

Corrosion tests in artificial atmospheres - Salt spray tests (ISO 9227:2012)

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NATIONAL FOREWORD

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Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 15.05.2012.	Date of Availability of the European standard is 15.05.2012.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

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ICS 77.060

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English Version

Corrosion tests in artificial atmospheres - Salt spray tests (ISO 9227:2012)

Essais de corrosion en atmosphères artificielles - Essais aux brouillards salins (ISO 9227:2012)

Korrosionsprüfungen in künstlichen Atmosphären - Salzsprühnebelprüfungen (ISO 9227:2012)

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Foreword

This document (EN ISO 9227:2012) has been prepared by Technical Committee ISO/TC 156 "Corrosion of metals and alloys" in collaboration with Technical Committee CEN/TC 139 "Paints and varnishes" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2012, and conflicting national standards shall be withdrawn at the latest by November 2012.

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Endorsement notice

The text of ISO 9227:2012 has been approved by CEN as a EN ISO 9227:2012 without any modification.

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Introduction

There is seldom a direct relation between resistance to the action of salt spray and resistance to corrosion in other media, because several factors influencing the progress of corrosion, such as the formation of protective films, vary greatly with the conditions encountered. Therefore, the test results should not be regarded as a direct guide to the corrosion resistance of the tested metallic materials in all environments where these materials might be used. Also, the performance of different materials during the test should not be taken as a direct guide to the corrosion resistance of these materials in service.

Nevertheless, the method described gives a means of checking that the comparative quality of a metallic material, with or without corrosion protection, is maintained.

Salt spray tests are generally suitable as corrosion protection tests for rapid analysis for discontinuities, pores and damage in organic and inorganic coatings. In addition, for quality control purposes, comparison can be made between specimens coated with the same coating. As comparative tests, however, salt spray tests are only suitable if the coatings are sufficiently similar in nature.

It is often not possible to use results gained from salt spray testing as a comparative guide to the long-term behaviour of different coating systems, since the corrosion stress during these tests differs significantly from the corrosion stresses encountered in practice.

Corrosion tests in artificial atmospheres — Salt spray tests

1 Scope

This International Standard specifies the apparatus, the reagents and the procedure to be used in conducting the neutral salt spray (NSS), acetic acid salt spray (AASS) and copper-accelerated acetic acid salt spray (CASS) tests for assessment of the corrosion resistance of metallic materials, with or without permanent or temporary corrosion protection.

It also describes the method employed to evaluate the corrosivity of the test-cabinet environment.

It does not specify the dimensions of test specimens, the exposure period to be used for a particular product, or the interpretation of results. Such details are provided in the appropriate product specifications.

The salt spray tests are particularly useful for detecting discontinuities, such as pores and other defects in certain metallic, organic, anodic oxide and conversion coatings.

The neutral salt spray test is the test method in which a 5 % sodium chloride solution in the pH range from 6,5 to 7,2 is atomized under a controlled environment. It particularly applies to:

- metals and their alloys,
- metallic coatings (anodic and cathodic),
- conversion coatings,
- anodic oxide coatings, and
- organic coatings on metallic materials.

The acetic acid salt spray test is the test method in which a 5 % sodium chloride solution with the addition of glacial acetic acid in the pH range from 3,1 to 3,3 is atomized under a controlled environment. It is especially useful for testing decorative coatings of copper + nickel + chromium, or nickel + chromium. It has also been found suitable for testing anodic coatings on aluminum.

The copper-accelerated acetic acid salt spray test is the test method in which a 5 % sodium chloride solution with the addition of copper chloride and glacial acetic acid in the pH range from 3,1 to 3,3 is atomized under a controlled environment. It is useful for testing decorative coatings of copper + nickel + chromium, or nickel + chromium. It has also been found suitable for testing anodic coatings on aluminum.

The salt spray methods are all suitable for checking that the comparative quality of a metallic material, with or without corrosion protection, is maintained. They are not intended to be used for comparative testing as a means of ranking different materials relative to each other with respect to corrosion resistance.

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 1514, *Paints and varnishes — Standard panels for testing*

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

ISO 3574, *Cold-reduced carbon steel sheet of commercial and drawing qualities*

ISO 8407, *Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens*

ISO 17872, *Paints and varnishes — Guidelines for the introduction of scribe marks through coatings on metallic panels for corrosion testing*

3 Test solutions

3.1 Preparation of the sodium chloride solution

Dissolve a sufficient mass of sodium chloride in distilled or deionized water with a conductivity not higher than 20 $\mu\text{S}/\text{cm}$ at $25\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$ to produce a concentration of $50\text{ g/l} \pm 5\text{ g/l}$. The sodium chloride concentration of the sprayed solution collected shall be $50\text{ g/l} \pm 5\text{ g/l}$. The specific gravity range for a $50\text{ g/l} \pm 5\text{ g/l}$ solution is 1,029 to 1,036 at $25\text{ }^\circ\text{C}$.

The sodium chloride shall contain less than 0,001 % mass fraction of copper and less than 0,001 % mass fraction of nickel, as determined by atomic absorption spectrophotometry or another analytical method of similar sensitivity. It shall not contain more than 0,1 % of a mass fraction of sodium iodide, or more than 0,5 % of a mass fraction of total impurities calculated for dry salt.

NOTE If the pH of the prepared solution at $25\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$ is outside the range 6,0 to 7,0, investigate the presence of undesirable impurities in the salt and/or the water.

3.2 pH adjustment

3.2.1 pH of the salt solution

Adjust the pH of the salt solution to the desired value on the basis of the pH of the sprayed solution collected.

3.2.2 NSS test

Adjust the pH of the salt solution (3.1) so that the pH of the sprayed solution collected within the test cabinet (4.2) is 6,5 to 7,2 at $25\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$. Check the pH using electrometric measurement or in routine checks, with a short-range pH paper, which can be read in increments of 0,3 pH units or less. Make any necessary corrections by adding hydrochloric acid, sodium hydroxide or sodium bicarbonate solution of analytical grade.

Possible changes in pH may result from loss of carbon dioxide from the solution when it is sprayed. Such changes can be avoided by reducing the carbon dioxide content of the solution by, for example, heating it to a temperature above $35\text{ }^\circ\text{C}$ before it is placed in the apparatus, or by making the solution using freshly boiled water.

3.2.3 AASS test

Add a sufficient amount of glacial acetic acid to the salt solution (3.1) to ensure that the pH of samples of sprayed solution collected in the test cabinet (4.2) is between 3,1 and 3,3. If the pH of the solution initially prepared is 3,0 to 3,1, the pH of the sprayed solution is likely to be within the specified limits. Check the pH using electrometric measurement at $25\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$, or in routine checks, with a short-range pH paper which can be read in increments of 0,1 pH units or less. Make any necessary corrections by adding glacial acetic acid or sodium hydroxide of analytical grade.

3.2.4 CASS test

Dissolve a sufficient mass of copper(II) chloride dihydrate ($\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$) in the salt solution (3.1) to produce a concentration of $0,26\text{ g/l} \pm 0,02\text{ g/l}$ [equivalent to $(0,205 \pm 0,015)\text{ g}$ of CuCl_2 per litre].

Adjust the pH using the procedures described in 3.2.3.

3.3 Filtration

If necessary, filter the solution before placing it in the reservoir of the apparatus, to remove any solid matter which might block the apertures of the spraying device.