

Corrosion of metals and alloys - Corrosion in artificial atmosphere - Accelerated corrosion test involving exposure under controlled conditions of humidity cycling and intermittent spraying of a salt solution

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EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN ISO 16701:2008 sisaldab Euroopa standardi EN ISO 16701:2008 ingliskeelset teksti. Standard on kinnitatud Eesti Standardikeskuse 20.06.2008 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas. Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 16.04.2008. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN ISO 16701:2008 consists of the English text of the European standard EN ISO 16701:2008. This standard is ratified with the order of Estonian Centre for Standardisation dated 20.06.2008 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation. Date of Availability of the European standard text 16.04.2008. The standard is available from Estonian standardisation organisation.
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Aru 10 Tallinn 10317 Eesti; www.evs.ee; Telefon: 605 5050; E-post: info@evs.ee

English Version

Corrosion of metals and alloys - Corrosion in artificial
atmosphere - Accelerated corrosion test involving exposure
under controlled conditions of humidity cycling and intermittent
spraying of a salt solution (ISO 16701:2003)

Corrosion des métaux et alliages - Corrosion en
atmosphère artificielle - Essai de corrosion accélérée
comprenant des expositions sous conditions contrôlées à
des cycles d'humidité et à des vaporisations intermittentes
de solution saline (ISO 16701:2003)

Korrosion von Metallen und Legierungen - Korrosion in
künstlicher Atmosphäre - Schnellkorrosionsprüfungen unter
zyklischer Einwirkung von Feuchte und intermittierendem
Versprühen einer Salzlösung unter kontrollierten
Bedingungen (ISO 16701:2003)

This European Standard was approved by CEN on 21 March 2008.

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Management Centre: rue de Stassart, 36 B-1050 Brussels

Foreword

The text of ISO 16701:2003 has been prepared by Technical Committee ISO/TC 156 "Corrosion of metals and alloys" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 16701:2008 by Technical Committee CEN/TC 262 "Metallic and other inorganic coatings" the secretariat of which is held by BSI.

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 October 2008, and conflicting national standards shall be withdrawn at the latest by October 2008.

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Endorsement notice

The text of ISO 16701:2003 has been approved by CEN as a EN ISO 16701:2008 without any modification.

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Introduction

As an alternative to the continuous salt spray test methods of ISO 9227^[3], intermittent salt spray test methods may be used. The results of such tests provide a better correlation with the effects of exposure in environments where there is a significant influence of chloride ions, such as from a marine source or road de-icing salt.

Accelerated corrosion tests to simulate atmospheric corrosion in such environments should include cyclic exposure to the following conditions.

- a) A wet phase, during which the test object is repeatedly subjected first to a spray of aqueous salt-containing solution then to a wet stand-by period during which residual wetness remains on the test object. This sequence provides a prolonged period of continuous exposure to wetness, extending over several hours.
- b) A phase of controlled cyclic humidity conditions, where the test object is subjected to an environment which alternates between high humidity and comparative dryness.

These two phases should be cycled for an appropriate number of times.

The test method described in this International Standard conforms with these requirements, as follows.

In the first (wet) phase of exposure, the test objects are sprayed for 15 min with a 1 % (mass fraction) aqueous solution of sodium chloride acidified to pH 4,2, to simulate the rather acidic precipitation present in industrialized areas, followed by a 1 h 45 min period of wet stand-by. This sequence is repeated three times to give a total of 6 h exposure to wetness. The whole of this first phase of the test cycle is repeated twice a week. If spraying is carried out more frequently or a more concentrated solution of sodium chloride is used during this phase, phenomena may appear that are seldom experienced in the field, e.g. severe diffusion blocking by red rust or excessive dissolution of zinc.

The major part of the test cycle, however, consists of humidity cycling between the two levels of 95 % RH and 50 % RH at a constant temperature of 35 °C. To simulate the wet phase of humidity cycling, the humidity level has been set close to the condensation limit, but at a level at which test conditions can be satisfactorily controlled. Introducing 100 % humidity conditions, inevitably results in loss of control of the amount of salt deposited on a test object.

The test method described in this International Standard is 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 within which it may be used. Nevertheless, the method provides valuable information on the relative performance of materials exposed to salt-contaminated environments similar to those used in the test. See Annex A.

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1 Scope

This International Standard defines an accelerated corrosion test method to be used in assessing the corrosion resistance of metals in environments where there is a significant influence of chloride ions, mainly as sodium chloride from a marine source or road de-icing salt.

This International Standard specifies the test apparatus and test procedure to be used in conducting the accelerated corrosion test to simulate, in a very controlled way, atmospheric corrosion conditions.

In this International Standard, the term “metal” includes metallic materials with or without corrosion protection.

The accelerated laboratory corrosion test applies to

- metals and their alloys;
- metallic coatings (anodic and cathodic);
- chemical conversion coatings;
- organic coatings on metals.

The method is especially suitable for comparative testing in the optimization of surface treatment systems.

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 4628-1, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 1: General introduction and designation system*

ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering*

ISO 4628-4, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking*

ISO 4628-5, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 5: Assessment of degree of flaking*

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

ISO 10289, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates — Rating of test specimens and manufactured articles subjected to corrosion tests*

3 Reagent

A salt solution, prepared by dissolving a sufficient mass of sodium chloride in distilled or deionized water to a concentration of $10 \text{ g l}^{-1} \pm 1 \text{ g l}^{-1}$. The distilled or deionized water used shall have a conductivity not higher than 2 mS m^{-1} at $25 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$.

The maximum permissible amounts of impurities in the sodium chloride are given in Table 1.

Table 1 — Maximum permissible amounts of impurities in the sodium chloride as calculated for dry salt

Impurity	Maximum mass fraction of impurity %	Note
Copper (calculated for dry salt)	0,001	Determined by atomic absorption spectro-photometry or other method with similar accuracy
Nickel (calculated for dry salt)	0,001	
Sodium iodide	0,1	
Total	0,5	

Check the pH of the salt solution by using potentiometric measurement at $25 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$. Finely adjust the pH of the salt solution to a value of $4,2 \pm 0,1$ by standard addition of a diluted sulphuric acid solution (e.g. 1 ml of $0,05 \text{ N H}_2\text{SO}_4$ is added to 1 l of salt solution).

4 Apparatus

4.1 Climate chamber

The climate chamber shall be designed so that the following test conditions can be obtained, controlled and monitored during the test.

An instantaneous maximum deviation from set relative humidity value of $\pm 4 \text{ } \%$ in the range from $50 \text{ } \%$ to $95 \text{ } \%$ at $35 \text{ }^{\circ}\text{C}$, which corresponds to a temperature accuracy requirement of $\pm 0,8 \text{ }^{\circ}\text{C}$ at that temperature. For the mean value in relative humidity during a period of constant climatic conditions 7 h to 8 h an accuracy of $\pm 2 \text{ } \%$ shall apply, corresponding to temperature accuracy requirement of in this case $\pm 0,4 \text{ }^{\circ}\text{C}$.

NOTE To meet the temperature and humidity accuracy requirements, the climate chamber should be equipped with means for efficient circulation of air to provide for small temperature and humidity variations in the chamber. Sufficient insulation of the chamber walls and lids are required in order to avoid excessive condensation on these surfaces.

The climate chamber shall also be designed so that the relative humidity may be changed linearly with respect to time from $95 \text{ } \%$ to $50 \text{ } \%$ within 2 h and back from $50 \text{ } \%$ to $95 \text{ } \%$ also within 2 h. Figure B.1 shows a suitable design of climate chamber.

The humidity and temperature levels of the climate chamber during a test cycle shall be continuously monitored or regularly checked so that it can be confirmed that the relative humidity versus time for a complete test cycle is within the specified ranges at $95 \text{ } \%$ RH and $50 \text{ } \%$ RH. For measurement of the relative humidity use a hygrometer designed for measurements at high humidity levels, e.g., a high-quality combined temperature and capacitance humidity sensor or a gold mirror dewpoint meter. For measurement of temperature preferably use Pt 100 sensors.