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Paints and varnishes — Electro- deposition coatings —

Part 10: Edge protection

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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).

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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.

Paints and varnishes — Electro-deposition coatings —

Part 10: Edge protection

1 Scope

This document specifies a test method for the evaluation of protection against corrosion of edges and stamping burrs by 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, *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 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 11997-1:2017, *Paints and varnishes — Determination of resistance to cyclic corrosion conditions — Part 1: Wet (salt fog)/dry/humid*

ISO 11997-3,¹⁾ *Paints and varnishes — Determination of resistance to cyclic corrosion conditions — Part 3: Testing of coating systems on materials and components in automotive construction*

ISO 13076, *Paints and varnishes — Lighting and procedure for visual assessments of coatings*

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 terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

1) Under preparation. Stage at the time of publication: ISO/DIS 11997-3:2021.

— IEC Electropedia: available at <https://www.electropedia.org/>

3.1 edge protection

ability of an electro-deposition coating to save stamping burrs from corrosion

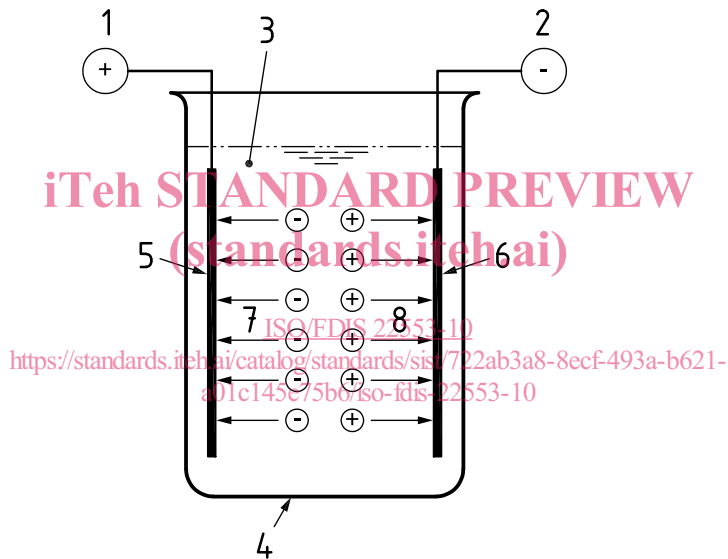
4 Principle

The electro-deposition-coating material is deposited at defined holes. The edge protection is determined by testing the corrosion behaviour at the edge of the holes.

5 Apparatus and test equipment

Ordinary laboratory apparatus together with the following.

5.1 Laboratory deposition system, consisting 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 electro-deposition coating material (cathodic e-coat) as an 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 °C.

5.4 Oven, in which the test can be carried out safely and in which the specified or agreed test temperature can be held to within $\pm 2\text{ }^{\circ}\text{C}$ (for temperatures up to $150\text{ }^{\circ}\text{C}$) or $\pm 3,5\text{ }^{\circ}\text{C}$ (for temperatures between $150\text{ }^{\circ}\text{C}$ and $200\text{ }^{\circ}\text{C}$).

6 Test panels

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

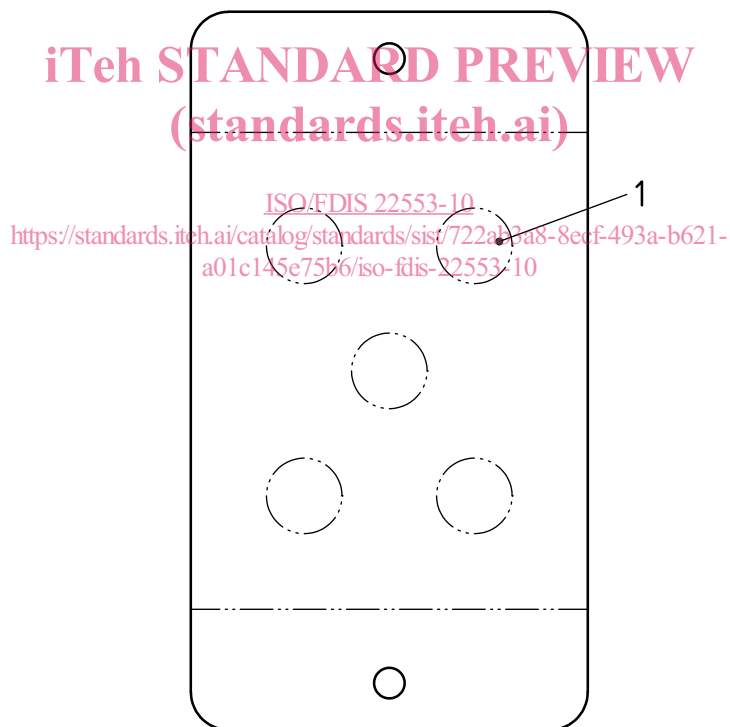
Five holes with a diameter of 20 mm and a stamping burr of about 90° are stamped into the test panel. The side with the stamping burr shall be marked.

NOTE 1 The height and the roughness of the burrs on the backside of the holes could have an impact on the corrosion.

The test panels are pretreated in accordance with the product specification of the electro-deposition coating material (e-coat).

NOTE 2 Experience has shown that holes prepared by laser cutting lead to different test results compared to stamped holes. An internal comparison with holes prepared by laser cutting has shown results with poorer reproducibility data.

An example for a test panel is shown in [Figure 2](#).



Key

1 hole, diameter 20 mm

Figure 2 — Example for a test panel showing the position of the stamped holes

7 Number of determinations

Carry out the determination in triplicate.

8 Procedure

8.1 Coating of the test panels

Fill the tank with the electro-deposition coating material up to about 1 cm below the upper part of the tank 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 $\pm 0,5 \text{ }^\circ\text{C}$.

NOTE 1 Usually the temperature is in the range from $25 \text{ }^\circ\text{C}$ 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 $140 \text{ }^\circ\text{C}$ 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 three points of the test panel, and calculate the mean value.

8.2 Corrosion test

Carry out a corrosion test with the coated panels, e.g.

- ISO 11997-1:2017, Method B;
- ISO 11997-3;
- ISO 9227.

The corrosion test shall be agreed between the interested parties.

NOTE The results are likely to be different depending on which corrosion test is used.

9 Evaluation

Carry out the assessment of the five holes of each panel under defined conditions as specified in ISO 13076 and evaluate the defects visually as specified in ISO 4628-1.

The rating of the edge corrosion on each of the five holes of each of the three panels shall be in accordance with [Table 1](#).

Table 1 — Rating scheme for the edge corrosion on the hole

Rating	Intensity of edge corrosion on the hole
0	Edge without rust
1	Single rust spots at the edges, or up to 15 %
2	Rust spots at less than 1/3 of the edges, or up to 30 %
3	1/3 to 1/2 of the edges covered by rust, or up to 50 %
4	1/2 to 3/4 of the edges covered by rust, or up to 75 %
5	More than 3/4 of the edges rusted

Disregard the two best and the two most severe ratings for every test panel, so that the median is remaining.

State the mean value from the three single ratings of the three test panels as the result.

10 Marking of the test result

The tested product may be marked with a designation code that summarizes the test result.

The marking shall be stated in the following form:

Number of this document — Rating

EXAMPLE Tested in accordance with ISO 22553-10, Rating 1

ISO 22553-10 — 1

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11 Precision

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No precision data are currently available.
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12 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 22553-10:—;
- 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 film thickness;
- h) the corrosion test used;
- i) the test results in accordance with [Clause 9](#);
- j) any agreed or other deviation from the specified test method;
- k) any unusual observation (anomalies) observed during the test;
- l) the date of the test.

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