

INTERNATIONAL STANDARD

ISO
1518

Second edition
1992-04-01

Paints and varnishes — Scratch test

Peintures et vernis — Essai de rayure

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ISO 1518:1992

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Reference number
ISO 1518:1992(E)

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.

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.

International Standard ISO 1518 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Sub-Committee SC 9, *General test methods for paints and varnishes*.

This second edition ~~cancels and replaces the first edition~~ (ISO 1518:1973), clauses 3 and 6 and the annex of which have been technically revised.

Annex A forms an integral part of this International Standard. Annex B is for information only.

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Paints and varnishes — Scratch test

1 Scope

1.1 This International Standard is one of a series of standards dealing with the sampling and testing of paints, varnishes and related products.

It specifies a test method for determining under defined conditions the resistance of a single coating or a multi-coat system of paint, varnish or related product to penetration by scratching with a hemispherically tipped needle. Penetration of the needle is to the substrate, except in the case of a multi-coat system, where the penetration of the needle may be either to the substrate or to an intermediate coat.

1.2 The method is intended for application as follows:

- a) either as a pass/fail test, by testing with a single specified load applied to the needle to assess compliance with a particular specification;
- b) or by applying increasing loads to the needle to determine the minimum load at which the coating is penetrated.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1512:1991, *Paints and varnishes — Sampling of products in liquid or paste form.*

ISO 1513:—¹⁾, *Paints and varnishes — Examination and preparation of samples for testing.*

ISO 1514:—²⁾, *Paints and varnishes — Standard panels for testing.*

ISO 2808:1991, *Paints and varnishes — Determination of film thickness.*

ISO 3270:1984, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing.*

3 Required supplementary information

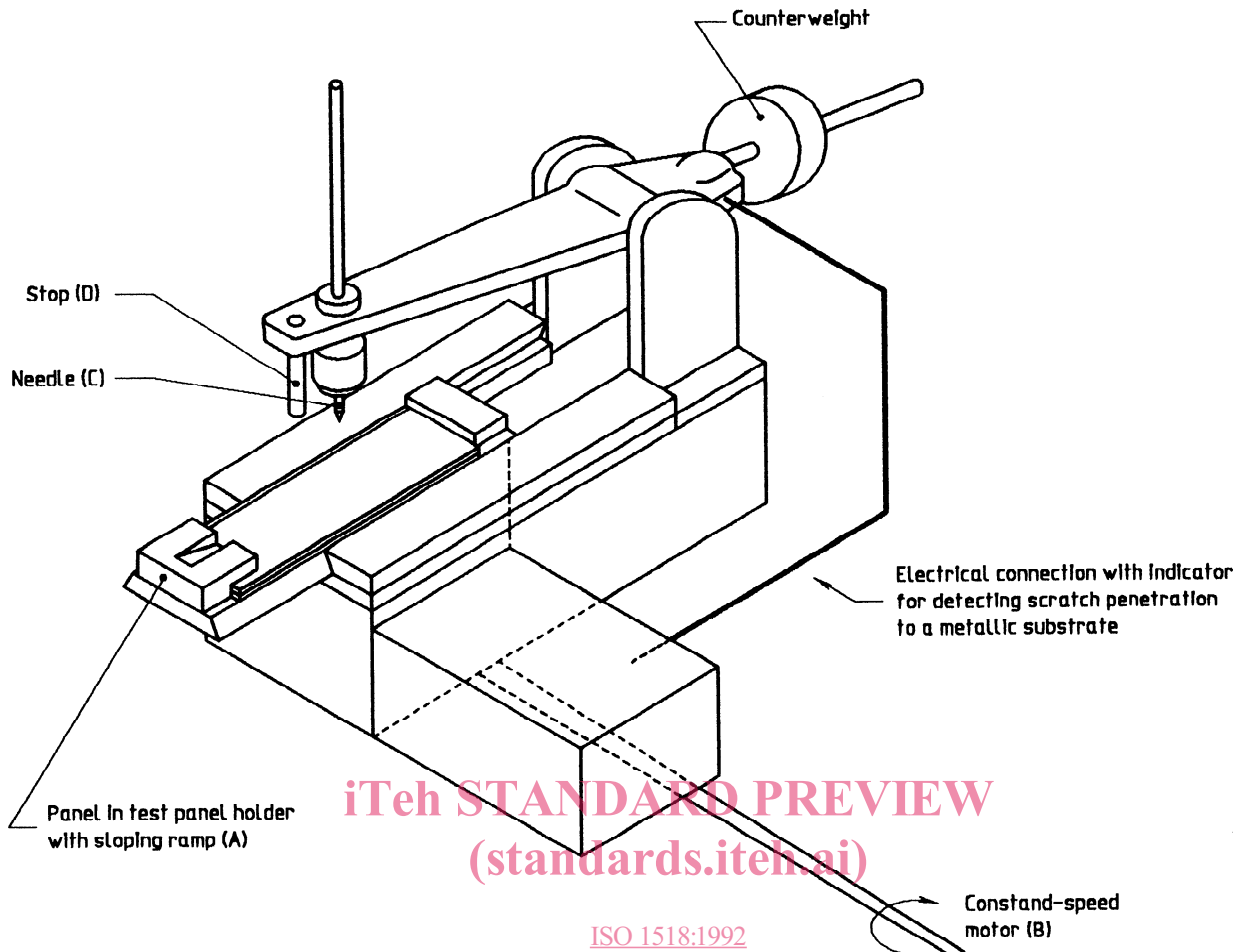
For any particular application, the test method specified in this International Standard needs to be completed by supplementary information. The items of supplementary information are given in annex A.

4 Apparatus

4.1 **Scratch apparatus**, the principle of which is illustrated in figure 1; other arrangements which give a similar performance can be used, however. This apparatus consists essentially of a horizontally sliding test panel holder (A) driven by a constant-speed motor (B) at a rate of 30 mm/s to 40 mm/s beneath the point of a scratching needle (C), which is perpendicular to the test panel. The needle is fixed in a chuck, directly above which is a holder capable of carrying weights up to a mass of 2 kg. The maximum load for which the apparatus is designed shall be marked on the test apparatus.

1) To be published. (Revision of ISO 1513:1980)

2) To be published. (Revision of ISO 1514:1984)



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Figure 1 — Scratch apparatus

The apparatus is adjusted so that the needle comes smoothly into contact with the film, i.e. before the stop (D) reaches the bottom of the sloping ramp, to form a straight scratch not less than 60 mm in length. A ramp with an angle of 10° to 15° to the horizontal has been found to be satisfactory. The panel holder can be designed to allow a lateral movement of test pieces so that more than one scratch test can be carried out on the same test piece.

NOTE 1 Apparatus is now becoming available which will permit a scratch test to be conducted under continuously increasing load.

4.2 Indicating device, based on electrical contact between the needle and the metallic substrate to show when the paint film has been penetrated.

NOTE 2 This device is not suitable for paints containing electrically conducting pigments, or if the substrate is non-metallic, or if penetration to an intermediate non-conducting coat is required.

4.3 Needle, having a hard hemispherical tip of 1 mm diameter. The hemispherical tip shall be firmly attached and the exposed part shall be free from any contaminants.

NOTE 3 Details about the tip and the needle are given in annex B.

5 Sampling

Take a representative sample of the product to be tested (or of each product in the case of a multi-coat system), as described in ISO 1512.

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

6 Test panels

6.1 Substrate

Unless otherwise agreed, the substrate shall comply with the requirements of ISO 1514 for burnished

tinplate, burnished steel or hard aluminium prepared by acid chromating.

The test panels may be cut to fit the apparatus after coating the substrate and drying, provided no distortion occurs.

6.2 Preparation and coating

Unless otherwise specified, prepare each test panel in accordance with ISO 1514 and then coat it by the specified method with the product or system under test. If the product under test is applied by brushing, any brush marks shall be parallel to the direction of the scratch on the panel.

NOTE 4 Poorer precision is often obtained if the coating has been applied by brush.

6.3 Drying and conditioning

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

6.4 Thickness of coating

Determine the thickness, in micrometres, of the dried coating by one of the procedures specified in ISO 2808.

7 Procedure

7.1 Test conditions

Carry out the test at (23 ± 2) °C and a relative humidity of (50 ± 5) %, unless otherwise agreed (see also ISO 3270).

Conduct the test on a bench free from vibrations.

7.2 Procedure for a single specified load ("pass/fail" test)

7.2.1 Examine a needle (4.3) under $\times 30$ magnification to check that the hard tip is smooth, hemispherical and free from contamination.

7.2.2 Fix the needle in the chuck so that, when in position on the test panel, the needle will be perpendicular to the panel holder. Balance the needle holder arm by means of the adjustable counterweight. Ensure that the indicating device (4.2), if used, is operational by contacting the needle with the panel holder.

7.2.3 Clamp the test panel, with the coating under test uppermost, to the panel holder of the apparatus, with the longer side of the panel parallel to the direction in which the scratch will be made.

7.2.4 Place weights on the holder above the needle to obtain the specified load.

7.2.5 Start the motor of the apparatus and allow the scratch to be made on the coating. Observe the indicating device during the test, if appropriate, to determine whether electrical contact between the needle and the panel occurs.

7.2.6 Remove the panel and examine the scratch to see if the coating has been penetrated to the extent specified. If, by agreement between the interested parties, the scratch is observed under suitable magnification, state the degree of magnification in the test report.

7.2.7 The sequence of operations shall be carried out three times on each of two test panels. If on none of the six test surfaces the coating has been penetrated beyond the performance required under the specified conditions, report the result as "pass". If the coating has been penetrated beyond the performance required on one or more of the six test surfaces, report the result as "fail".

7.3 Procedure for determination of minimum load to cause penetration

Carry out the procedure given in 7.2.1 to 7.2.6, using a different part of the test panel for each scratch, starting at a load somewhat less than that expected to cause penetration of the coating and successively increasing the mass on the needle by suitable increments (for example masses of 50 g), until the coating is penetrated. Record the minimum load at which the needle penetrates the coating to the extent specified. Repeat the procedure on a further two panels. Report the lowest result of the three determinations.

8 Precision

The repeatability of results by the "pass/fail" test (7.2) will usually be ± 10 % of the load.

NOTE 5 The precision of the result is strongly dependent on the (uniformity of the) film thickness of the coating.

9 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 International Standard (ISO 1518);
- 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 data referred to in c) above;
- e) the results of the test:
 - either, for each determination, whether or not the coating was penetrated under the specified conditions (pass/fail),
 - or the minimum load at which the needle penetrated the coating;
- f) any deviation from the test method specified;
- g) the date(s) of the test.

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Annex A (normative)

Required supplementary information

The items of supplementary information listed in this annex shall be supplied as appropriate to enable the method to be carried out.

The information required 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.

- | | |
|---|--|
| <ul style="list-style-type: none"> a) Material (including thickness) and surface preparation of the substrate. b) Method of application of the test coating to the substrate, including duration and conditions of drying between coats in the case of a multi-coat system. | <ul style="list-style-type: none"> c) Duration and conditions of drying (or stoving) the coat, and conditions of ageing, if applicable, before testing. d) 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. e) Temperature and humidity for the test, if different from those specified in 7.1 (see ISO 3270). f) Procedure to be carried out (see 1.2). g) Specified load to be applied to the needle during the test, if applicable. h) Performance required of the test coating in terms of penetration by the needle (see 1.1). |
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Annex B (informative)

Procedure found to be convenient for manufacture and re-tipping of scratch test needles

B.1 Manufacture of new needles

B.1.1 Fix a batch of shanks in the vertical position with the dimpled end uppermost by inserting them in a tray made from perforated sheet metal.

B.1.2 Place a very small quantity of a suitable solder paste on the end of each shank, and then put a steel ball in position, relying on the solder paste to hold the ball in position at this stage.

NOTE 6 The amount of solder paste to be used is judged by experience; insufficient will not make a firm soldered joint and too much will lead to more or less complete envelopment of the steel ball.

B.1.3 Place the tray of shanks in an oven or muffle furnace adjusted to a temperature of 210 °C to 220 °C for about 5 min to melt the solder and thus secure the ball in the dimple at the end of the shank.

B.1.4 Remove the needles from the source of heat, allow to cool, and wipe each ball to remove flux residues.

B.1.5 Check that the ball is securely fixed and that there is no solder on the part of the ball which will be used to make the scratch.

B.2 Re-tipping of needles

B.2.1 Fix the needles in a tray made from perforated sheet metal as described in B.1.1 above.

B.2.2 Place the tray of needles in an oven or muffle furnace adjusted to a temperature of 210 °C to 220 °C and, as soon as the solder has softened, remove the tray and brush the end of the needles with a clean brush in order to dislodge the steel balls.

B.2.3 When the shanks have cooled, proceed as described in B.1.2 to B.1.5.

B.3 Guidance on tip material

The following tips are in common use:

a) Steel balls

Depending on the circumstances, this type of tip may show signs of early wear. In view of the ease with which needles with steel balls can be made, it is recommended that they be used once only and then re-tipped.

b) Tungsten carbide tips

These tips last much longer than steel tips and can be obtained commercially.

c) Ruby tips

These (ceramic) tips last a very long time. The tips have to be attached to the shank by glueing rather than by soldering and can be obtained commercially.

In all cases, it is important that a suitable steel shank is used which will hold the tip securely in the correct position. An example of a suitable shank is given in figure B.1.

Dimensions in millimetres

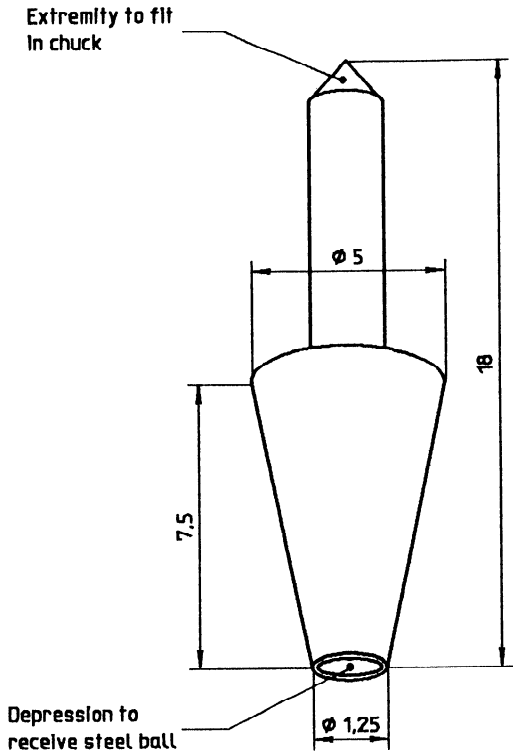


Figure B.1 — Suitable shank for scratch test tip
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