
**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 percutant guidé

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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 document 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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This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 139, *Paints and varnishes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 20567-2:2017), which has been technically revised.

The main changes are as follows:

- [A.4](#) has been re-worded so that the use of a knife or similar instrument can be carried out without using another method beforehand;
- in [B.3](#), the requirement on how often the instrument shall be calibrated has been deleted;
- the normative references have been updated.

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

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. ISO 20567-1 describes multi-impact testing, while this document and ISO 20567-3 describe single-impact tests.

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

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

1 Scope

This document specifies a method to evaluate the resistance of automobile finishes and other coatings to the impact of a wedge-shaped body which is projected onto the surface under test to simulate the impact of stones.

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

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

EN 573-3, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition and form of products*

3 Terms and definitions

No terms and definitions are listed in this document.

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 under test is checked by projecting a specified 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.

The loose fragments of coating material are removed.

The stone-chip resistance is evaluated by measuring the total width of the delaminated coating, including the mark left by the wedge.

5 Apparatus and materials

Use ordinary laboratory apparatus, together with the following.

5.1 Single-impact tester

[Figure 1](#) shows the upper part of 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 66 HRC).

The test panel is inserted on the tester with the wedge-shaped end of the impact body 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 ($p = 300 \text{ kPa} = 3 \text{ bar}^1$) 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.

6 Test panels

6.1 Substrate

Use test panels of at least $100 \text{ mm} \times 100 \text{ mm}$ in size that are at least 0,7 mm thick.

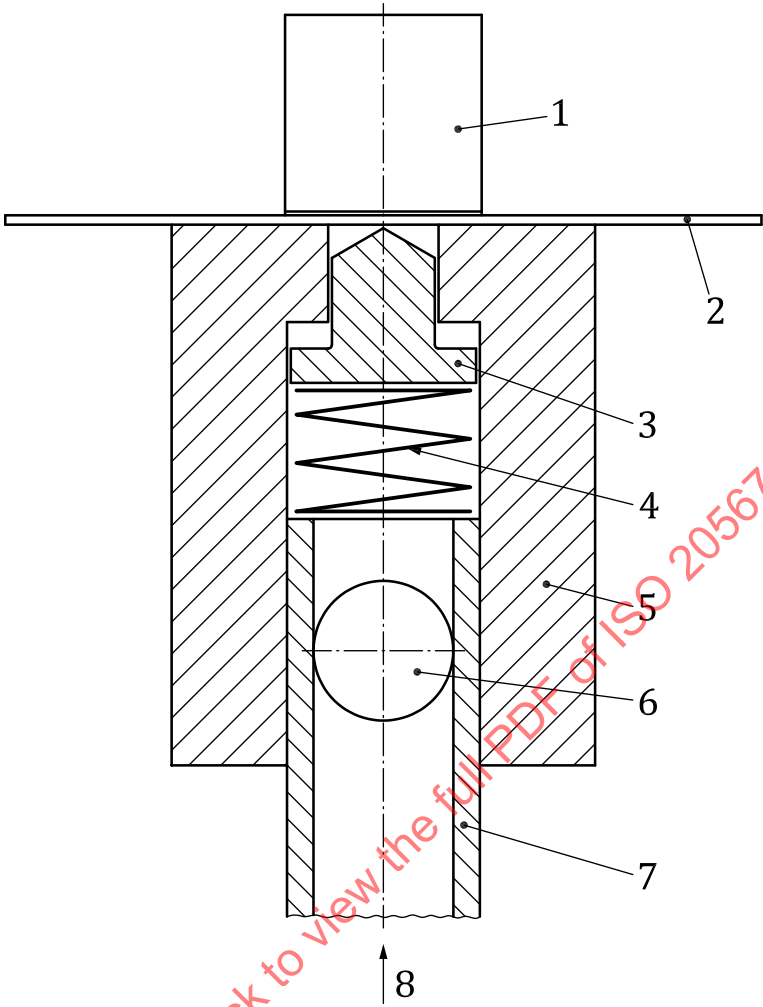
6.2 Preparation and coating

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) $1 \text{ bar} = 0,1 \text{ MPa} = 10^5 \text{ Pa}$; $1 \text{ MPa} = 1 \text{ N/mm}^2$.



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 — Upper part of the test apparatus showing position of impact body

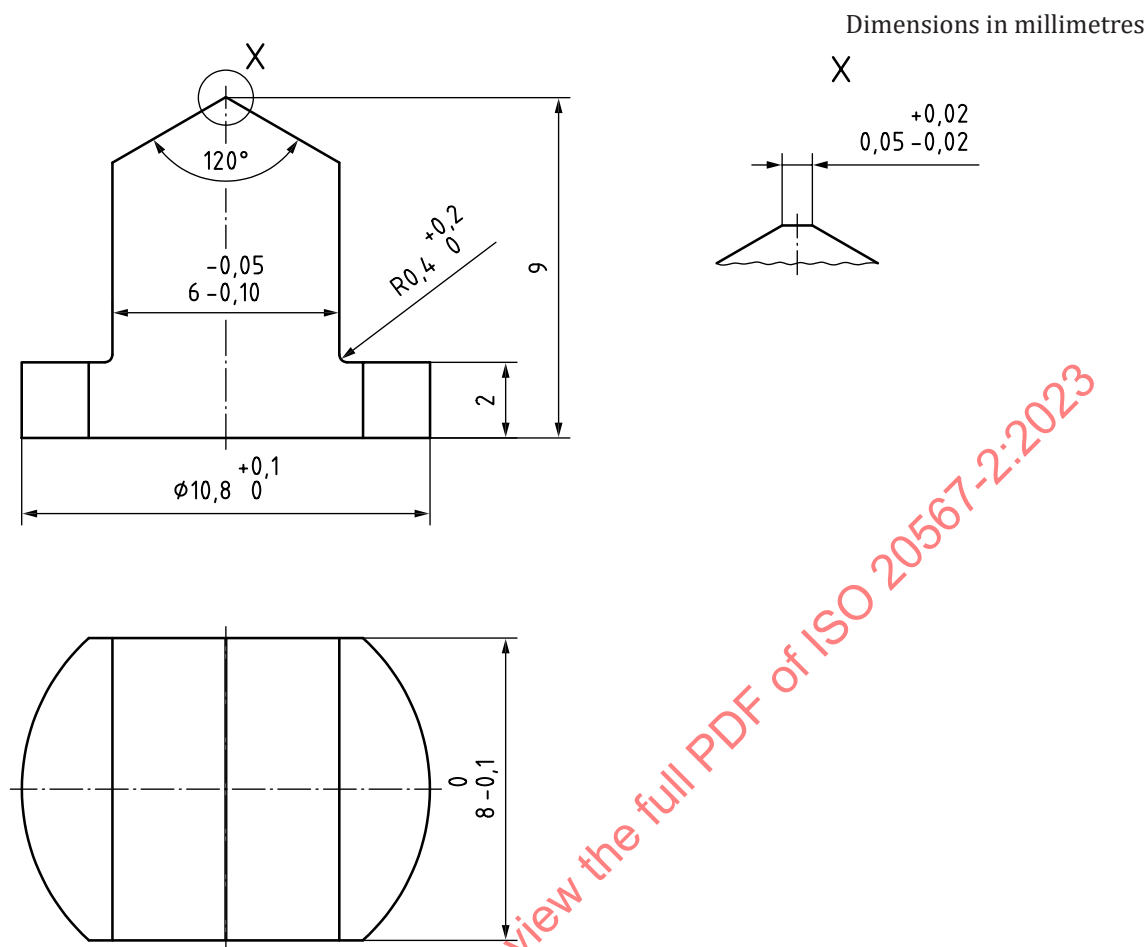


Figure 2 — Impact body

7 Procedure

7.1 Calibration

Follow the instructions for the calibration of the tester as specified in [Annex B](#).

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 in accordance with ISO 3270.

7.3 Test conditions

Carry out the test at room temperature, i.e. 18°C to 28°C . State the temperature in the test report.

After conditioning, ensure that condensation does not form prior to or during the test.

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 shall 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.

Remove any loose paint from the test area. Examples of suitable methods are given in [Annex A](#). The method for removing the loose paint shall be agreed between the interested parties and shall be stated in the test report.

8 Evaluation

Determine the extent of the damage:

- by measuring the total width, in millimetres, of the delaminated 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](#).

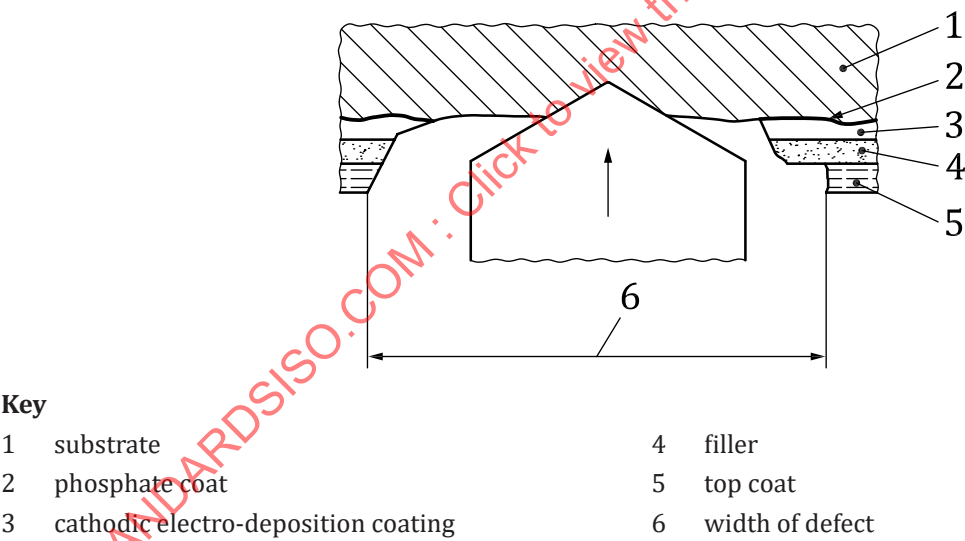


Figure 3 — Example of a result of a test run

Dimensions in millimetres

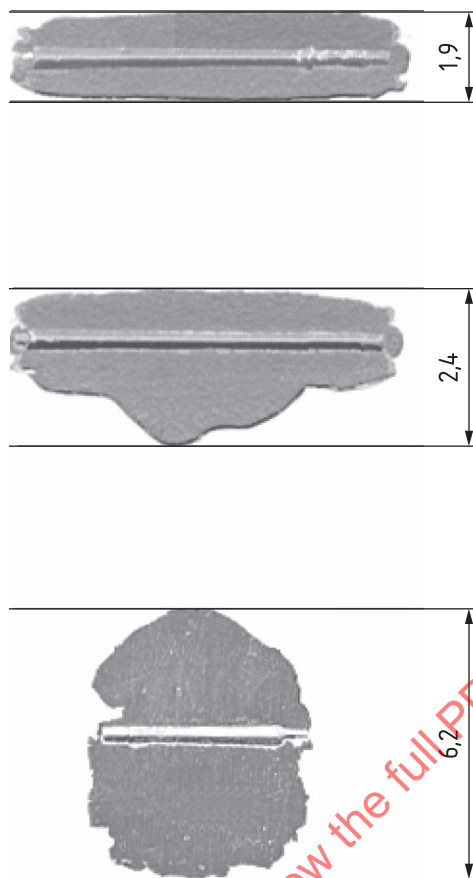


Figure 4 — Examples of defects

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 1,4 mm, relative to the mean value of the test results.

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 2,2 mm, relative to the mean value of the test results.