SLOVENSKI STANDARD
oSIST prEN 13523-1:2023

01-september-2023

Prevlečene kovine, ki se navijajo - Preskusne metode - 1. del: Debelina premaza

Coil coated metals - Test methods - Part 1: Film thickness

Bandbeschichtete Metalle - Prüfverfahren - Teil 1: Schichtdicke

Tôles prélaquées - Méthodes d'essai - Partie 1 : Épaisseur du revêtement

Ta slovenski standard je istoveten z: **prEN 13523-1**

ICS:

17.040.20	Lastnosti površin	Properties of surfaces
25.220.60	Organske prevleke	Organic coatings

oSIST prEN 13523-1:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 13523-1

July 2023

ICS 25.220.60; 17.040.20

Will supersede EN 13523-1:2017

English Version

Coil coated metals - Test methods - Part 1: Film thickness

Tôles prélaquées - Méthodes d'essai - Partie 1 : Épaisseur du revêtement

Bandbeschichtete Metalle - Prüfverfahren - Teil 1: Schichtdicke

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

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European foreword

This document (prEN 13523-1:2023) has been prepared by Technical Committee CEN/TC 139 “Paints and varnishes”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13523-1:2017.

In comparison with the previous edition, the following technical modifications have been made:

a) ruggedized optical interference (ROI) has been added as method E;

b) the text has been editorially revised and the normative references have been updated.

The EN 13523 series, *Coil coated metals — Test methods*, consists of the following parts:

— *Part 0: General introduction*

— *Part 1: Film thickness*

— *Part 2: Gloss*

— *Part 3: Colour difference and metamerism — Instrumental comparison*

— *Part 4: Pencil hardness*

— *Part 5: Resistance to rapid deformation (impact test)*

— *Part 6: Adhesion after indentation (cupping test)*

— *Part 7: Resistance to cracking on bending (T-bend test)*

— *Part 8: Resistance to salt spray (fog)*

— *Part 9: Resistance to water immersion*

— *Part 10: Resistance to fluorescent UV radiation and water condensation*

— *Part 11: Resistance to solvents (rubbing test)*

— *Part 12: Resistance to scratching*

— *Part 13: Resistance to accelerated ageing by the use of heat*

— *Part 14: Chalking (Helmen method)*

— *Part 16: Resistance to abrasion*

— *Part 17: Adhesion of strippable films*

— *Part 18: Resistance to staining*

— *Part 19: Panel design and method of atmospheric exposure testing*

— *Part 20: Foam adhesion*

— *Part 21: Evaluation of outdoor exposed panels*

— *Part 22: Colour difference — Visual comparison*

— *Part 23: Resistance to humid atmospheres containing sulfur dioxide*

— *Part 24: Resistance to blocking and pressure marking*

— *Part 25: Resistance to humidity*

— *Part 26: Resistance to condensation of water*

— *Part 27: Resistance to humid poultice (Cataplasm test)*

— *Part 29: Resistance to environmental soiling (Dirt pick-up and striping)*

1 Scope

This document specifies the procedures for determining the dry-film thickness of an organic coating on a metallic substrate (coil coating).

Five appropriate methods are given in this document:

a) magnetic induction;

b) eddy current;

c) micrometer;

d) optical;

e) ruggedized optical interference.

The methods are applicable only to products with smooth and flat substrates, but the coating itself can be textured. In that case, for methods a) and b), the average of a series of readings will represent an average of the thickness of the organic coating, while method c) will give the maximum thickness, method d) can provide the minimum, maximum and average thickness, and e) will give the total thickness.

Non-destructive continuous-web methods on measurement of dry-film thickness are only applicable on method a).

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.

EN 13523-0:2021, *Coil coated metals — Test methods — Part 0: General introduction*

EN 23270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing (ISO 3270)*

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

ASTM D8331, *Standard Test Method for Measurement of Film Thickness of Thin-Film Coatings by Non-Destructive Means Using Ruggedized Optical Interference*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13523-0 and the following apply.

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

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

3.1
film thickness
distance between the surface of the film and the surface of the substrate

[SOURCE: EN ISO 2808:2019, 3.1]

4 Principle

4.1 Method A: Measurement on magnetic substrate – magnetic induction

The film thickness on a magnetic substrate is determined by means of an electromagnetic probe placed on the coating and developing an electromagnetic field. The variation of this field is a function of the distance between the probe and the substrate. This signal is measured and converted to the film thickness reading.

4.2 Method B: Measurement on a non-magnetic substrate – eddy current

The film thickness on a non-magnetic conductive substrate is determined by means of an electromagnetic probe placed on the coating and generating eddy currents in the substrate. The magnitude of the eddy currents is a function of the distance between the probe and the substrate. This measuring signal is derived from the impedance change in the probe and converted to the film thickness reading.

4.3 Method C: Measurement on all substrates – micrometer method

The film thickness is determined by measuring the coated sample and then removing the organic coating and re-measuring the sample minus the coating or by measuring a film of organic coating that has been removed from the sample.

4.4 Method D: Measurement on all substrates – optical method

The film thickness is determined by microscopical measurement of a section cut through the film. The defined cut may be made in the coating using a special blade (symmetrical cut), a special paint borer (conical bore) or a milling tool (sloping cut).

4.5 Method E: Measurement on all substrates – ruggedized optical interference (ROI)

The film thickness on a non-magnetic conductive substrate is determined by means of non-contact, ROI technology which measures multi-layer coatings and thin film thicknesses down to sub-micron levels.

5 Apparatus and materials

5.1 Instruments for measuring film thickness, using the principles described in Clause 4.

5.2 Solvent, suitable for removing organic coatings, for example methyl ethyl ketone (2-butanone).

5.3 Suitable abrasive and/or **blunt knife** or other means of removing softened organic coatings that do not damage the substrate.

5.4 Cutting tool, for Method D.

5.4.1 Blade, for making a symmetrical cut in the coating.

5.4.2 Paint borer, for making a conical bore in the coating.

5.4.3 Milling tool, for making a sloping cut in the coating.

6 Sampling

Shall be in accordance with EN 13523-0.

7 Test panels

Shall be in accordance with EN 13523-0.

8 Procedure

8.1 Calibration

8.1.1 General

For the measurement, the instructions of the manufacturer of the instrument shall be taken into account, in particular regarding the calibration and/or setting up procedure.

Before use, calibrate each instrument in accordance with the manufacturer's instructions using calibration standards. For instruments that cannot be calibrated, determine the deviation from the nominal value by comparison with calibration standards and take this into consideration for all measurements.

During use, check the calibration of the instrument as specified by the instrument's manufacturer.

8.1.2 Calibration standards

Calibration standards of known and uniform thickness are available either as foils or shims, or as coated standards with assigned values traceable to nationally recognized standards.

Calibration foils are generally made of plastics materials. They are subject to indentation and shall, therefore, be replaced frequently.

For methods A and B the surface and magnetic properties and the thickness of the metallic substrate of the coated calibration standards shall be similar to those of the test specimen.

For methods C and D the substrate of the test specimen and of the calibration standards shall be the same, provided the critical thickness (see Note) is not exceeded.

NOTE For each method, there is a critical thickness of metallic substrate above which instruments will not be affected by an increase in thickness.

8.2 Scale rating

For methods A and B, and if necessary, select the scale with a maximum above the estimated thickness of the coating and adjust the instrument to the thickness of a known non-metallic standard measured on the reference plate. The readings at several positions shall not vary by more than ±5 %. The thickness of the standard shall be greater than half the measuring scale used.

8.3 Measurement

8.3.1 Ambient conditions

Measure the film thickness at ambient temperature. For more accurate measurements, as required for instance in case of dispute, the temperature shall be (23 ± 2) °C and the relative humidity (50 ± 5) %, in accordance with EN 23270. Conditioning is carried out in accordance with EN 13523-0:2021, Clause 6.

8.3.2 Number of measurements

For methods A and B, take at least five measurements on smooth surfaces, and at least 10 measurements on textured coatings.

For methods C and D, it is recommended that a minimum number of five measurements is taken.

For method E take at least three measurements.

8.3.3 Method A: Magnetic induction

The samples shall be measured on a non-metallic and non-conductive table.

Place the probe perpendicular to and in contact with the coated panel and read the film thickness on the standard scale.

In the case of metallic coated steel (e.g. galvanized steel), the electromagnetic probe cannot measure simultaneously the metallic and the organic coating. Therefore, determine first the total thickness of the metallic coating and organic coating and, after having removed the organic coating, measure the thickness of the metallic coating on the same place. The difference gives the thickness of the organic coating.

Remove the organic coating with a solvent (5.2). After an adequate period of contact with the solvent, remove the softened organic coating by abrasive action using an abrasive and/or blunt knife (5.3). This stripping process shall not remove any metallic coating.

8.3.4 Method B: Eddy current

The samples shall be measured on a non-metallic and non-conductive table.

Place the probe perpendicular to and in contact with the coated panel and read the film thickness on the standard scale.

8.3.5 Method C: Micrometer method

Operate all instruments so that the coated specimen side is facing the spindle. With the hand-held type, press the specimen against the fixed measuring tip. Carry out each measurement such that the spindle of the micrometer is pressed against the surface to be tested. Turn the spindle until the ratchet is activated.

Remove the organic coating with a solvent (5.2). After an adequate period of contact with the solvent, remove the softened organic coating by abrasive action using an abrasive and/or blunt knife (5.3). This stripping process shall not remove any metallic coating.

Repeat the second measurement after removing the film. Calculate the film thickness from the difference in the readings for the total thickness and the substrate thickness.

For measuring free films, remove a filmstrip and measure the thickness according to above.

The external micrometer gauge design shall conform to the requirements of EN ISO 3611. An example is shown in Figure 1. Both jaws shall be in the same plane.

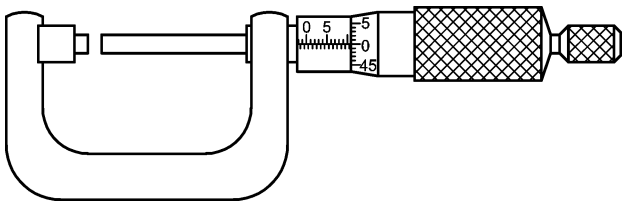

Figure 1 — Micrometer screw gauge