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**Petroleum, petrochemical and  
natural gas industries — Prevention  
of corrosion on pipeline systems  
influenced by stray currents**

*Industries du pétrole, de la pétrochimie et du gaz naturel —  
Prévention de la corrosion sur les systèmes de conduites soumis à  
l'influence de courants vagabonds*



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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)).

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

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 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 2, *Pipeline transportation systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 219, *Cathodic protection*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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

This document provides guidance for the prevention of external corrosion when a pipeline is influenced by electrical interference. Electrical interference can be from stray currents (defined in ISO 8044) and from naturally occurring interference caused by geomagnetic or tidal activity.

International Standards on cathodic protection (e.g. ISO 15589-1 and ISO 15589-2) refer to a structure-to-electrolyte potential value that is considered to indicate that cathodic protection is effective. When the potential is influenced by stray currents, however, it is not always possible to obtain a meaningful structure-to-electrolyte potential and other methods of assessment are needed. These other methods can include mathematical analysis of the potentials and/or direct assessment of the corrosion rate using electrical resistance probes.

An affected structure carrying stray currents, e.g. a pipeline or cable can itself affect other nearby structures.

This document is not intended to inhibit the use of alternative equipment or engineering solutions for individual applications. Where an alternative is offered, it is intended that any variations from this document be identified and documented.

# Petroleum, petrochemical and natural gas industries — Prevention of corrosion on pipeline systems influenced by stray currents

## 1 Scope

This document establishes the general principles for the evaluation and minimization of the effects of stray current corrosion on external surfaces of buried or immersed pipeline systems caused by AC and DC electrical interference.

Other stray current effects such as overheating, and interference with welding operations are not covered in this document.

A brief description of AC effects, general principles and some guidelines, are provided.

NOTE 1 See ISO 18086 for the effects of alternating current on buried or immersed pipelines.

Systems that can also be affected by stray currents include buried or immersed metal structures such as the following:

- a) pipeline systems;
- b) metal sheathed cables;
- c) tanks and vessels;
- d) earthing systems;
- e) steel reinforcement in concrete;
- f) sheet steel piling.

This document gives guidelines for

- the design of cathodic protection systems that might produce stray currents,
- the design of pipeline systems, or elements of pipeline systems, which are buried or immersed, and which can be subject to stray current corrosion, and
- the selection of appropriate protection or mitigation measures.

Internal corrosion risks from stray currents are not dealt with in detail in this document but principles and measures described here can be applicable for minimizing the interference effects.

NOTE 2 The impact of electromagnetic interference on above-ground appurtenances of pipeline systems is covered in EN 50443, IEC 61140, IEC 60364-4-41, IEC 60479-1, IEC 60364-5-52, IEC/TS 61201 and IEC/TR 60479-5.

This document can also be used for pipeline systems outside of the petrochemical and natural gas industries and other buried or immersed structures.

NOTE 3 EN 50162 provides guidance for railway related structures.

## 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.

IEC 62128-2:2013, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 2: Provisions against the effects of stray currents caused by d.c. traction systems*

ISO 15589-1, *Petroleum, petrochemical and natural gas industries — Cathodic protection of pipeline systems — Part 1: On-land pipelines*

ISO 8044, *Corrosion of metals and alloys — Vocabulary*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15589-1, IEC 62128-2:2013, ISO 8044 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 coating

electrically insulating covering bonded to a metal surface for protection against corrosion by preventing contact between the electrolyte and the metal surface

#### 3.2 remote earth

theoretical concept that refers to a ground electrode of zero impedance placed an infinite distance away from the ground under test

Note 1 to entry: In practice, remote earth is approached when the mutual resistance between the ground under test and the test electrode becomes negligible. Remote earth is normally considered to be at zero potential.

[SOURCE: IEEE Std 81-2012<sup>[1]</sup>]

#### 3.3 conductive coupling

transfer of energy occurring when a part of the current belonging to the interfering system returns to the system earth via the interfered system

Note 1 to entry: Also, when the voltage to the reference earth of the ground in the vicinity of the influenced object rises because of a fault in the interfering system, and the results of which are conductive voltages and currents.

#### 3.4 drainage electrical drainage

transfer of stray current from an affected structure to the current source by means of a deliberate bond

Note 1 to entry: For drainage devices see *direct drainage bond* (3.5), *unidirectional drainage bond* (3.7) and *forced drainage bond* (3.6).

#### 3.5 direct drainage bond

device that provides *electrical drainage* (3.4) by means of a bi-directional, metallic bond between an affected structure and the stray current source

Note 1 to entry: The bond can include a series resistor to reduce the current.