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Paints and varnishes — Determination of viscosity using rotational viscometers —

Part 2: Relative measurement of viscosity using disc or ball spindles at specified speeds

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

Partie 2: Mesurage relatif de la viscosité avec des agitateurs à disque ou à bille à des vitesses spécifiées

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Foreword

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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 2884-2:2003), which has been technically revised.

The main changes are as follows:

— terminology and symbols have been adapted to ISO 3219-1;

— a statement has been added that this document refers to a relative value for viscosity;

— 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 2: Relative measurement of viscosity using disc or ball spindles at specified speeds

1 Scope

This document specifies a general procedure for determining the viscosity of paints, varnishes and related products, as well as binders. The method is primarily used to determine the relative viscosity of a product and to monitor this while thinning during a manufacturing process. It describes a relative measurement of viscosity using disc or ball spindles at specified speeds.

The method specified in this document is suitable for all paints and varnishes whether they are Newtonian in behaviour or not. It can also be applied to materials containing dispersions of particles.

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 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

4.1 General

The measuring assembly consists of a rotational viscometer with a relative measuring geometry (disc or ball spindle in accordance with 4.2) and a defined container (in accordance with 4.3), in which the sample to be tested is contained. It shall be possible to control the temperature of the sample (in accordance with 4.4).

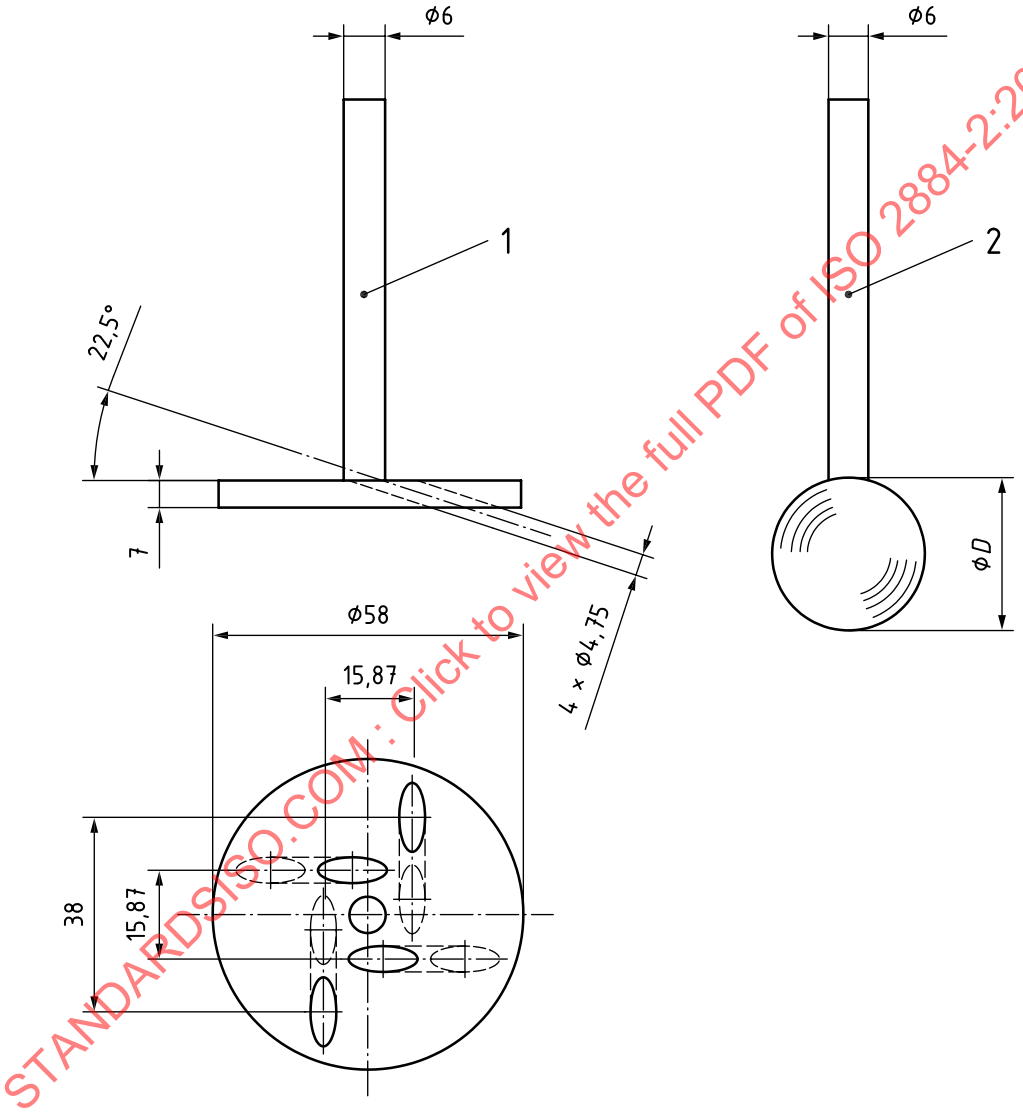
4.2 Spindles

The following types of spindles shall be used in the viscosity ranges described in Table 1:

— Disc spindle (type 1) for use at relative viscosity values of up to 1,5 Pa·s at a rotational speed of 200 min^{-1}. The disc shall have cross-channels designed to produce a slight agitating action. The dimensions shall be as shown in Figure 1.

— Ball spindles (type 2 and type 3) for use with relative viscosity values up to 6,5 Pa·s (type 2) and 34 Pa·s (type 3) at rotational speeds of 44 min^{-1} or 20 min^{-1}. The dimensions shall be as shown in Figure 1. The viscosity ranges of the spindles are shown in Table 1.

Dimensions in millimetres



Key

1 disc spindle (type 1)

2 ball spindle (type 2 and type 3)

Spindle	Diameter *D*
Type 2	31,75 mm
Type 3	19,05 mm

Figure 1 — Disc and ball spindles

Table 1 — Viscosity ranges of the spindles

Spindle	Viscosity range
Type 1 (disc spindle)	up to 1,5 Pa·s
Type 2 (ball spindle)	up to 6,5 Pa·s
Type 3 (ball spindle)	up to 34 Pa·s

4.3 Container

The container shall comprise a round container (e.g. paint can) as shown in Figure 2, having a capacity of 250 ml, a nominal internal diameter of typically 74 mm, a height of 74 mm and a filling-aperture diameter of 61 mm. If a different container is used, the rotational viscometer shall be calibrated accordingly (see Clause 6).

The use of different containers can result in different viscosity values being obtained. During comparison measurements, containers with the same geometry shall be used to allow comparisons between samples.

Dimensions in millimetres

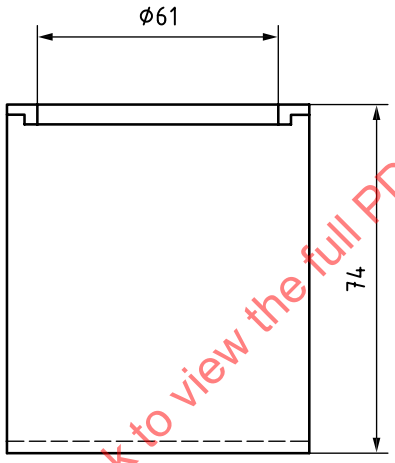


Figure 2 — Typical container

4.4 Temperature control device,

The temperature control device shall be capable of maintaining the container and fluid at (23 ± 0,5) °C.

4.5 Reference fluids

Standard mineral oils with Newtonian flow behaviour shall be used. The viscosity values shall be within ±5 % of the relevant stated value and shall have been determined by a recognized laboratory following an absolute method of determination.

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

5 Sampling

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

6 Checking the measuring assembly

The measuring system and temperature control system used shall be adjusted, calibrated and verified. Inspect the measuring geometries 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 ±5 % from the setpoint value, then the measuring assembly shall be checked.

7 Performance of the measurement

7.1 General

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 ± 2) °C, relative humidity: (50 ± 5) %].

Following the sequence stated in 7.2 and 7.3, carry out the test in duplicate immediately after preparation of the sample in accordance with Clause 5.

7.2 With a reference fluid

Mineral oils (no silicone oils) shall be used as the reference fluid. The device shall be tested with three reference fluids (4.5) that cover the measuring range of the application.

Fill one of the reference fluids into the 250-ml container (4.3), which shall be maintained at (23 ± 0,5) °C (or at the temperature range agreed by the contractual parties) and fill the container. Place the filled container under the rotational viscometer in such a way that the spindle is centrally positioned. Slowly lower the spindle into the fluid until it reaches a defined height within the container. Then add fluid until the level reaches the line on the spindle shaft. During these operations, ensure that there are no air bubbles trapped in the fluid, paying special attention to the rotating surfaces and the container walls. Any air bubbles present shall be removed.

Allow the measuring assembly to stand for a sufficient period of time to ensure thermal equilibrium between the fluid, container and spindle. With the spindle to be used located in the measuring position and at one of the rotational speeds to be used, determine the viscosity value. Compare this value with the certified viscosity of the reference fluid.

Repeat with each reference fluid, cleaning the spindle immediately after each measurement using a suitable solvent.

7.3 With a sample

The determination shall be performed at (23 ± 0,5) °C unless agreed otherwise between the contractual partners.

Prior to use, ensure the instrument is thoroughly clean and free from any deposits. Pour the sample to be tested into a 250-ml container of the same size as the one used for calibration.

If the sample is required to be thinned to a specific viscosity, add small, measured amounts of thinner, at the same temperature as the sample, until the desired value is obtained. Allow sufficient time for the mixture to become homogeneous before determining the viscosity.

With some samples, it is possible that the measuring result does not remain constant, and that it instead slowly decreases or increases until a stable value is obtained that is dependent upon time and shear. In this case, separate agreements shall be made between the contractual parties. These can include defined initial peak and end values, or values after defined times.

The results shall be defined in the test report (see Clause 9).

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