



International
Standard

ISO 2884-1

**Paints and varnishes —
Determination of viscosity using
rotational viscometers —**

**Part 1:
Absolute viscosity measurement
with cone-plate measuring
geometry at high shear rates**

*Peintures et vernis — Détermination de la viscosité au moyen de
viscosimètres rotatifs —*

*Partie 1: Mesurage de la viscosité absolue par géométrie de
mesure cône/plateau à des vitesses de cisaillement élevées*

**Second edition
2024-09**

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents		Page
Foreword.....		iv
1	Scope.....	1
2	Normative references.....	1
3	Terms and definitions.....	1
4	Measuring assembly.....	1
5	Sampling.....	2
6	Checking the measuring assembly.....	2
7	Procedure.....	2
8	Repeatability and measuring error.....	2
9	Test report.....	3
Annex A (informative) Cone-and-plate viscometer.....		4

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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 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).

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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 2884-1:1999), which has been technically revised.

The main changes are as follows:

- terminology and symbols have been adapted to ISO 3219-1;
- when describing the measuring assembly, the current state of the art was taken into account and adapted to ISO 3219-2;
- reference to alternative measuring geometries has been added to [Clause 7](#);
- description of the test procedure including the test report has been updated;
- the normative references have been updated.

A list of all parts in the ISO 2884 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 viscosity using rotational viscometers —

Part 1:

Absolute viscosity measurement with cone-plate measuring geometry at high shear rates

1 Scope

This document specifies the general procedure to be followed in determining the dynamic viscosity of unpigmented coating materials, such as paints, varnishes and related products, as well as binders at a shear rate range between $9\,000\text{ s}^{-1}$ and $12\,000\text{ s}^{-1}$. It describes an absolute viscosity measurement with cone-plate measuring geometry at high shear rates.

The measured value gives information about the resistance offered by the material to brushing, spraying and roller coating during application.

The method specified in this document is suitable for all paints and varnishes whether they are Newtonian in behaviour or not. For materials containing dispersions of large particles, the measuring geometry is expected to be adapted.

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 3219-1, *Rheology — Part 1: Vocabulary and symbols for rotational and oscillatory rheometry*

ISO 3219-2, *Rheology — Part 2: General principles of rotational and oscillatory rheometry*

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 3219-1 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/>

4 Measuring assembly

The measuring assembly consists of a rotational viscometer with a cone-plate measuring geometry that covers the shear rate range between $9\,000\text{ s}^{-1}$ and $12\,000\text{ s}^{-1}$. Details about the measuring assembly shall be indicated in the test report (see [Clause 9](#)). A cone-plate measuring geometry is described in [Annex A](#).

5 Sampling

Take a representative sample of the product to be tested, as specified in ISO 15528. Then examine the sample and prepare it for testing, as specified in ISO 1513.

Samples without particles should be used for application of this document. Samples containing particles lead to anomalous results and can cause damage to the measuring geometry. When using samples with particles, a cone-plate measuring geometry with a flattened cone tip shall be used. The maximum size of heterogeneous components should not exceed 10 % of the gap width of the removed cone tip.

6 Checking the measuring assembly

The measuring system and temperature control system used shall be adjusted, calibrated and verified. Inspect the cones regularly for wear and replace them as required.

Regularly check the measuring assembly, consisting of measuring device, measuring geometry and temperature control system, in accordance with the recommendations of the manufacturer and using a reference fluid. If the viscosity value measured in this way deviates by more than 15 % from the setpoint value, then the measuring assembly shall be checked.

Mineral oils (no silicone oils) shall be used as the reference fluid.

7 Procedure

7.1 The ambient conditions under which the rotational viscometer is operated shall meet the requirements of the device manufacturer. The measuring device should be placed in a climate-controlled room [temperature: $(23 \pm 2) ^\circ\text{C}$, relative humidity: $(50 \pm 5) \%$].

Following the sequences stated in [7.2](#) to [7.5](#), carry out the test in duplicate immediately after preparation of the sample in accordance with [Clause 5](#).

If not otherwise agreed, perform the determination at $(23 \pm 0,2) ^\circ\text{C}$ and state the temperature in the test report.

7.2 Adjust the temperature of the rotational viscometer to $(23 \pm 0,2) ^\circ\text{C}$ or to an alternative agreed temperature. Apply a suitable amount of the coating material under testing to the lower plate of the measuring geometry, taking care to avoid the inclusion of air bubbles. Trim the sample and bring it to a thermal equilibrium.

7.3 The measuring profile is defined through preliminary tests. Potential measuring errors such as emptying of the gap can be avoided by choosing a cone-plate geometry with a different diameter or a different cone angle.

7.4 Carry out the measurement and document the results in the test report (see [Clause 9](#)).

7.5 After every measurement, clean the measuring geometry with a suitable solvent.

8 Repeatability and measuring error

Starting from an adjusted and calibrated measuring assembly, the results of two viscosity determinations performed within a short period of time, one after the other in the same laboratory by the same operator, shall not deviate by more than $\pm 5 \%$ from the mean value of the two measurements.

In the event of emptying of the gap, the measuring geometry used should be checked and, if necessary, replaced with a cone having a smaller diameter. If this measure is not sufficient to prevent emptying of the gap, then a coaxial-cylinders measuring geometry as specified in ISO 3219-2 shall be used.

Further measuring errors such as solvent loss or structural changes to the sample shall be avoided.

9 Test report

The test report shall contain at least the following information:

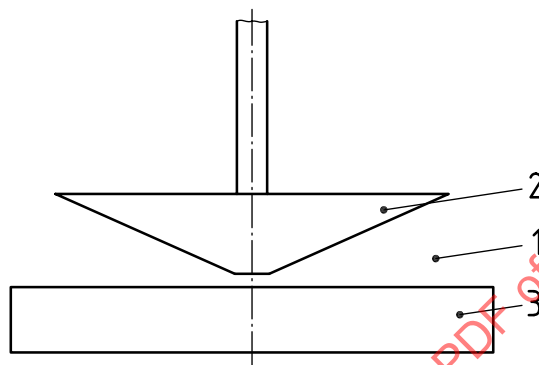
- a) a reference to this document, i.e. ISO 2884-1:2024;
- b) information about the tested sample, including:
 - 1) identification,
 - 2) sampling date and procedure,
 - 3) if necessary, details on the preparation of the sample that take place outside of the rotational viscometer (e.g. homogenization, pre-temperature control and venting), and as part of the measurement (e.g. pre-application of shear),
 - 4) if necessary, sample properties such as the maximum particle size, droplet size, mean molecular mass, molecular mass distribution, solvent(s), pH value, density;
- c) measuring device and accessories used, including:
 - 1) the type of rotational viscometer used, temperature control unit, measuring geometry, further optional accessories [e.g. cover with solvent trap and solvent(s) used],
 - 2) date of last calibration;
- d) test method/measuring profile, including:
 - 1) measuring temperature in °C,
 - 2) statement of the measuring method (e.g. measuring point duration),
 - 3) type of evaluation (e.g. numerical, mean value calculation),
 - 4) if necessary, preparation of the rotational viscometer (e.g. zero-point adjustment, trim position);
- e) statement of the measuring result, including:
 - 1) measured value with unit, e.g. shear viscosity expressed in Pa·s (at a shear rate expressed in s⁻¹, and a temperature expressed in °C),
 - 2) if necessary, graphical representation of the measuring result,
 - 3) if necessary, error analysis and statement of the error, comparison with specified tolerances;
- f) any deviations from the specified test procedure;
- g) any unusual observations (deviations) during the test;
- h) name of the person who carried out the test;
- i) date of the test.

Annex A (informative)

Cone-and-plate viscometer

A.1 Description of the measuring geometry

The measuring geometry consists of a cone and a plate, see [Figure A.1](#).



Key

- 1 sample chamber
- 2 cone
- 3 plate

Figure A.1 — Schematic sketch of a cone-plate measuring geometry

The angle between the cone and the plate (cone angle) shall be as small as possible, and under no circumstances greater than 5° . The influence of friction between the cone tip and plate is avoided by the flattened cone tip (truncated cone). The flattened cone tip and angle create the specified measuring gap for the individual cone. See [Figure A.2](#) for details. The extent to which the cone tip decreases, i.e. the distance between the flattened cone tip and the plate, has an impact on the measuring result.