
**Paints and varnishes — Bend test
(cylindrical mandrel)**

Peintures et vernis — Essai de pliage sur mandrin cylindrique

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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 1519 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

This third edition cancels and replaces the second edition (ISO 1519:2002), which has been technically revised. The main changes are:

- a) A principle clause has been added.
- b) The requirement to carry out the test at a controlled relative humidity has been deleted (although the relative humidity is measured and recorded during the test). A maximum limit for the time between conditioning and testing has therefore been added.
- c) The supplementary test conditions (formerly Annex A) have been integrated in the test report.
- d) Information has been given on the precision of the method.

Introduction

This International Standard is one of six 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.

The other five documents are:

- ISO 1520, *Paints and varnishes — Cupping test*
- ISO 6272-1, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 1: Falling-weight test, large-area indenter*
- ISO 6272-2, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 2: Falling-weight test, small-area indenter*
- ISO 6860, *Paints and varnishes — Bend test (conical mandrel)*
- ISO 17132, *Paints and varnishes — T-bend test*

The method chosen will depend on the property to be measured and on agreement between the interested parties. In principle, all these tests differ from each other technically and in their accuracy.

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Paints and varnishes — Bend test (cylindrical mandrel)

1 Scope

This International Standard specifies 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 or plastics substrate when subjected to bending round a cylindrical mandrel under standard conditions.

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

The method specified can be carried out

- either as a “pass/fail” test, by carrying out the test with a single specified size of mandrel, to assess compliance with a particular requirement;
- or by repeating the procedure using successively smaller mandrels to determine the diameter of the first mandrel over which the coating cracks and/or becomes detached from the substrate.

Two types of apparatus are specified, type 1 being appropriate for use on test panels of thickness up to 0,3 mm, and type 2 for use on test panels of thickness up to 1,0 mm. Both types of apparatus have been found to give similar results with the same coating, but normally only one will be used for testing a given product.

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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 test samples*

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 Principle

A coated test panel is clamped in the test apparatus and then bent round a cylindrical mandrel. The bent panel is examined to see if the coating has been cracked when using the agreed or specified size of mandrel (“pass/fail test”) or, alternatively, the diameter of the first (smallest) mandrel over which the coating cracks and/or becomes detached from the substrate is determined.

4 Apparatus

4.1 Bend test apparatus

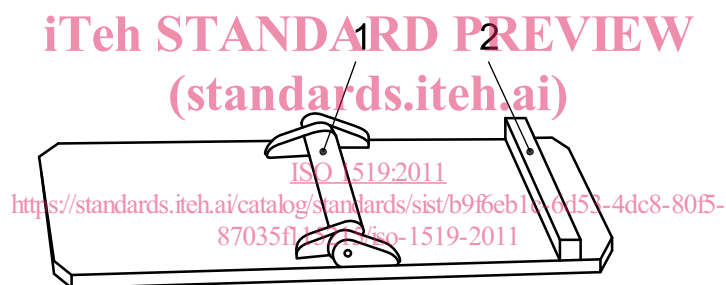
4.1.1 Material

In both types of apparatus specified below, the mandrels shall be made of a rigid and suitably corrosion-resistant material, for example stainless steel.

4.1.2 Type 1 mandrel tester

An example of a type 1 tester is shown in Figures 1 and 2. This type of tester is used with test panels of thickness not greater than 0,3 mm. A set of hinges is provided, each incorporating a cylindrical mandrel. The diameters of the mandrels are 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm and 32 mm, respectively, with a tolerance of $\pm 0,1$ mm. The dimensions of the apparatus are not critical, except that the gap between the surface of the mandrel and the plates of the hinges shall be $(0,55 \pm 0,05)$ mm. The mandrel shall be free to rotate on its axis and the apparatus shall be provided with a stop to ensure that, when the test panel is bent, the two parts are parallel.

Especially with the 2 mm diameter mandrel, it is important to ensure that no distortion of the mandrel takes place during the bending process, and not to use any mandrel showing such distortion.



Key

- 1 mandrel
- 2 stop of similar height to mandrel

Figure 1 — Type 1 bend test apparatus

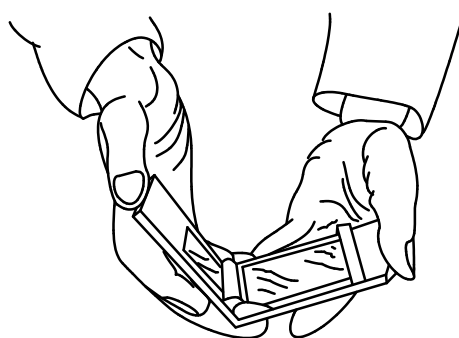


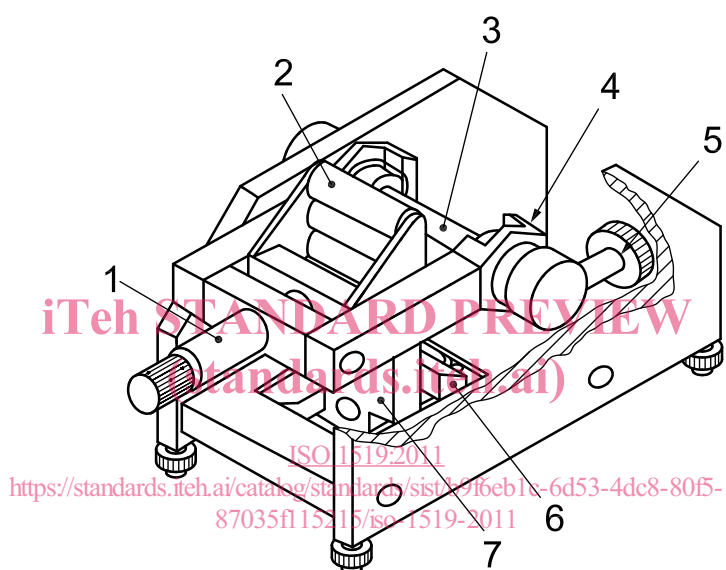
Figure 2 — Type 1 bend test apparatus in use

4.1.3 Type 2 mandrel tester

An example of a type 2 tester is shown in Figures 3 and 4. Type 2 testers are normally used for panels with a thickness of up to 1,0 mm. With coatings on soft metals, for example aluminium, and on plastics, thicker panels may be used with the provision that there is no deformation of the mandrel (see 6.3). The diameters of the mandrels are 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm and 32 mm, with a tolerance of $\pm 0,1$ mm.

By agreement between the interested parties, mandrels of other diameters may be used with the type 2 tester.

NOTE The bending piece of the type 2 tester, illustrated as an example in Figures 3 and 4, consists of three PVC rolls which are arranged side by side and run on pivoting bearings. Thus, the coating is not exposed to damage or shear stress during the test.



Key

- 1 screw handle
- 2 bending piece
- 3 mandrel
- 4 mandrel bearing
- 5 adjusting screw
- 6 clamping jaw
- 7 thrust bearing

Figure 3 — Example of a type 2 mandrel bending tester