INTERNATIONAL STANDARD

ISO 8130-5

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Coating powders —

Part 5:
Determination of flow properties of a powder/air mixture

Poudres pour revêtement —

Partie 5: Détermination de l'aptitude à la fluidisation d'un mélange poudre/air

Reference number
ISO 8130-5:1992(E)

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.

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.

International Standard ISO 8130-5 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Sub-Committee SC 9, *General test methods for paints and varnishes*.

ISO 8130 consists of the following parts, under the general title *Coating powders*:

— *Part 1: Determination of particle size distribution by sieving*

— *Part 2: Determination of density by gas comparison pyknometer (referee method)*

— *Part 3: Determination of density by liquid displacement pyknometer*

— *Part 4: Calculation of lower explosion limit*

— *Part 5: Determination of flow properties of a powder/air mixture*

— *Part 6: Determination of gel time of thermosetting coating powders at a given temperature*

— *Part 7: Determination of loss of mass on stoving*

— *Part 8: Assessment of the storage stability of thermosetting powders*

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— *Part 9: Sampling*

Annexes A and B of this part of ISO 8130 are for information only.

Coating powders —

Part 5:
Determination of flow properties of a powder/air mixture

1 Scope

This part of ISO 8130 specifies a method for determining the flow properties of a mixture of coating powder and air. The method reflects commercial practice in powder spraying (see "Bibliography", annex B).

The results obtained are influenced by the composition of the coating powder, its density, particle size distribution and particle shape, together with the tendency of the particles to agglomerate and to accept a triboelectric charge.

NOTE 1 It is well known that the transport and spraying characteristics of powders are highly dependent on their flow properties in bulk and in air. The procedure described in this method is considered to be more meaningful than the "flow angle" approach sometimes used to evaluate bulk flow properties. In the latter, the angle of the cone formed when a powder is allowed to flow through a vertical funnel on to a horizontal surface is measured. A given mass of powder with good flow properties forms a shallower cone than an equal mass of a powder with poorer flow. The objections to the flow angle method are that it is difficult to obtain a precise measurement and that the powder is used alone, whereas during application it is mixed with air.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 8130. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8130 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8130-9:1992, *Coating powders — Part 9: Sampling*.

3 Principle

Under draught-free conditions, a specified quantity of coating powder is placed in a vessel and is fluidized with clean dry air under standard conditions of atmospheric temperature and pressure. The height of the powder during and after fluidization is measured and the rate at which the fluidized powder flows through a specified orifice is then determined.

The measurements are used to calculate the fluidization factor ϕ and the powder flow rate (flow factor) R which together define the transport and spraying characteristics of the powder.

4 Apparatus

4.1 Apparatus for the determination of flow properties, consisting of a fluidization vessel with a circular opening in the wall and a device for measuring the height of powder in the vessel. A means for weighing the amount of powder that flows through the opening is also included.

NOTE 2 A suitable apparatus is shown in figure 1 and described below. Other apparatus may be used if it gives comparable results.

A typical apparatus consists of the elements described in 4.1.1 to 4.1.3.

4.1.1 Vessel for fluidizing the powder (vessel A), outer diameter approximately 110 mm, inner diameter approximately 100 mm, height not less than approximately 200 mm, made of transparent poly(methyl methacrylate) and having a bottom made of a sintered-bronze disc of uniform porosity and a maximum pore size of approximately 40 µm diameter.

NOTE 3 A disc of 5 mm thickness capable of passing air at a rate of approximately (200 ± 10) l/h under a pressure of 5 kPa above atmospheric has been found to be satisfactory.

A 4-mm-diameter circular opening D that can be closed with stopper E shall be situated in the wall of the vessel, 10 mm above the top of the porous disc.

4.1.2 Air regulation unit B, with flowmeter F for adjusting the air flow.

4.1.3 Container C, sufficiently large to collect the powder discharged during measurement of the powder flow rate (see figure 1).

4.2 Supply of clean dry air, sufficient to undertake the test.

Dimensions in millimetres

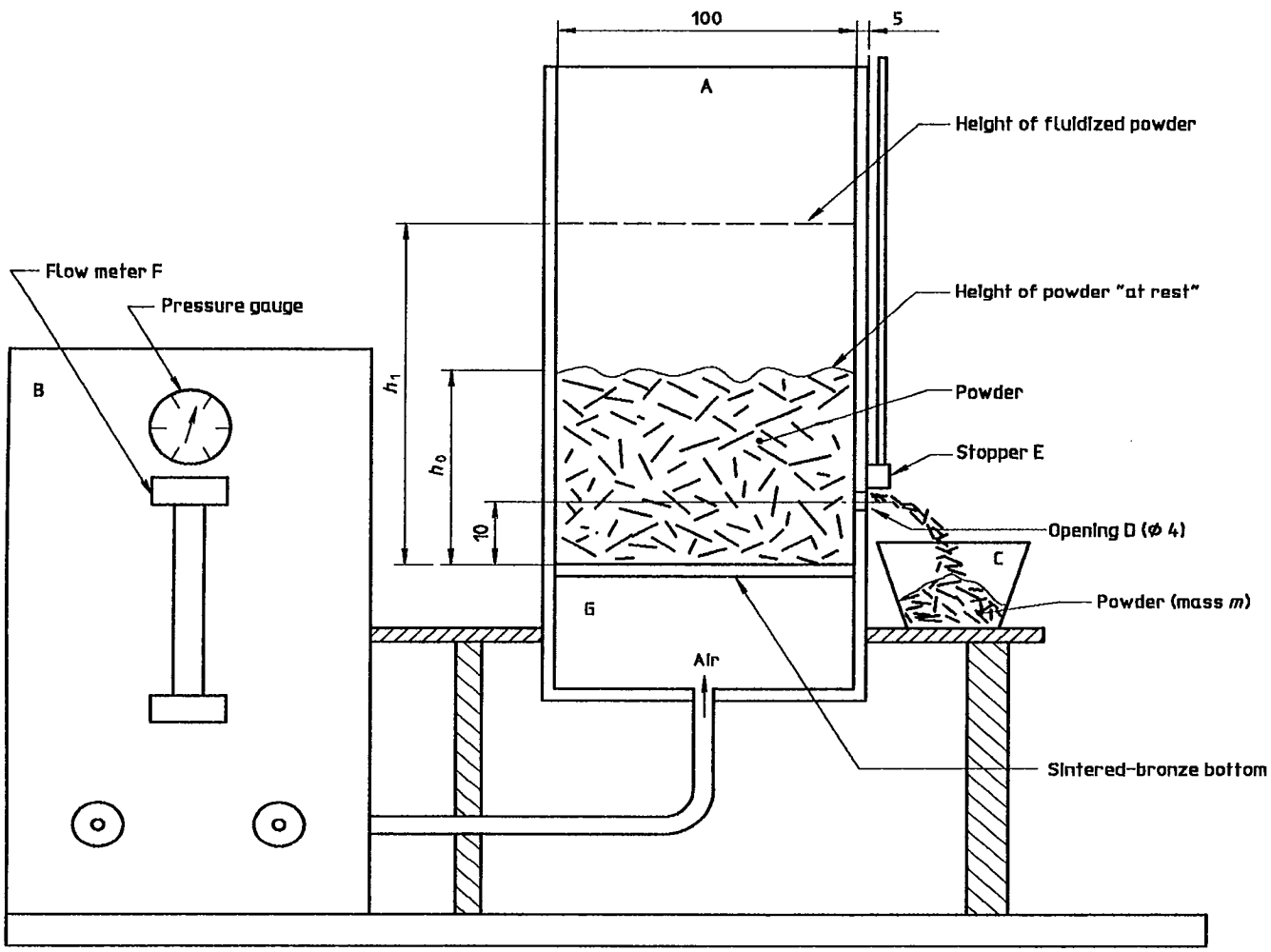

Figure 1 — Example of an apparatus for the determination of flow properties (for illustrative purposes only)

4.3 Timer, accurate to 1 s.

4.4 Analytical balance, of capacity 500 g, capable of weighing to 0,1 g.

4.5 Device for measuring the height of the powder in vessel A, graduated in millimetres.

4.6 Spatula.

5 Sampling

Take a representative sample of the product to be tested, as described in ISO 8130-9.

The quantity of the sample shall be sufficient for three determinations (see 7.3).

NOTE 4 A sample of 1 kg is recommended.

6 Procedure

6.1 Calibration of apparatus

Calibrate the apparatus at a temperature of 23 °C and an air pressure of 101,3 kPa (1 013 mbar) (see annex A for guidance).

6.2 Determination of flow properties

Carry out the determination in duplicate.

Close opening D with stopper E and charge vessel A with (250 ± 10) g of the coating-powder sample.

Introduce clean dry air (4.2) through the porous bottom at a rate sufficient to achieve optimum fluidization of the powder, normally (200 ± 10) l/h. Note the air flow rate as measured on the flow meter F. To prevent "channelling" and "bubbling" during fluidizing, stir the powder with the spatula (4.6) until the height of the bed remains constant between stirrings.

NOTE 5 This takes about 1 min to 2 min.

If optimum fluidization takes place at air flow rates outside the range 190 l/h to 200 l/h, use the appropriate air flow rate.

NOTE 6 Direct comparison of the performance of powder fluidized at different air flow rates may not be valid.

Measure the height h_1 of the fluidized bed to an accuracy of 2 mm. Switch off the air and allow the powder to settle (this may require 1 min to 2 min). Measure to within 2 mm the height h_0 of the powder at rest.

Fluidize the powder again at the same rate of air supply, assist fluidizing by stirring and wait until the fluidized powder bed has reached a constant level. Remove stopper E from opening D, starting the timer (4.3) at the same time, and collect the powder discharged through the opening during (30 ± 1) s. Close opening D with stopper E. Weigh the collected powder (m) to the nearest 0,1 g.

7 Expression of results

7.1 Calculate the fluidization factor ϕ, using the equation

$$\phi = \frac{h_1}{h_0}$$

where

h_0 is the height, in millimetres, of the powder at rest;

h_1 is the height, in millimetres, of the fluidized powder bed.

7.2 Calculate the powder flow rate R, in grams, using the equation

$$R = m \cdot \phi$$

where

m is the mass, in grams, of powder collected in container C;

ϕ is as given in 7.1.

7.3 If the results differ by less than 5 % of the lower value, calculate the arithmetic mean of ϕ and R. If the difference between the two results exceeds 5 %, carry out a third determination and calculate the arithmetic mean of all three results. If the difference between the result of the third determination and those of the other determinations is greater than 5 %, state this and the individual results in the test report.

8 Test report

The test report shall contain at least the following information:

a) all details necessary to identify the product tested;

b) a reference to this part of ISO 8130 (ISO 8130-5);

c) the temperature and pressure of the air in the test room;

d) the air flow rate;

e) an indication of irregularities in the fluidized bed (such as "channelling" or "bubbling"), if observed;

f) the results of the test as indicated in 7.3;

g) any deviation from the test method specified;

h) the date of the test.

Annex A
(informative)

Notes on apparatus and procedure

A.1 Construction of apparatus

To prevent cleaning difficulties and/or clogging of the sintered-bronze bottom, it is strongly recommended that the air entrance compartment G (below the porous bottom of vessel A) be removable (for example by a screw mechanism).

A.2 Corrections

Usually flow meter F is calibrated with air under standard conditions of temperature and pressure. Mostly, however, it is used under other conditions, so it is necessary to make corrections to obtain the real flow rate of 200 l/h. If C is the correction factor and q_r the required flow rate [e.g. (200 $\pm$ 10) l/h as given in 6.2], then the flow meter reading q_f is given by:

$$q_f = \frac{q_r}{C}$$

This correction factor C ($= C_1 \cdot C_2$) depends on

a) the difference in air pressure during the calibration and during the test:

$$C_1 = \sqrt{\frac{p_2}{p_1}}$$

where

p_1 is the air pressure, in kilopascals, during the calibration,

p_2 is the air pressure, in kilopascals, during the test;

b) the difference in the absolute temperature of the air during the calibration and during the test:

$$C_2 = \sqrt{\frac{T_1}{T_2}}$$

where

T_1 is the temperature, in kelvins, of the air during the calibration,

T_2 is the temperature, in kelvins, of the air during the test.

A.3 Example

A test is carried out using a flow meter that has been calibrated in litres of air per hour at 23 °C and 101,3 kPa (1 013 mbar).

If the test is carried out at 15 °C and 120 kPa (1 200 mbar), the following calculations can be used to determine the reading on the flow meter which will obtain a real flow rate of 200 l/h:

$$C_1 = \sqrt{\frac{1{,}2}{1{,}013}} = 1{,}088$$

$$C_2 = \sqrt{\frac{296}{288}} = 1{,}014$$

Thus

$$q_f = \frac{200}{1{,}088 \times 1{,}014} = 181 \text{ l/h}$$

To obtain a real flow rate of 200 l/h under the conditions of the test, the flow meter should therefore be adjusted to 181 l/h.

Annex B
(informative)

Bibliography

[1] DOUMA, G.H. and SELIER, P. *I-Lack*, **41**, No. 9, p. 361 (1973).

[2] DE LANGE, P.G. *I-Lack*, **42**, No. 9, p. 339 (1974).

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