received condition. In certain instances the powder may be dried. However, if the powder is susceptible to oxidation, the drying shall take place in vacuum or in inert gas. If the powder contains volatile substances it shall not be dried.

7 Procedure

7.1 Fill the funnel having the 2,5 mm diameter orifice with the powder while keeping the orifice closed with a dry finger.

7.2 Allow the powder to flow through the orifice into the cup until this is completely filled and powder flows over. Level the powder in one operation with a non-magnetic straight-edge without compressing it and take care not to jar or vibrate the cup.

7.2.1 If the powder does not flow through this funnel, use the funnel having the 5 mm diameter orifice.

7.2.2 If the powder still does not flow, it is allowable to attempt to initiate flow by poking once with a 1 mm wire from the top of the funnel. The wire shall not enter the cup.

7.3 After levelling the powder, tap the cup to settle the powder in order to avoid spilling it during transport. Make sure that there are no adhering particles on the exterior of the cup.

7.4 Determine the mass of the powder to the nearest 0,05 g.

Carry out the determination on three test portions.

8 Expression of results

The apparent density is given by the formula

$$\rho_{ac} = \frac{m}{V} = \frac{m}{25}$$

Report the arithmetical mean of the three determinations to the nearest 0,01 g/cm³, and the highest and the lowest results if the scatter between results exceeds 1 % of the mean.

9 Test report

The test report shall include the following information :

- a) reference to this International Standard;
- b) all details necessary for the identification of the test sample;
- c) the drying procedure, if the powder has been dried;
- d) the nominal diameter of the orifice and the use of a wire, if applied;
- e) the result obtained;
- f) all operations not specified in this International Standard, or regarded as optional;
- g) details of any occurrence which may have affected the result.

Dimensions in millimetres

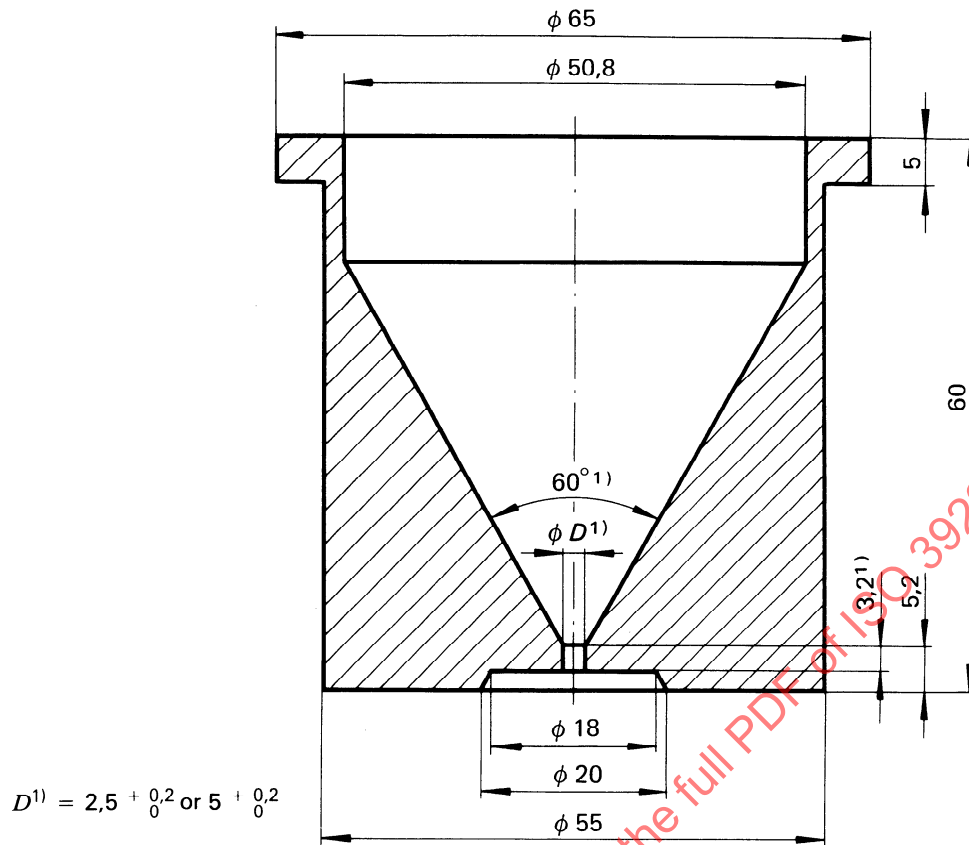


Figure 1

Dimensions in millimetres

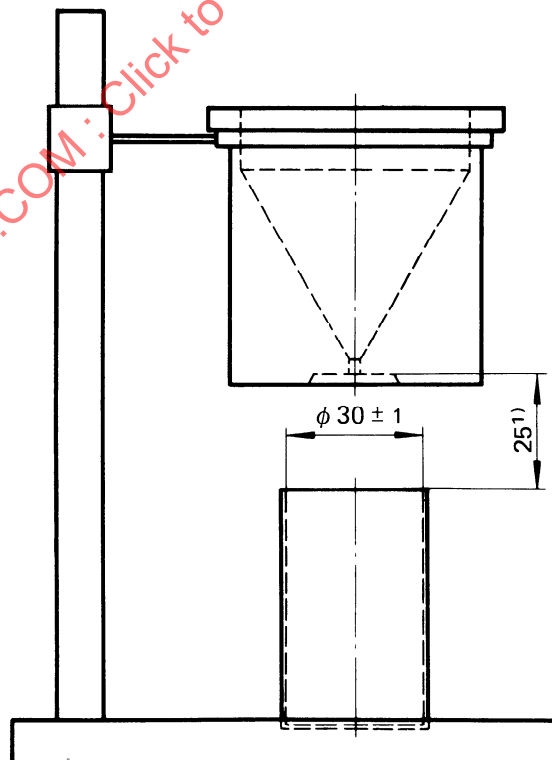


Figure 2

1) These values are mandatory.

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