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**Coating powders —**

**Part 3:**

**Determination of density by liquid  
displacement pycnometer**

*Poudres pour revêtement*

*Partie 3: Détermination de la masse volumique à l'aide d'un  
pycnomètre à déplacement de liquide*

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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](http://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](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 139, *Paints and varnishes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 8130-3:1992), which has been technically revised. The main changes compared to the previous edition are as follows:

- the scope has been revised editorially;
- the terms and definitions clause ([Clause 3](#)) has been added;
- the reference for the pycnometer has been changed from ISO 787-10 to ISO 2811-1;
- the use of acetone for cleaning the pycnometer has been deleted;
- the order of filling the pycnometer has been changed;
- the acceptable difference between two results ([Clause 9](#)) is given as a percentage;
- the text has been editorially revised and the normative references have been updated.

A list of all 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](http://www.iso.org/members.html).

# Coating powders —

## Part 3: Determination of density by liquid displacement pycnometer

### 1 Scope

This document specifies a liquid displacement pycnometer method for the determination of the density of coating powders. The method is based on a determination of the mass and the volume of a test portion.

Coating powders with density  $<1 \text{ g/cm}^3$ , can be measured in accordance with ISO 1183-1 and the appropriate method, by agreement.

### 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 2811-1, *Paints and varnishes — Determination of density — Part 1: Pycnometer method*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

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

The density of the coating powder is determined in a liquid displacement pycnometer, using a liquid that completely wets the product under test without swelling or dissolving it.

### 5 Materials

**5.1 Water**, of at least grade 3 purity as defined in ISO 3696, freshly boiled and cooled.

**5.2 Displacement liquid:** a suitable aliphatic hydrocarbon or mixture of aliphatic hydrocarbons, free from aromatic compounds, with a boiling point within the range 80 °C to 140 °C.

Ensure that there is no interaction with the product or its components under test; otherwise a suitable alternative liquid may be used. For coating powders of density <1 g/cm<sup>3</sup>, water can be used as the displacement liquid, in accordance with ISO 1183-1.

## 6 Apparatus

Ordinary laboratory apparatus, together with the following:

- 6.1 **Pycnometer**, complying with ISO 2811-1.
- 6.2 **Vacuum pump**, with rubber pressure tube attachment.
- 6.3 **Balance**, capacity 200 g, capable of weighing to 1 mg.

## 7 Sampling

Take a representative sample of the product to be tested as described in ISO 15528.

## 8 Procedure

### 8.1 Number of determinations

Carry out the determination in duplicate at (23 ± 1) °C and at a relative humidity of (50 ± 5) %.

### 8.2 Determination of the density of the displacement liquid

Weigh the empty clean pycnometer (6.1) ( $m_0$ ), fill it to the mark with the displacement liquid (5.2) and reweigh ( $m_1$ ). Empty the pycnometer, clean and dry it. Refill the pycnometer with water at (23 ± 1) °C (5.1) and reweigh ( $m_2$ ).

Calculate the density  $\rho_1$ , in grams per cubic centimetre, of the displacement liquid at (23 ± 1) °C, using [Formula \(1\)](#):

$$\rho_1 = \frac{m_1 - m_0}{m_2 - m_0} \times \rho_0 \quad (1)$$

where

$m_0$  is the mass, in grams, of the empty pycnometer;

$m_1$  is the mass, in grams, of the pycnometer containing the displacement liquid;

$m_2$  is the mass, in grams, of the pycnometer containing water;

$\rho_0$  is the density, in grams per cubic centimetre, of the water.

For the purposes of this document, take the density of water at 23 °C as 0,998 g/cm<sup>3</sup>.

### 8.3 Determination of the density of the coating powder

Empty the pycnometer, clean and dry it. Fill the pycnometer to the half with the displacement liquid. Slowly introduce a test portion of the sample appropriate to the type and volume of the pycnometer

( $m_3$ ), in a manner that the powder is wetted by the displacement liquid. Air bubbles, when evident, can be removed by using the vacuum pump (6.2).

Then fill the pycnometer to the mark with the displacement liquid, taking care not to disturb the sedimented powder. Reweigh the filled pycnometer ( $m_4$ ).

Take care also on filling in order to avoid powder remaining in the neck of the pycnometer.

## 9 Expression of results

Calculate the density  $\rho_p$ , in grams per cubic centimetre, of the coating powder at  $(23 \pm 1)^\circ\text{C}$ , following [Formula \(2\)](#):

$$\rho_p = \frac{m_3}{(m_1 - m_0) - (m_4 - m_3 - m_0)} \times \rho_1 \quad (2)$$

where

$m_0$  is the mass, in grams, of the empty pycnometer;

$m_1$  is the mass, in grams, of the pycnometer containing the displacement liquid;

$m_3$  is the mass, in grams, of the test portion;

$m_4$  is the mass, in grams, of the pycnometer containing the test portion and the displacement liquid;

$\rho_1$  is the density, in grams per cubic centimetre, of the displacement liquid at  $(23 \pm 1)^\circ\text{C}$ .

If the two results differ by more than 2 %, repeat the procedure described in [Clause 8](#).

Calculate the mean of two valid determinations and report the result to the nearest 0,01 g/cm<sup>3</sup>.

## 10 Precision

No precision data are currently available.

## 11 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 document, i.e. ISO 8130-3:2021;
- c) the type and volume of pycnometer used;
- d) the type and grade of displacement liquid used;
- e) the mass of the test sample;
- f) the result of the test (individual values and mean value);
- g) any deviation from the test method specified;
- h) any unusual features (anomalies) observed during the test;
- i) the date of the test.

## Bibliography

- [1] ISO 787-10, *General methods of test for pigments and extenders — Part 10: Determination of density — Pyknometer method*
- [2] ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

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