SLOVENSKI STANDARD
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Barve in laki - Ugotavljanje debeline plasti (ISO/DIS 2808:2018)

Paints and varnishes - Determination of film thickness (ISO/DIS 2808:2018)

Beschichtungsstoffe - Bestimmung der Schichtdicke (ISO/DIS 2808:2018)

Peintures et vernis - Détermination de l'épaisseur du feuil (ISO/DIS 2808:2018)

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Paints and varnishes — Determination of film thickness

Peintures et vernis — Détermination de l'épaisseur du feuil

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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).

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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, SC 9, *General test methods for paints and varnishes.*

This fifth edition cancels and replaces the fourth edition (ISO 2808:2007), which has been technically revised.

The main changes compared to the previous edition are as follows:

a) the definitions were adapted to the current editions of ISO 4618 and ISO Guide 99;

b) the principle was revised;

c) white-light interferometer has been newly included as Method 6C;

d) the terahertz method has been newly included as Method 11;

e) the existing methods were adapted to the current state of metrology;

f) the characterisation of the methods and procedures in Annex A was revised;

g) the information in Annex A on the precision of the individual methods was adapted to current standards;

h) the references to test standards and constructions standards in Annex A were updated;

i) Section 7 on measurement of the film thickness on rough surfaces was transferred to an informative Annex (Annex B);

j) a new informative Annex (Annex C) on factors which influence measuring accuracy when measurements are performed on wood was included.

Paints and varnishes — Determination of film thickness

1 Scope

This document describes a number of methods that are applicable to the measurement of the thickness of coatings applied to a substrate. Methods for determining wet-film thickness, dry-film thickness and the film thickness of uncured powder layers are described. Reference is made to individual standards where these exist. Otherwise the method is described in detail.

An overview on the methods is given in Annex A, in which the field of application, existing standards and the precision are specified for the individual methods.

This document also defines terms concerning the determination of film thickness.

NOTE This standard consistently enumerateds the individual coatings applied in a multi-layer system by referring to the first coating applied on the substrate as coating 1. Some other standards referring to individual test methods enumerate in reverse order

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 463, *Geometrical Product Specifications (GPS) — Dimensional measuring equipment — Design and metrological characteristics of mechanical dial gauges*

ISO 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics*

ISO 4618:2014, *Paints and varnishes — Terms and definitions*

ISO 8503-1, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces*

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:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
substrate
surface to which a coating material is applied or is to be applied

[SOURCE: ISO 4618: 2014, 2.244]

3.2
coating
continuous layer formed from a single or multiple application of a coating material to a substrate

[SOURCE: ISO 4618: 2014, 2.50.1]

3.3
film thickness
distance between the surface of the film and the surface of the substrate

3.4
wet-film thickness
thickness of a freshly applied wet coating material, measured immediately after application

3.5
dry-film thickness
thickness of a coating remaining on the surface when the coating has hardened

3.6
thickness of uncured powder layer
thickness of a freshly applied coating material in powder form, measured immediately after application and before stoving

3.7
relevant surface area[1)]
part of an object covered or to be covered by the coating and for which the coating is essential for serviceability and/or appearance

3.8
test area[1]
representative part of the relevant surface area within which an agreed number of single measurements is made as a spot-check

3.9
measurement area[1]
area over which a single measurement is made

3.10
minimum local film thickness[1]
lowest value of the local film thickness found on the relevant surface area of a particular test specimen

3.11
maximum local film thickness[1)]
highest value of the local film thickness found on the relevant surface area of a particular test specimen

3.12
mean film thickness[1]
arithmetic mean of all the individual dry-film thicknesses in the test area or the result of a gravimetric determination of the thickness

1) Measurement of this property is only required for the extended evaluation of film thickness measurements; see Clause 8 (test report), items k) and l).

3.13
calibration
operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication

Note 1 to entry: A calibration may be expressed by a statement, calibration function, calibration diagram, calibration curve, or calibration table. In some cases, it may consist of an additive or multiplicative correction of the indication with associated measurement uncertainty.

Note 2 to entry: Calibration should not be confused with adjustment of a measuring system, often mistakenly called "self-calibration", nor with verification of calibration.

Note 3 to entry: Often, the first step alone in the above definition is perceived as being calibration.

[ISO Guide 99:2007, 2.39]

3.14
verification
provision of objective evidence that a given item fulfils specified requirements

EXAMPLE 1 Confirmation that a given reference material as claimed is homogeneous for the quantity value and measurement procedure concerned, down to a measurement portion having a mass of 10 mg.

EXAMPLE 2 Confirmation that performance properties or legal requirements of a measuring system are achieved.

EXAMPLE 3 Confirmation that a target measurement uncertainty can be met.

Note 1 to entry: When applicable, measurement uncertainty should be taken into consideration.

Note 2 to entry: The item may be, e.g. a process, measurement procedure, material, compound, or measuring system.

Note 3 to entry: The specified requirements may be, e.g. that a manufacturer's specifications are met.

Note 4 to entry: Verification in legal metrology, as defined in VIML, and in conformity assessment in general, pertains to the examination and marking and/or issuing of a verification certificate for a measuring system.

Note 5 to entry: Verification should not be confused with calibration. Not every verification is a validation.

Note 6 to entry: In chemistry, verification of the identity of the entity involved, or of activity, requires a description of the structure or properties of that entity or activity.

[ISO Guide 99:2007, 2.44]

3.15
Reference material
RM
material, sufficiently homogeneous and stable with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties

Note 1 to entry: Examination of a nominal property provides a nominal property value and associated uncertainty. This uncertainty is not a measurement uncertainty.

Note 2 to entry: Reference materials with or without assigned quantity values can be used for measurement precision control whereas only reference materials with assigned quantity values can be used for calibration or measurement trueness control.

Note 3 to entry: "Reference material" comprises materials embodying quantities as well as nominal properties.

EXAMPLE 1 Examples of reference materials embodying quantities:

a) water of stated purity, the dynamic viscosity of which is used to calibrate viscometers;

b) human serum without an assigned quantity value for the amount-of-substance concentration of the inherent cholesterol, used only as a measurement precision control material;

c) fish tissue containing a stated mass fraction of a dioxin, used as a calibrator.

EXAMPLE 2 Examples of reference materials embodying nominal properties:

a) colour chart indicating one or more specified colours;

b) DNA compound containing a specified nucleotide sequence;

c) urine containing 19-androstenedione.

Note 4 to entry: A reference material is sometimes incorporated into a specially fabricated device.

EXAMPLE 3 Substance of known triple-point in a triple-point cell.

EXAMPLE 4 Glass of known optical density in a transmission filter holder.

EXAMPLE 5 Spheres of uniform size mounted on a microscope slide.

Note 5 to entry: Some reference materials have assigned quantity values that are metrologically traceable to a measurement unit outside a system of units. Such materials include vaccines to which International Units (IU) have been assigned by the World Health Organization.

Note 6 to entry: In a given measurement, a given reference material can only be used for either calibration or quality assurance.

Note 7 to entry: The specifications of a reference material should include its material traceability, indicating its origin and processing (Accred. Qual. Assur.:2006).

Note 8 to entry: ISO/REMCO has an analogous definition but uses the term "measurement process" to mean "examination" (ISO 15189:2007, 3.4) , which covers both measurement of a quantity and examination of a nominal property.

Note 9 to entry: Reference materials may be coated thickness standards, or shims. If agreed to by the contracting parties, a part of the test specimen may be used as a thickness standard for a particular job.

[ISO Guide 99:2007, 5.13 modified: Note 9 to entry supplemented]

3.16
adjustment of a measuring system
adjustment
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured

Note 1 to entry: Types of adjustment of a measuring system include zero adjustment of a measuring system, offset adjustment, and span adjustment (sometimes called gain adjustment).

Note 2 to entry: Adjustment of a measuring system should not be confused with calibration, which is a prerequisite for adjustment.

Note 3 to entry: After an adjustment of a measuring system, the measuring system must usually be recalibrated.

Note 4 to entry: Most digital measurement instruments can be adjusted on a thickness standard or on a shim, where the thickness of the coating or of the shim is known.

[ISO Guide 99:2007, 3.11, modified: Note 4 to entry supplemented] .

3.17
measurement accuracy
accuracy of measurement
accuracy
quantity value and a true quantity value of a measurand

Note 1 to entry: The concept "measurement accuracy" is not a quantity and is not given a numerical quantity value. A measurement is said to be more accurate when it offers a smaller measurement error.

Note 2 to entry: The term "measurement accuracy" should not be used for measurement trueness and the term measurement precision should not be used for 'measurement accuracy', which, however, is related to both these concepts.

Note 3 to entry: "Measurement accuracy" is sometimes understood as closeness of agreement between measured quantity values that are being attributed to the measurand.

[ISO Guide 99:2007, 2.13]

4 Determination of wet-film thickness

4.1 General

Annex A gives an overview of the methods used for the determination of wet-film thickness.

4.2 Mechanical methods

4.2.1 Principle

With all mechanical procedures the measuring instrument (see Figures 1, 2 and 3, Legend 4) passes through by the coating being placed on the surface of the substrate. The difference between the points of contact (substrate, see Figures 1, 2 and 3, Key 1) and the coating surface touched from the top of the measurement instrument (Figures 1, 2 and 3, Key 3) corresponds to the readable wet-film thickness.

4.2.2 Field of application

The mechanical principle is suitable for all film-substrate combinations. The substrate has to be flat in at least one direction in the area where the measurement is performed. Curvature of the surface in a single plane is permissible (e.g. internal or external surface of pipes).

4.2.3 General

Classification as a destructive or non-destructive method depends on:

a) the rheological properties of the coating material;

b) the nature of the wetting contact between the contact surfaces of the measurement instrument and the coating material;

c) whether the thickness measurements will make the coating unsuitable for the purpose for which it is intended.

Since the possibility of pigment particles remaining between the gauge and the substrate cannot be excluded, all mechanical methods contain a systematic error: the film thickness displayed is smaller than the actual wet-film thickness by at least the mean diameter of the pigment particles.

In the case of a wheel gauge (method 1B, see 4.2.5), the wheel has to be wetted by the coating material. If not, this represents a further source of systematic error which can result in exaggerated readings and is a function of:

— the surface tension and the rheological properties of the coating material;

— the material of the wheel gauge;

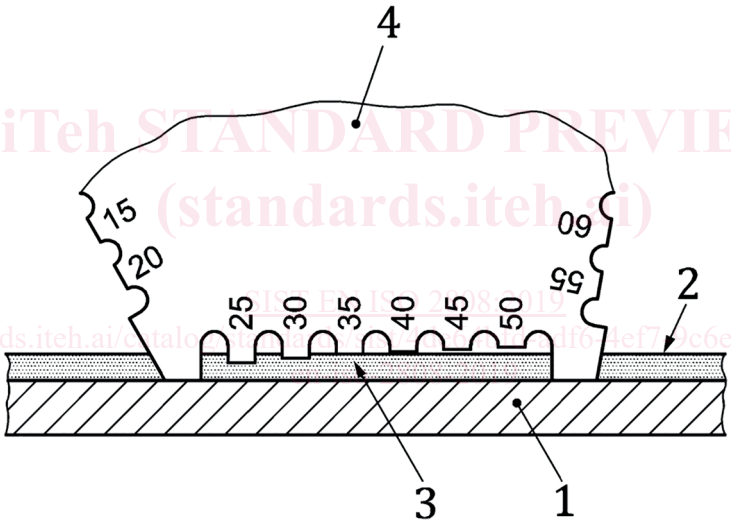
— the speed at which the wheel is turned.

4.2.4 Method 1A — Comb gauge

4.2.4.1 Description of instrument

A comb gauge is a flat plate made of a corrosion-resistant material with teeth along its edges (see Figure 1). The reference teeth at the corners of the plate define a baseline along which the inner teeth are arranged to give a graduated series of gaps. Each tooth is labelled with the assigned gap value.

With commercially available comb gauges the maximum thickness which can be measured is typically 2 000 µm and the smallest increment is typically 5 µm.



Key

1 substrate
2 coating
3 point of wetting contact
4 comb gauge

Figure 1 — Example of a comb gauge

4.2.4.2 Procedure

Ensure that the teeth are clean and not worn or damaged. Place the comb gauge onto the flat specimen surface such that the teeth are normal to the plane of the surface. Allow sufficient time for the coating to wet the teeth prior to removing the gauge.

In the case of specimens curved in a single plane, the comb gauge shall be placed in position parallel to the axis of curvature.

The thickness shall be measured directly after application since the result will be influenced, for example, by physical drying, curing or solvent loss.

Note the greatest gap reading of the tooth wetted by the coating material as the wet-film thickness.

4.2.5 Method 1B — Wheel gauge

4.2.5.1 Description of instrument

A wheel gauge consists of a wheel, made of hardened and corrosion-resistant steel, with three projecting rims (see Figure 2).

Two rims are ground to the same diameter and are configured concentrically to the wheel axle. The third rim has a smaller diameter and is eccentrically ground. One of the outer rims has a scale from which the respective protrusion of the concentric rims relative to the eccentric rim can be read.

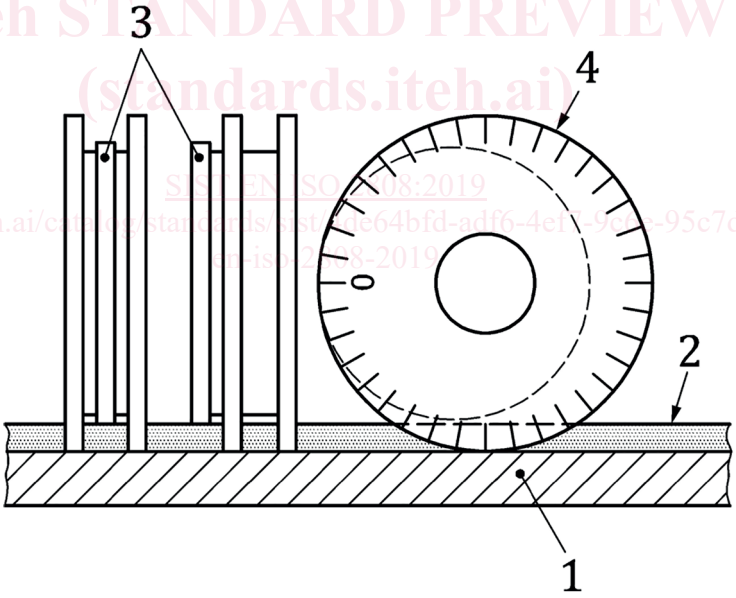
Two versions are available:

— version 1 has the eccentric rim located between the concentric rims;

— version 2 has the eccentric rim located systemtically outside the concentric rims and closely adjacent to one of them.

NOTE Unlike version 1, the design of version 2 allows parallax-free reading of the wet-film thickness.

With commercially available wheel gauges, the maximum thickness which can be measured is typically 1 500 µm and the smallest increment is typically 2 µm.



Key

1 substrate
2 coating
3 eccentric rim
4 wheel gauge

Figure 2 — Example of a wheel gauge

4.2.5.2 Procedure

Grip the wheel gauge with the thumb and index finger by the wheel axle and press the concentric rims onto the surface at the point of the largest reading on the scale.