SLOVENSKI STANDARD
oSIST prEN ISO 13517:2019

01-julij-2019

Kovinski praški - Ugotavljanje hitrosti pretoka z uporabo kalibriranega lija (merilnik pretoka po Gustavssonu) (ISO/DIS 13517:2019)

Metallic powders - Determination of flowrate by means of a calibrated funnel (Gustavsson flowmeter) (ISO/DIS 13517:2019)

Metallpulver - Ermittlung der Durchflussrate mit Hilfe eines kalibrierten Trichters (Gustavsson flowmeter) (ISO/DIS 13517:2019)

Poudres métalliques - Détermination du temps d'écoulement au moyen d'un entonnoir calibré (cône d'écoulement de Gustavsson) (ISO/DIS 13517:2019)

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ICS:

77.160	Metalurgija prahov	Powder metallurgy

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DRAFT INTERNATIONAL STANDARD

ISO/DIS 13517

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Metallic powders — Determination of flowrate by means of a calibrated funnel (Gustavsson flowmeter)

Poudres métalliques — Détermination du temps d'écoulement au moyen d'un entonnoir calibré (cône d'écoulement de Gustavsson)

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

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This second edition cancels and replaces the first edition (ISO 13517:2013), which has been technically revised.

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

— Tolerance for the funnel angle added

— Reference grit used instead of Chinese emery grit

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Metallic powders — Determination of flowrate by means of a calibrated funnel (Gustavsson flowmeter)

1 Scope

This International Standard specifies a method for determining the flow rate of metallic powders, including powders for hardmetals and mixes of metallic powders and organic additives such as lubricants, by means of a calibrated funnel (Gustavsson flowmeter).

The method is applicable only to powders which flow freely through the specified test orifice.

2 Principle

Measurement of the time required for 50 g of a metallic powder to flow through the orifice of a calibrated funnel of standardized dimensions.

3 Apparatus

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3.1 Calibrated funnel, with the dimensions shown in Figure 1 (see Clause 4). The dimensions shown for the flowmeter funnel, including the orifice, are not to be considered controlling factors. Calibration with emery, as specified in Clause 4, determines the working flow rate of the funnel.

The funnel shall be made of a non-magnetic, corrosion-resistant metallic material with sufficient wall thickness and hardness to withstand distortion and excessive wear.[1)]

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3.2 Stand and horizontal vibration-free base, to support the funnel rigidly, e.g. as indicated in Figure 2[1)].

3.3 Balance, of sufficient capacity, capable of weighing the test portion to an accuracy of ± 0,05 g.

3.4 Timing divice, capable of measuring the elapsed time to an accuracy of ± 0,1 s.

3.5 Reference grit, a reference powder used for calibration of the funnel.[1)]

1) Material complying with 3.5 can be purchased as “Chinese emery grit” from ACuPowder International, LLC, 901 Lehigh Avenue, Union, NJ 07083, USA. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the company named above. Equivalent products may be used if they can be shown to lead to the same results.

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Dimensions in millimetres

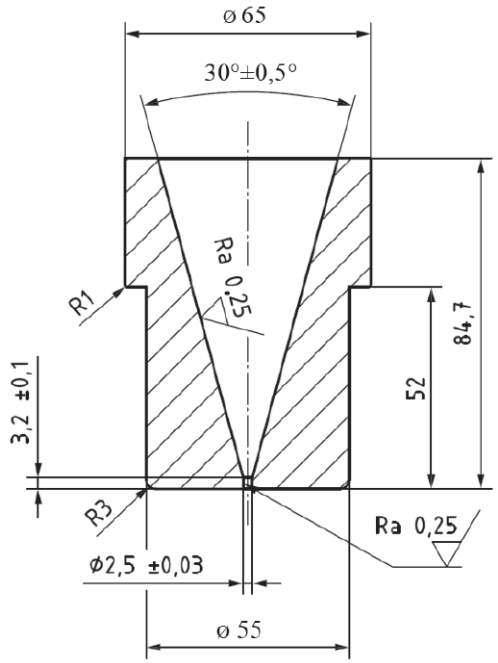

Figure 1 — Calibrated funnel (Gustavsson flowmeter)

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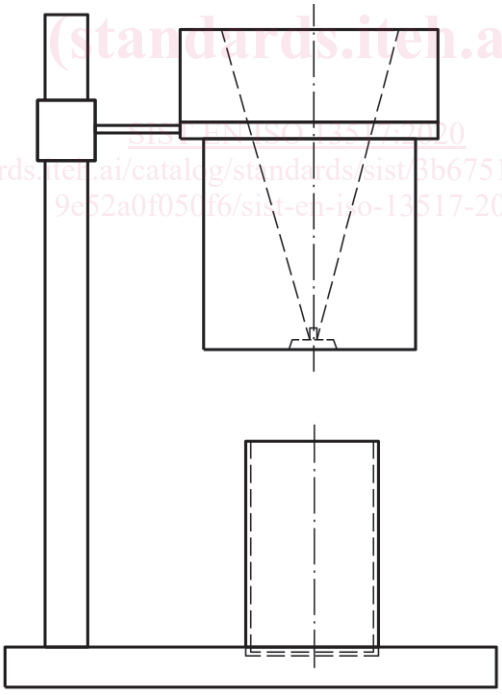

Figure 2 — Arrangement of calibrated funnel and stand

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4 Calibration of the funnel

4.1 Calibration by the manufacturer of the funnel

The manufacturer shall supply the flowmeter calibrated as follows:

a) Dry the reference grit (3.5) in an open and clean glass jar at 110 °C for 60 min in air;

b) Cool the reference grit to room temperature in a desiccator;

c) Weigh out 50,0 g ± 0,1 g of the grit;

d) Follow the procedure outlined in Clause 6;

e) Repeat the procedure with the same 50 g mass of the grit, until there are five determinations within 0,4 s;

f) The average of these five determinations is stamped on the bottom of the funnel and shall be within 40,0 s ± 0,5 s.

4.2 Calibration by the user of the funnel

The flow rate of the reference sample shall be determined by the above method. If the flow rate has changed to be outside 40,0 s/50 g ± 0,5 s/50 g, a correction factor must be used when measuring different powders. This correction factor is obtained by dividing 40,0 by this new value for the Reference grit.

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It is recommended that the users periodically verify whether a correction is needed or not.

It is recommended that, before a correction factor is adopted, the cause of the change be investigated. If the flow rate has decreased, it is probable that repeated use has burnished the orifice and a (new) correction factor is justified. An increase in flow rate may indicate a coating of soft powder on the orifice. This coating should be carefully removed and the calibration test repeated.

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It is recommended that the use of a funnel be discontinued after the duration of flow of the reference sample has decreased to less than 37 s.

5 Sampling

5.1 The mass of the test sample shall be at least 200 g.

5.2 In general, the powder shall be tested in the as-received condition. In certain cases, and after agreement between the supplier and user, the powder may be dried. However, if the powder is susceptible to oxidation, the drying shall take place in a vacuum or in inert gas. If the powder contains volatile substances, it shall not be dried.

5.3 Immediately before the test, weigh out a 50,0 g ± 0,1 g test portion.

5.4 Alternatively, a test portion of 90 to 110 g can be sampled and weighed to a precision of ± 0,1 g or better.

5.5 The determination shall be carried out on three test portions.

NOTE The intention of the alternative execution according to 5.4 is to facilitate full automation of measurement of flow and apparent density of powders.

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6 Procedure

Transfer the test portion to the funnel, keeping the discharge orifice closed by a dry finger. Take care that the stem of the funnel is filled with powder. Start the timing device (3.4) when the orifice is opened and stop it at the instant when the last of the powder leaves the orifice. Record the elapsed time measured to the nearest 0,1 s.

Alternatively, the orifice can be kept open, when the test portion is transferred to the funnel with the rest of the procedure being the same.

NOTE If the powder does not begin to flow when the orifice is opened, one slight tap on the funnel to start the flow is permitted. If this has no effect, or if the flow stops during the test, the powder is considered to possess no flowability according to the test method described in this International Standard.

7 Expression of results

Calculate the arithmetic mean of the results of the three determinations and report the value in seconds per 50 g, rounded to the nearest second.

If the alternative size of the test portion according to 5.4 is applied, the result of each determination shall, before the calculation of the arithmetic mean of the results, be divided by the mass of the sample and then be multiplied by 50 g. The result is thus recalculated in seconds per 50 g.

If a correction factor (see 4.2) should be used, the average shall be multiplied by this correction factor.

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8 Precision

Two plain iron powders and four iron or bronze powder mixes were included in the inter-laboratory study to develop this precision statement. Compositions of the mixes are presented in Table 1.

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Table 1 — Mix compositions of powder included in the inter-laboratory study

Designation	Mix composition
Plain iron powder 1	Plain atomized iron powder
Plain iron powder 2	Plain sponge iron powder
Iron powder mix 1	Atomized iron powder + 0,8 % Graphite + 0,8 % Amide wax
Bronze powder mix	Bronze powder + 0,375 % Stearic acid + 0,375 % Zinc stearate
Iron powder mix 2	Atomized iron powder + 2 % Ni powder + 0,8 % Graphite + 0,8 % Amide wax
Iron powder mix 3	Atomized iron powder + 0,8 % Graphite + 0,8 % Zinc stearate

In Table 2 the repeatability and reproducibility are presented as one standard deviation.

Table 2 — Repeatability and reproducibility as standard deviations

Tested powder	Level (average flow time)	Repeatability standard deviation s_r	Reproducibility standard deviation s_R
Plain iron powder 1	25 s	0,3 s	0,6 s
Plain iron powder 2	32 s	0,5 s	0,7 s
Iron powder mix 1	48 s	1,1 s	2,2 s
Bronze powder mix	45 s	2,6 s	3,2 s
Iron powder mix 2	56 s	1,0 s	2,0 s
Iron powder mix 3	60 s	0,8 s	4,7 s

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