# SLOVENSKI STANDARD
# SIST EN ISO 15589-2:2014

**01-julij-2014**

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**Petrokemična industrija ter industrija za predelavo nafte in zemeljskega plina - Katodna zaščita cevovodov - 2. del: Cevovodi na morju (ISO 15589-2:2012)**

Petroleum, petrochemical and natural gas industries - Cathodic protection of pipeline transportation systems - Part 2: Offshore pipelines (ISO 15589-2:2012)

Erdöl- und Erdgasindustrie - Kathodischer Schutz für Transportleitungssysteme - Teil 2: Offshore-Pipelines (ISO 15589-2:2012)



Industries du pétrole, de la pétrochimie et du gaz naturel - Protection cathodique des systèmes de transport par conduites - Partie 2: Conduites en mer (ISO 15589-2:2012)



**Ta slovenski standard je istoveten z:** **EN ISO 15589-2:2014**

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**ICS:**

| | | |
|---|---|---|
| 75.200 | Oprema za skladiščenje nafte, naftnih proizvodov in zemeljskega plina | Petroleum products and natural gas handling equipment |

**SIST EN ISO 15589-2:2014** **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN ISO 15589-2

March 2014

ICS 75.200

English Version

# Petroleum, petrochemical and natural gas industries - Cathodic protection of pipeline transportation systems - Part 2: Offshore pipelines (ISO 15589-2:2012)

Industries du pétrole, de la pétrochimie et du gaz naturel - Protection cathodique des systèmes de transport par conduites - Partie 2: Conduites en mer (ISO 15589-2:2012)

Erdöl- und Erdgasindustrie - Kathodischer Schutz für Transportleitungssysteme - Teil 2: Offshore-Pipelines (ISO 15589-2:2012)

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## Contents

Page

# Foreword

The text of ISO 15589-2:2012 has been prepared by Technical Committee ISO/TC 67 “Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 15589-2:2014 by Technical Committee CEN/TC 219 “Cathodic protection” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2014, and conflicting national standards shall be withdrawn at the latest by September 2014.

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**Endorsement notice**

The text of ISO 15589-2:2012 has been approved by CEN as EN ISO 15589-2:2014 without any modification.

INTERNATIONAL STANDARD

**ISO 15589-2**

Second edition
2012-12-01

# Petroleum, petrochemical and natural gas industries — Cathodic protection of pipeline transportation systems —

## Part 2: Offshore pipelines



*Industries du pétrole, de la pétrochimie et du gaz naturel — Protection cathodique des systèmes de transport par conduites — Partie 2: Conduites en mer*



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# Contents

Page

 

# 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.

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ISO 15589-2 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offhore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 2, *Pipeline transportation systems*.

This second edition cancels and replaces the first edition (ISO 15589-2:2004), which has been technically revised as follows:



— In Clause 6 recommendations for isolating joints are included.

— In Clause 7 a subclause on hydrogen-induced stress cracking evaluation is included.



— In Clause 7 coating breakdown factors have been reorganized by splitting into “with” and “without” concrete coating. More conservative values for some coating systems have been selected based on feedback from daily practice in industry.

— In Clause 8 recommendations on anode electrochemical properties for seawater with low salinity are included.

— Design values for electrochemical capacity in Clause 8 have been reduced. Higher values are permitted if properly documented.

— Quality control of anodes has been adjusted regarding tolerances, straightness, mass, surface irregularities and cracking (Clause 10).

— The guidance on attenuation calculation has been significantly extended. A new Annex B has been introduced and includes several examples and alternative methods.

— Regarding anode testing, only free-running testing is accepted (see Annex C).

ISO 15589 consists of the following parts, under the general title *Petroleum, petrochemical and natural gas industries — Cathodic protection of pipeline transportation systems*:

— *Part 1: On-land pipelines*

— *Part 2: Offshore pipelines*

# Introduction

The technical revision of this part of ISO 15589 has been carried out in order to accommodate the needs of industry and to move this International Standard to a higher level of service within the petroleum, petrochemical and natural gas industry.

Pipeline cathodic protection is achieved by the supply of sufficient direct current to the external pipe surface, so that the steel-to-electrolyte potential is lowered on all the surface to values at which external corrosion is reduced to an insignificant rate.

Cathodic protection is normally used in combination with a suitable protective coating system to protect the external surfaces of steel pipelines from corrosion.

Users of this part of ISO 15589 should be aware that further or differing requirements may be needed for individual applications. This part of ISO 15589 is not intended to prevent alternative equipment or engineering solutions from being used for individual applications. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, it is intended that any variations from this part of ISO 15589 be identified and documented.

This part of ISO 15589 can also be used for offshore pipelines outside the petroleum, petrochemical and natural gas industries.

# Petroleum, petrochemical and natural gas industries — Cathodic protection of pipeline transportation systems —

# Part 2: Offshore pipelines

## 1 Scope

This part of ISO 15589 specifies requirements and gives recommendations for the pre-installation surveys, design, materials, equipment, fabrication, installation, commissioning, operation, inspection and maintenance of cathodic protection (CP) systems for offshore pipelines for the petroleum, petrochemical and natural gas industries as defined in ISO 13623.

This part of ISO 15589 is applicable to carbon steel, stainless steel and flexible pipelines in offshore service.

This part of ISO 15589 is applicable to retrofits, modifications and repairs made to existing pipeline systems.

This part of ISO 15589 is applicable to all types of seawater and seabed environments encountered in submerged conditions and on risers up to mean water level.



## 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 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods*

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

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

ISO 13623, *Petroleum and natural gas industries — Pipeline transportation systems*

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

ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

ASTM D1141[1)], *Standard Practice for the Preparation of Substitute Ocean Water*

AWS D1.1/D1.1M[2)], *Structural Welding Code — Steel*

EN 10025 (all parts)[3)], *Hot rolled products of structural steels*

EN 10204:2004, *Metallic products — Types of inspection documents*

1) American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.

2) American Welding Society, 550 NW Le Jeune Road, Miami, FL 33126, USA.

3) European Committee for Standardization, Management Centre, Avenue Marnix 17, B-1000, Brussels, Belgium.

## 3 Terms and definitions

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

**3.1**
**anode potential**
anode-to-electrolyte potential

**3.2**
**anode sled**
anodes installed on a structure and connected to the pipeline by a cable

**3.3**
**closed-circuit anode potential**
anode potential while electrically linked to the pipeline to be protected

**3.4**
**coating breakdown factor**
$f_c$
ratio of current density required to polarize a coated steel surface as compared to a bare steel surface

**3.5**
**cold shut**
horizontal surface discontinuity caused by solidification of the meniscus of the partially cast anodes as a result of interrupted flow of the casting stream



**3.6**
**driving voltage**
difference between the pipeline/electrolyte potential and the anode/electrolyte potential when the cathodic protection is operating



**3.7**
**electric field gradient**
change in electrical potential per unit distance through a conductive medium, arising from the flow of electric current

**3.8**
**electrochemical capacity**
$\varepsilon$
total amount of electric charge that is produced when a fixed mass (usually 1 kg) of anode material is consumed electrochemically

NOTE Electrochemical capacity is expressed in ampere hours.

**3.9**
**final current density**
estimated current density at the end of the lifetime of the pipeline

NOTE Final current density is expressed in amperes per square metre.

**3.10**
**hydrogen-induced stress cracking**
**HISC**
cracking due to a combination of load and hydrogen embrittlement caused by the ingress of hydrogen formed at the steel surface due to the cathodic polarization

 

**3.11**
**IR drop**
voltage due to any current, measured between two points of the metal of the pipe or two points of the electrolyte, such as seawater or seabed, in accordance with Ohm's law

NOTE IR drop and electric field gradient are related terms.

**3.12**
**master reference electrode**
reference electrode, calibrated with the primary calibration reference electrode, used for verification of reference electrodes that are used for field or laboratory measurements

**3.13**
**mean current density**
estimated average cathodic current density for the entire lifetime of the pipeline

NOTE Mean current density is expressed in amperes per square metre.

**3.14**
**protection potential**
structure-to-electrolyte potential for which the metal corrosion rate is considered as insignificant

**3.15**
**pitting resistance equivalent number**
**PREN**
number, developed to reflect and predict the pitting resistance of a stainless steel, based on the proportions of Cr, Mo, W and N in the chemical composition of the alloy



**3.16**
**primary calibration reference electrode**
reference electrode used for calibration of master reference electrodes



**3.17**
**remotely operated vehicle**
**ROV**
underwater vehicle operated remotely from a surface vessel or installation

[ISO 14723]

**3.18**
**riser**
part of an offshore pipeline, including any subsea spool pieces, which extends from the seabed to the pipeline termination point on an offshore installation

[ISO 13623]

**3.19**
**utilization factor**
***μ***
fraction of the anodic material weight of a galvanic anode that can be consumed before the anode ceases to provide the minimum required current output