SLOVENSKI STANDARD
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Barve in laki - Ugotavljanje gostote - 1. del: Metoda s piknometrom (ISO/DIS 2811-1:2022)

Paints and varnishes - Determination of density - Part 1: Pycnometer method (ISO/DIS 2811-1:2022)

Beschichtungsstoffe - Bestimmung der Dichte - Teil 1: Pyknometer-Verfahren (ISO/DIS 2811-1:2022)

Peintures et vernis - Détermination de la masse volumique - Partie 1: Méthode pycnométrique (ISO/DIS 2811-1:2022)

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Paints and varnishes — Determination of density —

Part 1:
Pycnometer method

Peintures et vernis — Détermination de la masse volumique —

Partie 1: Méthode pycnométrique

ICS: 87.040

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Contents

Page

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 fourth edition cancels and replaces the third edition (ISO 2811-1:2016), which has been technically revised.

The main changes are as follows:

— a requirement to de-areate the sample prior to the determination in order to achieve reproducible results for the density has been added to 8.2;

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

A list of all parts in the ISO 2811 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.

Paints and varnishes — Determination of density —

Part 1: Pycnometer method

1 Scope

This document specifies a method for determining the density of paints, varnishes and related products using a metal or Gay-Lussac pycnometer.

The method is limited to materials of low or medium viscosity at the temperature of test. The Hubbard pycnometer (see ISO 3507) can be used for highly viscous materials.

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 1513, *Paints and varnishes — Examination and preparation of test samples*

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

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
density
ρ
mass divided by the volume of a portion of a material

Note 1 to entry: It is expressed in grams per cubic centimetre.

4 Principle

A pycnometer is filled with the product under test. The density is calculated from the mass of the product in the pycnometer and the known volume of the pycnometer.

5 Temperature

The effect of temperature on density is highly significant with respect to filling properties, and varies with the type of product.

For international reference purposes, it is essential to standardize one test temperature, and (23,0 ± 0,5) °C is specified in this document. It can be more convenient, however, to carry out comparative testing at some other agreed temperature, for example (20,0 ± 0,5) °C, as specified by relevant weights and measures legislation (see B.2).

The test sample and pycnometer shall be conditioned to the specified or agreed temperature, and it shall be ensured that the temperature variation does not exceed 0,5 °C during testing.

6 Apparatus

Ordinary laboratory apparatus and glassware, together with the following.

6.1 Pycnometer

6.1.1 Metal pycnometer, with a volume of either 50 cm^3 or 100 cm^3, a circular cross-section and a cylindrical form, made of a smoothly finished corrosion-resistant material with a snugly fitting lid having a hole in its centre.

The inside of the lid shall be concave (see Figure 1).

or

6.1.2 Glass pycnometer, with a volume in the range 10 cm^3 to 100 cm^3 (Gay-Lussac type) (see Figure 2).

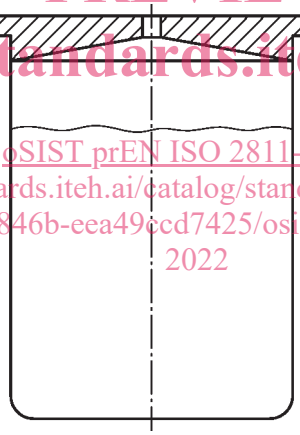

Figure 1 — Metal pycnometer

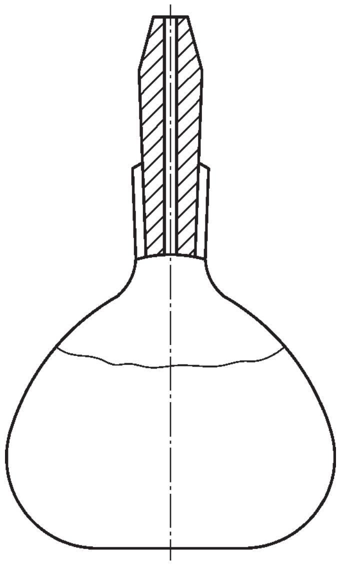

Figure 2 — Gay-Lussac pycnometer

6.2 Analytical balance, accurate to 1 mg for pycnometers for less than 50 ml or accurate to 10 mg for 50 ml to 100 ml pycnometers.

The accuracy of the balance required depends on the size of the pycnometer used (see also 8.2).

6.3 Thermometer, with an accuracy of 0,2 °C.

NOTE Typically, a thermometer with an accuracy of 0,2 °C has a resolution of 0,05 °C.

6.4 Temperature-controlled chamber, capable of accommodating the balance, pycnometer and test sample and maintaining them at the specified or agreed temperature (see Clause 5), or **water bath**, capable of maintaining the pycnometer and test sample at the specified or agreed temperature.

7 Sampling

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

Examine and prepare the sample as specified in ISO 1513. The sample shall be free from any air bubbles.

8 Procedure

8.1 General

Carry out a single determination on a fresh test sample.

The pycnometer shall be calibrated. An example of a calibration method is given in Annex A.

8.2 Determination

If working with a temperature-controlled chamber (see 6.4), put the pycnometer (6.1) and the test sample next to the balance (6.2) in the chamber maintained at the specified or agreed temperature.

If working with a water bath (see 6.4) rather than a temperature-controlled chamber, put the pycnometer and the test sample in the water bath, maintained at the specified or agreed temperature.

Allow approximately 30 min for temperature equilibrium to be reached.

Using the thermometer (6.3), measure the temperature, t_T, of the test sample.

Check throughout the determination that the temperature of the chamber or water bath remains within the specified limits.

Weigh the pycnometer and record the mass, m_1, to the nearest 10 mg for 50 cm^3 to 100 cm^3 pycnometers and to the nearest 1 mg for pycnometers less than 50 cm^3 in volume.

Depending on the matrix, the sample shall be de-aerated prior to the determination in order to achieve reproducible results for the density.

NOTE 1 For waterborne coating matrices, de-aeration with a suitable mixing machine for about 30 s at 2 000 min^{-1} was found to be suitable.

Fill the pycnometer with the product under test, if necessary, after de-aeration, taking care to avoid the formation of air bubbles.

Place the lid or stopper of the pycnometer firmly in position and wipe off any excess liquid from the outside of the pycnometer with an absorbent material wetted with solvent; wipe carefully with cotton wool.

Record the mass of the pycnometer filled with the product under test, m_2.

NOTE 2 Liquid adhering to the ground-glass surfaces of a glass pycnometer or to the areas of contact between the lid and body of a metal pycnometer causes too high a balance reading. This source of error can be minimized by ensuring that the joints are firmly seated and by limiting air bubbles.

9 Calculation

Calculate the density, ρ, of the product, in grams per cubic centimetre, at the test temperature, t_T, using Formula (1):

$$\rho = \frac{m_2 - m_1}{V_t} \quad (1)$$

where

m_1 is the mass, in grams, of the empty pycnometer;

m_2 is the mass, in grams, of the pycnometer filled with the product at the test temperature, t_T;

V_t is the volume, in cubic centimetres, of the pycnometer at the test temperature, t_T, determined in accordance with Annex B.

NOTE The result is not corrected for air buoyancy because the uncorrected value is required by most filling-machine control procedures and the correction (0,001 2 g/cm^3) is negligible in relation to the precision of the method.

If the test temperature used is not the reference temperature, the density may be calculated using Formula (B.2).