BRITISH STANDARD

BS EN ISO 6860:2006
BS 3900-E11:2006

Paints and varnishes — Bend test (conical mandrel)

The European Standard EN ISO 6860:2006 has the status of a British Standard

ICS 87.040

BSI British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN ISO 6860:2006. It supersedes BS EN ISO 6860:1995 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee STI/10, Test methods for paints.

A list of organizations represented on STI/10 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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Peintures et vernis - Essai de pliage (mandrin conique) (ISO 6860:2006)

Beschichtungsstoffe - Dornbiegeversuch (mit konischem Dorn) (ISO 6860:2006)

This European Standard was approved by CEN on 14 March 2006.

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Foreword

This document (EN ISO 6860:2006) has been prepared by Technical Committee ISO/TC 35 "Paints and varnishes" in collaboration with Technical Committee CEN/TC 139 "Paints and varnishes", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2006, and conflicting national standards shall be withdrawn at the latest by September 2006.

This document supersedes EN ISO 6860:1995.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of ISO 6860:2006 has been approved by CEN as EN ISO 6860:2006 without any modifications.

EN ISO 6860:2006

INTERNATIONAL STANDARD

ISO 6860

Second edition
2006-03-15

Paints and varnishes — Bend test (conical mandrel)

Peintures et vernis — Essai de pliage (mandrin conique)

Reference number
ISO 6860:2006(E)

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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 6860 was prepared by Technical Committee 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 6860:1984), which has been technically revised. The main changes are:

— an indication of the rolling direction of aluminium panels has been added to Subclause 5.1;

— the diameter of the small end of the cone has been changed to $(3{,}1 \pm 0{,}1)$ mm so that the apparatus standardized in ASTM fits into the International Standard;

— the text has been editorially revised.

Introduction

This International Standard is one of five documents (see also ISO 1519, ISO 1520, ISO 6272-1 and ISO 6272-2) which specify empirical test procedures for assessing the resistance of coatings of paints, varnishes and related products to cracking and/or detachment from the substrate under different conditions of deformation.

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Paints and varnishes — Bend test (conical mandrel)

1 Scope

This International Standard describes an empirical test procedure for assessing the resistance of a coating of paint, varnish or related product to cracking and/or detachment from a metal substrate when subjected to bending around a conical mandrel under standard conditions.

For a multi-coat system, each coat may be tested separately or the complete system may be tested.

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

3 Apparatus

A suitable apparatus is shown in Figure 1.

The mandrel of the test assembly shall be in the form of a truncated cone, such that its small diameter (d_0) is (3,1 ± 0,1) mm and its large diameter (d_1) is (38 ± 0,1) mm, over a length (l) of (203 ± 3) mm (see Figure 2).

The mandrel is mounted horizontally on a base plate. An operating lever with a draw bar is provided for bending the test panel around the mandrel. The assembly is also fitted with a device for clamping the test panel.

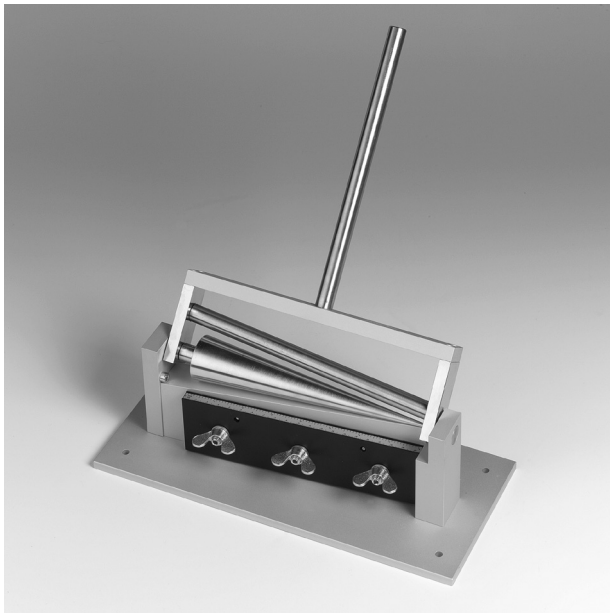
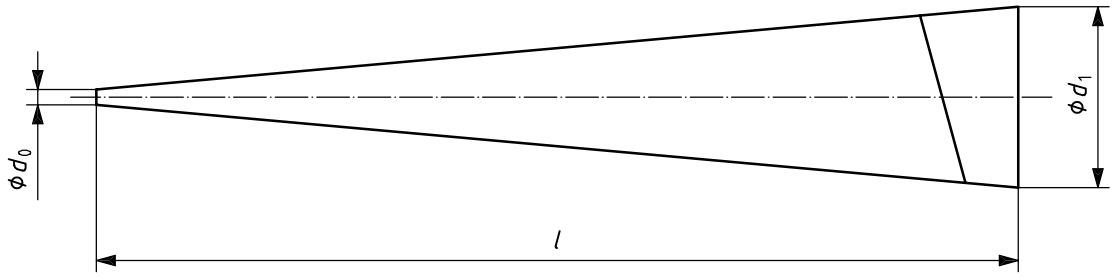


Figure 1 — Conical mandrel test apparatus



Key

d_0 = (3,1 ± 0,1) mm
d_1 = (38 ± 0,1) mm
l = (203 ± 3) mm

Figure 2 — Cone with bent test panel

4 Sampling

Take a representative sample of the coating material to be tested (or of each coating material 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.

5 Test panels

5.1 Substrate

Unless otherwise agreed, the test panels shall conform to the requirements of ISO 1514 and shall be made of burnished steel, burnished tinplate or soft aluminium.

The test panels shall be plane (flat) and free from distortion and the surface shall be free from any visible ridges or cracks.

The test panels shall be rectangular with sides measuring approximately 75 mm × 150 mm and shall have a maximum thickness of 0,8 mm, unless otherwise agreed or specified between the interested parties. The test panels may be cut to size after coating and drying, provided no distortion occurs. In the case of aluminium panels, the longitudinal direction of metallurgical rolling shall be at an angle of 90° to the axis of the cone.

5.2 Preparation and coating

Unless otherwise agreed, prepare each test panel in accordance with ISO 1514. Coat the panels by a method agreed between the interested parties with the coating material or system under test. If the coating under test is applied by brushing, any brush marks shall be at an angle of 90° to the axis of the cone.

5.3 Drying and conditioning

Dry (or stove and age) each coated test panel for the specified time. Then condition the coated panels at (23 ± 2) °C and (50 ± 5) % relative humidity (see also ISO 3270) for a minimum period of 16 h. Carry out the test procedure as soon as possible after conditioning.

5.4 Thickness of the coating

Determine the thickness, in micrometres, of the dry coating using one of the procedures described in ISO 2808.

6 Procedure

6.1 Number of determinations

Carry out the determination in triplicate.

6.2 Test conditions

Carry out the test at (23 ± 2) °C and (50 ± 5) % relative humidity, unless otherwise specified or otherwise agreed between the interested parties. If conditions other than (23 ± 2) °C and (50 ± 5) % relative humidity are used, they shall be recorded in the test report.

Avoid warming or undue handling of the test panel.

6.3 Bending of the panel

If agreed between interested parties, make incisions in the coating through to the substrate, parallel to the short edges of the panel at distances of 20 mm.

NOTE 1 Without incisions, cracks starting at the small diameter can propagate over the whole length of the cone.

Insert the panel with the coated side towards the draw bar and in such a position that one short edge touches the small end of the mandrel. Clamp the panel and, using the draw bar, bend the panel evenly and without jerking over the mandrel through 180° within a period of 2 s to 3 s.

NOTE 2 A sheet of paper may be inserted over the coated surface between the panel and the draw bar to prevent the coating being damaged by the drawbar during the bending operation.

Mark the end of the crack that is farthest from the small end of the mandrel and then release the test panel.

6.4 Examination of the test panels

Immediately examine the coating for cracking and/or detachment from the substrate, using a lens of ×10 magnification and sufficient light, or, if agreed between interested parties, examine the coating with the unaided eye.

Measure the length of the extent of cracking along the panel from the small end of the mandrel to the last visible crack, in millimetres.

Calculate the mean of the three determinations and report the result to the nearest millimetre.

7 Supplementary information

For any particular application of the test method specified in this International Standard, more details in addition to those in the preceding clauses need to be given. These items of supplementary information, which should preferably be agreed between the interested parties and may be derived, in part or totally, from an international or national standard or other document related to the product under test, are as follows:

a) the substrate material and surface preparation to be used (see 5.1 and 5.2);

b) the method of application of the test coating to the substrate (see 5.2);

c) the duration and conditions of drying (or stoving) and ageing (if applicable) of the test panel before testing (see 5.3);

d) the thickness, in micrometres, of the dry coating and method of measurement in accordance with ISO 2808, and whether it is a single coating or a multi-coat system (see 5.4);

e) the temperature and humidity of the test, if different from those specified in 5.3 and 6.2.

8 Precision

8.1 Repeatability limit r

The repeatability limit r is the value below which the absolute difference between two test results, each the mean of triplicate determinations, 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 23 mm.

8.2 Reproducibility limit R

The reproducibility limit R is the value below which the absolute difference between two test results, each the mean of triplicate determinations, can be expected to lie, with a 95 % probability, when this 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 46 mm.

NOTE R was calculated from $R = 2 \times r$.

9 Test report

The test report shall contain at least the following information:

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

b) a reference to this International Standard (ISO 6860:2006);

c) details of the procedure, including:

- the size of the test panel, if not 75 mm × 150 mm,
- the supplementary information regarding test conditions referred to in Clause 7,
- a reference to the international or national standard, product specification or other document supplying the information referred to in Clause 7,
- details of any points on which agreement between the interested parties was necessary;

d) the result of the test, as specified in 6.4, and whether the examination was carried out with a lens or with the unaided eye;

e) any deviations from the procedure specified;

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

g) the date of the test;

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

Bibliography

[1] ISO 1519, *Paints and varnishes — Bend test (cylindrical mandrel)*

[2] ISO 1520, *Paints and varnishes — Cupping test*

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

[4] ISO 6272-1, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 1: Falling-weight test, large-area indenter*

[5] ISO 6272-2, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 2: Falling-weight test, small-area indenter*

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