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**Paints and varnishes — Electro-  
deposition coatings —**

**Part 14:  
Deposition behaviour**

*Peintures et vernis — Peintures d'électrodéposition —*

*Partie 14: Comportement de précipitation*

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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](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*.

A list of all parts in the ISO 22553 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](http://www.iso.org/members.html).

# Paints and varnishes — Electro-deposition coatings —

## Part 14: Deposition behaviour

### 1 Scope

This document specifies a method for determining the deposition behaviour of an electro-deposition coating (e-coat) on various substrates and with various pre-treatments.

It applies to electro-deposition coatings for automotive industries and other general industrial applications, e.g. chiller units, consumer products, radiators, aerospace, agriculture.

### 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 1514, *Paints and varnishes — Standard panels for testing*

ISO 2808, *Paints and varnishes — Determination of film thickness*

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

ISO 22553-1, *Paints and varnishes — Electro-deposition coatings — Part 1: Vocabulary*

ISO 23321, *Solvents for paints and varnishes — Demineralized water for industrial applications — Specification and test methods*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 and ISO 22553-1 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/>

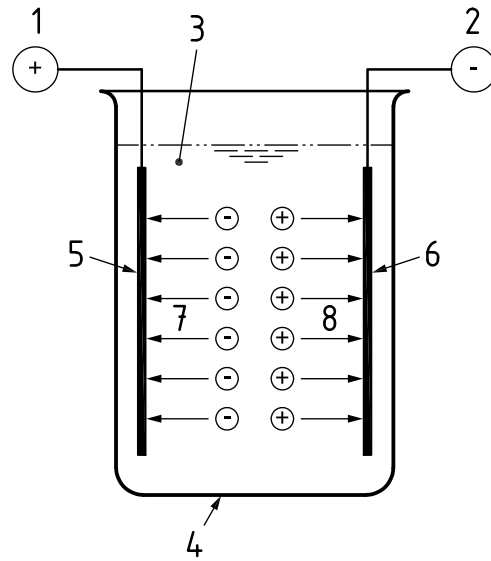
### 4 Principle

Two test panels (the test panel and another panel as the counter electrode) are placed in the deposition system and coated at different voltages and bath temperatures. The film thickness is measured for each combination of voltage and bath temperature.

### 5 Apparatus and test equipment

Ordinary laboratory apparatus together with the following.

**5.1 Laboratory deposition system.** A laboratory deposition system consists of a deposition tank with tank circulation system and DC voltage equipment. See [Figure 1](#).



**Key**

- |         |                                     |   |   |
|---------|-------------------------------------|---|---|
| 1       | anode                               | 5 | anode (counter electrode for cathodic e-coat) |
| 2       | cathode                             | 6 | cathode (test panel for cathodic e-coat)      |
| 3 and 8 | electro-deposition coating material | 7 | acid  |
| 4       | deposition tank                     |   |   |

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**Figure 1 — Schematic diagram of a laboratory deposition system with cathodic e-coat material as an example**

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The tank circulation system consists of a stirring machine, or a magnet stirrer or a pump.

The deposition conditions are adjusted according to the specifications.

**5.2 Film thickness measuring device**, maximum permissible error 0,3 µm.

**5.3 Thermometer**, with a reading accuracy of 0,1 °C.

**5.4 Timer**, with a reading accuracy of 1 s.

**5.5 Oven**, in which the test can be carried out reliably and in which the specified or agreed test temperature can be held to within ±2 °C (for temperatures up to 150 °C) or ±3,5 °C (for temperatures between 150 °C and 200 °C).

**6 Test panels**

Use electrically conductive test panels with pre-treatment as specified in ISO 1514 with dimensions of about 190 mm × 105 mm × 0,75 mm.

**7 Number of determinations**

Carry out a single determination.

## 8 Procedure

Fill the tank with the electro-deposition coating material up to about 1 cm below the edge and homogenize the coating material, e.g. using a stirring machine with paddle stirrer (minimum diameter 50 mm) at  $500 \text{ min}^{-1}$ , so that sufficient tank circulation is visually detectable.

Immerse the test panel in the laboratory deposition system and connect the anode and cathode to the current source. Maintain stirring of the electro-deposition coating material with a stirring machine or a magnet stirrer.

Set the bath temperature to the temperature specifically required for the product to  $\pm 0,5 \text{ }^\circ\text{C}$ .

NOTE 1 Usually the temperature is in the range of  $25 \text{ }^\circ\text{C}$  to  $35 \text{ }^\circ\text{C}$ .

Select the deposition voltage and deposition time so that the expected dry film thickness of the electro-deposition coating on the test panel corresponds to the nominal dry film thickness.

Increase the voltage to the selected coating voltage (if necessary without series resistor). Maintain that voltage over the selected time.

After completion of the deposition process, remove the coated test panel from the tank. Rinse it thoroughly using demineralized water specified in ISO 23321, so that any excess of the electro-deposition coating material (cream coat) is removed.

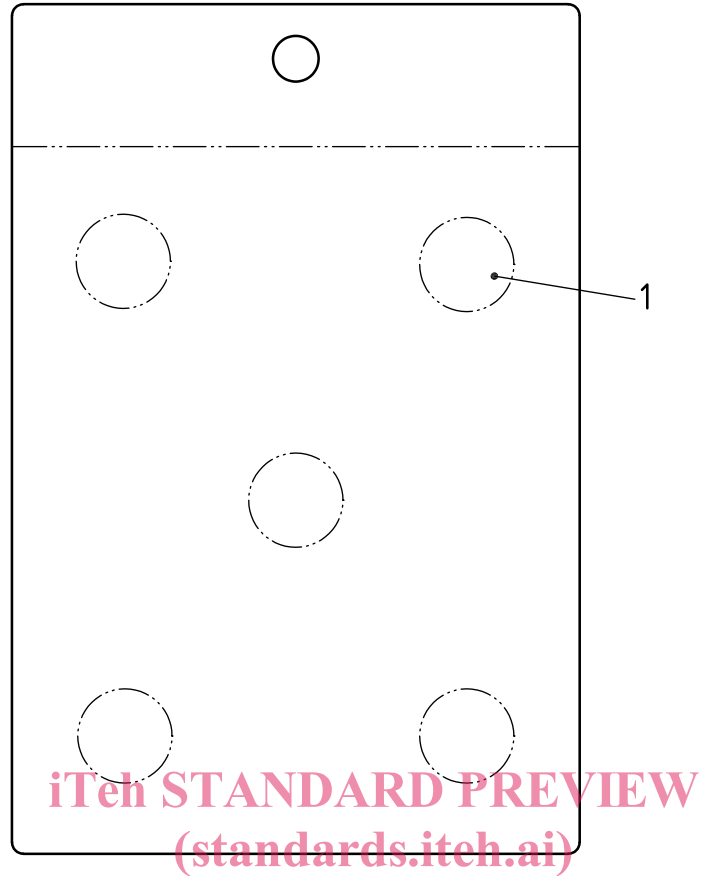
Stove the electro-deposition coating in accordance with its specifications.

The stoving temperature shall be the object temperature, not the indicated oven temperature.

NOTE 2 The stoving temperature is usually between  $100 \text{ }^\circ\text{C}$  and  $180 \text{ }^\circ\text{C}$ .

After the test panel has cooled down, measure the dry film thickness in accordance with one of the methods specified in ISO 2808 at five points (see Figure 2) of the test panel, and calculate the mean value.

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**Key**

1 measuring point for film thickness

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**Figure 2 — Coated test panel**

If necessary, use additional test panels to determine the voltage ( $U_0$ ), bath temperature ( $t_0$ ) and deposition time that are required to achieve the nominal dry film thickness on the test panel.

Based on the conditions determined for achieving the nominal dry film thickness, coat test panels with a different voltage (“voltage series”) and with a different bath temperature. The deposition time remains constant.

**9 Evaluation**

Report the dry film thickness  $t_d$  for each combination of bath temperature and deposition voltage (mean value of five individual measurements as shown in [Figure 2](#)). For a template for recording the measured dry film thicknesses, see [Table 1](#).

**Table 1 — Template for recording the measured dry film thicknesses  $t_d$**

Bath temperature	Film thickness at given deposition voltage			
	$U_0 - 20\text{ V}$	$U_0$	$U_0 + 20\text{ V}$	$U_0 + 40\text{ V}$
$t_0 - 2\text{ K}$	$t_{d1}$	$t_{d2}$	$t_{d3}$	$t_{d4}$
$t_0$	$t_{d5}$	$t_{d0}$ (nominal dry film thickness)	$t_{d6}$	$t_{d7}$
$t_0 + 2\text{ K}$	$t_{d8}$	$t_{d9}$	$t_{d10}$	$t_{d11}$



Visually inspect the entire test panel for surface defects, e.g. pinholes.

## 10 Precision

No precision data are currently available.

## 11 Test report

The test report shall contain at least the following information:

- a) all details necessary for the identification of the tested coating material;
- b) a reference to this document, i.e. ISO 22553-14:2021;
- c) the bath voltage;
- d) the bath temperature;
- e) the deposition time: adjustment time and holding time, in seconds;
- f) the stoving temperature and time;
- g) the test results in accordance with [Clause 9](#);
- h) any agreed or other deviation from the specified test method;
- i) any unusual observation (anomalies) observed during the test;
- j) the date of the test.

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