



SLOVENSKI STANDARD
oSIST prEN ISO 2811-3:2023
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Barve in laki - Določanje gostote - 3. del: Oscilacijska metoda (ISO/DIS 2811-3:2023)

Paints and varnishes - Determination of density - Part 3: Oscillation method (ISO/DIS 2811-3:2023)

Beschichtungsstoffe - Bestimmung der Dichte - Teil 3: Schwingungsverfahren (ISO/DIS 2811-3:2023)

Peintures et vernis - Détermination de la masse volumique - Partie 3: Méthode par oscillation (ISO/DIS 2811-3:2023)

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Barve in laki

Paints and varnishes

oSIST prEN ISO 2811-3:2023

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Paints and varnishes — Determination of density —

Part 3: Oscillation method

*Peintures et vernis — Détermination de la masse volumique —**Partie 3: Méthode par oscillation*

ICS: 87.040

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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).

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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 third edition cancels and replaces the second edition (ISO 2811-3:2011), which has been technically revised.

The main changes are as follows:

- a requirement to de-aerate the sample prior to the determination in order to achieve reproducible results for the density has been added to [8.2](#);
- Table B.3 has been deleted because tetrachloroethylene is no longer mentioned for determining the apparatus constant;
- 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 3: Oscillation method

1 Scope

This document specifies a method for determining the density of paints, varnishes and related products using an oscillator.

The method is suitable for all materials, including paste-like coatings. If a pressure-resistant type of apparatus is used, the method is also applicable to aerosols.

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.

[SOURCE: ISO 2811-1:2016]

4 Principle

A glass or stainless-steel U-tube is filled with the product under test. The tube is clamped at both ends and then subjected to oscillation. The resonance frequency of the filled tube varies with the mass contained in the tube, i.e. the density of the product under test.

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5 Temperature

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

Carry out the test at $(23,0 \pm 0,5)$ °C.

NOTE For some purposes a different temperature, for example $(20,0 \pm 0,5)$ °C, might be needed.

The test sample, tube and oscillator 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 Oscillator, consisting of a glass or stainless-steel U-tube and apparatus to cause the U-tube to oscillate. One model displays the resonance frequency; another calculates and displays the density.

6.2 Thermometer, with an uncertainty of measurement of 0,2 °C and graduated at intervals of 0,2 °C or finer.

6.3 Temperature-controlled chamber, capable of maintaining the oscillator and test sample at the specified or agreed temperature (see [Clause 5](#)).

6.4 Disposable plastic syringe, of sufficient capacity to fill the U-tube.

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.

8 Procedure

8.1 General

Carry out a single determination on a fresh test sample.

8.2 Determination

Ensure that the apparatus is clean, both by inspection and by checking that the display indicates the density of air (or the corresponding period of oscillation at resonance). Density values for damp air see [Annex B](#).

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 $2\ 000\ \text{min}^{-1}$ was found to be suitable.

Fill the U-tube with the product under test (about $2\ \text{cm}^3$), if necessary, after de-aeration, in accordance with the oscillator manufacturer's instructions (i.e. until the level is above the upper of the two clamps holding the U-tube). Avoid introducing air bubbles, which cause unsteady readings.

NOTE 2 The presence of non-visible air bubbles becomes apparent due to the fact that the measured values vary considerably.

Close the upper filler-hole. Using the thermometer (6.2), check that the temperature of the temperature-controlled chamber is within the specified limits.

Start up and operate the oscillator in accordance with the manufacturer's instructions.

If using an apparatus which displays the period of oscillation at resonance, take at least three readings of the period of oscillation, T , and at least two of the temperature. The values of T shall not differ by more than 0,000 1 ms. If they do, make three more measurements.

If using an apparatus which displays the density directly, take at least three readings of the density and at least two of the temperature. The density values shall not differ by more than 0,000 2 g/cm³. If they do, make three more measurements.

After the measurements, clean the apparatus in accordance with the manufacturer's instructions. It is essential to leave it clean and dry, and to check that the display indicates the density of air (or the corresponding period of oscillation).

9 Calculation

If the period of oscillation, T , has been read, calculate the density, ρ , using [Formula \(1\)](#):

$$\rho = \frac{1}{A} \times (T^2 - B) \quad (1)$$

where A and B are two apparatus constants (see [Annex A](#)).

If the temperature used is not the reference temperature, the density can be calculated using [Annex C](#).

10 Precision

10.1 General

The precision of the method depends on the characteristics of the product to be tested. For materials which contain no entrapped air, the values in [10.2](#) and [10.3](#) are valid.

10.2 Repeatability limit, r

The value below which the absolute difference between two single test results, obtained on identical material by one operator in one laboratory using the same equipment within a short interval of time using the standardized test method, may be expected to lie, with a 95 % probability, is 0,001 g/cm³.

10.3 Reproducibility limit, R

The value below which the absolute difference between two test results, obtained on identical material by operators in different laboratories using the standardized test method, may be expected to lie, with a 95 % probability, is 0,002 g/cm³.

11 Test report

The test report shall include at least the following information:

- a) all details necessary to identify the product tested;
- b) a reference to this document, i.e. ISO 2811-3:—;
- c) the type (model) of apparatus used;
- d) the test temperature;

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- e) the density measurement determined in accordance with [8.2](#), or the density calculated in accordance with [Clause 9](#), in grams per cubic centimetre, rounded to the nearest 0,001 g/cm³;
- f) any deviation from the test method specified;
- g) any unusual features (anomalies) observed during the test;
- h) the date of the test.

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