
**Paints and varnishes — Evaluation of
properties of coating systems related to
the application process —**

**Part 1:
Relevant vocabulary and preparation of
test panels**

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*Peintures et vernis — Évaluation des propriétés des systèmes de
revêtement liés au mode d'application —*

Partie 1: Vocabulaire pertinent et préparation des panneaux d'essai

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 28199-1 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

ISO 28199 consists of the following parts, under the general title *Paints and varnishes — Evaluation of properties of coating systems related to the application process*:

- Part 1: *Relevant vocabulary and preparation of test panels*
- Part 2: *Colour stability, process hiding power, re-dissolving, overspray absorption, wetting, surface texture and mottling*
- Part 3: *Visual assessment of sagging, formation of bubbles, pinholing and hiding power*

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Introduction

In many areas (e.g. car manufacture, industrial coatings, coatings for plastics) the coating materials used are adapted to the specific application equipment and technologies of the particular user. A coating material is, therefore, to be understood as a semi-manufactured product that only receives its final form in combination with the specific application conditions. The adaptation to the application conditions is therefore decisive for the quality of the coated product.

The test methods specified in ISO 28199 are based on studies by a Working Group of the European Council for Automotive R&D (EUCAR).

They may be used for evaluation of coating materials in research, development and production with regard to their suitability and safety for industrial processes, and error analysis. The properties of coating materials and coatings to be evaluated depend on the film thickness, so a coating system of increasing thickness is applied to a test panel under defined conditions.

The following characteristics are measured (in this part of ISO 28199):

- film thickness in accordance with ISO 2808;
- surface texture;
- colour in accordance with ISO 7724 (all parts).

In combination with visual assessment, the following properties are determined:

- colour stability, process hiding power, re-dissolving, overspray absorption, wetting, surface texture and mottling (ISO 28199-2);
- tendency toward sagging, formation of bubbles, pinholing and hiding power (ISO 28199-3).

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning the locally related measurements used in Version A in Clauses 8 and 9.

ISO takes no position concerning the evidence, validity and scope of this patent right.

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Paints and varnishes — Evaluation of properties of coating systems related to the application process —

Part 1: Relevant vocabulary and preparation of test panels

1 Scope

This part of ISO 28199 defines terms relating to the evaluation of coating materials in research, development and production with regard to their suitability and safety for industrial processes and error analysis.

This part of ISO 28199 specifies methods for the preparation of test panels and the subsequent measurement of film thickness, colour and surface texture.

2 Normative references

The following referenced documents are indispensable for the application 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 1513, *Paints and varnishes — Examination and preparation of samples for testing*

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

ISO 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

ISO 7724-1, *Paints and varnishes — Colorimetry — Part 1: Principles*

ISO 7724-2, *Paints and varnishes — Colorimetry — Part 2: Colour measurement*

ISO 7724-3, *Paints and varnishes — Colorimetry — Part 3: Calculation of colour differences*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

ISO 28199-2, *Paints and varnishes — Evaluation of properties of coating systems related to the application process — Part 2: Colour stability, process hiding power, re-dissolving, overspray absorption, wetting, surface texture and mottling*

ISO 28199-3, *Paints and varnishes — Evaluation of properties of coating systems related to the application process — Part 3: Visual assessment of sagging, formation of bubbles, pinholing and hiding power*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

bubble

closed or already burst blister in a layer, arising when solvents or cleavage products evaporate too rapidly

NOTE If bubbles are caused by the process control and/or the formulation components, the viscosity of the paint film has increased too rapidly during the drying phase so that solvents/reaction products still in the paint film have built up at the polymer paint skin which forms, usually resulting in closed blisters and sometimes resulting in burst blisters.

3.2

bubble formation limit

first appearance of continuous bubbles in the measuring area

NOTE A single bubble does not define the bubble formation limit. Bubbles at the edge of the measuring area and in the perforated area of the panel (see Figure 2) should not be taken into account.

3.3

colour stability

non-variability, or variability within agreed tolerances, of colour despite variation of influencing factors

NOTE Examples of influencing factors are thickness and application method.

3.4

cratering

formation in a film of small circular depressions that persist after drying

[ISO 4618:2006]

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NOTE 1 Craters can extend as far as the next lower layer.

NOTE 2 Craters are caused by local inhomogeneities in the surface tension of the coating, most frequently due to incompatible contamination substances on the substrate, in the applied coating material or in the form of foreign particles or small oil drops.

3.5

locally related measurements

measurements of film thickness and optical surface property which are taken at the same point, i.e. within a radius of < 10 mm

3.6

locally unrelated measurements

measurements of film thickness and optical surface property which are not taken at the same point, i.e. within a radius of \geq 10 mm

3.7

minimum film-build

lowest thickness at which a coating material forms a continuous film on a substrate

3.8

mottling

non-uniform appearance of a film caused by presence of irregularly shaped, randomly distributed areas on the surface that vary in colour and/or gloss

[ISO 4618:2006]

3.9**overspray absorption**

ability of a coating material already applied to absorb dried overspray particles of the same coating material resulting from a subsequent application

NOTE Evidence of poor overspray absorption is shown, for example, by raised surface texture and low colour stability as well as mottling.

3.10**pinholing**

presence of small holes in a film resembling those made by a pin

[ISO 4618:2006]

NOTE Pinholes can be caused by gas inclusions in the base coat which burst after the application of the clear coat and leave a hole both in the clear coat and base coat. They are often the result of inappropriate process parameters. Pinholes are often confused with craters.

3.11**pinholing limit**

first appearance of pinholing in the measuring area

NOTE A single pinhole does not define the pinholing limit. Pinholes at the edge of the measuring area and in the perforated area of the panel (see Figure 2) should not be taken into account.

3.12**process hiding power**

minimum thickness above which the complete coating system in combination with the colour of the substrate (e.g. the colour of the priming coat) provides colour stability and represents the lower limit of the film thickness range of the serial coating plant

NOTE See also "hiding power" defined in ISO 4618:2006 as "ability of a coating material or a coating to obliterate the colour or the differences in colour of a substrate"

3.13**re-dissolving**

mutual effect of an already applied coating material on a subsequently applied coating material, in which the solvent of the later coating interacts with the already dried previous coating

NOTE The interaction could be evidenced by a change in colour.

3.14**sagging**

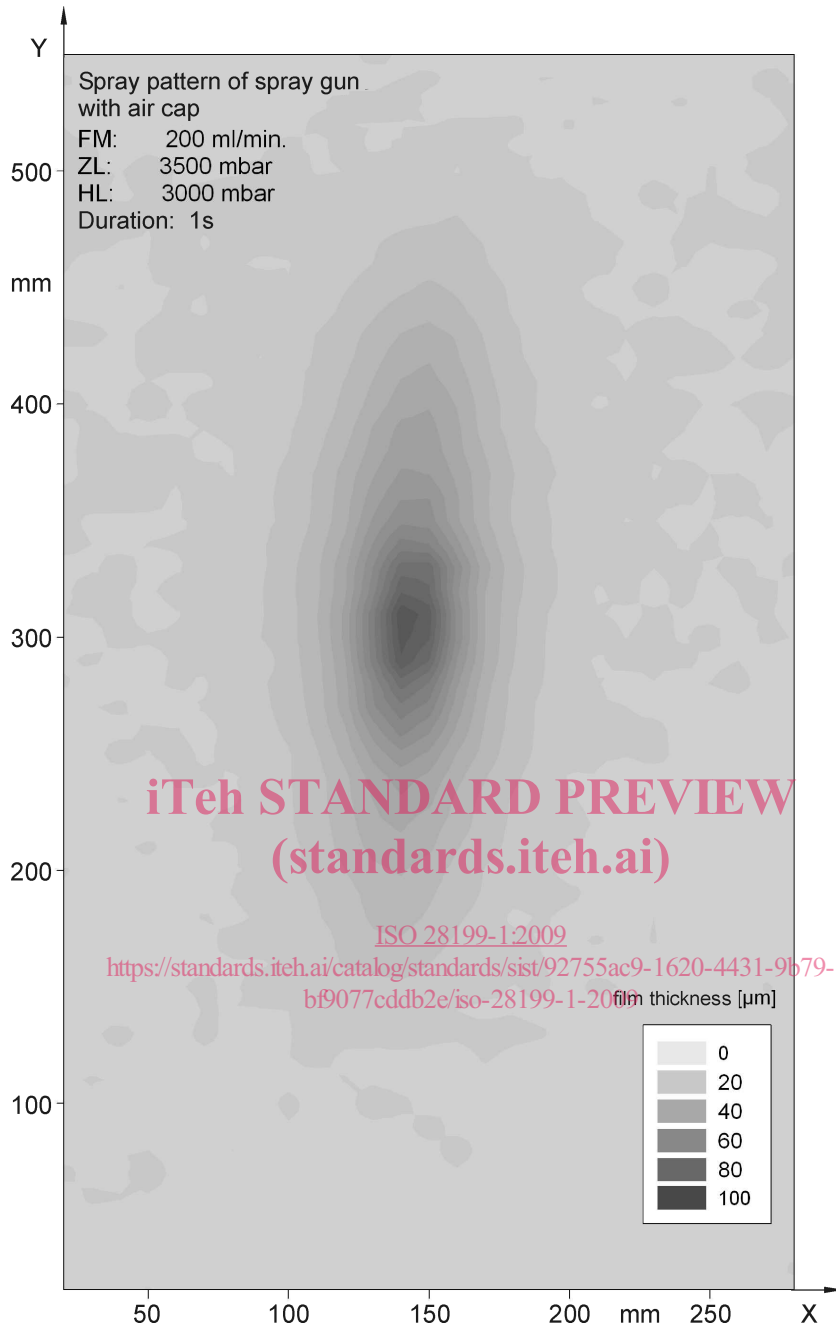
downward movement of a coating material during drying in a vertical or an inclined position that results in irregularities in the dry coat

[ISO 4618:2006]

3.15**static spray pattern**

distribution of the coating material after spray application using defined parameters, with both coated object and spray application system at rest

NOTE See Figure 1.



Key

- X width of the test panel
- Y length of the test panel

Figure 1 — Static spray pattern

3.16 surface texture

visual appearance and visible texture in the surface

NOTE The surface texture depends on the topographic characterization, the observation distance and the image clarity of the surface. In the case of the so-called "orange peel" texture which can occur with automotive paints, the range of the wavelength of the surface waviness is between 0,1 mm and 30 mm. Typically, two ranges are used in this part of ISO 28199:

- a) short-wavelength range: 0,3 mm to 1,2 mm;
- b) long-wavelength range: 1,2 mm to 12 mm.

The surface texture is, for example, influenced by the levelling (as defined in ISO 4618) of the still-liquid coating as well as the substrate.

3.17

wetting

complete coverage of a substrate by a coating material

4 Principle

The coating material to be tested is applied to a test panel in the form of a wedge. Various optical properties are measured by an appropriate procedure dependent on the film thickness.

5 Apparatus

Ordinary laboratory apparatus and the following.

5.1 Programmable automatic painting machine, used to coat the specified test panels according to the procedure and accuracy specified in this part of ISO 28199.

In order to achieve this, at least the following features of the machine shall be separately adjustable or changeable:

- spray gun;
- fan air (pressure- or volume-controlled);
- atomizer air (pressure- or volume-controlled);
- flow rate;
- distance to the object;
- feed speed of atomizer;
- pitch between traverses of machine.

The quality of the film thickness profiles (wedge-shaped or constant) produced has a decisive influence on the reproducibility and repeatability of the results obtained when using this procedure, and the application parameters should therefore be as close as possible to those of the process to be simulated.

NOTE 1 Examples of suitable application parameters are given in Annex A, Table A.1.

Unless otherwise agreed, the wedge-shaped coating shall be applied in two spraying stages using identical application parameters.

NOTE 2 The wedge can be produced either purely pneumatically or with pneumatic-electrostatic support.