

Paints and varnishes - Determination of flow time by use of flow cups (ISO 2431:2019, Corrected version 2019-09)

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 2431:2019 sisaldab Euroopa standardi EN ISO 2431:2019 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 2431:2019 consists of the English text of the European standard EN ISO 2431:2019.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 10.07.2019.	Date of Availability of the European standard is 10.07.2019.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 87.040

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

Paints and varnishes - Determination of flow time by use  
of flow cups (ISO 2431:2019, Corrected version 2019-09)

Peintures et vernis - Détermination du temps  
d'écoulement au moyen de coupes d'écoulement (ISO  
2431:2019, Version corrigée 2019-09)

Beschichtungsstoffe - Bestimmung der Auslaufzeit mit  
Auslaufbechern (ISO 2431:2019)

This European Standard was approved by CEN on 11 June 2019.

This European Standard was corrected and reissued by the CEN-CENELEC Management Centre on 09 October 2019.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

## European foreword

This document (EN ISO 2431:2019) has been prepared by Technical Committee ISO/TC 35 "Paints and varnishes" in collaboration with Technical Committee CEN/TC 139 "Paints and varnishes" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2020, and conflicting national standards shall be withdrawn at the latest by January 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 2431:2011.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Endorsement notice

The text of ISO 2431:2019, Corrected version 2019-09 has been approved by CEN as EN ISO 2431:2019 without any modification.

# Contents

Page

<b>Foreword</b>	<b>iv</b>
<b>Introduction</b>	<b>v</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms and definitions</b>	<b>1</b>
<b>4 Temperature considerations</b>	<b>2</b>
<b>5 Apparatus</b>	<b>2</b>
5.1 Flow cups	2
5.1.1 Dimensions	2
5.1.2 Material	2
5.1.3 Construction	2
5.1.4 Finish	3
5.1.5 Measurement range	4
5.1.6 Marking	5
5.1.7 Care and checking of flow cups	5
5.2 Supplementary apparatus	6
<b>6 Sampling</b>	<b>6</b>
<b>7 Procedure</b>	<b>6</b>
7.1 Preliminary check for Newtonian flow	6
7.2 Determination of flow time	6
7.2.1 Choice of flow cup	6
7.2.2 Temperature adjustment	6
7.2.3 Preparation of the flow cup	7
7.2.4 Filling the flow cup	7
7.2.5 Measurement of flow time	7
7.2.6 Repeat determinations	7
<b>8 Marking of products tested</b>	<b>7</b>
<b>9 Precision</b>	<b>8</b>
9.1 General	8
9.2 Repeatability limit, $r$	8
9.3 Reproducibility limit, $R$	8
<b>10 Test report</b>	<b>9</b>
<b>Annex A (normative) Checking flow cups for wear and tear</b>	<b>10</b>
<b>Annex B (informative) Conversion of flow times from one temperature to another</b>	<b>12</b>
<b>Bibliography</b>	<b>14</b>

## 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](http://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](http://www.iso.org/patents)).

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](http://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 sixth edition cancels and replaces the fifth edition (ISO 2431:2011), which has been technically revised. The main changes compared to the previous edition are as follows:

- a general reference to ISO 4618 has been added in [Clause 3](#);
- the information in [Clause 4](#) on measuring at other temperatures and humidities specified in this document has been amended;
- [Figure 1](#) has been corrected;
- information on conduction of measurements in a fume cupboard has been added to [Clause 4](#).

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](http://www.iso.org/members.html).

This corrected version of ISO 2431:2019 incorporates the following correction:

- In [Table 1](#), the formula for calculating the kinematic viscosity,  $\nu$ , of flow cup No 5 was corrected to read:  $\nu = 3,28 \times t - \frac{220}{t}$ .

## Introduction

The first edition of this document, ISO 2431, published in 1972, specified only one flow cup with an orifice diameter of 4 mm. The second edition specified three flow cups with an orifice diameter of 3 mm, 4 mm and 6 mm. The third edition corrected errors in Figures 2 and 4 and the formulae for those figures. The fourth edition specified four flow cups with an orifice diameter of 3 mm, 4 mm, 5 mm and 6 mm. In the fifth edition the curves in Figures 2 to 5 have been placed in a single figure ([Figure 2](#)) and the formulae for the conversion of flow time to kinematic viscosity and vice versa represented by the curves in these figures have been moved from the figures to a table ([Table 1](#)). The procedure for checking the flow cups for wear and tear has been revised to include two alternative methods (one using a certified reference material or secondary working standard, the other using a certified flow cup) and has been moved to an informative annex. The main changes made in this sixth edition are given in the foreword.

As is well known, many countries over the years have developed their own standard flow cups and the difficulty in correlation between them has led to considerable confusion in comparing values. The standardization of an improved design of flow cup has been recommended after careful consideration of the role of flow cups for the measurement of the flow time of paints, varnishes and related products.

Flow times are a measure for sample viscosity only for products with Newtonian or near-Newtonian flow properties. This effectively limits the practical use of flow cups. Nevertheless, for checking purposes, these flow cups do serve a useful purpose. Furthermore, the measurement of flow time is often used to confirm the application consistency.

Paints often contain thickening agents to ensure increased viscosity. Such paints exhibit non-Newtonian flow properties. Their viscosity during application can only be properly assessed using viscometers such as that described in ISO 3219.

Resins and varnishes can exhibit Newtonian or near-Newtonian flow at much higher viscosities than most paints and, where this applies, flow cups can provide a useful means of controlling the consistency. As a result, this document provides flow cups suitable for viscosities up to about 700 mm<sup>2</sup>/s.

With thixotropic materials, stirring or other such mechanical stress immediately before testing will reduce the flow time compared with that for an unstirred sample. With such materials, uncertain and variable flow time values are obtained with all the flow cups. The repeatability and reproducibility limits given in [Clause 9](#) cannot be achieved in the determination of the flow time of such materials.

# Paints and varnishes — Determination of flow time by use of flow cups

## 1 Scope

This document specifies a method for determining the flow time of paints, varnishes and related products that can be used to control consistency.

Four flow cups of similar dimensions, but having orifice diameters of 3 mm, 4 mm, 5 mm and 6 mm, are specified. Two methods for checking the flow cups for wear and tear are given (see [Annex A](#)).

Flow cups with a replaceable jet are not covered by this document as the close tolerances on the supply of the material under test to the jet are not met.

Commonly used dipping flow cups are also not covered by this document.

**NOTE** Since the fabrication tolerances for such flow cups are greater than those of the flow cups specified in this document, flow time determinations with dipping flow cups give a precision which is lower than that obtained with the flow cups specified in this document (see [Clause 9](#)).

The method described in this document is limited to testing materials for which the breakpoint of the flow from the orifice of the flow cup can be determined with certainty. This point is difficult to determine and reproduce for materials with flow times near the upper limit of the measurement range (100 s) due to slowing-down effects.

## 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 4618, *Paints and varnishes — Terms and definitions*

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 4618 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1

#### flow time

*t*

time that elapses from the moment when the material under test starts to flow from the orifice of the filled flow cup to the moment when the flow stream of material first breaks off close to the orifice