INTERNATIONAL STANDARD

ISO 4623-1

Second edition
2018-10

Paints and varnishes — Determination of resistance to filiform corrosion —

Part 1: Steel substrates

Peintures et vernis — Détermination de la résistance à la corrosion filiforme —

Partie 1: Subjectiles en acier

Reference number
ISO 4623-1:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 4623-1:2000), which has been technically revised. The main changes compared to the previous edition are as follows:

a) the text has been aligned with ISO 4623-2;

b) the introduction of ISO 4623-2 has been copied;

c) the definition of filiform corrosion has been aligned with ISO 4623-2;

d) in 10.2 a reference to ISO 17872 for the cutting tool has been added;

e) in 10.3.3 the time of exposure of the test panels to neutral salt fog has been shortened from 24 h to 4 h;

f) the supplementary test conditions previously in Annex A have been integrated into the test report;

g) the text has been editorially revised and the normative references have been updated.

A list of all parts in the ISO 4623 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A scribe mark cut through a coating of paints or varnishes on metal can give rise to various types of corrosion, such as blistering of the coating, corrosion of the metal under the coating, as well as filiform corrosion. Filiform corrosion tends to develop under specific conditions of temperature and relative humidity and when traces of acids, bases, or salts are present either under the paint coating or at breaks in the coating. These conditions are often found in marine and/or industrial environments. A certain amount of under-corrosion of the coating, starting from the scribe mark, will always occur. Filiform corrosion, however, is considered to be present only if the typical pattern in the form of threads is obvious.

Paints and varnishes — Determination of resistance to filiform corrosion —

Part 1:
Steel substrates

1 Scope

This document describes a test procedure for assessing the protective action of coatings of paints or varnishes on steel against filiform corrosion arising from a scribed mark cut through the coating.

It is only suitable for assessing the performance of the coating/substrate combination tested. It is not suitable for predicting the performance of the coating on different substrates.

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 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*[1)]

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

ISO 4618, *Paints and varnishes — Terms and definitions*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

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

3.1
filiform corrosion
type of corrosion proceeding under a coat of paint, varnish, or related product, in the form of threads, generally starting from bare edges or from local damage to the coating

Note 1 to entry: Usually the threads are irregular in length and direction of growth, but they can also be nearly parallel and of approximately equal length. They usually follow the extrusion direction and do not cross over one another. They need to be initiated by aggressive ions.

1) Under preparation. Stage at the time of publication ISO/DIS 2808:2018.

4 Principle

A coated test panel is scribed in a defined way. A small amount of sodium chloride is introduced into the scribed mark, either by dipping the panel in a solution of the salt or by exposure to salt fog. The panel is then exposed in a test cabinet at 40 °C and a relative humidity of 80 %. The effects of exposure are evaluated by criteria agreed in advance between the interested parties, these criteria either being of a subjective nature or as given in ISO 4628-10.

5 Limitations

Temperature and humidity are important parameters affecting test results. Deviations from the requirements specified can lead to results that are not comparable. However, the interested parties may agree upon alternative parameters and these parameters shall be reported.

6 Sampling

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

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

7 Apparatus

Ordinary laboratory apparatus and glassware, together with the following:

7.1 Test cabinet, capable of being maintained at (40 ± 2) °C and a relative humidity of (80 ± 5) %, and having provision for placing or hanging the test panels in an approximately vertical position so that the distance between the faces of adjacent panels is at least 20 mm.

NOTE If a cabinet with automatic humidity control is not available, the specified humidity can be obtained by means of a saturated aqueous solution of ammonium sulfate. This gives a constant relative humidity of 79 % at 40 °C (see ISO 483). Further details and guidance are given in Annex A.

7.2 Ruler, accurate to 1 mm.

8 Reagents

8.1 Sodium chloride solution (for the dipping technique).

Unless otherwise specified, prepare the solution by dissolving 1 g of analytical grade sodium chloride in 1 l of distilled or demineralized water of at least grade 3 as defined in ISO 3696. Place the solution in a vessel suitable for complete immersion of the test panel (see 9.1 and 10.3.2).

9 Test panels

9.1 Material and dimensions

The test panels shall be of ground steel complying with the requirements of ISO 1514 and of minimum dimensions 150 mm × 75 mm × 0,3 mm.

9.2 Preparation and coating

Prepare the test panels by grinding as described in ISO 1514, unless otherwise specified, and then coat them by the specified method with the product or system under test.

The back and edges of the panel shall be coated with the product or system under test.

If the coating on the back and edges of the panel differs from that of the product under test, it shall have a corrosion resistance greater than that of the product under test.

9.3 Drying and conditioning

Dry and age (if applicable) each coated test panel for the specified time under the specified conditions, condition it at the standard conditions defined in ISO 3270 for at least 16 h, with free circulation of air and without exposing it to direct sunlight. The test procedure shall then be carried out as soon as possible.

9.4 Thickness of coating

Determine the thickness, in micrometres, of the dried coating by one of the non-destructive procedures described in ISO 2808.

10 Procedure

10.1 Number of determinations

Carry out all tests in duplicate unless otherwise agreed.

10.2 Scribing the test panels

Unless otherwise specified, make two scribed marks at least 30 mm long on each test panel using a suitable tool (see note). Make the scribed marks using one of the scribing tools described in ISO 17872 perpendicular to each other and arranged in such a way that their distance from each other or from the edge of the panel is not less than 20 mm (see Figure 1). Ensure that the cutting edge completely penetrates the coating. Remove the debris from the scribed marks. Ensure that the metal is clearly visible over the entire length of the scribed marks by use of a magnifying glass of ×10 magnification.

NOTE It has been found that the use of a mechanical scribing device gives a better scribe and has better repeatability than a hand-held scribing tool. The precise nature of the scribing tool is not critical provided that it produces a thin line with well-defined edges. A sharp blade such as the single-blade cutting tool defined in ISO 2409 has been found to be suitable.

Dimensions in millimetres

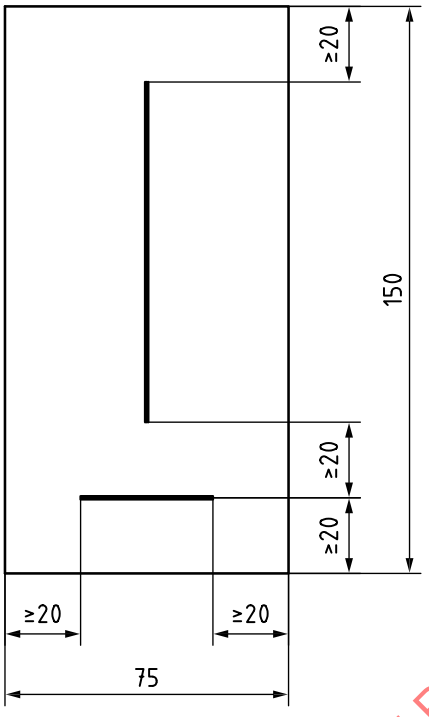

Figure 1 — Arrangement of scribes on test panel

10.3 Testing

10.3.1 General

Two alternative procedures are available, based on initiation by dipping in sodium chloride solution or by exposure to salt fog. The dipping technique is generally preferable for air-drying and low-durability materials. For high-durability systems such as automobile finishes applied to phosphated steel, the dipping technique may not produce filiform corrosion and for these systems it is preferable to adopt the salt fog technique. In such cases, the necessary period of exposure to salt fog will depend on the durability of the material under test but should rarely need to exceed 4 h. It should be noted that salt fog exposure is not normally suitable for low-durability materials since with such systems it commonly produces heavy general corrosion spreading from the scribed marks and the filiform corrosion is suppressed.

10.3.2 Dipping technique

Immerse the scribed test panels for 30 s to 60 s in the sodium chloride solution (8.1).

Take the panels out of the solution and remove any drops of liquid remaining on the surface, taking care not to remove the solution from the scribed marks.

Place the panels in the test cabinet (7.1) maintained at (40 ± 2) °C and a relative humidity of (80 ± 5) %. Repeat the immersion procedure, as specified above, every 3 or 4 days until the end of the specified test period.

10.3.3 Salt fog technique

Expose the scribed test panels to neutral salt fog as described in ISO 9227 for the specified period.

Take the panels out of the salt fog cabinet and remove any drops of liquid remaining on the surface, taking care not to remove the solution from the scribed marks.

Place the panels in the test cabinet (7.1) maintained at (40 ± 2) °C and a relative humidity of (80 ± 5) % for the specified test period.

10.4 Inspection of test panels

Where appropriate, at the specified intervals of re-immersion and on completion of the test, inspect the test panels for filiform corrosion (see ISO 4628-10). Do not allow the test panels to become completely dry at any time during the test period or during inspection, as this may affect the development of the filiform corrosion.

11 Evaluation of the degree of filiform corrosion

Evaluation of the degree of filiform corrosion is normally carried out subjectively and reported in general terms such as “slight”, “moderate” or “severe” as in ISO 4628-10. If specified, using the ruler (7.2) determine the maximum extent of the filiform corrosion as described in ISO 4628-10.

If specified, determine corrosion other than filiform about the scribe marks as described in ISO 4628-8.

If specified, remove the coating with a non-corrosive paint remover and re-examine the substrate.

Photographs of the test panels at the conclusion of the test may be useful in assessing the extent of filiform corrosion.

12 Precision

No relevant precision data are currently available.

13 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 document, i.e. ISO 4623-1:2018;

c) details of the preparation of the test panels, including

   1) the material, the thickness, and the surface preparation of the substrate (see 9.1 and 9.2),

   2) the method of application of the coating material to the substrate, including the duration and conditions of drying between coats in the case of a multi-coat system and details on sealing of the edges and backs of the test panels (if required) (see 9.2),

   3) the duration and conditions of drying and ageing (if applicable) of the coating before testing (see 9.3),

   4) the thickness, in micrometres, of the dry coating and the method of measurement used in ISO 2808, and whether it is a single coating or a multi-coat system (see 9.4);

d) complete details of the scribing tool and scribe mark made (see 10.2);

e) the method to initiate corrosion, including the period of exposure (see 10.3);

f) the duration of the test (see 10.3.2 and 10.3.3);

g) the results of the test as indicated in Clause 11;

h) any deviation, by agreement or otherwise, from the test procedure described;

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

j) the date of the test.