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

**Part 13:
Determination of re-solving behaviour**

Peintures et vernis — Peintures d'électrodéposition —

Partie 13: Détermination du comportement de redissolution

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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).

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.

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

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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.

Paints and varnishes — Electro-deposition coatings —

Part 13:

Determination of re-solving behaviour

1 Scope

This document specifies a method for determining the re-solving effect of electro-deposition coatings.

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 4628-1:2016, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 1: General introduction and designation system*

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, ISO 22553-1 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

re-solving

dissolving of a freshly deposited electro-deposition coating in the electro-deposition coating material itself and/or by the subsequent rinsing processes, e.g. ultrafiltrate rinsing

**3.2
ultrafiltration
UF**

membrane filtration process using membranes with pore sizes of $\leq 0,05 \mu\text{m}$ to retain dissolved, suspended or emulsified higher-molecular components

[SOURCE: DIN 19643-4:2012, 3.12, modified — Note 1 to entry deleted.]

**3.3
ultrafiltrate**

permeate obtained from the electro-deposition coating material by ultrafiltration

4 Principle

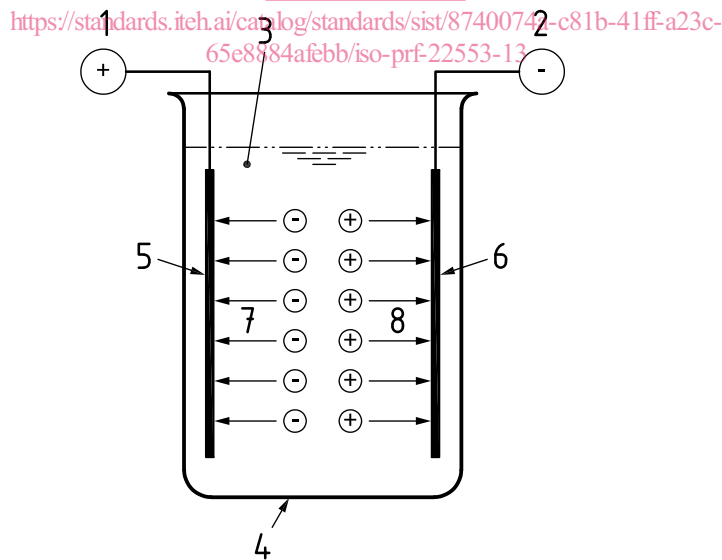
Two test panels (the test panel and another panel as the counter electrode) are put in the electro-deposition coating material and coated in accordance with the product specifications. After coating, the test panels are put in the electro-deposition coating material and the ultrafiltrate of the electro-deposition coating material for a specified period of time.

After stoving, the film thickness is measured and the test panels are visually evaluated for surface defects.

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 | | |

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

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 0,1 μm .

5.3 Thermometer, with a reading accuracy of 0,1 $^{\circ}\text{C}$.

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 $^{\circ}\text{C}$ (for temperatures up to 150 $^{\circ}\text{C}$) or $\pm 3,5$ $^{\circ}\text{C}$ (for temperatures between 150 $^{\circ}\text{C}$ and 200 $^{\circ}\text{C}$).

6 Test panels

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

7 Number of determinations

Carry out a single determination.

8 Procedure

8.1 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 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 $\pm 0,5$ $^{\circ}\text{C}$.

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

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.

8.2 Immerse 2/3 of the coated surface of the coated test panel (see [Figure 1](#)) in the electro-deposition coating material and leave it there, while stirring, for 10 min without applied voltage. Remove the panel and rinse with demineralized water. Immerse 1/3 of the so coated surface of the coated test panel in the electro-deposition coating material again and leave it there, while stirring, for another 10 min without applied voltage. Remove the panel and rinse with demineralized water.

8.3 Immerse 2/3 of the coated surface of another test panel coated in accordance with [8.1](#) (see [Figure 1](#)) in ultrafiltrate prepared by ultrafiltration of the electro-deposition coating material under test and leave it there, while stirring, for 10 min. Remove the panel and rinse with demineralized water.

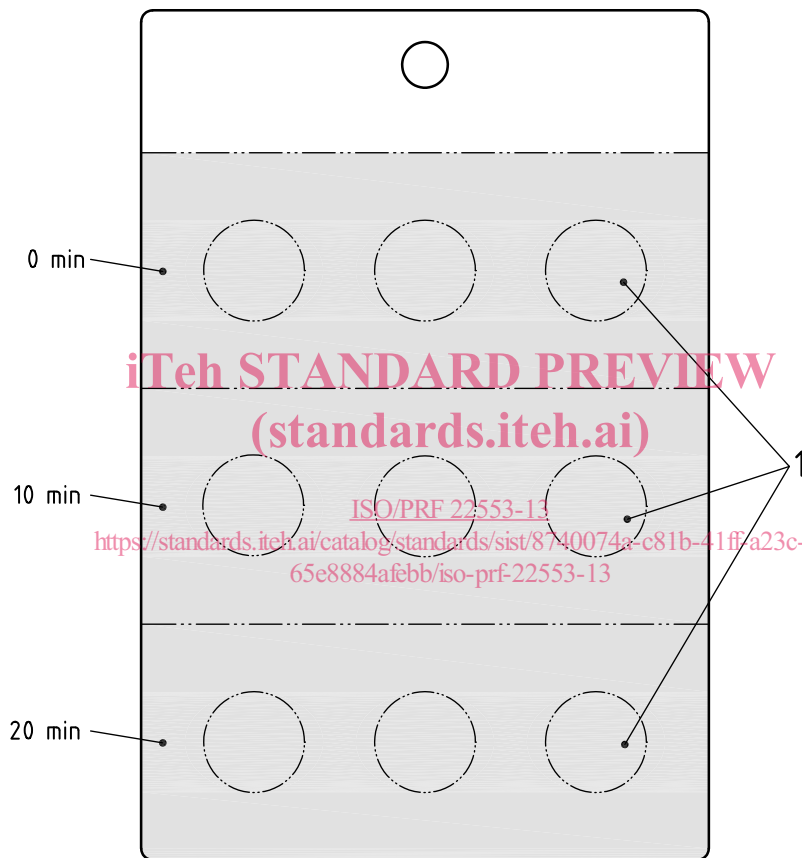
Immerse 1/3 of the so coated surface of the coated test panel in the ultrafiltrate again and leave it there, while stirring, for another 10 min. Remove the panel and rinse with demineralized water.

8.4 Stove/cure the coated test panels from 8.2 and 8.3 in the oven as specifically required for the product.

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

NOTE The stoving temperature is normally between 100 °C and 180 °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 three points per area (see Figure 2) on one side of the test panel, and calculate the mean value for each area.



Key

1 measuring point for film thickness

Figure 2 — Coated test panel

9 Evaluation

Report the mean value of the film thickness for each of the three areas.

Visually inspect the areas whose film thickness was measured for surface defects, e.g. streaks. Report the result in accordance with Table 1 and give a description where applicable.

Table 1 — Rating scheme for designating the intensity of changes (in accordance with ISO 4628-1:2016, Table 3)

Rating	Intensity of change
0	unchanged, i.e. no perceptible change
1	very slight, i.e. just perceptible change
2	slight, i.e. clearly perceptible change
3	moderate, i.e. very clearly perceptible change
4	considerable, i.e. pronounced change
5	very marked change

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 22553-13:2021;
- 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 result in accordance with [Clause 9](#);
- h) any agreed or other deviation from the specified test method;
- i) any unusual observations (anomalies) observed during the test;
- j) the date of the test.