



BSI Standards Publication

Corrosion of metals and alloys — Electrochemical measurements — Test method for monitoring atmospheric corrosion

National foreword

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*Corrosion des métaux et alliages — Mesures électrochimiques —
Méthode d'essai pour la surveillance de la corrosion atmosphérique*



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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).

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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*.

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.

Introduction

The purpose of this document is to provide instructions on the use of electrochemical sensors for monitoring atmospheric corrosion. These sensors are used to measure thin film electrolyte conductance, corrosion current or coating condition over long periods. This method permits the instantaneous evaluation of corrosion current that can be related to specific environmental conditions in real time. The instantaneous corrosion current measurements are not accessible using electrical resistance sensors or mass loss techniques. The technology described in this document complements other standard techniques for assessing atmospheric corrosion such as mass loss coupons, electrical resistance sensors or coated test panels (see [ISO 8407](#) and [ISO 4628-8](#)). These continuous records of material condition can be useful for studying atmospheric corrosion, evaluating materials or managing assets[21][22][23][24][25][26][27][28][29].

This document was developed based on ANSI/NACE TM0416-2016.

This document is relevant to alloy and coating manufacturers and users in transportation, chemical process, energy and infrastructure applications.

Corrosion of metals and alloys — Electrochemical measurements — Test method for monitoring atmospheric corrosion

1 Scope

This document specifies a test method for atmospheric corrosion measurements, using two-electrode electrochemical sensors.

It is applicable to measurements of the corrosion rate of uncoupled metal surfaces (i.e. “free” corrosion rate), galvanic corrosion rate, conductance of thin film solutions and barrier properties of organic coatings. It specifies electrochemical sensors that are used with or without organic coatings. The sensors are applicable to corrosion measurements made in laboratory test chambers, outdoor exposure sites and service environments.

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 4618](#), *Paints and varnishes — Terms and definitions*

ISO 4628 (all parts), *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance*

[ISO 8044](#), *Corrosion of metals and alloys — Vocabulary*

[ISO 9223](#), *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in [ISO 4618](#), ISO 4628 (all parts), [ISO 8044](#), [ISO 9223](#) and the following apply.

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

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

3.1

electrical resistance sensor

device for measuring corrosion involving measurement of the ratio of the potential difference along a conductor and the current through the conductor

Note 1 to entry: ISO 15091:2019, 3.1, defines “electrical resistance” as the “ratio of the potential difference along a conductor and the current through the conductor”.

3.2

electrochemical sensor

device for measuring corrosion involving anodic and cathodic reactions

Note 1 to entry: [ISO 8044:2020](#), 4.1, defines “electrochemical corrosion” as “corrosion involving at least one anodic reaction and one cathodic reaction”.

3.3

electrode digit

single finger of an *interdigitated electrode* ([3.5](#))

3.4

corrosion penetration

distance between the corroded surface of a metal and the original surface of the metal

Note 1 to entry: [ISO 8044:2020](#), 3.11, defines “corrosion depth” as the “distance between a point on the surface of a metal affected by corrosion and the original surface of the metal”.

3.5

interdigitated electrode

electronic conductors interlocked like fingers

3.6

sensor range

upper and lower measurement values

3.7

sensor span

difference between maximum and minimum measurement values

3.8

solution resistance

ratio of electrode potential increment to the corresponding current increment dependent on solution

3.9

thin film conductance

solution layer current transport capacity

Note 1 to entry: ISO 15091:2019, 3.3, defines “conductance” as the “reciprocal of the resistance”.

3.10

zero-resistance ammeter

instrument used for current measurement between two electrodes with no potential drop between them

4 Summary of sensors

The atmospheric corrosion measurements are made using three types of sensors to measure: a) free corrosion current, b) galvanic corrosion current and c) surface conductance.

Electrochemical sensors for atmospheric corrosion shall have a planar gage area. They are composed of two metallic electrodes separated by a dielectric material that electrically isolates the electrodes (see [Figures A.1](#) and [A.2](#)). The electrochemical sensors have interdigitated electrode geometries and may be produced using composite laminate or thin film processes (see [Annex A](#)). The sensor gage area is defined as the area of the electrodes exposed to the environment.