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# International Standard



# 7253

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Paints and varnishes — Determination of resistance to neutral salt spray

*Peintures et vernis — Détermination de la résistance au brouillard salin neutre*

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 7253 was developed by Technical Committee ISO/TC 35, *Paints and varnishes*, and was circulated to the member bodies in July 1982.

It has been approved by the member bodies of the following countries :

Australia	India	Portugal
Austria	Iran	Romania
Belgium	Iraq	South Africa, Rep. of
Canada	Israel	Sri Lanka
China	Italy	Sweden
Czechoslovakia	Jamaica	Switzerland
Egypt, Arab Rep. of	Kenya	Thailand
France	Korea, Rep. of	United Kingdom
Germany, F. R.	Netherlands	USSR
Hungary	Poland	

No member body expressed disapproval of the document.

# Paints and varnishes — Determination of resistance to neutral salt spray

## 0 Introduction

There is seldom a direct relationship between the resistance of organic coatings to the action of salt spray and the resistance to corrosion in other environments. This is because the effect of each of the several factors influencing the progress of corrosion, such as the formation of protective films, varies greatly with the conditions encountered. Therefore, the results obtained in the test should not be regarded as a direct guide to the corrosion resistance of the tested coatings in all environments where these coatings may be used. Also, performance of different coatings in the test should not be taken as a direct guide to the relative corrosion resistance of these coatings in service even under the severe conditions of marine exposure. Nevertheless, the method described gives a means of checking that the quality of a paint or paint system is being maintained.

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

For any particular application, the method of test described in this International Standard requires to be completed by the following supplementary information. This information shall be derived, partly or totally, from the (inter)national standard or other document for the product under test or, where appropriate, shall be the subject of agreement between the interested parties.

- a) Material and surface preparation of the substrate.
- b) Method of application of the test coating to the substrate.
- c) Duration and conditions of drying the coat (or conditions of stoving and 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) Whether a scratch is to be made before exposure and, if so, its nature and position.
- f) Duration of the test.
- g) How inspection of the test coating is to be made and what characteristics are to be considered in evaluating its resistance properties.

NOTE — The apparatus and operating conditions described in this International Standard comply, but do not necessarily equate, with ISO 3768. The minimum size of cabinet permissible for testing paints, varnishes and related products is greater (see 4.1).

## 1 Scope and field of application

This International Standard describes a method for determining the resistance of coatings to the neutral salt spray test performed in accordance with the requirements of coating or product specifications.

## 2 References

- ISO 1512, *Paints and varnishes — Sampling.*
- ISO 1513, *Paints and varnishes — Examination and preparation of samples for testing.*
- ISO 1514, *Paints and varnishes — Standard panels for testing.*
- ISO 2409, *Paints and varnishes — Cross-cut test.*
- 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 3768, *Metallic coatings — Neutral salt spray test (NSS test).*

## 3 Test solution

**3.1** The test solution shall be prepared by dissolving sodium chloride in distilled or demineralized water to produce a concentration of  $50 \pm 5$  g/l. The sodium chloride shall be white, of minimum assay 99,6 % (m/m), and substantially free from copper and nickel; it shall contain not more than 0,1 % (m/m) of sodium iodide. If the pH of the solution is outside the range 6,0 to 7,0, the presence of undesirable impurities in the salt or the water or both shall be investigated.

**3.2** The pH of the salt solution (3.1) shall be adjusted so that the pH of sprayed solution collected within the test cabinet (see clause 4) shall be between 6,5 and 7,2. Control of the pH shall

be based on electrometric measurement at 25 °C but a short-range pH paper which can be read in increments of 0,3 pH unit or less and which has been calibrated against electrometric measurements may be used in routine checks. Any necessary correction shall be made by additions of solutions of hydrochloric acid or sodium hydroxide of analytical grade.

NOTE — Attention is drawn to the possible changes in pH resulting from loss of carbon dioxide from the solution when it is sprayed. Such changes may be avoided by reducing the carbon dioxide content of the solution by, for example, heating it to a temperature above 35 °C before it is placed in the apparatus or by making the solution from freshly boiled water.

**3.3** The solution shall be filtered before it is placed in the reservoir of the apparatus, in order to remove any solid matter which might block the apertures of the spraying device.

## 4 Apparatus

The apparatus shall comprise the following components :

**4.1 A spray cabinet**, made of, or lined with, material resistant to corrosion by the sprayed solution. The cabinet shall have a capacity of not less than 0,4 m<sup>3</sup> since, with smaller volumes, difficulties are experienced in ensuring even distribution of spray. The ceiling or cover shall be sloped upwards at an angle of not less than 25° to the horizontal so that drops of solution which accumulate on it do not fall on the panels being tested.

The size and shape of the cabinet shall be such that the quantity of solution collected in the collecting devices (4.4) is within the limits stated in 8.2.

Cabinets with a volume greater than 2 m<sup>3</sup> will be difficult to operated unless careful consideration is given to their design and construction. Factors which should be taken into consideration are given in the annex.

**4.2 Means of supply and controlling heat**, adequate to maintain the cabinet and its contents at the specified temperature (see 8.1). The temperature shall be controlled by a thermostat element placed either within the cabinet at least 100 mm from the walls or in a water jacket on the cabinet. In either case a thermometer, capable of being read from the outside, shall be placed wholly within the cabinet at least 100 mm from the walls or cover.

**4.3 Means for spraying the salt solution**, comprising a supply of clean air of controlled pressure and humidity, a reservoir to contain the solution to be sprayed and one or more atomizers made of material resistant to the solution.

The compressed air supply to each atomizer shall be passed through a filter to remove all traces of oil or solid matter and shall be at a pressure of 70 to 170 kPa\*. In order to prevent evaporation of the sprayed droplets, the air shall be humidified before entering each atomizer by passage through a saturation

tower containing water at a temperature several degrees Celsius higher than that of the cabinet. The appropriate temperature depends on the pressure used and on the type of atomizer nozzle and shall be adjusted so that the rate of collection of spray in the cabinet and the concentration of the collected spray are kept within the specified limits (see 8.2).

The reservoir to contain the solution to be sprayed shall be a tank made of material resistant to the solution and shall be provided with means of maintaining a constant level of solution in the reservoir.

The atomizers shall be made of inert material, for example, glass or plastics material. Baffles may be used to prevent direct impingement of spray on the test specimens and the use of adjustable baffles is helpful in obtaining uniform distribution of spray throughout the cabinet.

NOTE — In order to avoid a build up of pressure within the cabinet (4.1), it is common practice to vent the apparatus to the atmosphere outside the laboratory.

**4.4 Collecting devices**, at least two of glass or other chemically inert material (see note 1). The collecting devices shall be placed in the zone of the cabinet where the test specimens are placed, one close to an inlet of spray and one remote from an inlet. They shall be so placed that only spray and not liquid falling from test panels or from parts of the cabinet is collected.

### NOTES

1 Glass funnels with the stems inserted into graduated cylinders have been found to be suitable collecting devices. Funnels with a diameter of 100 mm have a collecting area of approximately 80 cm<sup>2</sup>.

2 If two or more atomizers are used, the number of collecting devices should be at least twice the number of atomizers.

**4.5** If the equipment has been used for a spray test or for any other purpose with a solution differing from that specified for this test, it shall be thoroughly cleaned before use.

## 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 the sample for testing as described in ISO 1513.

## 6 Test panels

### 6.1 Material and dimensions

Unless otherwise specified or agreed, the test panels shall be of burnished steel complying with the requirements of ISO 1514 and approximately 150 mm × 100 mm.

\* 1 kPa = 1 kN/m<sup>2</sup> (= 0,01 bar)

## 6.2 Preparation and coating

Prepare the test panels in accordance with 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, unless otherwise specified.

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

## 6.3 Drying and conditioning

Dry (or stove and age) the coated test panels for the specified time and under the specified conditions. Unless otherwise specified, condition them at  $23 \pm 2$  °C and a relative humidity of  $50 \pm 5$  % for a minimum of 16 h, with free circulation of air and without exposing them to direct sunlight. Then carry out the test procedure as soon as possible.

## 6.4 Thickness of coating

Determine the thickness, in micrometres, of the dry coating, by the method specified, using one of the non-destructive procedures described in ISO 2808.

## 6.5 Preparation of scratch

If specified, make a scratch or scribed mark through the coating to the substrate. Unless otherwise specified, use the single cutting tool described in ISO 2409 and locate the scratch at least 20 mm from any edge of the test panel.

## 7 Method of exposure of test panels

7.1 The panels shall be so placed in the cabinet that they are not in the direct line of travel of spray from the atomizer. Baffles may be used to prevent direct impact of the sprayed solution on the panels.

7.2 The angle at which each panel is exposed in the cabinet is very important. Each test surface shall be placed in the cabinet, facing upwards at an angle of  $20^\circ \pm 5^\circ$  to the vertical.

NOTE — By agreement between the interested parties, it is sometimes necessary to expose painted components of different shapes. When such tests are conducted it is of particular importance to expose the shaped components in their normal attitude in use. Within this restriction the component should be placed so as to minimize the disruption of flow. Furthermore, other test panels and components cannot be tested at the same time if the shape of the painted component interferes with the general direction of flow.

It should be noted that the degree of film breakdown with different aspects may vary and due consideration should be made in the interpretation of these results.

7.3 The panels shall be so arranged that they do not come into contact with one another or with the cabinet and that the surfaces to be tested are exposed to the spray only where it is settling freely. Panels should be placed preferably at one level

within the cabinet so that the solution cannot drip from panels or their supports at one level on to other panels placed below.

NOTE — It may be advantageous to alter the position of the panels periodically, for example at the inspection intervals (see clause 10). Any change, however, should be stated in the test report.

7.4 The support for the panels shall normally be racks made of inert non-metallic material such as glass, plastics or suitably coated wood. If, exceptionally, it is necessary to suspend test panels, the material used shall on no account be metallic and shall be synthetic fibre, cotton thread or other inert insulating material.

## 8 Operating conditions

8.1 The measured temperature inside the spray cabinet shall be  $35 \pm 2$  °C.

8.2 The solution collected in each of the collecting devices (4.4) shall have a sodium chloride concentration of  $50 \pm 10$  g/l and a pH of 6,5 to 7,2 (see 3.2).

The average rate of collection of solution in each device measured over a minimum period of 24 h shall be 1 to 2 ml/h for a horizontal collecting area of 80 cm<sup>2</sup>.

8.3 Test solution which has been sprayed shall not be re-used.

## 9 Procedure

Carry out the determination in duplicate, unless otherwise specified.

9.1 Set up the apparatus (clause 4) as described in clause 8.

9.2 Arrange the test panels in the cabinet (4.1) as described in clause 7.

9.3 Close the cabinet and start the flow of the test solution (clause 3) through the atomizers (4.3). Continuously spray throughout the prescribed test period, except for a short daily interruption (see clause 10) to inspect, re-arrange or remove test panels, to check and replenish the solution in the reservoir and to make necessary recordings as described in clause 8.

## 10 Examination of test panels

Periodic visual examination of the panels should be made, but the surfaces under test shall not be damaged. Each periodic examination shall not exceed 60 min in any 24 h period and should, whenever possible occur at the same time of day. The panels shall not be allowed to become dry. (See also the note to 7.3.)

At the end of the specified test period, remove the panels from the apparatus and rinse with clean water to remove residues of salt solution from the surface. Immediately examine the test

surfaces for signs of deterioration, for example blistering, staining, loss of adhesion, creep of corrosion from scratch (see clause 0, g)).

If required, keep the panels in the standard atmosphere in accordance with 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 the specified method.

## 11 Test report

The test report shall contain at least the following information :

- a) the type and identification of the product tested;
- b) a reference to this International Standard (ISO 7253);

c) the items of supplementary information referred to in the introduction to this International Standard;

d) a reference to the (inter)national standard, product specification or other document supplying the information referred to in c) above;

e) the duration of the test;

f) whether the position of the panels was changed (see the note to 7.3);

g) the results of the test;

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

j) the dates of the test.

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## Annex

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### Factors to be taken into account in the design and construction of salt spray cabinets greater than 2 m<sup>3</sup> in volume (see 4.1)

**A.1** The number and positioning of atomizers and baffles required to produce an even spray distribution within the limits specified in 8.2.

**A.2** The number of collecting devices required to monitor the spray as required in 4.4.

**A.3** The heating, insulation and means of temperature control required to produce a uniform temperature within the cabinet at all positions where test specimens are exposed.

**A.4** The design of the ceiling (for example a false ceiling) needed to prevent drops of solution falling onto the test panels if the size of the chamber does not allow an angle of 25° as required in 4.1.