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Coating powders —

Part 1: Determination of particle size distribution by sieving

Poudres pour revêtement —

Partie 1: Détermination de la distribution granulométrique par tamisage

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 8130-1:1992), which has been technically revised.

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

— a “Terms and definitions” clause has been added;

— a “Principle” clause has been added;

— the choice of sieving method and sieve selectivity has been added;

— manual sieving and sieving using vibration mechanism has been added;

— the text has been editorially revised and the normative references have been updated.

A list of all the parts in the ISO 8130 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Coating powders —

Part 1:
Determination of particle size distribution by sieving

1 Scope

This document specifies a method for the determination of the particle size distribution of coating powders by sieve analysis. Particle size distributions with a maximum of less than 100 µm is determined by laser diffraction, ISO 8130-13. This method is used especially for determining the oversize material or for the presence of contamination and can be used as a quality control procedure ("go"/"no go" test) by checking the amount retained on a single sieve.

The following particle sizes are typical for coating powders, however the particle size can deviate depending on the application:

— thin-film technology: 1 µm to 63 µm;

— electrostatic coating: 10 µm to 200 µm;

— fluidizing-bed method: 100 µm and above.

NOTE Sieves with a mesh size smaller than 32 µm are not practical and are likely to become blind during use.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 3310-2, *Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate*

ISO 8130-14, *Coating powders — Part 14: Vocabulary*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8130-14 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Principle

A weighed amount of the coating powder is separated into fractions by one or more sieves and the mass of the retained fraction on the sieve is determined. Sieve analysis can be carried out by using individual sieves or with a set of sieves either manually or using a machine. The transport of the coating powder particles through the sieve mesh is due to either gravity, shear and/or flow forces.

5 Apparatus

Ordinary laboratory apparatus, together with the following:

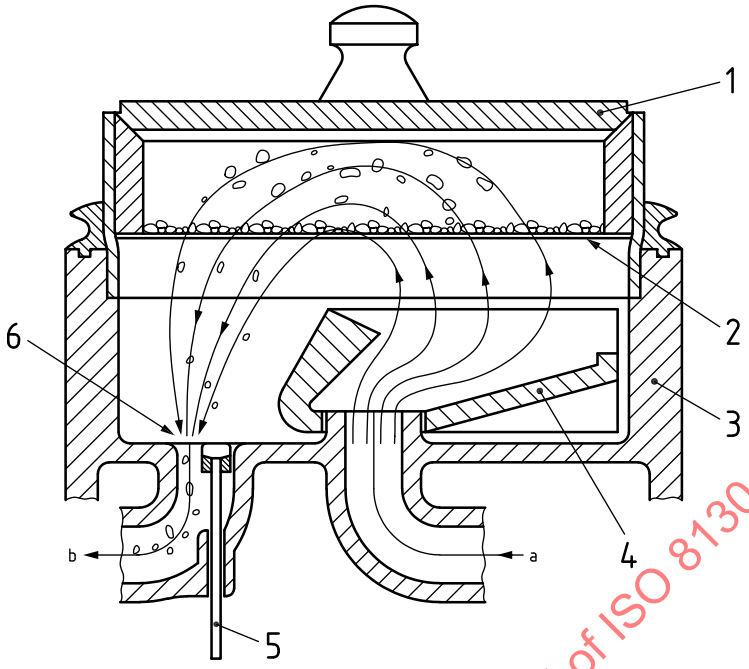
5.1 Test sieve with a sieve bottom, as specified in ISO 3310-1 and ISO 3310-2, circular with a sieving area having a diameter of 200 mm. Sieves with a sieving area having a diameter of 300 mm may also be used. The frame and the mesh of the test sieves shall be of metal. The range of nominal mesh apertures shall be between 32 µm and 300 µm or as agreed between the interested parties and shall comply with the specifications in ISO 565 for supplementary sizes, see Annex A. The test sieve shall be covered with a transparent lid.

The choice of mesh apertures, see Annex A, will depend on the test sample. If the approximate particle size distribution of the sample is known, then it is necessary to use only those test sieves that are appropriate to the particular particle size range. It is also permissible to restrict the choice of test sieves to those that give sufficient data for a specific purpose. Appropriate details shall be agreed between the interested parties.

5.2 Air-jet sieve apparatus (see Figure 1), consisting of a cylindrical casing which contains the test sieve (5.1). In the base of the casing shall be an outlet to which an extractor fan is connected and an air inlet to permit the injection of air.

The air inlet is connected to a jet rotating at 20 min^{-1} to 25 min^{-1} and consisting of a slot-shaped nozzle arranged radially beneath and very close to the sieve mesh. When the jet rotates, it blows air continuously through the mesh, preventing the coating powder particles from blocking the test sieve. The air is then extracted through the outlet, drawing the finer particles through the sieve.

The flow of air is controlled by adjusting a slot at the outlet.



Key

1 transparent lid
2 sieve
3 casing
4 rotating rim
5 manometer
6 adjustable slot
a Air inlet.
b To vacuum pump.

NOTE This diagram illustrates the functioning of the air-jet sieve apparatus and is schematic only.

Figure 1 — Air-jet sieve apparatus

5.3 Vibratory sieve machine, consisting of a cylindrical casing which contains the test sieve (5.1). The machine can be set up with either a single sieve or can be used with a set of sieves stacked in order of decreasing particle size thereby allowing particles to pass through the apertures into a collection pan at the bottom of the stack. The degree of vibration may be machine dependent or as agreed between interested parties. Ensure that the coating powder particles are not shattered due to attrition.

5.4 Balance, capable of weighing to the nearest 0,01 g.

5.5 Mallet, up to 200 g in weight, with a plastics head, suitable for tapping the apparatus to dislodge deposited powder.

5.6 Magnifying glass, of magnification at least ×5.

5.7 Ultrasonic cleaning bath, to clean the sieve mesh.

5.8 Soft hair pencil brush, to manually clear the apertures.

6 Sampling

Take a representative sample of the product under test as specified in ISO 15528.

7 Choice of sieving method and sieve selectivity

The following sieving methods may be used for coating powders:

a) manual sieving by hand using individual sieves or a set of sieves, if necessary with assistance by a gaseous, stationary fluid;

b) machine sieving with a stationary single sieve or set of sieves with a gaseous, moving fluid, e.g. an air-jet sieve or a set of sieves with a vibrant air column;

c) machine sieving with a moving single sieve or moving set of sieves (vibratory-sieve machine).

The choice depends on the requirements as agreed between the interested parties.

Factors which can influence sieving include, the nominal mesh size of the test sieve and its classification limit, these may not be identical and the latter should be determined with respect to the sieving method.

Sieve selectivity and its classification limit can be affected by the following:

a) Apparatus and method:
   1) type of the sieve;
   2) size and shape of the sieve mesh;
   3) distribution of the sieve mesh apertures;
   4) effective sieve area;
   5) movement of the sieve;
   6) sieving aid;
   7) proportion of the not blinded sieve mesh;

b) Test material:
   1) mass and bulk volume;
   2) particle size distribution;
   3) shape of the particles;
   4) agglomeration;
   5) humidity;
   6) hygroscopicity;
   7) static;
   8) strength (resistance against attrition);

c) Test equipment:
   1) sieving duration;
   2) air jet flow;
   3) vibration frequency.

8 Preparation of the test sieve

8.1 Using the magnifying glass (5.6), check that the test sieve is clean and undamaged and is not blocked by material used in a previous determination.

8.2 To remove particles which are blocking the sieve mesh apertures, turn the sieve and gently tap it on a suitable bed or frame. Cleaning of sieves with a mesh size of 150 µm to 1 mm may be supported by circular movements using a soft hair pencil brush (5.8). General cleaning of sieves with a mesh size of less than 200 µm may be supported by using an ultrasonic cleaning bath (5.7) with a suitable solution.

9 Procedure

9.1 Number of determinations

Carry out the determination in duplicate, using fresh powder for the second test.

9.2 Manual sieving (with mesh sizes greater than 100 µm)

9.2.1 The amount of the sample shall be limited to sieve every particle within an agreed time limit and not to exceed the load of the sieve bottom

9.2.2 Weigh, to the nearest 0,01 g, the test sieve (5.1) with its transparent lid.

9.2.3 Weigh, to the nearest 0,01 g, a 10 g test portion of the powder sample. The test portion amount can differ depending on the type of coating powder and should be agreed between interested parties.

9.2.4 Place the sieve(s) on a sieve pan and close it with a transparent lid. For this method, a maximum of two sieves should be used. More than two sieves may be impractical.

9.2.5 Take the sieve or the set of sieves, incline at 20° to 30° to the horizontal and knock 6 to 8 times the higher part of the sieve frame. Then shake the sieve or set of sieves horizontally and turn 90° to the vertical axis. Repeat this knocking, shaking and turning until the fine material portion has disappeared. This is shown by a significant free-flowing behaviour or a visual change of the powder. The sieving process is stopped by knocking against the sieve frame to remove any fine material from the underside of the sieve bottom and the under part of the frame. Eventually any adhering powder shall be taken off using a soft hair pencil brush (5.8) and introduced to the nearest finer sieve.

9.3 Machine sieving using an air-jet sieve apparatus

9.3.1 Sieving machines mainly differ from manual sieving by conferring a relative movement between the test material and the sieve bottom. This movement is caused by:

— movement of the sieve bottom in one, two or three directions;

— movement of the air;

— a combination of both.

The use of an air-jet sieve apparatus has been found suitable for coating powders.

9.3.2 Weigh, to the nearest 0,01 g, the test sieve (5.1) with its transparent lid.

9.3.3 Weigh, to the nearest 0,01 g, a 10 g test portion of the sample. The test portion amount can differ depending on the type of coating powder and should be agreed between interested parties.

9.3.4 Secure the selected test sieve in position in the sieve apparatus (5.2) and transfer the test portion to the test sieve. Secure the transparent lid, reduce the pressure in the apparatus by (2 ± 0,3) kPa and initiate the rotation of the nozzle. Unless otherwise specified, operate the apparatus for (300 ± 15) s.

If it can be demonstrated or observed via the transparent lid that all the sub-size powder passes through the test sieve within (180 ± 15) s, then it is permissible to use this shorter sieving time, ensuring that the alternative time is noted in the test report. If any material becomes attached to the frame and/or the transparent lid, lightly tap either or both with a mallet (5.5) to dislodge the attached powder.

NOTE The addition of a suitable, extremely fine sieving aid (pyrogenic silica or pyrogenic alumina) to the test sample at the maximum level of 0,1 % (by mass, based on the initial mass of the test portion) can aid the sieving process.

9.3.5 At the end of the test period, allow the air pressure to slowly equalize with that of the room. Remove the lid and the test sieve together with the retained material and weigh to the nearest 0,01 g.

To determine the particle size distribution, repeat the procedure described in 9.3.2 to 9.3.5 using a fresh test powder portion for each size of test sieve, in ascending order, in the range to be reported (see 5.1).

9.4 Machine sieving using vibration mechanism

9.4.1 The use of stacked sieves (5.1) can help to determine the particle size distribution providing the vibration frequency does not cause sieve blinding.

9.4.2 Weigh, to the nearest 0,01 g, the test sieve (5.1) with its transparent lid.

9.4.3 Weigh, to the nearest 0,01 g, a 10 g to 100 g test portion of the sample. The test portion amount can differ depending on the type of coating powder and should be agreed between interested parties. The amount of the sample shall be limited to sieve every particle within an agreed time limit and not to exceed the capacity of the collecting pan.

9.4.4 Secure the selected test sieve(s) in position in the vibratory sieve machine (5.3) and transfer the test portion of powder to the test sieve. Secure the transparent lid and start the vibration mechanism by using a frequency which does not shatter the powder particle to give false results or the frequency may be chosen by agreement between interested parties. The mode of operation can be either continuous or intermittent, the latter is preferred because it allows the different shaped particles to settle and then with vibration shaken to pass through the sieve mesh. If any material becomes attached to the frame and/or the transparent lid, lightly tap either or both with the mallet (5.5) to dislodge the attached powder.

9.4.5 If stacked sieves are used then fresh weighed powder (see 9.4.3) shall be introduced into the top sieve.

10 Expression of results

For the test sieve used, calculate the percentage of material retained, R, expressed as a percentage by mass using Formula (1):

$$R = \frac{m_2 - m_0}{m_1} \cdot 100 \qquad (1)$$

where

m_0 is the mass, in grams, of the test sieve and transparent lid;

m_1 is the mass, in grams, of the test portion;

m_2 is the mass, in grams, of the test sieve and transparent lid plus the retained material after the sieving operation.

If the two results (duplicates) differ by more than 3 % (absolute), repeat the procedure described in Clause 9.

Calculate the mean of two valid determinations and report the result to the nearest integer.

Results can be reported from a series of determinations using test sieves of different aperture sizes either in tabular form or graphically or as agreed between the interested parties.

NOTE For the graphical representation of results, plotting the sieve fraction against the mass fraction as a double logarithmic function is recommended. Extrapolation to lower or higher particle sizes can lead to doubtful results.

11 Precision

No precision data are currently available.

A reference material is not available of standardized size because this will vary for the different types of coating powder.

12 Test report

The test report shall contain at least the following information:

a) all details necessary to identify the powder product tested;

b) a reference to this document, i.e. ISO 8130-1:2019;

c) the test method used;

d) the initial mass of the sample;

e) the result for the test sieve used, as indicated in Clause 10;

f) any deviation from the test method specified;

g) any unusual features (anomalies) observed during the test;

h) the date of the test.