

~~ISO/DIS 2811-3:2022~~2023(E)

ISO TC 35/SC 9/WG 30

Date: 2023-06-0208-17

Paints and varnishes — Determination of density

Part 3: Oscillation method

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

Style Definition: Heading 1: Indent: Left: 0 pt, First line: 0 pt, Tab stops: Not at 21.6 pt

Style Definition: Heading 2: Font: Bold, Tab stops: Not at 18 pt

Style Definition: Heading 3: Font: Bold

Style Definition: Heading 4: Font: Bold

Style Definition: Heading 5: Font: Bold

Style Definition: Heading 6: Font: Bold

Style Definition: ANNEX

Style Definition: zzCopyright

Style Definition: Footer

Style Definition: Header

Style Definition: IneraTableMultiPar: Font: (Default) Cambria, Not Bold, Justified, Space Before: 0 pt, After: 12 pt, Don't keep with next

Style Definition: AMEND Terms Heading: Font: Bold

Style Definition: AMEND Heading 1 Unnumbered: Font: Bold

Formatted: English (United Kingdom)

Formatted: English (United Kingdom)

Formatted: English (United Kingdom)

Formatted: English (United Kingdom)

Formatted: Different first page header

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 2811-3

<https://standards.iteh.ai/catalog/standards/sist/1b36244f-2443-45bb-b2b3-917371a7ee1d/iso-2811-3>

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO ~~copyright office~~ Copyright Office

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font

Formatted: Indent: Left: 0 pt, Right: 0 pt, Space Before: 0 pt, No page break before, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

CP 401 • ~~Ch. de Blandonnet 8~~

CH-1214 Vernier, Geneva

Phone: +41 22 749 01 11

Formatted: Indent: Left: 0 pt, First line: 0 pt, Right: 0 pt, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Email: copyright@iso.org

Email: copyright@iso.org

Website: www.iso.org

Published in Switzerland

Formatted: English (United Kingdom)

Formatted: Indent: Left: 0 pt, First line: 0 pt, Right: 0 pt, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: English (United Kingdom)

Formatted: English (United Kingdom)

ISO 2811-3

<https://standards.iteh.ai/catalog/standards/sist/1b36244f-2443-45bb-b2b3-917371a7ee1d/iso-2811-3>

2

© ISO 2023 – All rights reserved

ii

© ISO 2023 – All rights reserved

Formatted: Font: 11 pt

Formatted: Space After: 0 pt, Line spacing: single

Edited DIS - MUST BE USED FOR FINAL DRAFT

Contents

Foreword.....iv

1 Scope.....1

2 Normative references.....1

3 Terms and definitions.....1

4 Principle.....1

5 Temperature.....1

6 Apparatus.....2

7 Sampling.....2

8 Procedure.....2

8.1 General.....2

8.2 Determination.....2

9 Calculation.....3

10 Precision.....3

10.1 General.....3

10.2 Repeatability limit, r3

10.3 Reproducibility limit, R3

11 Test report.....3

Annex A (informative) Calibration of the apparatus — Determination of the apparatus constants.....5

A.1 General.....5

A.2 Procedure.....5

A.3 Calculation of apparatus constants.....5

Annex B (informative) Density values for damp air and air-free water.....6

Annex C (informative) Calculation of density at the reference temperature from measurements at other temperatures.....8

Bibliography.....9

© ISO 2023 – All rights reserved

© ISO 2023 – All rights reserved

Formatted: Font: 11 pt

Formatted: Space After: 0 pt, Line spacing: single

Foreword..... iv

1 Scope..... 1

2 Normative references..... 1

3 Terms and definitions 1

4 Principle 1

5 Temperature 1

6 Apparatus..... 2

7 Sampling..... 2

8 Procedure..... 2

8.1 General..... 2

8.2 Determination 2

9 Calculation 3

10 Precision..... 3

10.1 General..... 3

10.2 Repeatability limit, r 3

10.3 Reproducibility limit, R 3

11 Test report..... 3

Annex A (informative) Calibration of the apparatus — Determination of the apparatus constants 5

A.1 General..... 5

A.2 Procedure..... 5

A.3 Calculation of apparatus constants..... 5

Annex B (informative) Density values for damp air and air-free water 6

Annex C (informative) Calculation of density at the reference temperature from measurements at other temperatures..... 8

Bibliography..... 9

STANDARD PREVIEW

(4)

Formatted: Font: 11 pt
Formatted: Space After: 0 pt, Line spacing: single

Edited DIS - MUST BE USED FOR FINAL DRAFT

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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.

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 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 has been added to 8.2, to de-aerate the sample prior to the determination in order to achieve reproducible results for the density;
- Table B.3 has been deleted;
- a bibliography has been added.

A list of all parts in the ISO 2811 series can be found on the ISO website.

© ISO 2023 – All rights reserved

© ISO 2023 – All rights reserved

Edited DIS - MUST BE USED FOR FINAL DRAFT

Formatted: Font: Not Italic

Formatted: Font: Not Italic

Formatted: Font: Not Italic

Formatted: Default Paragraph Font

Formatted: Font: 11 pt

Formatted: Space After: 0 pt, Line spacing: single

ISO/DIS 2811-3:2023(E)

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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 2811-3

<https://standards.iteh.ai/catalog/standards/sist/1b36244f-2443-45bb-b2b3-917371a7ee1d/iso-2811-3>

6 © ISO 2023 - All rights reserved

vi © ISO 2023 - All rights reserved

Edited DIS - MUST BE USED FOR FINAL DRAFT

Formatted: Font: 11 pt

Formatted: Space After: 0 pt, Line spacing: single

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 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 2811-1:2023, 3.1]

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.

Formatted: Different first page header

Formatted: Don't adjust space between Latin and Asian text, Don't adjust space between Asian text and numbers

Formatted: Font: Bold, Not Italic

Formatted: Default Paragraph Font

Formatted: std_section

Formatted: Tab stops: Not at 21.6 pt

Formatted: Font: 12 pt

Formatted: Space After: 36 pt, Line spacing: Exactly 12 pt

5 Temperature

Formatted: Tab stops: Not at 21.6 pt

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 such as $(20,0 \pm 0,5)$ °C can be ~~needed~~required.

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

Formatted: Tab stops: Not at 21.6 pt

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

Formatted: Tab stops: Not at 21.6 pt

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

Formatted: Tab stops: Not at 21.6 pt

8.1 General

Carry out a single determination on a fresh test sample.

8.2 Determination

Formatted: Tab stops: Not at 21.6 pt

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 are shown in 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 min⁻¹ was found to be suitable.

Formatted: Font: 11 pt

Formatted: Space After: 0 pt, Line spacing: single

Fill the U-tube with the product under test (about 2 cm³), 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 the apparatus 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, can be expected to lie, with a 95 % probability, is 0,001 g/cm³.

Formatted: Right, Space After: 36 pt, Line spacing: Exactly 12 pt

Formatted: Font: 12 pt

Formatted: Superscript, Not Raised by / Lowered by

Formatted: Superscript, Not Raised by / Lowered by

Formatted: Tab stops: Not at 21.6 pt

Field Code Changed

Formatted: Tab stops: Not at 21.6 pt

Formatted: Tab stops: Not at 21.6 pt

Formatted: Superscript, Not Raised by / Lowered by

Formatted: Font: 11 pt

Formatted: Space After: 0 pt, Line spacing: single

ISO 2811-3:2023(E)

Formatted: Font: 12 pt

10.3 Reproducibility limit, *R*

Formatted: Space After: 36 pt, Line spacing: Exactly 12 pt

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, can be expected to lie, with a 95 % probability, is 0,002 g/cm³.

Formatted: Tab stops: Not at 21.6 pt

11 Test report

Formatted: Superscript, Not Raised by / Lowered by

The test report shall include at least the following information:

Formatted: Tab stops: Not at 21.6 pt

- 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;
- e) the density of the product tested, either directly read ~~form~~from the display of the test apparatus in accordance with 8.2 or 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.

Formatted: cite_sec

Formatted: Superscript, Not Raised by / Lowered by



ISO 2811-3

<https://standards.iteh.ai/catalog/standards/sist/1b36244f-2443-45bb-b2b3-917371a7ee1d/iso-2811-3>

Formatted: Font: 11 pt

Formatted: Space After: 0 pt, Line spacing: single