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Paints and varnishes — Determination of stone-chip resistance of coatings —

Part 4: Mobile multi-impact testing on a small testing area

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Foreword

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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 20567 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 stone-chip resistance of the body finish is an important quality characteristic. A standard procedure for testing this characteristic is the method according to ISO 20567-1, which is performed with a stationary tester on a large test area. The method described here can be used in mobile form.

Paints and varnishes — Determination of stone-chip resistance of coatings —

Part 4:
Mobile multi-impact testing on a small testing area

1 Scope

This document specifies a mobile method for evaluating the resistance of automotive finishes to chilled-iron grit projected onto the surface under test to simulate the effect of stone chipping.

Results from the test specified in this document are not comparable with results specified in ISO 20567-1.

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 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

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

ISO 4618, *Paints and varnishes — Vocabulary*

ISO 11124-2, *Preparation of steel substrates before application of paints and related products — Specifications for metallic blast-cleaning abrasives — Part 2: Chilled-iron grit*

ISO 11125-2, *Preparation of steel substrates before application of paints and related products — Test methods for metallic blast-cleaning abrasives — Part 2: Determination of particle size distribution*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 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

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

4 Principle

The stone-chip resistance of the coating is tested with many small, sharp-edged impact bodies, which impact in portions and are largely independent of one another. The material used in the test is chilled-iron grit, which is projected onto the coating at an angle of 90° using compressed air. The extent of the damage depends on the working pressure, the grit, the projection duration and the design of the tester. Loose fragments of coating material are removed. The degree of damage is evaluated by comparison with pictorial reference standards.

5 Apparatus and test equipment

Ordinary laboratory apparatus, together with the following shall be used.

5.1 Stone-chip resistance tester

5.1.1 Tester including pressure regulator, hoses, connections and connection adapters (see Figures 1 and 2).

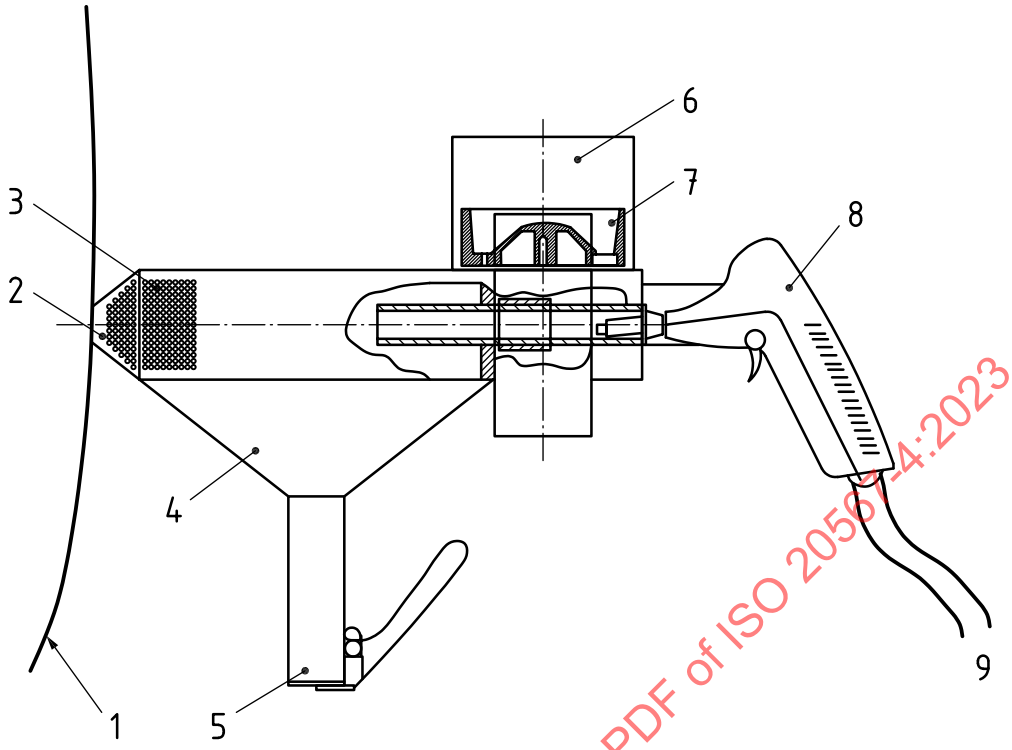
The dosing device shall be designed such that chilled-iron grit for the test (see 7.2) can be delivered in (10 ± 1) s.

The compressed air supply for the tester (compressed air line system or compressor) shall have an oil separator and water separator and shall meet the following requirements:

— output pressure min. 400 kPa;

— inner diameter of the connection hose min. 9,52 mm (3/8 inch);

— the connection hose between the compressed air supply and the tester shall be dimensioned (inside diameter, length) such that the correct working pressure can be set (see 6.1).



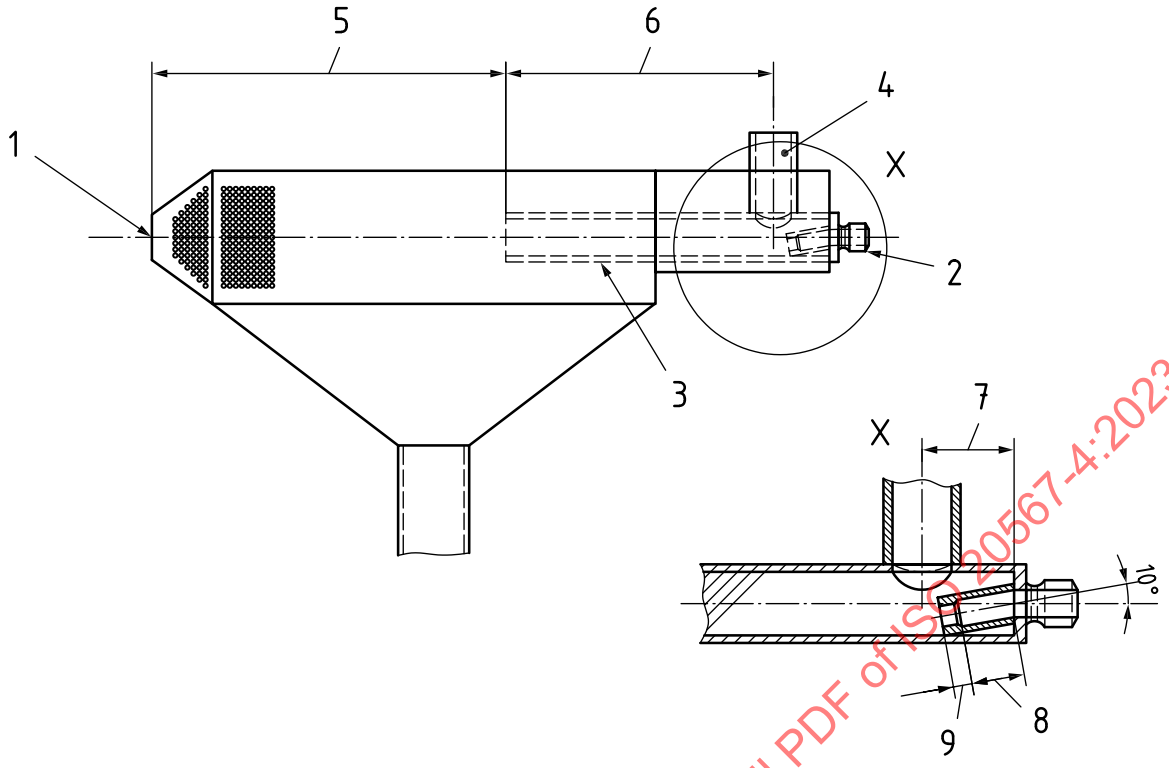
Key

1 sample
2 projection window
3 air outlet opening

NOTE The air hole outlets on the left and right of the air-outlet opening have a diameter of approx. 1,4 mm after the component has been powder coated. 294 holes are distributed 147 left and 147 right.

4 chilled-iron grit-catching chamber
5 discharge flap
6 dosing device
7 drum magazine
8 blowing device
9 compressed air connection

Figure 1 — Example of a mobile stone-chip tester



Key

1 projection opening (mask)
- dimensions: 20 mm × 20 mm

2 compressed air connection with nozzle

3 grit-accelerating pipe
- overall length: 143 mm
- inside diameter: 16 mm

4 feed pipe (connected to the chilled-iron grit storage magazine)
- length: 46 mm
- inside diameter: 16 mm

5 free grit jet
- distance between grit-accelerating pipe and mask: 155 mm
- height and depth: 60 mm

6 grit acceleration section
- distance between centre of feed pipe and the outlet opening of the grit-accelerating pipe: 118 mm

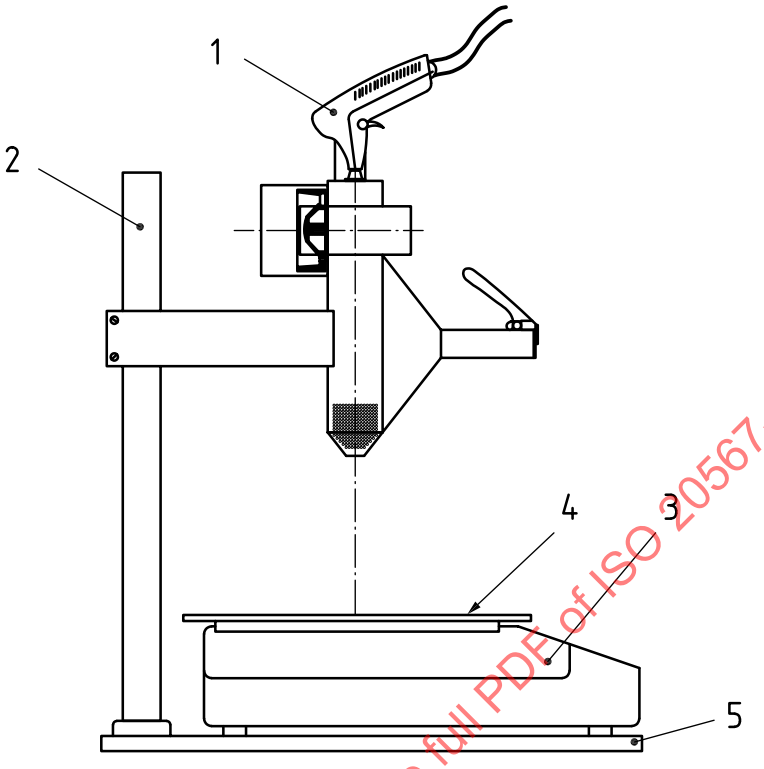
7 distance between nozzle inlet and centre of feed pipe: 25 mm

8 nozzle hole 1
- length (centre): 15 mm
- inside diameter: 7 mm

9 nozzle hole 2
- length: 5 mm
- inside diameter: 5 mm

Figure 2 — Grit-accelerating pipe details

5.1.2 Calibration device, for calibrating and adjusting the stone-chip tester (see Figure 3).



Key

1 tester
2 retaining device
3 scale which can be read off to an accuracy of 1,0 g
4 pressure plate with dimensions of 175 mm × 155 mm, distance between the projection opening (mask) and the pressure plate: 165 mm
5 base plate

Figure 3 — Calibration device with tester and scale

5.1.3 Illuminated magnifier, 10-fold with graduation, with a field of view that enables the entire test area to be examined.

5.2 Consumables

5.2.1 Chilled-iron grit

The grit shall be chilled-iron grit conforming to the requirements of ISO 11124-2. The particle size however shall be determined in accordance with ISO 11125-2 and ISO 565 and shall be as specified in Table 1.

Table 1 — Specification of the grit

	Mesh size mm	Fraction %
On the sieve	3,15	[a]
	2,80	15 to 20
	2,50	40 to 50
	2,24	30 to 40
Through the sieve	2,24	[a]
[a] To be discarded.		

25 g of this fraction shall contain 340 ± 20 grit particles.

NOTE The grit can separate during transport and storage.

The grit shall be replaced after a maximum of 25 test runs (i.e. after it has been projected 50 times) or at the end of the series of tests, during which the grit passes the point at which it has been used for a total of 25 test runs. One test run consists of projection of 2 × 100 g.

6 Apparatus functional test

6.1 Position the calibration device (5.1.2) on a flat, horizontal surface. With the pressure plate mounted, position the scale on the base plate and calibrate it.

6.2 Fix the stone-chip tester in the retaining device as shown in Figure 3 and connect it to the compressed air supply.

6.3 Set the pressure to 350 kPa on the pressure regulator. After actuating the compressed air trigger of the tester, a mass of (85 ± 2) g shall be indicated as a pressure-equivalent weight force on the scale. If the mass deviates from this set point, the pressure shall be adjusted to it.

7 Procedure

7.1 Set the working pressure on the pressure regulator of the apparatus in accordance with Clause 6.

7.2 Weigh (100 + 5) g of the chilled-iron grit in accordance with 5.2.1. Pour the grit into the dosing device and distribute evenly in the chambers by shaking gently. No pressure shall be applied on the grit in this case, as there is otherwise a risk of blocking.

7.3 Fix the sample in position vertically. A deviation of up to ±30° from the perpendicular is permissible (see Figure 4).

NOTE The precise projection position on the sample can be indicated with a fixing aid, e.g. adhesive tape or a marking point.

7.4 Move the apparatus up against the sample (see Figure 4), then first activate the compressed air and subsequently switch on the dosing device.

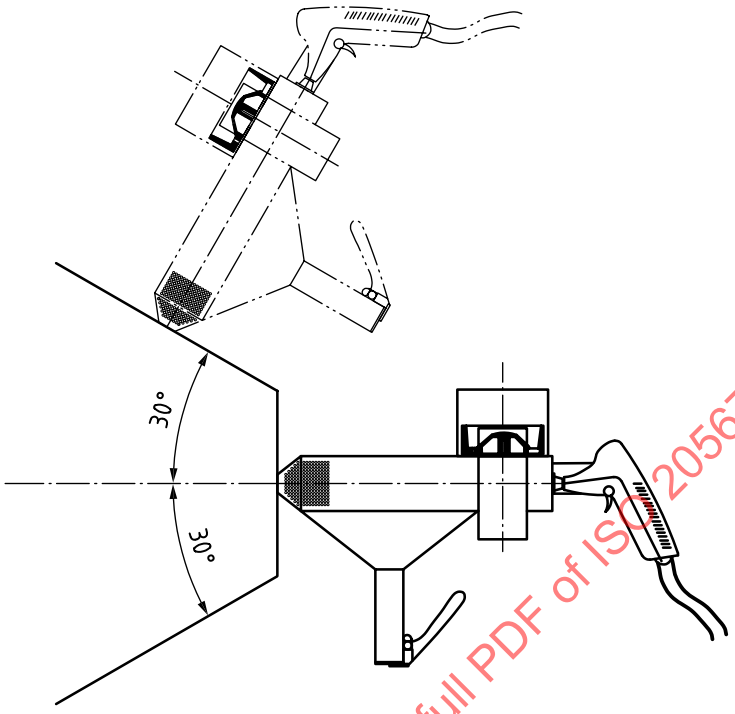


Figure 4 — Tester in usage positions

7.5 For the second test run, fetch the grit from the grit-catching chamber, pour it into the dosing device and repeat the step specified in 7.4 in the same location.

7.6 Remove all loose coating particles from the test area. Examples of suitable methods are described in Annex B. The method used to remove loose coating particles shall be agreed between the contract partners and shall be stated in the test report.

The grit shall be replaced after 25 tests (i.e. after being projected 50 times). The dosing device shall be cleaned (e.g. using compressed air) each time the grit is replaced.

8 Evaluation

Compare the test area (puncture or flaking) with Figures A.1, A.2, A.3 and A.4. The figures show the upper limit of the rating. The pictorial reference standards which are used shall be agreed between the contract partners. The pictorial standards which have been used shall be stated in the test report.

Perform the comparison visually with the illuminated magnifier (5.1.3). A rating of between 0 and 4 is achieved depending on the degree of damage.

In addition to the evaluation, note the assignment of the flaking to the main separation level or the respective layer, if possible.

Damage which shall be included in the evaluation exists if coating delamination and/or flaking has occurred, irrespective of the layer in which this has taken place. In the case of plastic substrates, displacement of the uppermost layer, in combination with the exposure of the layers beneath, often occurs instead of flaking. This is also regarded as damage and is included in the assessment.

Scratches or markings that have occurred due to indentations caused by the grit are not included in the damaged surface. This also applies to sharp punctures to the substrate.

The following rating scheme applies to the visual comparison with the pictorial reference standards, given in Figure A.1, Figure A.2, Figure A.3 and Figure A.4:

— Rating 0: only minimal visible flaking, see Figures A.1 to A.4 a) ;

— Rating 1: damage greater than rating 0, the upper limit is shown in Figures A.1 to A.4 b);

— Rating 2: damage greater than rating 1, the upper limit is shown in Figures A.1 to A.4 c);

— Rating 3: damage greater than rating 2, the upper limit is shown in Figures A.1 to A.4 d);

— Rating 4: damage greater than rating 3, e.g. a rating as shown in Figures A.1 to A.4 e).

State the rating as a single number without digitals (e.g. 1,5) or interim values (e.g. 1 to 2).

9 Test report

The test report shall contain at least the following information:

a) all details necessary for the identification of the tested coating;

b) a reference to this document, i.e. ISO 20567-4:2023;

c) the details of the test panels, including:

   1) the details of the substrate (including material and thickness) and its surface preparation,

   2) the method used to apply the product onto the substrate, including the drying/curing time and conditions for each layer,

   3) if applicable, the conditions under which the panels were aged,

   4) the details of how the test panels were conditioned before the test and, if applicable, details of any tests carried out previously with the same test panels, and

   5) the dry-film thickness of the coating, in micrometres, including the measuring method in accordance with ISO 2808, and a note as to whether it is a single layer or a multi-layer system;

d) the ambient temperature during the test;

e) all details required about the grit;

f) further details of the method used to remove loose coating (see Annex B);

g) which pictorial reference standards were used;

h) the result of the test, as described in Clause 8;

i) any deviations from the test method specified;

j) every unusual observation (deviation) during the test;

k) the date of testing;

l) the name of the person who carried out the test.