International Standard

ISO 14993

# Corrosion of metals and alloys — Accelerated testing involving cyclic exposure to salt mist, dry and wet conditions

*Corrosion des métaux et alliages — Essais accélérés comprenant des expositions cycliques à des conditions de brouillard salin, de séchage et d'humidité*

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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).

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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/TC 156, *Corrosion of metals and alloys.*

This third edition cancels and replaces the second edition (ISO 14993:2018), which has been technically revised.

The main changes are as follows:

— safety warnings have been added;

— apparatus has been revised to harmonize with ISO 16151.

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.

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# Introduction

Corrosion of metallic materials with or without corrosion protection is influenced by many environmental factors, the importance of which can vary depending on the type of metallic material and 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 that enhance the corrosion of metallic materials, however it is not possible to design a laboratory corrosion test in such a way that complexity and variations of real, in-service conditions are fully represented.

The accelerated corrosion test method described in this document is designed to simulate and enhance the environmental influence on a metallic material of exposure to an outdoor climate, where exposure to salt-contaminated conditions occurs and can promote corrosion.

The test method involves cyclic exposure of test specimens to a mist of salt solution, to drying conditions and to periods of high humidity. They are not intended to be used for comparative testing or as a means of ranking different materials relative to each other with respect to corrosion resistance or as means of predicting long-term corrosion resistance of the tested material (merely for testing the whole product). 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 within which it can be used. Nevertheless, the method gives a means of checking that comparative quality of a metallic material, with or without corrosion protection, is maintained when exposed to salt-contaminated environments similar to those used in the test[15].

This test method is based on Japanese Automobile Standards JASO M 609-91 and JASO M 610-92.

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# Corrosion of metals and alloys — Accelerated testing involving cyclic exposure to salt mist, dry and wet conditions

**WARNING — This document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.**

## 1 Scope

This document specifies the apparatus and test procedure to be used when conducting accelerated corrosion tests for the comparative quality evaluation of metallic materials with or without permanent corrosion protection or temporary corrosion protection in salt-contaminated outdoor environments. The test involves cyclic exposure of the specimens to neutral salt mist, "dry" and "wet" conditions. The type of test specimen and the exposure period are not specified.

The particular advantages of this test over common accelerated tests such as the neutral salt spray (NSS) test lie in its ability to better reproduce the corrosion that occurs in outdoor salt-contaminated environments.

This document is applicable to:

— metals and their alloys;

— metallic coatings (anodic and cathodic);

— conversion coatings;

— anodic oxide coatings;

— organic coatings on metallic materials.

NOTE Methods of test for coatings to determine their resistance, in the presence of scribe marks through to the substrate, to various cyclic corrosion conditions which include the condensation of water on the test specimens during periods of humidity are given in ISO 11997-1.

## 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 — Vocabulary*

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

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## 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 terminology databases for use in standardization at the following addresses:

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

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

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

**3.2**
**test specimen**
specific portion of the samples upon which the testing is to be performed

**3.3**
**substitute specimen**
specimen made of inert materials (such as plastic or glass) used for the substitute of a *test specimen* (3.2)

## 4 Test solution

### 4.1 General

Instructions for the preparation and use of a neutral sodium chloride solution are given in 4.2 and 4.3.

### 4.2 Preparation of the sodium chloride solution

Dissolve a sufficient mass of sodium chloride in distilled or deionized water with a conductivity no higher than 20 µS/cm at (25 ± 2) °C to produce a concentration of (50 ± 5) g/l. The sodium chloride concentration of the sprayed solution collected shall be (50 ± 5) g/l. The specific gravity range for a (50 ± 5) g/l solution is 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.

### 4.3 pH adjustment

Adjust the pH of the salt solution so that the pH of the sprayed solution collected within the test cabinet is 6,5 to 7,2 at (25 ± 2) °C. Check the pH using electrometric measurement. Measurements of pH shall be done using electrode suitable for measuring in weakly buffered sodium chloride solutions in deionized water. Make any necessary corrections by adding hydrochloric acid, sodium hydroxide or sodium bicarbonate solution of analytical grade.

**WARNING — Hydrochloric acid (CAS Registry Number®[1)] 7647-01-0) solution is toxic, corrosive, irritating and very toxic to aquatic life. Refer to the safety data sheet for details. Handling of hydrochloric acid solution shall be restricted to skilled personnel or conducted under their control. Care shall be taken in the disposal of this solution.**

1) CAS Registry Number® is a trademark of the American Chemical Society (ACS). This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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