



ANSI/NACE  
SP0607-2007  
Item no. 21125

First Edition,  
2007-11-05

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**ISO 15589-2: 2004, (Modified) Petroleum  
and natural gas industries — Cathodic  
protection of pipeline transportation  
systems —**

Part 2:

**Offshore pipelines**

*Industries du pétrole et du gaz naturel — Protection cathodique des  
systèmes de transport par conduites —*

*Partie 2: Conduites en mer*

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**Reference number**

ANSI/NACE SP0607-2007/ISO 15589-2 (MOD)

ISBN 1-57590-214-1

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Printed in the U.S.A. by NACE

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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.

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.

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.

ISO 15589-2 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*.

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

- *Part 1: On-land pipelines*
- *Part 2: Offshore pipelines*

In this American National Standard, certain technical modifications have been made. These technical modifications from the ISO Standard have been incorporated directly into this NACE adopted version.

The modifications are marked with a dotted underline throughout the text.

A complete list of modifications can be found in Annex G.

In this American National Standard, the following editorial changes have been made throughout the document:

<u>Clause/Subclause</u>	<u>Modification</u>
Paragraph 6.2.4	Add “under-saturated silver/silver chloride seawater” to “The potential of the <u>under-saturated silver/silver chloride/seawater</u> (Ag/AgCl/seawater) reference electrode is dependent upon the concentration of chloride ions in the electrolyte, and hence by the seawater resistivity.”
Figure 1	Add “under-saturated silver/silver chloride/seawater (Ag/AgCl/seawater) electrode” to caption under Figure 1: “Nomogram for the correction of potential readings made with the <u>under-saturated silver/silver chloride/seawater (Ag/AgCl/seawater) electrode</u> in waters of varying salinity and resistivity against the SCE and Cu/CuSO <sub>4</sub> reference electrodes. <sup>[5]</sup> ”

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Figure 1	<p>Add "under-saturated" to "Example" under Figure 1: If brackish water of 100 <math>\Omega</math>-cm resistivity exists at the pipeline potential measurement site, the least negative potential for effective corrosion protection electrode will be <math>-0,84</math> V and not <math>-0,80</math> V as given in Table 1, with reference to the <u>under-saturated Ag/AgCl/seawater</u> reference electrode.</p> <p>Paragraph C.4.2 Add "under-saturated" to "The <u>under-saturated silver/silver chloride/seawater (Ag/AgCl/seawater)</u> electrode is the most widely used electrode for seawater applications, particularly in conjunction with portable monitoring equipment."</p>
Paragraph C.4.2	<p>Add "under-saturated" to "Other reference electrodes that may be used in place of the <u>under-saturated Ag/AgCl/seawater</u> reference electrode are described below, with the respective protection potentials for carbon steel equivalent to the <math>-0,80</math> V versus Ag/AgCl/seawater criterion."</p>
References	<p>Add "References" section:</p> <ol style="list-style-type: none"><li>1. <u>E.D. Sunde, "Currents and Potentials Along Leaky Ground-Return Conductors." Electrical Engineering 55 (1936): pp. 1338-1346.</u></li><li>2. <u>R. Pope, "Attenuation of Forced Drainage Effects on Long Uniform Structures." Corrosion 2 (1946): pp. 307-319.</u></li><li>3. <u>H.H. Uhlig, Corrosion Handbook (New York, NY: John Wiley &amp; Sons, 1948).</u></li><li>4. <u>J. Morgan, Cathodic Protection (New York, NY: McMillan Co., 1960), pp 140-143.</u></li><li>5. <u>H.H. Uhlig, R.W. Revie, Corrosion and Corrosion Control, 3rd ed. (New York, NY: John Wiley &amp; Sons, 1985), pp. 421-423.</u></li><li>6. <u>S.N. Smith, P. Sloan, "Attenuation Analysis of Survey Data on a Subsea Pipeline with Retrofit Anodes," CORROSION/2005, paper no. 82 (Houston, TX: NACE, 2005).</u></li><li>7. <u>J.P. La Fontaine, G. Gibson, "Cathodic Protection Design of Pipelines using an Improved Attenuation Model," CORROSION/2004, paper no. 91 (Houston, TX: NACE, 2004).</u></li></ol>

## Introduction

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 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.

External corrosion control in general is covered by ISO 13623.

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 inhibit alternative equipment or engineering solutions to be used for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, any variations from this part of ISO 15589 should be identified.

Deviations from this part of ISO 15589 may be warranted in specific situations, provided it is demonstrated that the objectives expressed in this part of ISO 15589 have been achieved.

## INTERNATIONAL STANDARD

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# Petroleum 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 systems for offshore pipelines for the petroleum and natural gas industries as defined in ISO 13623.

This part of ISO 15589 is applicable to carbon and stainless steel 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.

**NOTE** Special conditions sometimes exist where cathodic protection is ineffective or only partially effective. Such conditions can include elevated temperatures, disbonded coatings, thermal insulating coatings, shielding, bacterial attack, and unusual contaminants in the electrolyte.

### 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 10474:1991, *Steel and steel products — Inspection documents*

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

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

ASTM D 1141<sup>1)</sup>, *Standard practice for the preparation of substitute ocean water*

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1) ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.