INTERNATIONAL STANDARD

ISO 15710

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Paints and varnishes — Corrosion testing by alternate immersion in and removal from a buffered sodium chloride solution

Peintures et vernis — Essais de corrosion par immersions-émersions alternées dans une solution tamponnée de chlorure de sodium

Reference number
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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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15710 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

Annex A forms a normative part of this International Standard.

Introduction

Coatings of paints, varnishes and similar materials are exposed to alternating wet and dry (humid) cyclic conditions using a specified salt solution in a cabinet in order to simulate, in the laboratory, processes occurring in aggressive outdoor conditions. Generally, correlations between such outdoor weathering and laboratory testing cannot be expected because of the large number of factors influencing the breakdown process. Correlation can only be expected if the effect on the coating of important parameters (e.g. nature of the salt, spectral distribution of the incident radiation in the relevant photochemical region, temperature of the specimen, type and cycle of wetting and relative humidity) is known. In contrast to outdoor weathering, laboratory testing in a cabinet is performed under a reduced number of variables which can be controlled and therefore the effects are more reproducible. The method may also give a means of checking that the quality of a paint or paint system is being maintained.

The method has been found to be useful in comparing the alternate immersion/emersion salt solution resistance of different coatings. It is most useful in providing relevant ratings for a series of coated panels exhibiting significant differences in alternate immersion/emersion salt solution resistance.

This method is intended principally for testing paints used in aerospace applications. The types of conditions specified may occur as an aircraft flies through a variety of environments including sudden changes in temperature and pressure. The results of the test specified in this International Standard will give an indication of the ability of a paint system to withstand these corrosive atmospheres.

Paints and varnishes — Corrosion testing by alternate immersion in and removal from a buffered sodium chloride solution

1 Scope

This International Standard describes a test procedure for assessing the protection offered by coatings of paints or varnishes on aluminium and aluminium alloys against corrosion arising against a scribe mark cut through the coating, when the coated panel is subjected to a test regime of alternate immersion in and removal from a dilute salt solution.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 4628-1, *Paints and varnishes — Evaluation of degradation of coatings — Designation of intensity, quantity and size of common types of defect — Part 1: General introduction and designation system*

ISO 4628-8, *Paints and varnishes — Evaluation of degradation of coatings — Designation of intensity, quantity and size of common types of defect — Part 8: Evaluation of corrosion around a scribe*

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

3 Principle

A coated test panel is scribed in a defined way. The panel is then exposed in a test chamber at 35 °C, where it is alternately immersed in salt solution and then removed and exposed at a relative humidity greater than 80 %. The effects of this test being then evaluated by criteria agreed in advance between the interested parties, these criteria usually being of a subjective nature.

4 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.

5 Initial test solution

Prepare the initial test solution by dissolving the following salts in water of at least grade 3 purity in accordance with ISO 3696, to produce the required concentration given in Table 1.

Table 1 — Salt solution concentration

Salt	Concentration g/l
Sodium chloride	30
Disodium hydrogen orthophosphate	0,19
Boric acid	1,25

The salts shall be white and shall comply with the purity requirements given in Table 2.

Table 2 — Salt purity

Impurity	Maximum mass percentage of impurity (calculated on the dry salt) %
Total	0,5
Iodide	0,1
Copper	0,001
Nickel	0,001

The pH of the initial test solution shall be in the range ($8 \pm 0{,}2$). The pH determination shall be based on electrometric measurement at 25 °C. Any necessary correction shall be made by adding hydrochloric acid or sodium carbonate solution (of purity complying with Table 2) of appropriate concentration.

6 Apparatus

Ordinary laboratory apparatus and glassware, together with the following:

6.1 Test cabinet, capable of being maintained at (35 ± 2) °C and a relative humidity of > 80 % unless otherwise agreed, which will hold the individual salt solution tanks (6.2). The cabinet shall also have provision for hanging the test panels in a vertical position and raising and lowering them automatically so that they will be fully immersed for 2 h in the individual salt solution tanks and then removed from the salt solution for 2 h, the cycle to be repeated until the end of the test period, unless otherwise specified.

6.2 Individual salt solution tanks, made of suitable material and capable of holding at least 4 ml of test solution per cm^2 of test panel. When a panel is immersed, it shall be at least 20 mm from the edge of the container.

When calculating the test panel area, the backs of the panels shall also be taken into account.

7 Sampling

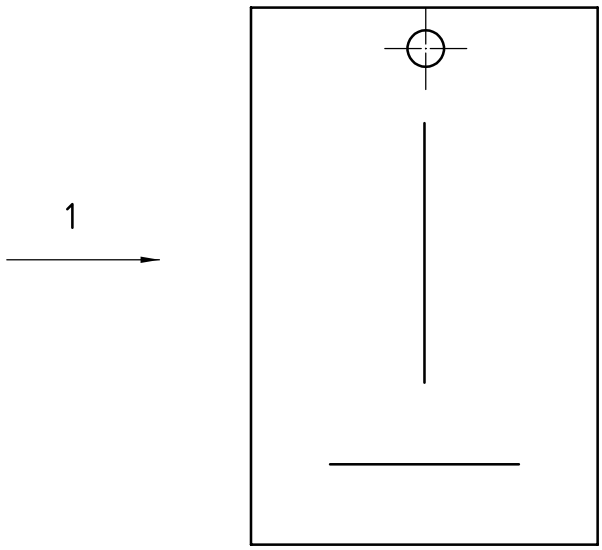
Take a representative sample of the product to be tested (or of each product in the case of a multi-coat system), as described in ISO 15528.

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

8 Test panels

8.1 Material and dimensions

Unless otherwise specified or agreed, the test panels shall be of aluminium complying with ISO 1514, and be of approximate minimum dimensions 100 mm × 40 mm × 0,8 mm with a small hole at one end. The short dimension shall be in the direction of rolling (see Figure 1).



Key

1 Direction of rolling

Figure 1 — Positions of scribe marks

8.2 Preparation and coating of panels

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.

Unless otherwise specified, 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 not contain corrosion-inhibiting ingredients (i.e. it shall be an inert coating) and it shall have a corrosion resistance greater than that of the product under test.

8.3 Drying and conditioning

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

8.4 Dry film thickness

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

8.5 Preparation of scribe marks

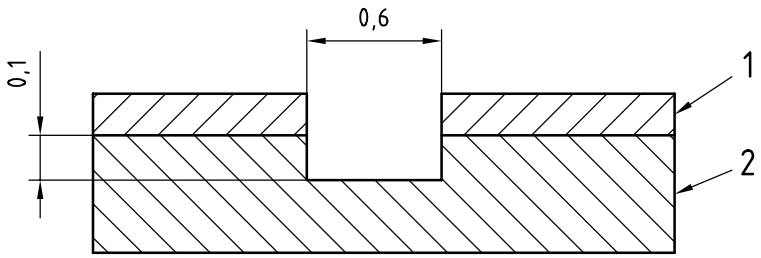
Unless otherwise specified, make two scribe marks at least 20 mm long on each test panel, with the longer scribe mark perpendicular to the direction of rolling. The scribe marks shall be of width (0,6 ± 0,1) mm and of depth 0,05 mm to 0,1 mm into the substrate. Make the scribe marks perpendicular to 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 10 mm (see Figure 1). Remove the debris from the scribe marks. Ensure that the metal is clearly visible over the entire length of the scribe marks by use of a magnifying glass of ×10 magnification.

If the substrate has surface cladding then the scribe mark shall penetrate the cladding layer by 0,05 mm to 0,1 mm.

Different scribing devices produce different amounts of corrosion in the scribe; it is therefore important that the manner of scribing is included in the test report.

An example of a scribe mark is shown in Figure 2.

Dimensions in millimetres



Key

1 Paint film

2 Substrate

Figure 2 — Example of a scribe mark

9 Procedure

Into each individual salt solution container (see 6.2), place at least 4 ml of test solution per cm^2 of test panel surface area and mark the outside of the container with the solution level. If the back of the panel is painted with an inert coating (see 8.2) this area need not be taken into account in calculating the surface area. Tie the test panels to the lifting device using nylon (or other non-corrosive or non-metallic) thread, and adjust the length of the thread such that the lifting device will fully immerse the panels in the test solution at least 20 mm from each side/bottom of the container and, when raised, the panels will be at least 20 mm above the test solution.

NOTE It is recommended that a control specimen of a paint with known durability be included with each series of test panels.

Operate the test cabinet at the temperature and relative humidity given in 6.1 unless otherwise specified. The intervals of immersion and emersion shall both be set to 2 h unless otherwise specified, until the end of the specified test period [see annex A, item f)].

At intervals of approximately 2 days, make up the solution in each individual container to the mark made previously, using water of at least grade 3 purity in accordance with ISO 3696.

Renew the test solution 3 days and 7 days after the start of the exposure, and then every 7 days thereafter for the duration of the test period.

It is permissible to test two panels in the same salt solution tank but only if they are exact duplicates, the correct volume of test solution to panel area condition can be met and they are separated by at least 10 mm.

10 Inspection of test panels

Where appropriate, at the specified intervals, inspect the test panels for corrosion in accordance with ISO 4628-1 and ISO 4628-8. During inspection, the panels shall not be out of the cabinet for more than 30 min, as this may affect the development of the corrosion.

At the end of the specified test period, remove the panels from the cabinet and rinse with water of at least grade 3 purity in accordance with ISO 3696 to remove residues of salt solution from the surface, and dry with absorbent paper. Immediately examine the test surfaces for signs of deterioration in accordance with ISO 4628-1 and ISO 4628-8.

If required, keep the panels in a standard atmosphere as defined in ISO 3270 for the specified period and examine the test surfaces for deterioration.

If it is required to examine the substrate for signs of attack, remove the coating by means of a non-corrosive paint remover, rinse with water, dry, and immediately inspect the substrate unless otherwise specified [see annex A, item g)].

11 Precision

No relevant precision data are currently available.

ISO/TC 35 intends to obtain precision data for all relevant standards, including ISO 15710. When precision data are available, they will be incorporated in this document.

12 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 15710);

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) above;

e) the intervals of immersion in and removal from the salt solution, the intervals of inspection, and the duration of the test;

f) the scribe instrument used;

g) the length, cross-sectional dimensions and location of each scribe mark;

h) the results of the test in terms of the stated requirements;

i) any deviations, by agreement or otherwise, from the test procedure specified;

j) the date of the test.

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.

a) Material, thickness and surface preparation of substrate (see 8.1 and 8.2).

b) Method of application of test coating and details of sealing of edges and backs of the test panels (see 8.2).

c) Thickness, in micrometres, of the dry coating, including method of measurement in accordance with ISO 2808 and whether it is a single coating or a multicoat system (see 8.4).

d) Duration and conditions of drying (or stoving) and ageing, if specified, of the coated test panels before testing (see 8.3).

e) Type of scribe instrument used, and profile and dimensions of scribe mark produced (see 8.5).

f) Duration of test (see clause 9).

g) How inspection of the test coating and, if required, the substrate is to be made and what characteristics are to be considered in evaluating their corrosion resistance properties (see clause 10).

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