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Metals and alloys — Atmospheric corrosion testing — General requirements

Métaux et alliages — Essais de corrosion atmosphérique — Exigences générales

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 8565 was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

This second edition cancels and replaces the first edition (ISO 8565:1992), which has been technically revised.

Introduction

Corrosion testing under atmospheric exposure conditions is carried out in order

— to obtain data on the corrosion resistance of metals, alloys[1)], metallic and other inorganic coatings in atmospheric environments,

— to evaluate the type of corrosion of particular metals, and

— to obtain data for corrosivity determination and estimation.

It involves exposure of the specimens to the action of atmospheric environments at the test sites, and periodic checking of the test specimens. It does not cover service corrosion testing.

The corrosion rate of the specified metal depends on the environment of the atmospheric corrosion test site. The relationship between corrosion rates for metals and atmospheric variables is complex. Therefore, the results of field tests cannot be used to predict service performance exactly, but do provide an approximate guidance to service performance.

1) Hereinafter referred to as “metals”.

Metals and alloys — Atmospheric corrosion testing — General requirements

1 Scope

This International Standard establishes general requirements for stationary corrosion testing of metals and metallic and other inorganic coatings under atmospheric conditions carried out in the open air or under shelters. It can also be applied for testing of complex specimens and assemblies of metallic materials.

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 4226, *Air quality — General aspects — Units of measurement*

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

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

ISO 9169, *Air quality — Definition and determination of performance characteristics of an automatic measuring system*

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

ISO 9225, *Corrosion of metals and alloys — Corrosivity of atmospheres — Measurement of environmental parameters affecting corrosivity of atmospheres*

ISO 9226, *Corrosion of metals and alloys — Corrosivity of atmospheres — Determination of corrosion rate of standard specimens for the evaluation of corrosivity*

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 Requirements for test specimens

3.1 Types of specimen

3.1.1 Flat sheet specimens

Rectangular specimens in the form of flat sheets are the preferred type as they can be readily weighed and measured, and their simple shape facilitates attachment to test frames. A convenient specimen size is 150 mm × 100 mm. Specimens may be of different size provided that they can be accurately evaluated. The specimen thickness shall be adequate to ensure that the specimens will survive the intended test period. The

specimen thickness shall also take into account the possibility of mechanical effects and of intergranular corrosion in some materials. The most convenient thickness is 1 mm to 3 mm.

For specimens with metallic coatings, the surface area of the test specimens should be as large as possible, in any case not less than 50 cm^2 (5 cm × 10 cm). If the coated articles used are smaller than 50 cm^2 in area, specimens of the same kind may be combined to total the required minimum surface area. However, the results obtained will not necessarily be comparable with those obtained on specially prepared test specimens of the specified minimum area.

3.1.2 Irregularly shaped specimens

Other specimen shapes, such as bolts, tubes, rods, angles and even assemblies, may be tested if necessary.

The ends of tube specimens shall be sealed if only corrosion of the outside surface is of interest.

Complex specimens, such as assemblies, may contain crevices, water traps, welded joints and dissimilar metals. It is therefore important to take account of the effects of these on the corrosion resistance of the assembly. Care should also be taken to position the assembly to simulate its intended use.

3.1.3 Specimens with welded joints

Atmospheric corrosion tests on welded joints are intended to reveal any tendency for preferential corrosion in the weld zone arising from metallurgical or compositional differences between the weld metal and the parent material. The joints shall preferably be placed in the centre of the test specimen, parallel to its long side (preferred position), or perpendicular.

3.2 Specimen preparation

Because atmospheric corrosion tests may extend over many years, it is important to ensure that specimens are clearly identified and records of data are carefully kept. It is normally necessary to cut specimens from larger pieces of the metal to be tested and to carry out deburring. These operations involve the risk of surface damage to the specimens and, with some metals, may lead to significant changes in metallurgical condition (for example, work-hardening of sheared or cut edges). Surface damage can be avoided with care, whilst work-hardened edges should be removed by machining, unless the effects of this condition are being specifically evaluated. Similar damage may be caused by other operations, such as flame-cutting, sawing and grinding. When the results of the test are to be compared with service performance, it is recommended that specimens be exposed with surfaces identical or similar to those, which would apply in service. For all other purposes, a well-defined surface preparation is needed.

Surface preparation may involve a combination of a degreasing stage using organic solvents or alkaline degreasing fluids and a mechanical or chemical descaling treatment for surfaces bearing mill scale, heat-treatment scale or rust. Suitable descaling treatments for a wide range of metals are given in ISO 8407.

For metallic and other inorganic coatings, it is absolutely necessary to avoid cleaning methods which may attack the surface of specimens.

3.3 Handling

After final surface cleaning before exposure, it is important that limited handling occurs. In general, it is necessary to use clean gloves in the final handling operations.

3.4 Marking of specimens

The test specimens may be marked in such a way that no confusion during the exposure is possible. Marking shall be legible and durable over the whole period of exposure and shall be made on those areas of the test specimens that are not subjected to visual assessment and have no functional purpose.

Methods suggested for marking are different. The test specimens may be marked with appropriate numbers by stamping. For metallic coatings, the preferred method is positional notch coding before the protective coating is applied. Other marking procedures can be used, provided that the requirements of legibility and durability are met.

The area affected by marking shall be minimized. The establishment of a reliable map of specimen identity, exposure data and location on the exposure frame is recommended.

3.5 Number of specimens

The number of test specimens of each type used in a given exposure shall not be less than three for each exposure time interval.

Three specimens should suffice for simple comparative test programmes. However, for more complex programmes, more specimens will be needed, according to the statistical requirements.

3.6 Control and reference specimens

3.6.1 General

It is desirable that extra specimens be included in the test programme, in order to fulfil various requirements of control and reference.

3.6.2 Control specimens

Control specimens are replicates of exposed test specimens which are stored under non-corrosive conditions (see 3.7). They may be used to determine changes in physical and mechanical properties as a result of exposure of the specimens.

3.6.3 Reference specimens

When testing new or modified materials, specimens of the original (known) material are used for comparison purposes and exposed together with the test specimens.

3.7 Storage

During storage of the test specimens before exposure, and during storage of control specimens, care shall be taken to avoid mechanical damage and contact with other specimens. A room with a controlled temperature and a relative humidity of 65 % or less shall be used for storage purposes. Particularly sensitive specimens shall be stored in a desiccator or sealed in plastic bags with desiccant.

3.8 Specimen data records

For each series of test specimens, records of data are needed for the assessment of the corrosion effects (see Clause 8). These records may include the following:

a) in the case of uncoated metal samples:

- chemical composition,
- mass,
- shape and size,
- surface finish characteristics,
- heat treatment,