

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 15589-2:2014 sisaldab Euroopa standardi EN ISO 15589-2:2014 inglisekeelset teksti.	This Estonian standard EVS-EN ISO 15589-2:2014 consists of the English text of the European standard EN ISO 15589-2:2014.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 26.03.2014.	Date of Availability of the European standard is 26.03.2014.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 75.200

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Aru 10, 10317 Tallinn, Eesti; www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:
Aru 10, 10317 Tallinn, Estonia; www.evs.ee; phone 605 5050; e-mail info@evs.ee

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)

This European Standard was approved by CEN on 6 March 2014.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

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

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols and abbreviated terms	4
4.1 Symbols	4
4.2 Abbreviated terms	4
5 General	5
5.1 Competence assurance	5
5.2 Compliance	5
6 Cathodic protection system requirements	5
6.1 General	5
6.2 Selection of CP systems	6
6.3 Isolating joints	6
7 Design parameters	7
7.1 General	7
7.2 Protection potentials	8
7.3 Design life	10
7.4 Design current densities for bare steel	10
7.5 Coating breakdown factors	12
8 Galvanic anodes	15
8.1 Design of system	15
8.2 Selection of anode material	16
8.3 Electrochemical properties	17
8.4 Anode shape and utilization factor	17
8.5 Mechanical and electrical considerations	18
9 Galvanic anode manufacturing	18
9.1 Pre-production test	18
9.2 Coating	18
9.3 Anode core materials	19
9.4 Aluminium anode materials	19
9.5 Zinc anode materials	20
10 Galvanic anode quality control	20
10.1 General	20
10.2 Steel anode cores	20
10.3 Chemical analysis of anode alloy	21
10.4 Anode mass	21
10.5 Anode dimensions and straightness	21
10.6 Anode core dimensions and position	22
10.7 Anode surface irregularities	22
10.8 Cracks	22
10.9 Internal defects, destructive testing	23
10.10 Electrochemical quality control testing	24
11 Galvanic anode installation	25
12 Impressed-current CP systems	26
12.1 Current sources and control	26
12.2 Impressed-current anode materials	26
12.3 System design	26

12.4	Manufacturing and installation considerations.....	27
12.5	Mechanical and electrical considerations.....	27
13	Documentation.....	28
13.1	Design, manufacturing and installation documentation.....	28
13.2	Commissioning procedures.....	29
13.3	Operating and maintenance manual.....	29
14	Operation, monitoring and maintenance of CP systems.....	30
14.1	General.....	30
14.2	Monitoring plans.....	30
14.3	Repair.....	30
Annex A (normative) Galvanic anode CP design procedures.....		31
Annex B (normative) Attenuation of protection.....		37
Annex C (normative) Performance testing of galvanic anode materials.....		40
Annex D (normative) CP monitoring and surveys.....		42
Annex E (normative) Laboratory testing of galvanic anodes for quality control.....		49
Annex F (informative) Interference.....		51
Annex G (informative) Pipeline design for CP.....		53
Bibliography.....		59

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 D1141¹⁾, *Standard Practice for the Preparation of Substitute Ocean Water*

AWS D1.1/D1.1M²⁾, *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.