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

Part 4:
**Compatibility of electro-deposition
coating materials with liquid, paste-
like and solid foreign materials**

*Peintures et vernis — Peintures d'électrodéposition —
Partie 4: Compatibilité des peintures d'électrodéposition avec des
matières liquides, pâteuses et solides*

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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principles	2
5 Apparatus and materials	2
6 Reagents	3
7 Foreign materials	3
8 Test panels	3
9 Method A — Direct contamination	3
9.1 Blank test	3
9.2 Number of determinations	4
9.3 Contamination of the electro-deposition tank with foreign material	4
9.3.1 Liquid foreign material	4
9.3.2 Paste-like foreign material	4
9.3.3 Solid foreign materials	5
9.4 Coating of the test panels	6
9.5 Evaluation	6
10 Method B — Contact contamination	6
10.1 Blank test	6
10.2 Number of determinations	6
10.3 Contamination of the test panels	6
10.4 Coating of the test panels	6
10.5 Evaluation	7
11 Method C — Contamination during the stoving process	7
11.1 Blank test	7
11.2 Number of determinations	7
11.3 Coating of the test panel	7
11.4 Preparation of the base panel with the foreign material	7
11.5 Stoving of the test specimens	8
11.6 Evaluation	8
12 Precision	8
13 Test report	9
Bibliography	10

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 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*, 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.

Introduction

During the electro-deposition coating process, foreign materials used in downstream production processes pass through the electro-deposition coating tank. Consequently, contamination of the electro-deposition coating tank material or defects in the surface of the coating can occur. Foreign materials can be, for example, oils, adhesives, insulating material and plastic building components.

Test methods for determining the compatibility of electro-deposition coating materials with a reference oil, which influences the properties of the electro-deposition coating, are described in ISO 22553-3.

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Paints and varnishes — Electro-deposition coatings —

Part 4:

Compatibility of electro-deposition coating materials with liquid, paste-like and solid foreign materials

1 Scope

This document specifies three different methods of electro-deposition coating material contamination with liquid, paste-like and solid foreign materials.

It is applicable 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, 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

foreign material

conscious or unconscious contaminant, used in all downstream processes up to the stoving of the electro-deposition coating

EXAMPLE Adhesive, insulating material, drawing oil, corrosion protection oil, prelubes (special oil with the properties of a drawing and corrosion protection oil).

4 Principles

Method A: The electro-deposition coating material is contaminated directly with foreign material. Then, the test panel is coated.

Method B: The test panel is contaminated with solid foreign material and is subsequently immersed in the electro-deposition coating material and coated.

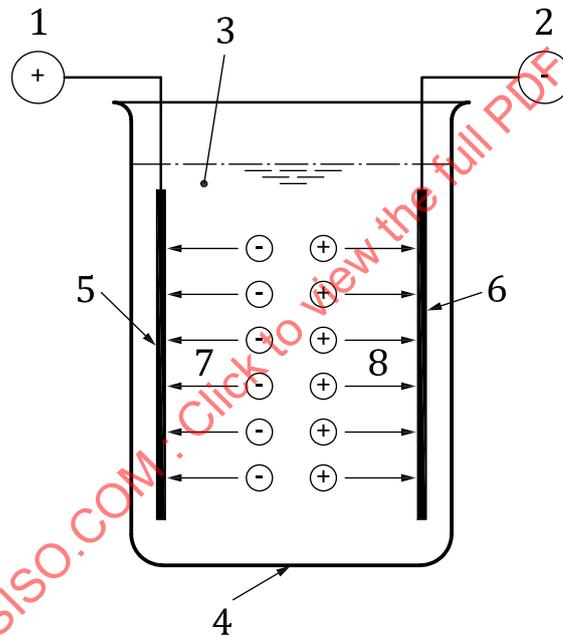
Method C: Paste-like or solid foreign material is applied on the base panel. A test panel coated with the electro-deposition coating material is put on this base panel at a specified distance and is stoved.

Subsequently, the coating of all the test panels is visually evaluated for surface defects.

5 Apparatus and materials

Ordinary laboratory apparatus, together with the following.

5.1 **Laboratory deposition system**, consisting of a deposition tank with tank recirculation 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 electro-deposition coating material | 7 acid |
| 4 deposition tank | 8 electro-deposition coating material |

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

The container of the deposition system is filled with the electro-deposition coating material and the tank circulation (stirrer or pump) is initiated. Subsequently, the test panels are immersed in the container. The deposition conditions are adjusted according to the specification and the deposition process is initiated. Upon completion of the deposition process, remove the test panels from the container and thoroughly rinse using demineralized water as specified in ISO 23321, so that any excess of the electro-deposition coating material (cream coat) is removed.

5.2 5-l container.

5.3 Film thickness measuring device, with a maximum permissible error of 0,1 μm .

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

5.5 Pipette, with a reading accuracy of 1 μl .

5.6 Oven, in which the test can be carried out reliably and where 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 Reagents

6.1 Butyl glycol, CAS-No 111-76-2, technically pure.

7 Foreign materials

Use one or several foreign material(s), as agreed by the contracting parties.

Observe that the foreign materials will not be contaminated during handling. Sample containers shall be clean. Disposable gloves shall be worn during sampling.

8 Test panels

Use electrically conductive test panels with pretreatment as specified in ISO 1514 and with dimensions of approximately 190 mm \times 105 mm \times 0,75 mm.

9 Method A — Direct contamination

9.1 Blank test

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 a paddle stirrer (diameter min. 50 mm) at 500 min^{-1} , so that sufficient tank circulation is visually detectable.

Put the test panel in the laboratory deposition system (5.1) and connect the anode and cathode to the current source. Maintain stirring 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 dry-film thickness to be expected 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 a series resistor). Maintain that voltage over the selected time.

Remove the test panel after coating, rinse with demineralized water and stove the electro-deposition coating in accordance with its specifications.

9.2 Number of determinations

Carry out a single determination.

Replicate determinations and calculation of the mean value from these would shift the result towards better results, since the contamination thins down during multiple successive coatings.

9.3 Contamination of the electro-deposition tank with foreign material

9.3.1 Liquid foreign material

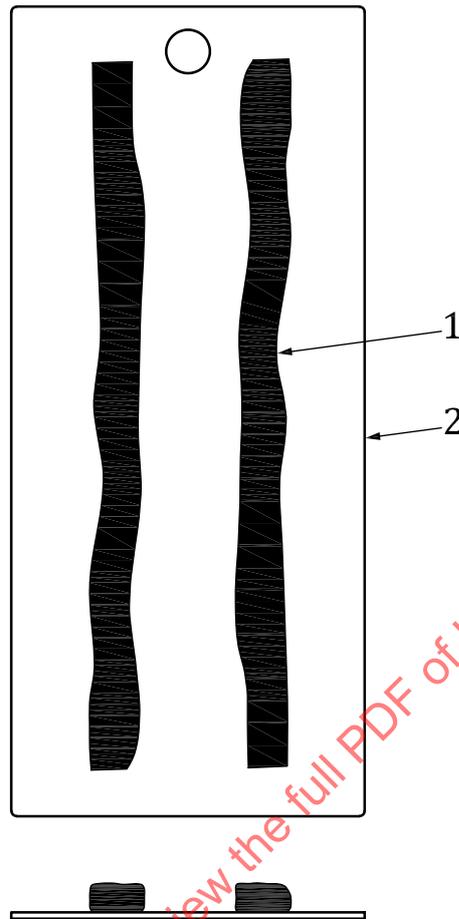
Mix 10 ml of the foreign material with 90 ml butyl glycol (6.1). Add 2,5 ml of this mixture to 5 l of electro-deposition coating material. Homogenize the sample for 24 h at a temperature of $(28 \pm 3) ^\circ\text{C}$, e.g. using a stirring machine with a paddle stirrer (diameter min. 50 mm) at 500 min^{-1} .

9.3.2 Paste-like foreign material

Apply two lines of the paste-like foreign material, respectively brought to temperature, e.g. adhesive, on a test panel (see [Figure 2](#)). The dimensions of the line geometry are:

- line length: about 180 mm;
- line base: $(8 \pm 2) \text{ mm}$;
- line height: $(12 \pm 2) \text{ mm}$.

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**Key**

- 1 paste-like foreign material
- 2 contamination panel

Figure 2 — Contamination panel with two lines of a paste-like foreign material

Immerse this contamination panel with the paste-like foreign material in 5 l of electro-deposition paint. Leave the contamination panel for 24 h at a temperature of $(28 \pm 3) ^\circ\text{C}$ while stirring, e.g. using a stirring machine with a paddle stirrer (diameter min. 50 mm) at 500 min^{-1} .

NOTE For an additional evaluation, contamination panel with the paste-like foreign material can also be coated with electro-deposition paint and stoved after the test panel (see 9.4).

9.3.3 Solid foreign materials

Add a sufficiently large piece (for examples of dimensions, see Table 1) of the solid foreign material to 5 l of electro-deposition coating material. Leave the test specimen for 24 h at a temperature of $(28 \pm 3) ^\circ\text{C}$ while stirring, e.g. using a stirring machine with a paddle stirrer (diameter min. 50 mm) at 500 min^{-1} .

Table 1 — Examples for the dimensions of solid foreign materials

Material	Dimensions
Foam piece	100 mm × 50 mm × 10 mm
Tube (diameter 12 cm)	30 cm total length, also in several parts
Small parts	Completely, if possible, in regard to the dimensions

9.4 Coating of the test panels

Position the test panel and the electro-deposition coating material in the laboratory deposition system (5.1) and connect the anode and cathode to the current source. Maintain stirring 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 $\pm 0,5$ °C.

NOTE Usually the temperature is in the range of 25 °C to 35 °C.

Select the deposition voltage and deposition time so that the dry-film thickness to be expected 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 a series resistor). Maintain that voltage over the selected time.

Remove the test panel after coating, rinse with demineralized water and stove the electro-deposition coating in accordance with its specifications.

9.5 Evaluation

Visually examine the test panel from the blank test and those of the contaminated test specimens regarding surface defects, e.g. craters, streaks. Record the number of craters on a surface area of 10 cm × 10 cm.

Measure the dry-film thickness in accordance with one of the test methods described in ISO 2808.

10 Method B — Contact contamination

10.1 Blank test

Carry out a blank test as described in 9.1.

10.2 Number of determinations

Carry out a single determination.

10.3 Contamination of the test panels

Rub the solid foreign material back and forth three times on the three uncoated test panels, exerting a gentle pressure. The contaminated stripe should be about 2,5 cm wide.

10.4 Coating of the test panels

Homogenize 5 l of the electro-deposition coating material at a temperature of (28 ± 3) °C, e.g. using a stirring machine with a paddle stirrer (diameter min. 50 mm) at 500 min⁻¹.

Position the test panel and the electro-deposition coating material in the laboratory deposition system (5.1) and connect the anode and cathode to the current source. Maintain stirring 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 $\pm 0,5$ °C.

NOTE Usually the temperature is in the range of 25 °C to 35 °C.

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

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

Remove the test panel after coating, rinse with demineralized water and stove the electro-deposition coating in accordance with its specifications.

10.5 Evaluation

Visually examine the test panel from the blank test and those of the contaminated test specimens regarding surface defects, e.g. craters, streaks. Record the number of craters on a surface area of 10 cm × 10 cm.

Measure the dry-film thickness in accordance with one of the test methods described in ISO 2808.

11 Method C — Contamination during the stoving process

11.1 Blank test

Carry out a blank test as described in [9.1](#).

The specimen of the blank test shall be stoved separately and before the contaminated test specimens.

11.2 Number of determinations

Carry out one single determination.

11.3 Coating of the test panel

Homogenize 5 l of the electro-deposition coating material at a temperature of $(28 \pm 3) ^\circ\text{C}$, e.g. using a stirring machine with a paddle stirrer (diameter min. 50 mm) at 500 min^{-1} .

Position the test panel and the electro-deposition coating material in the laboratory deposition system ([5.1](#)) and connect the anode and cathode to the current source. Maintain stirring 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 dry-film thickness to be expected of the electro-deposition coating on the test panels corresponds to the nominal dry-film thickness.

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

Remove the test panel after coating, rinse with demineralized water and do not stove.

11.4 Preparation of the base panel with the foreign material

Apply the liquid or paste-like foreign material on an uncoated test panel as the base panel in accordance with [9.3.1](#) or [9.3.2](#). Apply solid foreign materials in a sufficient size (see [9.3.3](#)) on the base panel.

Position spacers on all of the four corners of the base panel. The height of the spacers depends on the solid material: this should be as close as possible on the test panel, however, it shall not touch it. The spacer material shall cause no surface defect on the electro-deposition coat. Put the test panel coated with the electro-deposition coating material (see [11.3](#)) on the spacers. As example for such an arrangement, see [Figure 3](#).

NOTE Some foreign materials, e.g. foam pieces, can expand in the oven.

11.5 Stoving of the test specimens

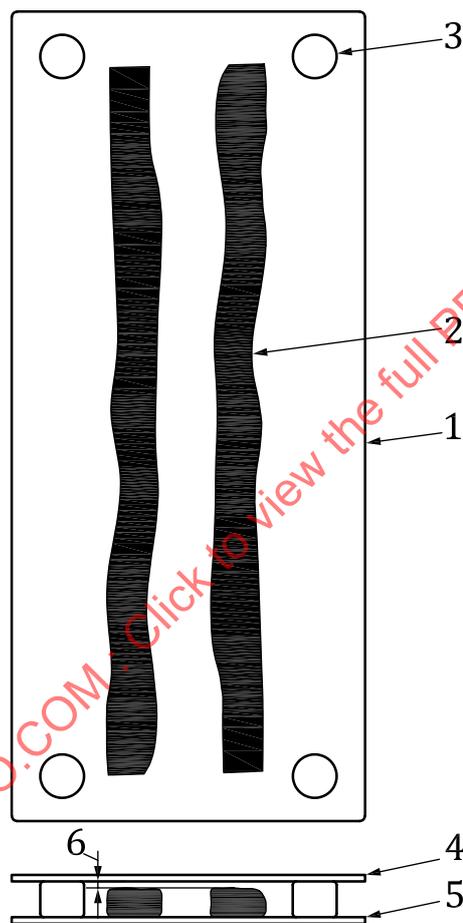
With the side facing the counter electrode inside the deposition system, put the test panel coated with electro-deposition coating material on the previously pretreated base panel with the foreign material.

Horizontally stove these drying systems in the oven (5.6) in accordance with the specification for the electro-deposition coating material.

11.6 Evaluation

Visually examine the test panel regarding surface defects, e.g. craters, floes and streaks.

Measure the dry-film thickness with one of the test methods described in ISO 2808.



Key

- 1 base panel
- 2 paste-like foreign material
- 3 spacer
- 4 coated test panel
- 5 base panel
- 6 distance between foreign material and coating on the test panel

Figure 3 — Test arrangement

12 Precision

No precision data are currently available.