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

Part 2:

**Single-impact test with a guided impact
body**

*Peintures et vernis — Détermination de la résistance des revêtements
aux impacts de cailloux —*

Partie 2: Essai de choc simple par corps de choc à vol conduit



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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 20567-2 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

ISO 20567 consists of the following parts, under the general title *Paints and varnishes — Determination of stone-chip resistance of coatings*:

- *Part 1: Multi-impact testing*
- *Part 2: Single-impact test with a guided impact body*

Introduction

In the automobile industry, multi-layer paint coatings are applied to car bodies for protection. Grit, road-metal and other materials can damage these coatings in such a way that individual layers come off or the whole coating delaminates from the substrate.

Stone chipping can be simulated by means of single- and/or multi-impact tests. Part 1 of this International Standard describes multi-impact testing, Part 2 describes a single-impact test.

This part of ISO 20567 is based on the German Standard DIN 55996-2:2001, *Beschichtungsstoffe — Prüfung der Steinschlagfestigkeit von Beschichtungen — Teil 2: Einzelschlagprüfung* (Paints and varnishes — Stone chip resistance test for coatings — Part 2: Single impact test).

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

Part 2: Single-impact test with a guided impact body

1 Scope

This part of ISO 20567 specifies a method for the evaluation of the resistance of automobile finishes and other coatings to the impact of a wedge-shaped body projected onto the surface under test to simulate the impact of stones.

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 1514, *Paints and varnishes — Standard panels 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 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

IEC 60454-2, *Specification for pressure-sensitive adhesive tapes for electrical purposes — Part 2: Methods of test*

3 Principle

The stone-chip resistance of the coating under test is checked by projecting a defined impact body onto it. The impact body used in the test has a wedge-shaped cutting edge to obtain a damage pattern equivalent to that produced in a multi-impact test. The wedge-shaped impact body is pushed onto the coating under test by the transmission of a pulse of energy from a steel ball accelerated using compressed air.

Loose fragments of coating material are removed using adhesive tape.

The stone-chip resistance is evaluated visually or by means of optical imaging.

4 Apparatus and materials

Ordinary laboratory apparatus, plus the following:

4.1 Single-impact tester

Figure 1 shows the test apparatus.

Figure 2 shows the shape of the impact body and its dimensions. The impact body shall be made of hardened steel (hardness 60 HRC to 62 HRC).

The impact body is inserted in the tester with the wedge-shaped end touching the coated test panel and the spring exerting a slight pressure on the body. A steel ball of mass inferior to that of the impact body is accelerated by a compressed-air blast ($p = 300 \text{ kPa}^1$) and transmits part of its energy to the impact body, which then strikes the test panel.

The impact body shall be checked, and replaced if necessary, after a maximum of 500 test runs (i.e. after 500 impacts) or at the end of the series of tests during which the impact body passes the point at which it has been used for a total of 500 test runs.

4.2 Adhesive tape

Unless otherwise agreed, adhesive tape with an adhesive strength between 6 N/25 mm width and 10 N/25 mm width (tested in accordance with IEC 60454-2) shall be used. The tape shall be at least 25 mm wide.

5 Sampling

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

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

6 Test panels

6.1 Substrate

Unless otherwise agreed, use 200 mm × 100 mm steel test panels that are between 0,7 mm and 1,0 mm thick.

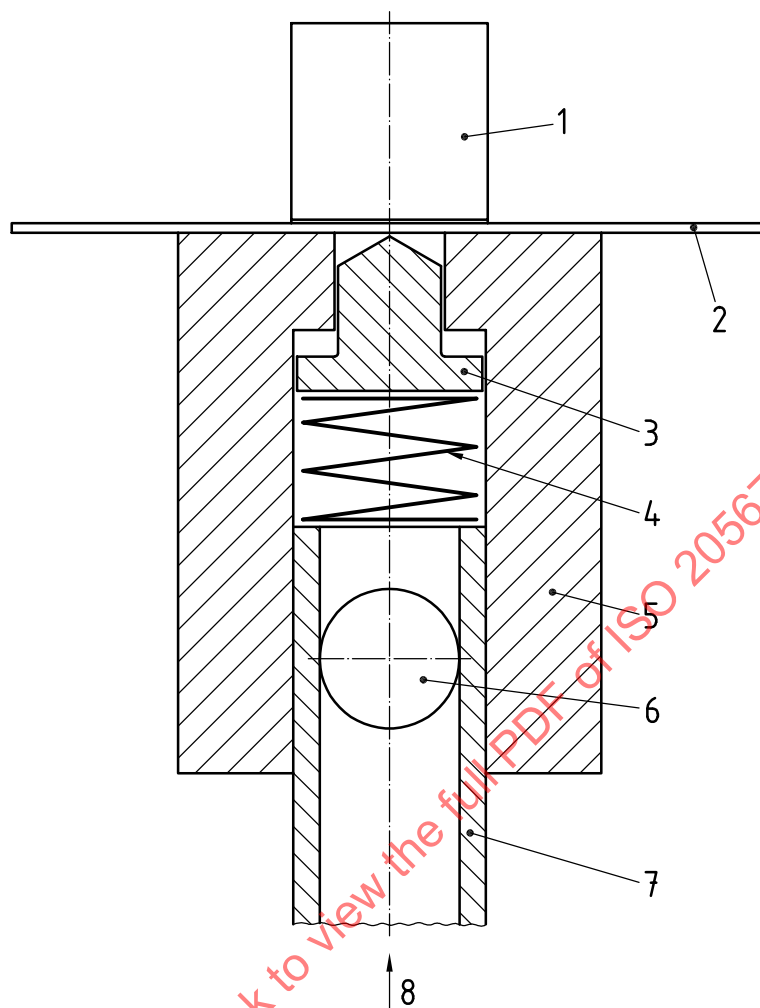
6.2 Preparation and coating

Unless otherwise agreed, prepare each test panel in accordance with ISO 1514 before coating and drying or stoving it. Use the application method specified by the paint manufacturer.

6.3 Thickness of the coating

Determine the thickness, in micrometres, of the dry coating by one of the procedures specified in ISO 2808.

1) 100 kPa = 1 bar.

**Key**

- | | |
|---|---|
| 1 counterweight (mass exceeding 1 kg) | 5 housing |
| 2 test panel | 6 steel ball, hardness 60 HRC to 66 HRC |
| 3 impact body | 7 pipe, bore $8,6_{-0}^{+0,015}$ mm |
| 4 steel spring, diameter of wire 0,8 mm, 2,5 windings | 8 compressed air |

Figure 1 — Test apparatus showing position of impact body

Dimensions in millimetres

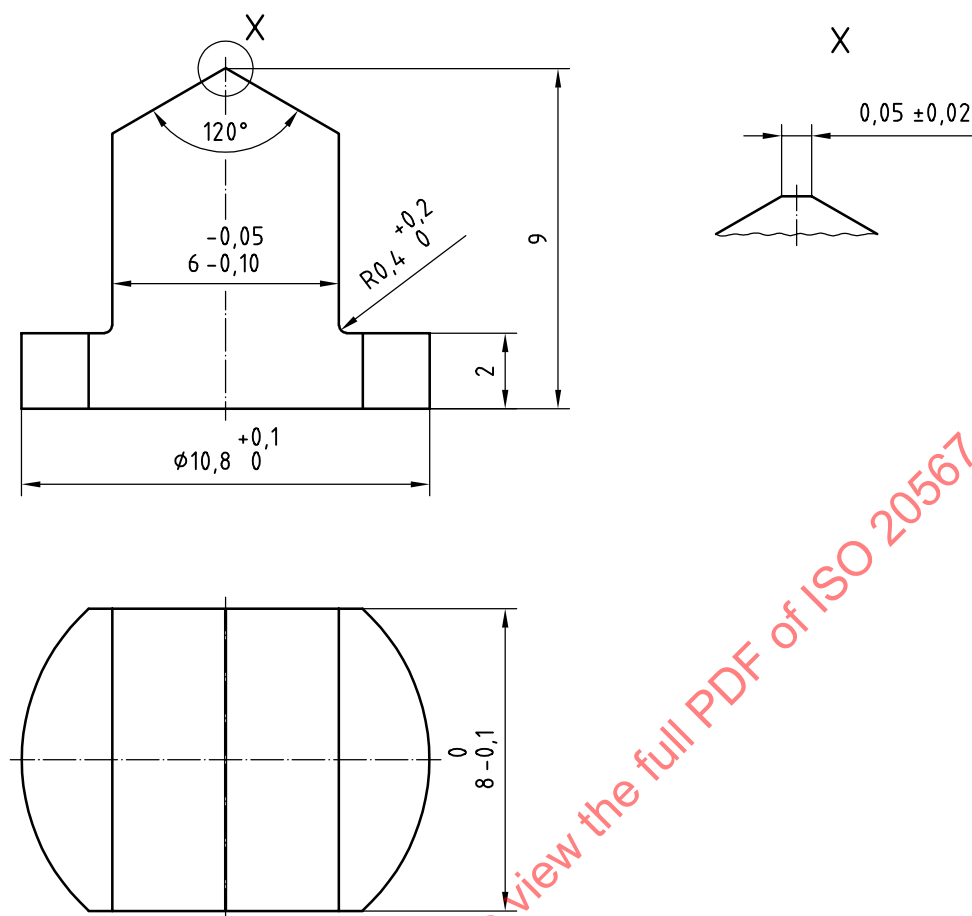


Figure 2 — Impact body

7 Procedure

7.1 Calibration

Instructions for the calibration of the tester are given in Annex A.

7.2 Conditioning of the test panels

Condition the test panels for at least 16 h at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ relative humidity before carrying out the test, unless otherwise agreed (see ISO 3270).

7.3 Test conditions

Carry out the test at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ relative humidity (see ISO 3270).

NOTE Exceptionally, other test conditions may be agreed between the interested parties.

7.4 Number of test runs

Unless otherwise agreed, each test shall comprise three test runs.

7.5 Determination

Prior to starting the test, set the pressure of the compressed-air supply to 300 kPa.

Place the test panel on the test apparatus with the coated side facing towards the impact body (see Figure 1), place a counterweight (of mass exceeding 1 kg) on it and turn on the compressed air to accelerate the steel ball and activate the impact body.

When several impacts are to be delivered to one test panel, turn off the compressed air after each impact, move the panel by about 20 mm, replace the counterweight and then repeat the impact.

After the final impact, place a strip of adhesive tape approximately 120 mm to 150 mm long over the damaged area of the test panel and press it firmly onto the surface. Bend one end of the tape upwards and pull the strip off with a jerk (at an angle of 90° to the test panel) to remove chips of paint that have not been completely separated from the panel. In addition, remove loose paint fragments that were not pulled off with the tape using a knife or similar instrument.

8 Evaluation

Evaluation of the damage can be done either visually or by means of digital optical imaging.

Determine the extent of the damage

- by measuring the total width, in millimetres, of the damage found in the coating, including the mark left by the wedge;
- by specifying, in addition, if possible, the main separation level or the layers of the paint system between which loss of adhesion occurred.

An example of the result of a test run is shown in Figure 3. Examples of defects caused are shown in Figure 4.

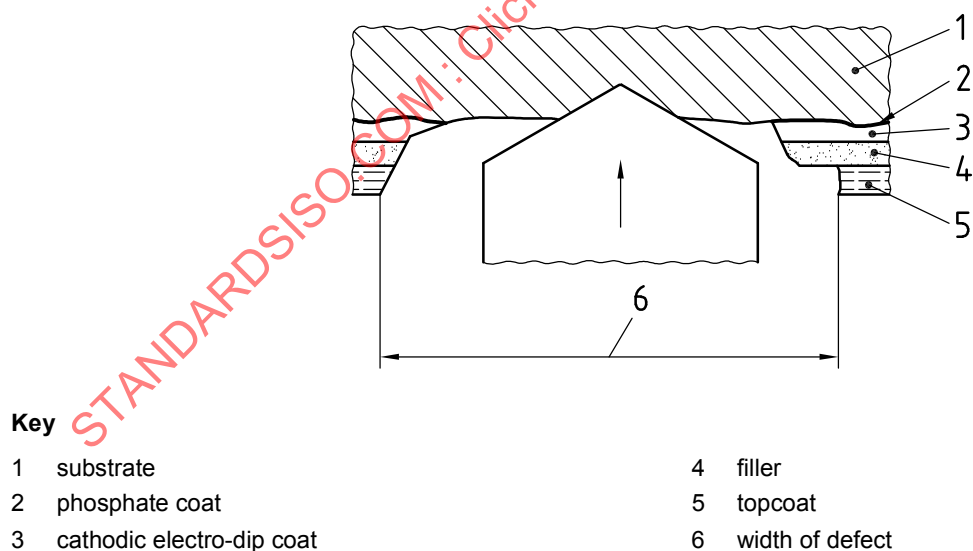
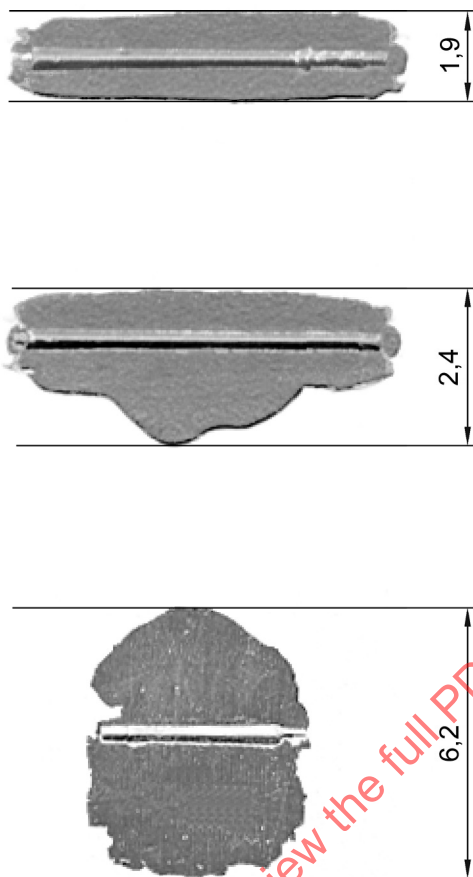


Figure 3 — Example of result of a test run

Dimensions in millimetres

**Figure 4 — Examples of defects**

9 Precision

9.1 Repeatability limit, r

The repeatability limit r is the value below which the absolute difference between two test results can be expected to lie, with a 95 % probability, 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 same apparatus.

For this method, r is 0,5 % of the mean value.

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, with a 95 % probability, 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 different apparatus.

For this method, R is 1,0 % of the overall mean value.