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**Corrosion of metals and alloys —  
Electrochemical measurement of ion  
transfer resistance to characterize  
the protective rust layer on  
weathering steel**

*Corrosion des métaux et alliages — Mesurage électrochimique de la  
résistance au transfert d'ions pour caractériser la couche de rouille  
protectrice sur l'acier autopatinable*



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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](http://www.iso.org/directives)).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://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](http://www.iso.org/members.html).

## Introduction

Weathering steel containing Cu, Ni, P, etc., is widely used for bridges, buildings, towers and other structures because of its maintenance-free characteristics resulting from the formation of a protective and adhesive rust layer when exposed to the atmosphere.

This feature makes it possible for weathering steel to be used without any surface treatment. It requires, however, several years of exposure to form the protective rust on untreated surfaces. During this period, quite complicated reactions occur within the rust layer affected by local environmental factors<sup>[1][2]</sup>. Therefore, there is a strong need for a quantitative and non-destructive monitoring method for the assessment of the protective rust layer condition on weathering steel structures<sup>[3]</sup>.



# Corrosion of metals and alloys — Electrochemical measurement of ion transfer resistance to characterize the protective rust layer on weathering steel

## 1 Scope

This document specifies a method for the electrochemical measurement of ion transfer resistance of the rust layer formed on weathering steel alloys in order to assess their protective properties against corrosion thereafter<sup>[3]</sup>. This method uses an electrochemical AC impedance measurement<sup>[4][5][6][7][8]</sup> together with harmonic analysis, to identify the ion transfer resistance, and a rust thickness measurement to characterize the stability of the protective rust layer in terms of corrosion protection under used 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 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

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 following terms and definitions 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

#### ion transfer resistance

resistance against an ionic current migrated by the voltage difference through media

Note 1 to entry: In this document, “media” means the rust layer and electrolyte.

### 3.2

#### protective rust layer

layer formed on *weathering steel* (3.3) after long-time exposure to the atmosphere that enables corrosion resistance

EXAMPLE Patina on Cu alloys.

Note 1 to entry: The protective rust layer usually consists of a double-layered structure comprising a dense protective rust layer (a-Rust) underneath a crystalline FeOOH rust layer.

### 3.3

#### weathering steel

low-alloyed steel containing Cu, Ni, P, etc. that allows for a *protective rust layer* (3.2)