

**SLOVENSKI STANDARD**  
**oSIST prEN ISO 18086:2017**  
**01-junij-2017**

---

**Korozija kovin in zlitin - Ugotavljanje nastanka AC korozije - Merila zaščite (ISO 18086:2015)**

Corrosion of metals and alloys - Determination of AC corrosion - Protection criteria (ISO 18086:2015)

Korrosion von Metallen und Legierungen - Bestimmung der Wechselstromkorrosion - Schutzkriterien (ISO 18086:2015)

Corrosion des métaux et alliages - Détermination de la corrosion occasionnée par les courants alternatifs - Critères de protection (ISO 18086:2015)

**Ta slovenski standard je istoveten z: prEN ISO 18086**

<https://standards.iteh.ai/catalog/standards/sist/0e9bdf11-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017>

<https://standards.iteh.ai/catalog/standards/sist/0e9bdf11-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017>

**ICS:**

77.060

Korozija kovin

Corrosion of metals

**oSIST prEN ISO 18086:2017**

**en**



# INTERNATIONAL STANDARD

**ISO  
18086**

First edition  
2015-06-01

---

---

## **Corrosion of metals and alloys — Determination of AC corrosion — Protection criteria**

*Corrosion des métaux et alliages — Détermination de la corrosion  
occasionnée par les courants alternatifs — Critères de protection*

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

[SIST EN ISO 18086:2017](https://standards.iteh.ai/catalog/standards/sist/0e9bdf11-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017)

<https://standards.iteh.ai/catalog/standards/sist/0e9bdf11-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017>



Reference number  
ISO 18086:2015(E)

© ISO 2015

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

SIST EN ISO 18086:2017

<https://standards.iteh.ai/catalog/standards/sist/0e9bdff1-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
[copyright@iso.org](mailto:copyright@iso.org)  
[www.iso.org](http://www.iso.org)

# Contents

Page

<b>Foreword</b>	<b>v</b>
<b>Introduction</b>	<b>vi</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms and definitions</b>	<b>1</b>
<b>4 Cathodic protection persons competence</b>	<b>4</b>
<b>5 Assessment of the AC influence</b>	<b>5</b>
5.1 General	5
5.2 Assessment of the level of interference	5
<b>6 Evaluation of the AC corrosion likelihood</b>	<b>6</b>
6.1 Prerequisite	6
6.1.1 General	6
6.1.2 AC voltage on the structure	6
6.2 AC and DC current density	7
6.2.1 General	7
6.2.2 AC current density	7
6.2.3 High cathodic DC current density	7
6.2.4 Low cathodic DC current density	7
6.2.5 Current ratio " $I_{a.c.}/I_{d.c.}$ "	8
6.2.6 Soil resistivity	8
6.3 Corrosion rate	8
6.4 Pipeline coatings	8
6.5 Evaluation of the metal loss	8
<b>7 Acceptable interference levels</b>	<b>8</b>
<b>8 Measurement techniques</b>	<b>9</b>
8.1 Measurements	9
8.1.1 General	9
8.1.2 Selection of test sites	9
8.1.3 Selection of measurement parameter	10
8.1.4 Sampling rate for the recording of interference levels	10
8.1.5 Accuracy of measuring equipment	10
8.1.6 Installation of coupons or probes to calculate current densities	10
8.2 DC potential measurements	10
8.3 AC voltage measurements	10
8.4 Measurements on coupons and probes	11
8.4.1 Installation of coupons or probes	11
8.4.2 Current measurements	11
8.4.3 Corrosion rate measurements	12
8.5 Pipeline metal loss techniques	13
<b>9 Mitigation measures</b>	<b>13</b>
9.1 General	13
9.2 Construction measures	13
9.2.1 Modification of bedding material	13
9.2.2 Installation of isolating joints	13
9.2.3 Installation of mitigation wires	13
9.2.4 Optimization of pipeline and/or powerline route	14
9.2.5 Power line or pipeline construction	14
9.3 Operation measures	14
9.3.1 Earthing	14
9.3.2 Adjustment of cathodic protection level	15
9.3.3 Repair of coating defects	15

**ISO 18086:2015(E)**

<b>10</b>	<b>Commissioning</b>	<b>16</b>
10.1	Commissioning	16
10.2	Preliminary checking	16
10.2.1	General	16
10.2.2	Coupon AC voltage and current startup	17
10.2.3	Verification of effectiveness	17
10.2.4	Installation and commissioning documents	17
<b>11</b>	<b>Monitoring and maintenance</b>	<b>17</b>
<b>Annex A</b> (informative)	<b>Simplified description of the AC corrosion phenomenon</b>	<b>19</b>
<b>Annex B</b> (informative)	<b>Coupons and probes</b>	<b>21</b>
<b>Annex C</b> (informative)	<b>Coulometric oxidation</b>	<b>26</b>
<b>Annex D</b> (informative)	<b>Influence of soil characteristics on the AC corrosion process</b>	<b>27</b>
<b>Annex E</b> (informative)	<b>Other criteria that have been used in the presence of AC influence</b>	<b>28</b>
<b>Annex F</b> (informative)	<b>Parameters to take into account to choose a DC decoupling device</b>	<b>32</b>
<b>Annex G</b> (informative)	<b>Method to determine the reference electrode location to remote earth</b>	<b>34</b>
<b>Annex H</b> (informative)	<b>Simultaneous measurement on coupon current densities with high rate</b>	<b>36</b>
<b>Bibliography</b>		<b>38</b>

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

SIST EN ISO 18086:2017

<https://standards.iteh.ai/catalog/standards/sist/0e9bdf11-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017>

## 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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword — Supplementary information](#).

The committee responsible for this document is ISO/TC 156, *Corrosion of metal and alloys*.

(<https://standards.iteh.ai>)  
Document Preview

SIST EN ISO 18086:2017

<https://standards.iteh.ai/catalog/standards/sist/0e9bdf1f-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017>

**ISO 18086:2015(E)****Introduction**

This International Standard has incorporated criteria and thresholds together with experience gained from the most recent data. Various countries have a very different approach to the prevention of AC corrosion depending primarily on the DC interference situation. These different approaches are taken into account in two different ways

- either in presence of “low” on-potentials, which allows a certain level of AC voltage (up to 15 V), or
- in presence of “high” on-potentials (with DC stray current interference on the pipeline for instance) which requires the reduction of the AC voltage towards the lowest possible levels.

This International Standard also gives some parameters to consider when evaluating the AC corrosion likelihood, as well as detailed measurement techniques, mitigation measures, and measurements to carry out for commissioning of any AC corrosion mitigation system. Note that [Annex E](#) proposes other parameters and thresholds that require further validation based on practical experiences.

iTeh Standards  
(<https://standards.iteh.ai>)  
Document Preview

SIST EN ISO 18086:2017

<https://standards.iteh.ai/catalog/standards/sist/0e9bdf1f-f3fd-4927-8e7e-3798114656c4/sist-en-iso-18086-2017>



# Corrosion of metals and alloys — Determination of AC corrosion — Protection criteria

## 1 Scope

This International Standard is applicable to buried cathodically-protected pipeline that is influenced by AC traction systems and/or AC power lines.

In the presence of AC interference, the protection criteria given in ISO 15589-1 are not sufficient to demonstrate that the steel is being protected against corrosion.

This International Standard provides limits, measurement procedures, mitigation measures, and information to deal with long term AC interference for AC voltages at frequencies between 16,7 and 60 Hz and the evaluation of AC corrosion likelihood.

This International Standard deals with the possibility of AC corrosion of metallic pipelines due to AC interferences caused by inductive, conductive or capacitive coupling with AC power systems and the maximum tolerable limits of these interference effects. It takes into account the fact that this is a long-term effect, which occurs during normal operating conditions of the AC power system.

This International Standard does not cover the safety issues associated with AC voltages on pipelines. These are covered in national standards and regulations (see e.g. EN 50443).

## 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 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 — Basic terms and definitions*

IEC 61010-1, *Safety requirements for electrical equipment for measurements, control, and laboratory use — Part 1: General requirements*

EN 13509, *Cathodic protection measurement techniques*

EN 15257, *Cathodic protection — Competence levels and certification of cathodic protection personnel*

EN 50443, *Effects of electromagnetic interference on pipelines caused by high voltage AC electric traction systems and/or high voltage AC power supply systems*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8044 and the following apply.

### 3.1

#### AC electric traction system

AC railway electrical distribution network used to provide energy for rolling stock

Note 1 to entry: The system can comprise the following:

— contact line systems;

**ISO 18086:2015(E)**

- return circuit of electric railway systems;
- running rails of non-electric railway systems, which are in the vicinity of and conductively connected to the running rails of an electric railway system.

**3.2****AC power supply system**

AC electrical system devoted to electrical energy transmission and includes overhead lines, cables, substations and all apparatus associated with them

**3.3****AC power system**

AC electric traction system or AC power supply system

Note 1 to entry: Where it is necessary to differentiate, each interfering system is clearly indicated with its proper term.

**3.4****copper/copper sulfate reference electrode****CSE**

reference electrode consisting of copper in a saturated solution of copper sulfate

**3.5****AC voltage**

voltage measured to earth between a metallic structure and a reference electrode

**3.6****interfering system**

general expression encompassing an interfering high voltage AC electric traction system and/or high voltage AC power supply system

**3.7****interfered system**

system on which the interference effects appear

Note 1 to entry: In this International Standard, it is the pipeline system.

**3.8****pipeline system**

system of pipe network with all associated equipment and stations

Note 1 to entry: In this International Standard, pipeline system refers only to metallic pipeline system.

Note 2 to entry: The associated equipment is the equipment electrically connected to the pipeline.

**3.9****earth**

conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to zero

[SOURCE: IEC 60050 826]

**3.10****operating condition**

fault-free operation of any system

Note 1 to entry: Transients are not to be considered as an operating condition.

**3.11****fault condition**

non-intended condition caused by short-circuit to earth, the fault duration being the normal clearing time of the protection devices and switches

Note 1 to entry: The short circuit is an unintentional connection of an energized conductor to earth or to any metallic part in contact with earth.

**3.12****conductive coupling**

coupling which occurs when a proportion of the current belonging to the interfering system returns to the system earth via the interfered system or 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

**3.13****inductive coupling**

phenomenon whereby the magnetic field produced by a current carrying circuit influences another circuit

Note 1 to entry: The coupling being quantified by the mutual impedance of the two circuits, and the results of which are induced voltages and hence currents that depend on, for example, the distances, length, inducing current, circuit arrangement, and frequency.

**3.14****capacitive coupling**

phenomenon whereby the electric field produced by an energized conductor influences another conductor

Note 1 to entry: The coupling being quantified by the capacitance between the conductors and the capacitances between each conductor and earth, and the results of which are interference voltages into conductive parts or conductors insulated from earth, these voltages depend, for example on the voltage of the influencing system, distances, and circuit arrangement.

**3.15****interference**

phenomenon resulting from conductive, capacitive, inductive coupling between systems and which can cause malfunction, dangerous voltages, damage, etc.

**3.16****disturbance**

malfunction of an equipment losing its capability to work properly for the duration of the interference

Note 1 to entry: When the interference disappears, the interfered system starts working properly again without any external intervention.

**3.17****damage**

permanent reduction in the quality of service which can be suffered by the interfered system

Note 1 to entry: A reduction in the quality of service could also be the complete cancellation of service.

EXAMPLE Coating perforation, pipe pitting, pipe perforation, permanent malfunction of the equipment connected to the pipes, etc.

**3.18****danger**

state of the influenced system which is able to produce a threat to human life

## ISO 18086:2015(E)

### 3.19

#### **interference situation**

maximum distance between the pipeline system and AC power system for which an interference is to be considered

### 3.20

#### **interference voltage**

voltage caused on the interfered system by the conductive, inductive, and capacitive coupling with the nearby interfering system between a given point and the earth or across an insulating joint

### 3.21

#### ***IR* drop**

voltage due to any current, developed in an electrolyte such as the soil, between the reference electrode and the metal of the structure, in accordance with Ohm's Law ( $U = I \times R$ )

### 3.22

#### ***IR*-free potential**

$E_{IR-free}$

pipe to electrolyte potential measured without the voltage error caused by the *IR* drop due to the protection current or any other current

### 3.23

#### **off-potential**

$E_{off}$

pipe to electrolyte potential measured after interruption of all sources of applied cathodic protection current with the aim of approaching an *IR*-free potential

Note 1 to entry: The delay before measurement varies according to circumstances.

### 3.24

#### **on-potential**

$E_{on}$

pipe to electrolyte potential measured while the cathodic protection system is continuously operating

### 3.25

#### **spread resistance**

ohmic resistance through a coating defect to earth or from the exposed metallic surface of a coupon towards earth

Note 1 to entry: This is the resistance which controls the DC or AC current through a coating defect or an exposed metallic surface of a coupon for a given DC or AC voltage.

### 3.26

#### **coupon**

metal sample of defined dimensions made of a metal equivalent to the metal of the pipeline

### 3.27

#### **probes**

device incorporating a coupon that provides measurements of parameters to assess the effectiveness of cathodic protection and/or corrosion risk

## 4 Cathodic protection persons competence

Persons who undertake the design, supervision of installation, commissioning, supervision of operation, measurements, monitoring, and supervision of maintenance of cathodic protection systems shall have the appropriate level of competence for the tasks undertaken.

EN 15257 or NACE Cathodic Protection Training and Certification Programme constitute suitable methods of assessing and certifying competence of cathodic protection personnel.