INTERNATIONAL STANDARD

ISO
9226

Corrosion of metals and alloys — Corrosivity of atmospheres — Determination of corrosion rate of standard specimens for the evaluation of corrosivity

Corrosion des métaux et alliages — Corrosivité des atmosphères — Détermination de la vitesse de corrosion d'éprouvettes de référence pour l'évaluation de la corrosivité

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 9226 was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

This second edition cancels and replaces the first edition (ISO 9226:1992), which has been technically revised. In particular, the use of helix specimens as standard specimens is no longer prescribed and Annex A has been updated.

Introduction

The characterization of an atmospheric corrosion test site or of a service location with respect to its corrosivity can be accomplished by determining the corrosion rate of standard specimens exposed for one year to the atmosphere at the respective location (corrosivity determination). The standard specimens are flat plate specimens of the four standard structural materials: aluminium, copper, steel and zinc. This method represents an economical way of evaluating corrosivity, taking into account all local environmental influences.

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Corrosion of metals and alloys — Corrosivity of atmospheres — Determination of corrosion rate of standard specimens for the evaluation of corrosivity

WARNING — Some of the procedures included in this International Standard entail the use of potentially hazardous chemicals. It is emphasized that all appropriate safety precautions should be taken.

1 Scope

This International Standard specifies methods which can be used for the determination of corrosion rate with standard specimens. The values obtained from the measurements (corrosion rates for the first year of exposure) are intended to be used as classification criteria for the evaluation of atmospheric corrosivity according to ISO 9223. They can also be used for informative evaluation of atmospheric corrosivity beyond the scope of ISO 9223.

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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.

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

ISO 8565, *Metals and alloys — Atmospheric corrosion testing — General requirements*

ISO 9223, *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*

ISO 9224, *Corrosion of metals and alloys — Corrosivity of atmospheres — Guiding values for the corrosivity categories*

3 Principle

The corrosivity of the exposure locations or of industrial installation sites is deduced from the corrosion rate, calculated from the loss of mass per unit area of standard specimens following the removal of corrosion products from the specimens after exposure periods of one year.

In the case of alloys of iron, zinc and copper, mass loss is a proven measure of corrosion damage. In the case of aluminium alloys, mass loss is a valid measure of corrosion. This International Standard describes only evaluation by mass loss and not corrosion penetration.

Corrosion rates for the first year of exposure may be used for the calculation of corrosion rates for long-term exposures in accordance with ISO 9224.

4   Standard specimens

The specimens are rectangular plates with dimensions of preferably 100 mm × 150 mm, but at least 50 mm × 100 mm, and a thickness of approximately 1 mm.

The materials used to prepare the standard specimens are of current fabrication, i.e.

steel: unalloyed carbon steel (Cu 0,03 % to 0,10 %, P < 0,07 %)

zinc: 98,5 % min.

copper: 99,5 % min.

aluminium: 99,5 % min.

Prior to exposure, all specimens shall be solvent degreased. The sample shall be free from oil and grease; in order to achieve this, it may be necessary to use different solvents in successive steps. Steel specimens with visible rust stains or corrosion products on their surfaces shall be polished with 120 grit abrasive paper prior to degreasing to remove these visible corrosion products. The cleaning of metal specimens by sand blasting can result in a surface that is more prone to corrosion and is therefore not recommended for the cleaning of the standard specimens for corrosivity classification in accordance with ISO 9223. Copper, zinc and aluminium specimens shall not be used if visible corrosion products are present before exposure.

NOTE   For details on the quality of recommended metallic materials, see the Bibliography.

5   Exposure of standard specimens

The exposure of the weighed and marked standard specimens shall be carried out in accordance with the specifications of ISO 8565.

Three specimens of each metal shall be exposed for one year, starting at the beginning of the worst corrosive period of the year (e.g. spring or autumn).

After exposure, the corrosion products formed on specimens shall be removed in accordance with the specifications of ISO 8407 and reweighed to the nearest 0,1 mg. The cleaning procedure shall be repeated several times in equal cleaning cycles.

NOTE   For procedures suitable for chemical cleaning, see Annex A.

6   Expression of results

The corrosion rate, r_{corr}, for each metal, expressed as a mass loss per unit area over time, is given by Equation (1):

$$r_{corr} = \frac{\Delta m}{A \cdot t} \tag{1}$$

where

r_{corr} is the corrosion rate, expressed in grams per square metre per year [g/(m2 a)];

Δm is the mass loss, expressed in grams (g);

A is the surface area, expressed in square metres (m^2);

t is the exposure time, expressed in years (a).

The corrosion rate can also be expressed as a thickness reduction rate given by Equation (2):

$$r'_{corr} = \frac{\Delta m}{A \cdot \rho \cdot t}$$

(2)

where

r'_{corr} is the corrosion rate, expressed in micrometres per year (µm/a);

ρ is the density of the metal (Fe: 7,86 g/cm^3; Zn: 7,14 g/cm^3; Cu: 8,96 g/cm^3; Al: 2,70 g/cm^3);

Δm is the mass loss, expressed in grams (g);

A is the surface area, expressed in square metres (m^2);

t is the exposure time, expressed in years (a).

The test report shall give all single values and their mean values. Any possible anomalies detected before, during and after exposure, which can have an influence of the mean result, shall be specified.

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