
**Corrosion of metals and alloys —
Accelerated cyclic test with exposure
to acidified salt spray, dry and wet
conditions**

*Corrosion des métaux et alliages — Essais cycliques accélérés avec
exposition au brouillard salin acidifié, en conditions «sèches» et en
conditions «humides»*





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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.

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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

This second edition cancels and replaces the first edition (ISO 16151:2005), which has been technically revised. The main technical changes are as follows:

- harmonization with ISO 9227;
- terms and definitions clause has been added.

Introduction

Corrosion of metallic materials, with or without corrosion protection, is influenced by many environmental factors, the importance of which may vary with the type of metallic material and with the type of environment. It is impossible, therefore, to design accelerated laboratory corrosion tests in such a way that all environmental factors influencing resistance to corrosion are taken into account. Laboratory tests are, therefore, designed to simulate the effects of the most important factors, which enhance the corrosion of metallic materials.

The accelerated corrosion-test methods described in this document are designed to simulate and enhance the environmental influence on a metallic material to outdoor climates, where exposure to acid rain and to salt-contaminated conditions occur and may promote corrosion. It has been prepared by reference to technical papers and reports (see the Bibliography).

The test methods involve cyclic exposure of test specimens to a mist of acidified-salt solution, to drying conditions, and to periods of high humidity. However, the methods are mainly intended for comparative testing and the results obtained do not permit far-reaching conclusions on the corrosion resistance of the tested metallic material under the whole range of environmental conditions in which they may be used. Nevertheless, the methods provide valuable information on the relative performance of materials exposed to salt and/or acid rain environments similar to those employed in the test.

Corrosion of metals and alloys — Accelerated cyclic test with exposure to acidified salt spray, dry and wet conditions

WARNING — This document may involve hazardous materials, operations and equipment. It does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices.

1 Scope

This document specifies two accelerated corrosion-test procedures, Methods A and B, for the comparative evaluation of metallic materials with or without permanent corrosion protection or temporary corrosion protection in outdoor salt and/or acid rain environments. It also specifies the apparatus used. The two tests involve cyclic exposure of the specimens to acidified salt spray, “dry” and “wet” conditions.

The particular advantages of the two tests over conventional accelerated tests, such as the neutral salt spray (NSS) test as specified in ISO 9227 lie in their better ability to reproduce the corrosion that occurs in outdoor salt and/or acid rain environments. They are also useful for evaluating cosmetic corrosion.

Method A is applicable to

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

Method B is applicable to

- steel coated with anodic coatings, and
- steel coated with anodic coatings covered with conversion coatings.

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

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

ISO 4623-2:2016, *Paints and varnishes — Determination of resistance to filiform corrosion — Part 2: Aluminium substrates*

ISO 8044, *Corrosion of metals and alloys — Basic terms and definitions*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8044 and the following apply.

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

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 reference material

material with known test performance

3.2 reference specimen

portion of the *reference material* (3.1) that is to be exposed with the intention to check the reproducibility and repeatability of the test results for the test cabinet in use

3.3 test specimen

specific portion of the samples upon which the testing is to be performed

3.4 substitute specimen

specimen made of inert materials (such as plastic or glass) used for the substitute of a *test specimen* (3.3)

4 Test solution

4.1 General

Instructions for the preparation and use of the solutions used in Methods A and B are given in 4.2 and 4.3.

4.2 Method A

4.2.1 Neutral sodium chloride solution

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

The sodium chloride shall not contain a mass fraction of the heavy metals of copper (Cu), nickel (Ni) and lead (Pb) in total more than 0,005 %. It shall not contain a mass fraction of sodium iodide more than 0,1 % and a mass fraction of total impurities more than 0,5 %, calculated for dry salt.

NOTE Sodium chloride with anti-caking agents can act as corrosion inhibitors or accelerators. A useful sodium chloride salt grade is a grade named Ph. Eur/USP or JIS, ACS.

4.2.2 Preparation of the acidified-salt solution

The pH of the solution shall be adjusted to a value of $3,5 \pm 0,1$ at $25^\circ\text{C} \pm 2^\circ\text{C}$, by adding the following reagents to 10 l of the prepared neutral sodium chloride solution in 4.2.1 as follows:

- 12 ml of nitric acid (HNO_3 , $\rho = 1,42 \text{ g/ml}$);
- 17,3 ml of sulfuric acid (H_2SO_4 , $\rho = 1,84 \text{ g/ml}$);
- a sufficient quantity of 10 % mass fraction of sodium hydroxide (NaOH) solution, to adjust the pH of the solution to $3,5 \pm 0,1$ (about 300 ml will be required).