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**Paints and varnishes — Rapid-deformation  
(impact resistance) tests —**

**Part 2:  
Falling-weight test, small-area indenter**

*Peintures et vernis — Essais de déformation rapide (résistance au choc) —  
Partie 2: Essai de chute d'une masse avec pénétrateur de surface réduite*  
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ISO 6272-2:2002

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**Contents**

	Page
1 Scope .....	1
2 Normative references .....	1
3 Term and definition .....	1
4 Required supplementary information .....	2
5 Principle .....	2
6 Significance and use .....	2
7 Apparatus .....	2
8 Reagents .....	2
9 Sampling .....	2
10 Test panels .....	3
11 Conditioning .....	3
12 Procedure .....	3
13 Precision .....	4
14 Test report .....	4

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**Annex**

A Required supplementary information .....	6
Bibliography .....	7

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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 3.

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 part of ISO 6272 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 6272-2 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

Together with ISO 6272-1, this part of ISO 6272 cancels and replaces ISO 6272:1993. The main change is the introduction of the option to increase the mass of the weight that is dropped onto the panel, thus enabling a more severe test to be carried out.

ISO 6272 consists of the following parts, under the general title *Paints and varnishes — Rapid-deformation (impact resistance) tests*:

- Part 1: *Falling-weight test, large-area indenter*
- Part 2: *Falling-weight test, small-area indenter*

Annex A forms a normative part of this part of ISO 6272.

# Paints and varnishes — Rapid-deformation (impact resistance) tests —

## Part 2: Falling-weight test, small-area indenter

**WARNING** — This part of ISO 6272 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this part of ISO 6272 to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

### 1 Scope

This part of ISO 6272 describes a method for rapidly deforming, by impact with a spherical indenter of diameter 12,7 mm or 15,9 mm, a coating film and its substrate and evaluating the effect of such deformation.

NOTE The term “impact resistance” is included in the title and text of this part of ISO 6272, but one important characteristic of the apparatus used is that it should produce rapid deformation rather than a true impact.

This test method should be restricted to testing in only one laboratory when numerical values are used because of the poor reproducibility of the method. Interlaboratory agreement is improved when ranking is used in place of numerical values.

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### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 6272. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 6272 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

### 3 Term and definition

For the purposes of this part of ISO 6272, the following term and definition apply.

#### 3.1

##### **impact resistance of a coating**

number of kilogram metres (inch pounds) required to produce cracking in a deformed coating

## 4 Required supplementary information

For any particular application, the test method specified in this part of ISO 6272 needs to be completed by supplementary information. The items of supplementary information are given in annex A.

## 5 Principle

The coatings under test are applied to suitable thin metal panels. After the coatings have cured, a standard weight is dropped a distance so as to strike an indenter that deforms the coating and the substrate. The indentation can be either an intrusion or an extrusion. By gradually increasing the distance the weight drops, the point at which failure usually occurs can be determined. Films generally fail by cracking, which is made more visible by the use of a magnifier, by the application of a copper sulfate ( $\text{CuSO}_4$ ) solution on steel, or by the use of a pinhole detector.

## 6 Significance and use

Coatings attached to substrates are subjected to damaging impacts during the manufacture of articles and their use in service. In its use over many years, this test method for impact resistance has been found to be useful in predicting the performance of organic coatings for their ability to resist cracking caused by such impacts.

## 7 Apparatus

**7.1 Tester**, consisting basically of a vertical tube to guide a cylindrical weight that is dropped on a punch resting on the test panel and including the components described in 7.1.1 to 7.1.4.

**7.1.1 Guide tube**, 0,6 m to 1,2 m (24 in to 48 in) long mounted vertically in a base plate. A slot is cut lengthwise on one side of the tube to act as a guide for a cylindrical weight that fits inside the tube. Graduations are marked in inch pounds along the slot. The base is constructed so that a thin flat panel can be inserted at 50 mm (2 in) below the tube.

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**7.1.2 Weight**, consisting of a metal cylinder made to fit inside the guide tube. A pin is fitted into one side of the weight to act as a guide by riding in the slot of the tube and to serve as a handle by which the weight can be raised and released and also to serve as the indicator of inch pounds (kilogram metres).

**7.1.3 Indenter**, consisting of a steel punch with a hemispherical head having a diameter of either 12,7 mm (0,500 in) or 15,9 mm (0,625 in). The head rests on the test panel and the punch is held vertically by a guide ring.

**7.1.4 Panel support**, consisting of a steel fixture with a 16,3 mm (0,64 in) diameter cylindrical hole centered under the indenter for supporting the test panel.

**7.2 Magnifier.**

**7.3 Pinhole detector.**

## 8 Reagents

**8.1 Acidified copper sulfate ( $\text{CuSO}_4$ ) solution**, prepared by dissolving 10 g of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  in 90 g of 1,0 N hydrochloric acid (HCl).

## 9 Sampling

Take a representative sample of the coating material to be tested (or of each product in the case of a multi-coat system), as described in ISO 15528.

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

## 10 Test panels

### 10.1 Substrate

Unless otherwise agreed, the substrate shall be metal, conforming to the requirements of ISO 1514.

The panels shall be 24 gauge (i.e. 0,63 mm or 0,25 in thick), planar and free from distortion. The dimensions shall be such as to allow the test to be carried out at at least five different positions not less than 40 mm from each other and not less than 20 mm from the edge of the panel.

Measure the thickness to the nearest 0,01 mm.

### 10.2 Preparation and coating

Unless otherwise agreed, prepare a minimum of four test panels in accordance with ISO 1514 and coat them by the specified method with the product or system under test.

### 10.3 Drying

Dry (or stove) and age (if applicable) each coated test panel for the specified time and under the specified conditions.

### 10.4 Thickness of coating

Determine the thickness, in micrometres, of the dried coating by one of the procedures specified in ISO 2808. Make the measurements at, or as near as possible to, the positions at which the test is to be carried out.

Use only test panels for which the film thickness values do not differ from the specified or agreed film thickness by more than 10 %.

## 11 Conditioning

Unless otherwise agreed upon between the producer and the user, condition the coated test panels at  $23\text{ °C} \pm 2\text{ °C}$  ( $73,5\text{ °F} \pm 3,5\text{ °F}$ ) and  $(50 \pm 5)\%$  relative humidity for at least 16 h. Conduct the test in the same environment or immediately on removal therefrom.

NOTE The minimum conditioning time is given as 16 h to equate to that given in ISO 6272-1. ASTM D 2794-93 gives a minimum conditioning time of 24 h. The conditioning time is included as part of the required supplementary information [see annex A, item d)].

## 12 Procedure

Install the indenter having the head diameter specified or agreed upon. Place the test panel in the apparatus with the coated side either up or down as specified or agreed upon. Be sure the panel is flat against the base support and that the indenter is in contact with the top surface of the panel. Lightly place the weight on the indenter and adjust the guide tube so that the lifting pin is at the zero mark. Raise the weight up the tube to a height where it is expected that no failure will occur. Release the weight so that it drops on the indenter.

Remove the test panel from the apparatus and observe the impact area for cracks in the coating. If no cracks are evident, repeat the procedure at a greater height, increasing 25 mm (1 in) at a time. Once visible cracks are observed, repeat the test five times at each of three heights: slightly above, slightly below and at that determined in the first trial. Test in a random fashion so that all impacts from one height are not made in succession or on one panel.

Examine the impacted areas for cracking by one of the following methods:

- a) Use a magnifier to examine the area for cracks.
- b) Hold a white flannel-type cloth saturated with acidified copper sulfate (CuSO<sub>4</sub>) solution (8.1) over the impacted areas for at least 15 min. Remove the cloth and examine both the test areas and cloth for evidence of copper deposition or iron-rust staining respectively.

NOTE The copper sulfate solution will not perform properly on zinc-phosphate-treated metal unless the conversion coating cracks.

- c) To detect breaks in the film with a pinhole detector, first connect the ground lead from the instrument to the bare substrate and connect the instrument to an electrical power source. Moisten the probe sponge with tap water and slowly draw the probe over the impact area. The presence of cracks will be indicated by an audible alarm.

For each kilogram metre (inch pound) level, tabulate the number of times the coating passed or failed. The value where the results change from mainly passing to mainly failing is the impact failure end point.

### 13 Precision

#### 13.1 General

The data given in this clause are taken from ASTM D 2794-93, which is the basis of this part of ISO 6272.

#### 13.2 Coefficient of variation

On the basis of an interlaboratory test in which operators in six laboratories tested three paints having a broad range of impact resistance on two metal substrates, the between-laboratories coefficients of variation were found to be as given in Table 1.

Table 1 — Coefficient of variation  
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	Intrusion %	Extrusion %
Brittle coating (less than 6 in.-lb)	25	100
Average coating (between 6 in.-lb and 140 in.-lb)	80	100
Flexible coating (more than 140 in.-lb) (0,625 in.-diameter punch)	10	25

#### 13.3 Bias

Since there is no accepted reference material suitable for determining the bias for the procedure in this test method, bias cannot be determined.

### 14 Test report

The test report shall contain at least the following information:

- a) all details necessary to identify the product tested;
- b) a reference to this part of ISO 6272 (ISO 6272-2:2002);
- c) the items of supplementary information referred to in annex A;
- d) a reference to the international or national standard, product specification or other document supplying the information referred to in c);
- e) the result of the test as indicated in clause 12, indicating the kilogram metres (inch pounds) at the impact failure end point;



- f) whether intrusion or extrusion was used;
- g) the diameter of the punch used;
- h) any deviation from the test method specified;
- i) the date of the test.

NOTE Because of the poor reproducibility of this method, the reporting of kilogram metres (inch pounds) in comparing coatings for impact resistance should be restricted to one laboratory. For interlaboratory comparisons, ranking of coatings for impact resistance should be reported.

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