
**Paints and varnishes — Determination
of the scratch resistance of a coating
system using a laboratory car-wash**

*Peintures et vernis — Détermination de la résistance à la rayure d'un
système de peinture sur un poste de lavage automobile de laboratoire*



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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.

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.

ISO 20566 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

It is based on the German standard DIN 55668, *Beschichtungsstoffe — Prüfung der Kratzfestigkeit von Beschichtungen mit einer Laborwaschanlage (Paints and varnishes — Determination of scratch resistance of coating systems using a laboratory car wash)*.

Introduction

With this test procedure, it is important to note that the test results will not, over time, remain constant, as a result of changes to the brush material. As the brush ages, the test will become more severe. As a result, the test procedure is suitable only for comparative tests carried out at any one time and using relatively short runs. Readings obtained using equipment which has accumulated different total numbers of operating hours are not comparable with each other.

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Paints and varnishes — Determination of the scratch resistance of a coating system using a laboratory car-wash

1 Scope

This International Standard describes a test procedure for assessing the scratch resistance of organic paint coatings¹⁾, in particular paint coatings used in the automotive industry (i.e. for assessing their car-wash resistance). Machine-based washing is simulated in the laboratory environment using a rotating brush and synthetic dirt. The test conditions have been designed to be as close as possible to the real conditions in a car-wash.

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 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85°*

ISO 4618-1:1998, *Paints and varnishes — Terms and definitions for coating materials — Part 1: General terms*

ISO 13803, *Paints and varnishes — Determination of reflection haze on paint films at 20°*

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

3 Apparatus

The apparatus²⁾ shall comprise the following individual components:

3.1 Washing brush:

Diameter	1 000 mm
Width	400 mm
Material	polyethylene
Profile	x-shaped, spliced

1) For the term “coating”, see ISO 4618-1:1998.

2) Information on procuring the equipment is available from DIN Deutsches Institut für Normung e.V., NAB, Burggrafenstrasse 6, 10787 Berlin, Germany.

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Bristle thickness	0,8 mm
Bristle length	440 mm visible
Penetration depth	100 mm (see Figure 1)
Speed of brush rotation	approximately 120 min^{-1} , opposite to direction of travel of test panel holder

3.2 Spray nozzles, made of stainless steel:

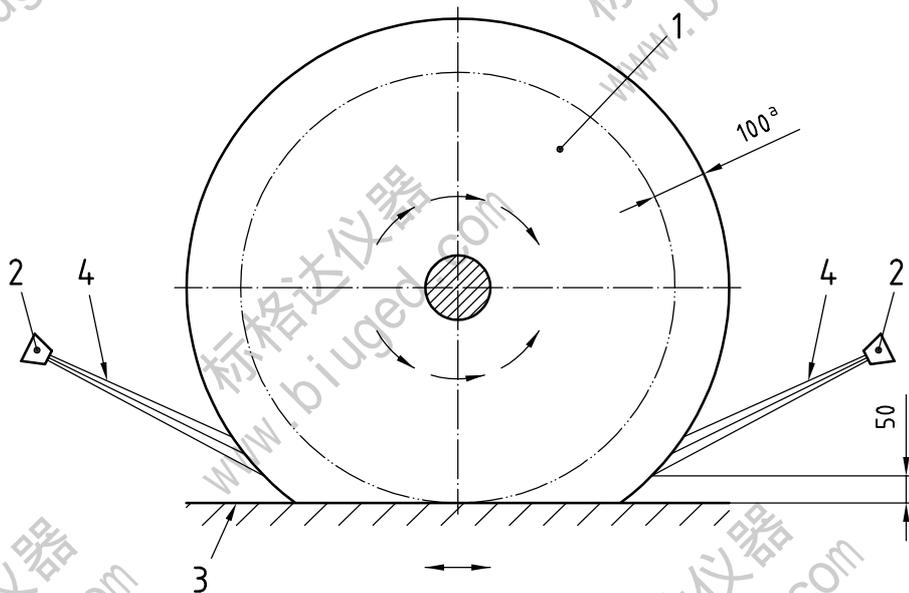
Spread of jet	60°
Water flow rate	$(2,2 \pm 0,1) \text{ l/min}$ at $(300 \pm 50) \text{ kPa}$

Each nozzle shall only spray on one side, against the direction of travel of the test panel holder. They shall produce the specified spray pattern (see Annex A).

3.3 Test panel holder:

Feed speed	$(5 \pm 0,2) \text{ m/min}$
Pattern of movement	see Figure 1

Dimensions in millimetres



Key

- 1 brush
- 2 spray nozzle
- 3 test panel holder
- 4 spray jet (jet strikes brush 50 mm above table)

^a Penetration depth.

Figure 1 — Pattern of movement of test panel holder

4 Materials

4.1 Washing suspension.

Prepare a suspension consisting of 1,5 g of silica powder (silica micro-powder having a mean particle size of $24 \mu\text{m}$)³⁾ per litre of tap water in a suitable container, mixing it by stirring vigorously. Unless otherwise agreed, the water temperature shall be between 15 °C and 28 °C.

The suspension shall be stirred continuously during the test procedure in such a way that the silica powder does not settle on the bottom of the container as this would result in variations in the concentration.

NOTE The suspension can be reused once the test equipment has come to a standstill. However, it is essential that the suspension is stirred thoroughly again before being reused.

5 Sampling

Take a representative sample of the product to be tested, as described in ISO 15528.

Examine and prepare each sample for testing, as described in ISO 1513.

If testing a clearcoat, the basecoat shall be a single shade of black.

6 Test panels

Panels shall be flat and free of deformations. The substrate and size shall be as agreed between the interested parties.

The spraying, drying/hardening and stoving parameters and the ageing and conditioning before the test shall be as agreed between the interested parties.

7 Procedure

Carry out the test at room temperature (20 °C to 30 °C), unless otherwise agreed.

Determine the parameter to be measured on the coated test panel, e.g. the gloss in accordance with ISO 2813 or haze in accordance with ISO 13803.

Perform a trial run without a test panel, carrying out 10 washing operations (10 double passes) as described in Annex A.

Set the required pressure and verify it.

Position the test panel on the test jig and carry out 10 washing operations (10 double passes) using the to-and-fro pattern of movement shown in Figure 1.

Rinse the washed test panel with cold water, then clean it with a suitable solvent, e.g. white spirit, using soft, non-scratching paper tissues and wiping in the direction of the scratches. Finally, leave for 10 min to dry off. This process is designed to remove all residues of silica powder, and any fibres from the brush.

If the test equipment is not to be used for some time (more than 8 h), it is recommended that it be rinsed thoroughly, particularly the brushes, with tap water.

3) Information on procuring the silica powder is available from DIN Deutsches Institut für Normung e.V., NAB, Burggrafenstrasse 6, 10787 Berlin, Germany.

8 Evaluation

Within 2 h of drying, take the final readings of e.g. the gloss in accordance with ISO 2813 or haze in accordance with ISO 13803 of the test panel across the direction of scratching. Only make measurements in homogeneous areas.

NOTE If specified, ΔL^* at an angle of reflection of 10° may be measured in accordance with ISO 7724-1 [1].

Calculate the mean of three readings across the entire area of damage on the test panel. From these values, calculate the difference in gloss (or haze), or the percentage change in gloss (or haze), relative to the initial readings. A visual assessment can also be made or a digital image produced.

Depending on the paint system used, a paint-flow (self-repairing) effect may be more or less evident. The timing of the measurements after washing shall therefore be very carefully defined. It can be informative to repeat the readings after 24 h or after ageing in an oven.

9 Precision

9.1 Repeatability limit r

The repeatability limit r is the value below which the absolute difference between two single test results, each the mean of duplicates, can be expected to lie when this method is used under repeatability conditions, i.e. when the test results are obtained on identical material by one operator in one laboratory within a short interval of time using the standardized test method. For this method, in the case of gloss measurement (reflectometer readings), r is 14 units, with a 95 % probability.

9.2 Reproducibility limit R

The reproducibility limit R is the value below which the absolute difference between two test results, each the mean of duplicates, can be expected to lie when this test method is used under reproducibility conditions, i.e. when the test results are obtained on identical material by operators in different laboratories using the standardized test method. For this method, in the case of gloss measurement (reflectometer readings), R is 20 units, with a 95 % probability.

10 Test report

The test report shall contain at least the following information:

- a) all information necessary for the identification of the sample tested (manufacturer, product name, batch number, etc.);
- b) a reference to this International Standard (ISO 20566:2005);
- c) details of the procedure, including:
 - 1) the type of test panel used and its dimensions,
 - 2) the spraying, drying/hardening and baking parameters, and any ageing and conditioning before the test,
 - 3) the temperature at which the test was carried out,
 - 4) any specific agreements not otherwise mentioned in 1), 2) or 3);

- d) the results of the test, including the results of the individual measurements and their mean, calculated as specified in Clause 8;
- e) any deviations from the procedure specified;
- f) any unusual features (anomalies) observed during the test;
- g) the date of the test;
- h) the name of the person who carried out the test.

Annex A
(normative)

Monitoring and calibration of the washing equipment

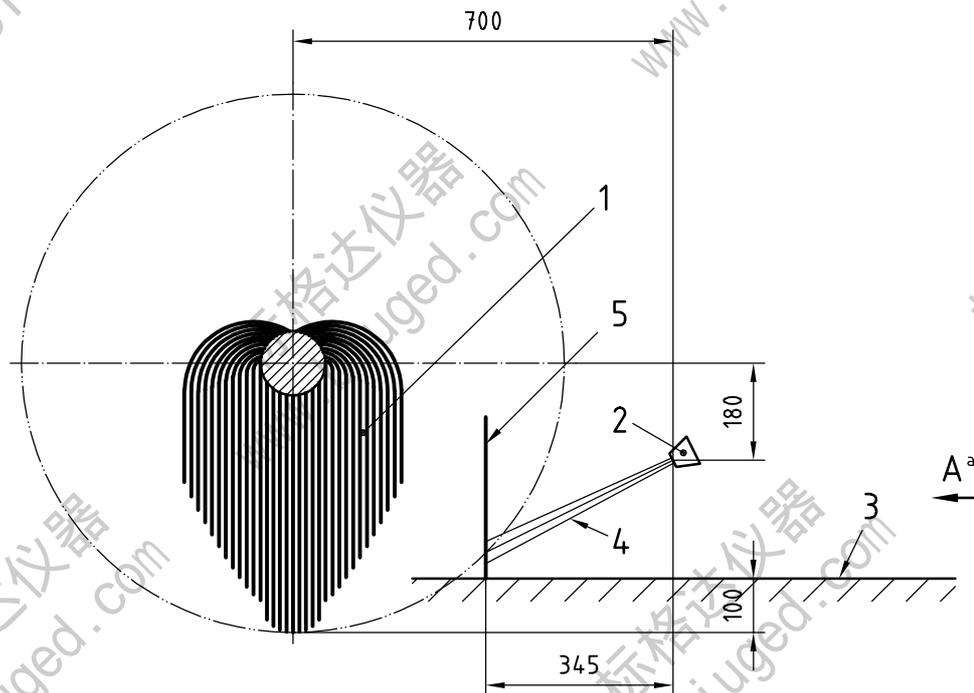
A.1 Inspection

As a result of their nature, polyethylene brushes are subject to constant change during use, i.e. test results will not, over time, remain constant. The scratching effect becomes more pronounced after long periods of use, all other conditions remaining constant. The state of the brushes shall therefore be monitored using appropriate reference standards and, where necessary, the brushes replaced.

A.2 Calibration

Set up the equipment as shown in Figure A.1. Fill with washing suspension (4.1) and wet the brush sufficiently. Determine the flow rate of the water, $(2,2 \pm 0,1)$ l/min, by measurement and adjust by altering the pressure, (300 ± 50) kPa. Check the spray pattern of the nozzles (see Figure A.2). If the spray pattern cannot be achieved or if the pressure regulation exceeds the tolerances, check, and if necessary replace, the nozzles.

Dimensions in millimetres

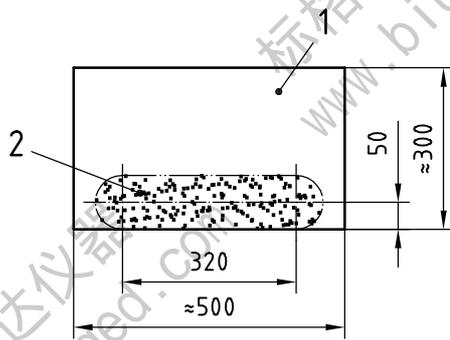


Key

- 1 brush
- 2 spray nozzle
- 3 test panel holder
- 4 spray jet
- 5 sheet of cardboard
- ^a View A (see Figure A.2).

Figure A.1 — Calibration arrangement

Dimensions in millimetres



Key

- 1 sheet of cardboard
- 2 spray pattern

Figure A.2 — View A of spray pattern

Bibliography

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

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