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Paints and varnishes — Electrodeposition coatings —

Part 9: Stoving loss

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Partie 9: Perte par d'étuvage

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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.

Introduction

The stoving loss of an electro-deposition coating is not an absolute parameter but instead depends on the temperature used during testing and the test duration. As a result, relative values alone and not the true values for the stoving loss are obtained when using this method.

The relative mass loss factor, the relative reaction loss factor, and the relative total stoving loss factor can be calculated relative to the coated and vented, pre-dried and stoved test panel. The calculation is specified in Annex A.

Paints and varnishes — Electro-deposition coatings —

Part 9:
Stoving loss

1 Scope

This document specifies a method for determining the volatile-matter content of electro-deposition coatings (e-coats) during stoving (stoving loss) used 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 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/

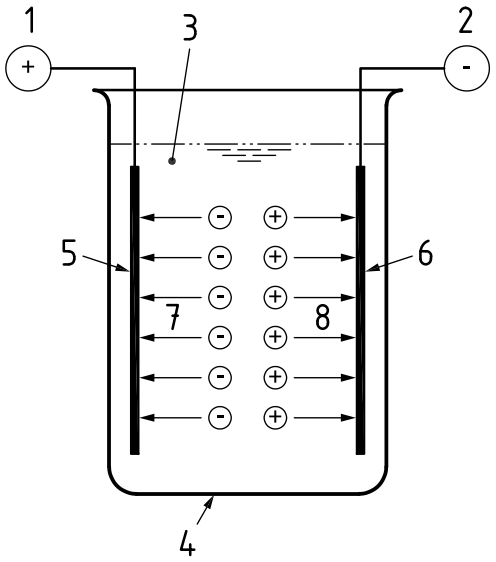
4 Principle

The non-volatile matter is determined after stoving of the electro-deposition coating and the stoving loss is calculated from this.

5 Apparatus and materials

Typical laboratory apparatus, together with the following:

5.1 Laboratory deposition system, which consists 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 an example

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

5.2 Ampere meter.

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

5.4 Analytical balance, with a weighing accuracy of 0,000 1 g.

5.5 Oven, in which the test can be carried out reliably and using 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).

5.6 Timer, with a reading accuracy of 1 s.

6 Test panels

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

7 Number of determinations

Carry out each determination in triplicate.

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

Weigh each of the three test panels on an analytical balance to within 1 mg (m_0).

Put the test panel in the laboratory deposition system 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 as specifically required for the product, to ±0,5 °C.

NOTE 1 Usually, the temperature is in the range of 25 °C to 35 °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 this voltage over the selected time.

Remove the test panel after coating, rinse with demineralized water and pre-dry for approx. 60 min at approx. 110 °C in an oven.

Weigh the test panels on an analytical balance to within 1 mg, m_1.

Calculate the mass of the applied electro-deposition coating, $m_{e\text{-}coat}$, in grams, using Formula (1):

$$m_{e\text{-}coat} = m_1 - m_0 \quad (1)$$

where

m_0 is the mass, in grams, of the uncoated test panel;

m_1 is the mass, in grams, of the coated, pre-dried test panel.

Stove/cure the coated, pre-dried test panels in the oven as specifically required for the product. The stoving temperature shall be the object temperature, not the displayed oven temperature.

NOTE 2 The stoving temperature is usually between 100 °C and 180 °C.

After the test panels have cooled down, weigh them to within 1 mg, m_2.

Calculate the mass loss of stoved electro-deposition coating material, m_t, in grams, using Formula (2):

$$m_t = m_1 - m_2 \quad (2)$$

where

m_1 is the mass, in grams, of the coated, pre-dried test panel;

m_2 is the mass, in grams, of the coated, stoved test panel.

Repeat this procedure with the two other test panels.