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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

Reference number
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Contents

Page

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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 20567-2:2005), which has been technically revised with the following main changes:

— a specification has been added, when the calibration of the apparatus shall be made;

— reference to optical imaging has been deleted;

— the clause on sampling has been deleted;

— the description of suitable methods for removal of loose paint have been transferred to an informative annex as examples, and, for the method using adhesive tape, the adhesive strength of the tape is no longer specified;

— some minor corrections have been made;

— this document is revised editorially and the normative references have been updated.

A list of all parts in the ISO 20567 series can be found on the ISO website.

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; ISO 20567-2 and ISO 20567-3 describe single-impact tests.

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 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 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 terminological databases for use in standardization at the following addresses:

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

— ISO Online browsing platform: available at http://www.iso.org/obp

4 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.

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

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 kPa) and transmits part of its energy to the impact body, which then strikes the test panel.

NOTE 100 kPa = 1bar.

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

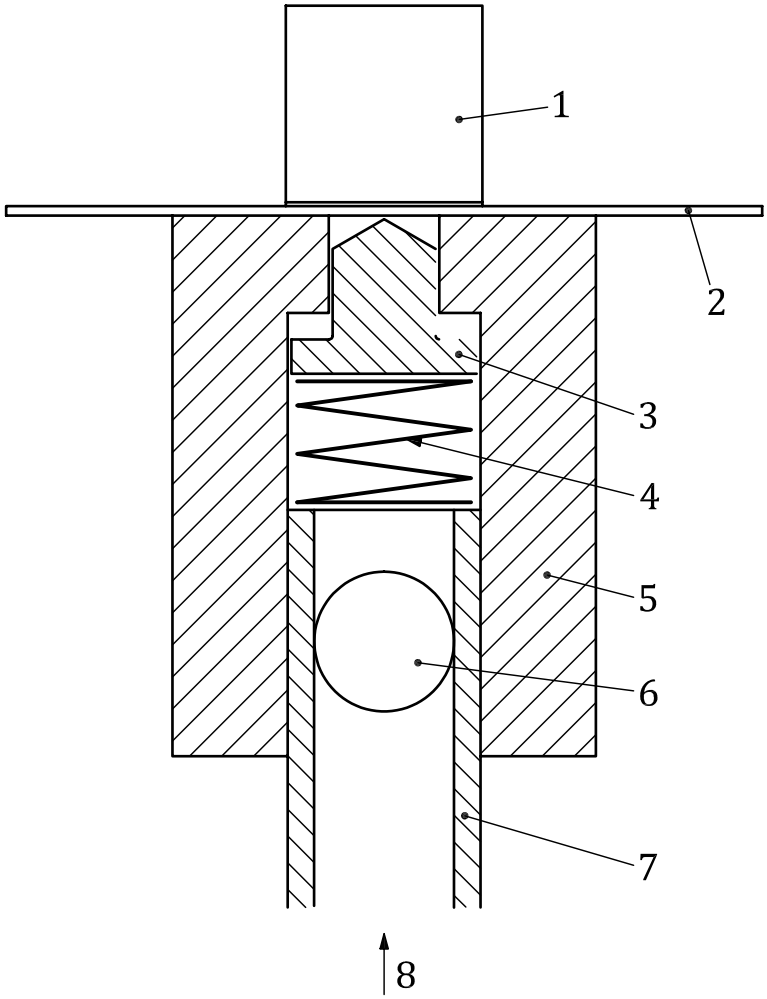
Use test panels of at least 100 mm × 100 mm in size that are at least 0,7 mm thick.

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.



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 $8{,}6^{0{,}015}_{0}$ 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

Dimensions in millimetres

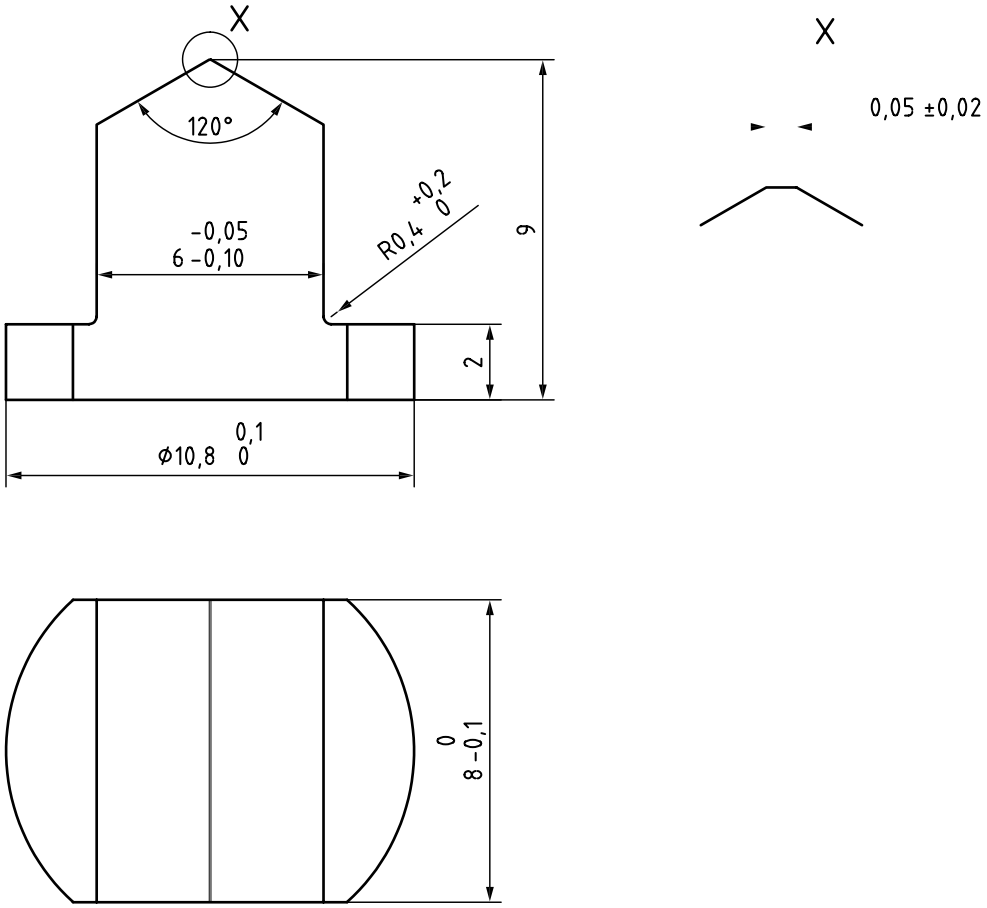


Figure 2 — Impact body

7 Procedure

7.1 Calibration

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

7.2 Conditioning of the test panels

Condition the test panels for at least 16 h at (23 ± 2) °C and (50 ± 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 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.

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.

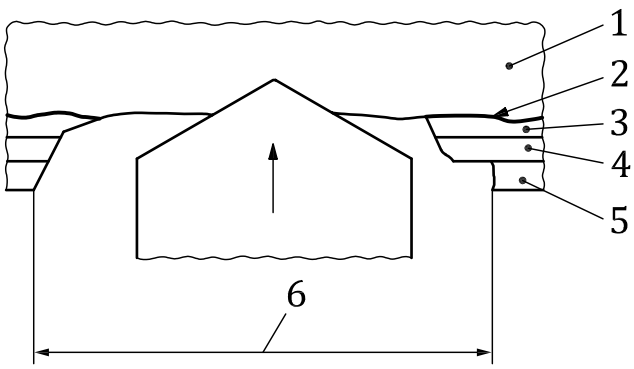
8 Evaluation

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.



Key

1	substrate	4	filler
2	phosphate coat	5	top coat
3	cathodic electro-deposition coating	6	width of defect

Figure 3 — Example of a result of a test run

Dimensions in millimetres

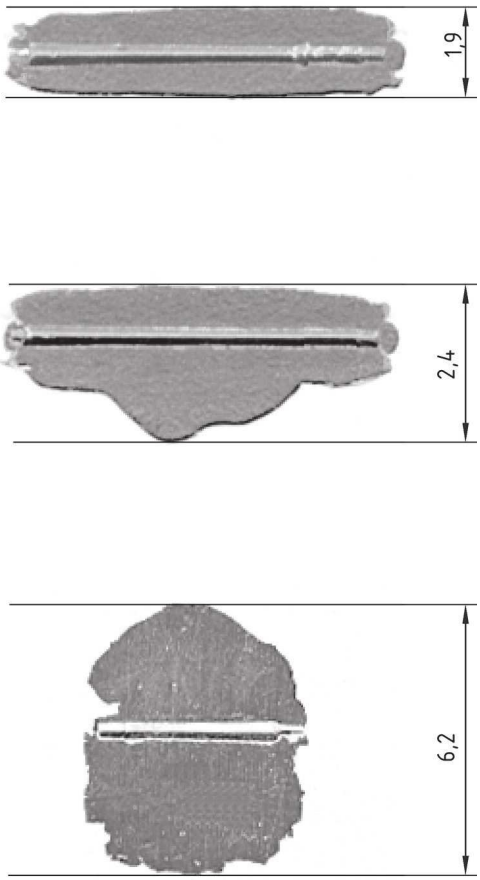


Figure 4 — Examples of defects

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.

10 Test report

The test report shall contain at least the following information:

a) all details necessary for complete identification of the product tested (manufacturer, trade name, batch number, etc.);

b) a reference to this document, i.e. ISO 20567-2;

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 to the substrate, including the drying time and drying 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,

   5) the dry-film thickness of the coating, in micrometres, and the method in ISO 2808 used to measure it, plus a note as to whether the tested coating consisted of a single layer or several layers;

d) the ambient temperature during the test;

e) the details of the method used to remove loose paint (see Annex A);

f) the results of the test, as described in Clause 8;

g) any deviations from the procedure specified;

h) any unusual features (anomalies) observed during the test;

i) the date of testing;

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

Annex A
(informative)

Examples of suitable procedures for removing loose paint

A.1 Brushing

Brush the panel lightly with a soft brush several times backwards and several times forwards.

A.2 Using pressure-sensitive adhesive tape

Place a strip of adhesive tape approximately 120 mm to 150 mm long over the test area of the test panel and press it firmly onto the surface using a fingertip, fingernail or suitable device. Bend one end of the tape upwards and pull the strip off with a jerk (at an angle of 60° to the test panel) to remove chips of paint that have not been completely separated from the panel.

To ensure good contact with the coating, rub the tape firmly with a fingertip or fingernail.

NOTE The operation of applying and removing the tape can be carried out more than once, depending on the kind of coating.

A.3 Using compressed air or nitrogen

Remove any loose paint with compressed air or nitrogen.

A.4 Using a knife or similar instrument

In addition, remove loose paint fragments that were not pulled off with, e.g. the adhesive tape, using a knife or similar instrument.

Annex B
(normative)

Calibration of the test apparatus

B.1 Materials

B.1.1 Calibration standard, cast aluminium panel conforming to the requirements of material number EN AW 5083, composition AlMg4,5Mn0,7, as specified in EN 573-3, surface roughness R_a < 0,8 mm.

B.2 Apparatus

B.2.1 Measuring microscope, with a scale reading to the nearest 20 µm, magnification × 50 to × 100.

B.3 Procedure

Calibrate the instrument after 500 test runs.

Set the compressed-air pressure to 300 kPa (3 bar).

Examine the leading edge of the impact body. It shall be smooth, and free from defects and deposits. If it shows any damage, change the impact body.

Place the calibration standard (B.1.1) on the test apparatus instead of a coated test panel, 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.

Measure the width of the impact (see Figure B.1) in several places using the microscope (B.2.1). Compare the average width with the stated value for the calibration standard. If the measured value differs by more than 50 µm from the stated value, recalibrate the apparatus in accordance with the manufacturer's instructions.

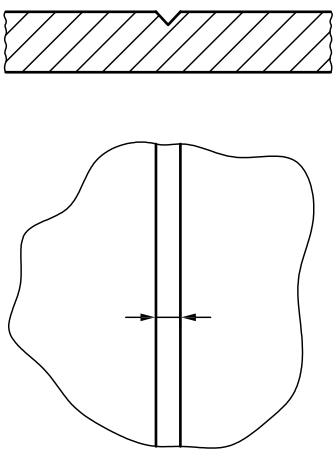


Figure B.1 — Width of indentation in calibration standard

ICS 87.040

Price based on 9 pages