



DRAFT International Standard

ISO/DIS 15589-1

Oil and gas industries including lower carbon energy — Cathodic protection of pipeline systems —

Part 1: On-land pipelines

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

Partie 1: Conduites terrestres

ICS: 75.200

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This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 15589-1:2024(en)

ISO/TC 67/SC 2

Secretariat: **UNI**

Voting begins on:
2024-04-05

Voting terminates on:
2024-06-28

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Published in Switzerland

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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).

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).

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 67, *Oil and gas industries including lower carbon energy*, Subcommittee SC 2, *Pipeline transportation systems*.

This third edition cancels and replaces the second edition (ISO 15589-1:2015), which has been technically revised with the following changes:

- cathodic protection criteria have been extended with further clarification on the application of the criteria;
- requirements for design have been more detailed and periodicities for inspection of cathodic equipment have been enlarged, and the option for remote monitoring added;
- requirements for measurements and testing during commissioning have been further detailed.

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

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

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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.

It is necessary that users of this part of ISO 15589 be aware that further or differing requirements can be needed for individual applications. This part of ISO 15589 is not intended to inhibit the use of alternative equipment or engineering solutions for the individual application. This can be particularly applicable where there is innovative or developing technology. It is necessary that, where an alternative is offered, any variations from this part of ISO 15589 be identified and documented.

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Oil and gas industries including lower carbon energy — Cathodic protection of pipeline systems —

Part 1: On-land pipelines

1 Scope

This part of ISO 15589 specifies requirements and gives recommendations for the pre-installation surveys, design, materials, equipment, installation, commissioning, operation, inspection, and maintenance of cathodic protection systems for on-land pipelines. On-land pipelines are defined in ISO 13623 or EN 14161 for the petroleum, petrochemical, and natural gas industries. They are also described in EN 1594, EN 12007-1 and EN 12007-3, which are used by gas supply industries in Europe.

This part of ISO 15589 is applicable to on-land pipelines and piping systems used in other industries and transporting other media such as industrial gases, waters, or slurries.

Throughout this document on-land pipelines means:

- pipelines that are buried,
- landfalls of offshore pipeline sections protected by onshore based cathodic protection installations,
- immersed sections of on-land pipelines such as river or lake crossings.

This part of ISO 15589 specifies requirements for pipelines of carbon steel, stainless steel, cast iron, galvanized steel, and copper. If other pipeline materials are used, the protection criteria to apply shall be the responsibility of the pipeline operator.

This part of ISO 15589 does not apply to pipelines made of reinforced concrete. ISO 12696 can be applied to reinforced concrete.

Note Special conditions sometimes exist where cathodic protection is ineffective or only partially effective. Such conditions can include shielding (e.g. disbonded coatings, thermal-insulating coatings, rocky soil, weight saddles and non-conducting support cushions.) and unusual contaminants in the electrolyte.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 10012, *Measurement management systems — Requirements for measurement processes and measuring equipment*

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

ISO 13847, *Petroleum and natural gas industries — Pipeline transportation systems — Welding of pipelines*

ISO 15257, *Cathodic protection — Competence levels of cathodic protection persons — Basis for a certification scheme*

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ISO 18086, *Corrosion of metals and alloys — Determination of AC corrosion — Protection criteria*

ISO 21809 (all parts), *Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems*

ISO 21857, *Petroleum, petrochemical and natural gas industries — Prevention of corrosion on pipeline systems influenced by stray currents*

ISO 22426, *Assessment of the effectiveness of cathodic protection based on coupon measurements*

IEC 60079-10-1, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 62561-3, *Lightning protection system components (LPSC) - Part 3: Requirements for isolating spark gaps (ISGs)*

EN 1594, *Gas infrastructure — Pipelines for maximum operating pressure over 16 bar — Functional requirements*

EN 12007-3, *Gas infrastructure — Pipelines for maximum operating pressure up to and including 16 bar - Part 3: Specific functional recommendations for steel*

EN 14161, *Petroleum and natural gas industries — Pipeline transportation systems (ISO 13623:2009 modified)*

IEC 62305-1, *Protection against lightning- Part 1: General principles*

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 backfill

added material immediately surrounding a buried anode

3.2 bond

metal conductor, usually copper, connecting two points on the same or on different structures

3.3 cathodic protection system

impressed current and galvanic anode systems consist of all the equipment necessary for the application of cathodic protection, such as impressed current installations, power supplies impressed current anodes, galvanic anodes, bonds and cables

3.4 coupon

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

3.5 coating defect

anomaly in the coating that results in the steel surface making direct contact with the surrounding electrolyte.

3.6 DC decoupling device

equipment that provides a low-impedance path for AC and high resistance for DC

EXAMPLE Polarization cells, capacitors, or diode assemblies

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3.7

drain point

location of the cable connection to the protected pipeline through which the protective current returns to its source

3.8

drainage

Transfer of stray current between structures by means of a deliberate bond

Note 1 to entry: See ISO 21587 for drainage devices (direct drainage bond, resistance drainage bond, unidirectional drainage bond, and forced drainage bond).

3.9

drainage station

equipment and materials required to provide drainage of stray currents from affected systems

3.10

galvanic anode

see Definition in ISO 8044 chapter 7.4.10

3.11

galvanic anode station

equipment and materials required to provide cathodic protection by the use of galvanic anodes

Note 1 to entry: Such materials and equipment include galvanic anodes and cables

3.12

groundbed

system of buried or immersed anodes

3.13

impressed current anode

electrode that delivers cathodic protection current

3.14

impressed current station

equipment and materials required to provide cathodic protection by impressed current

Note 1 to entry: Such materials and equipment include impressed current anodes, cables, and a DC source.

3.15

instant-off potential

See [3.23](#) "off potential"

3.16

IR drop

voltage that is the product of all currents flowing through the cathodic protection circuit and the resistance of the current path (mainly the electrolyte and the pipeline)

Note 1 to entry: This is derived from Ohm's law ($U = I \times R$)

3.17

IR free potential

coating defect or coupon to electrolyte potential without the voltage error caused by the IR drop due to the protection current or any other current

3.18

isolating joint

electrically insulating component inserted between two lengths of pipe to prevent electrical continuity between them

EXAMPLE Monobloc isolating joint, isolating flange

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3.19

isolating spark gap

component with discharge distance for isolating electrically conductive installation sections

Note 1 to entry: In the event of lightning strike, the installation sections are temporarily connected conductively as the result of response of the discharge

3.20

local earthing

earthed metallic electrode not directly electrically connected to any other main earthing system

3.21

measuring point

location where the actual potential measurement takes place

Note 1 to entry: In the case of pipe-to-electrolyte potential measurement, this refers to the location of the reference electrode.

3.22

on-potential

see Definition in ISO 8044 chapter 5.14

3.23

off potential

see Definition in ISO 8044 chapter 5.13

Note 1 to entry: The off potential of a pipeline is always a mixed potential resulting from the IR free (aline spelling over the entire text) potentials of multiple coating defects

3.24

structure to-electrolyte potential

difference in potential between a pipeline and a specified reference electrode in contact with the electrolyte.

3.25

pitting resistance equivalent number PREN

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

3.26

polarization

change of pipe-to-electrolyte potential with respect to the free corrosion potential caused by the application of an external electrical current

3.27

probe

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

3.28

protection potential

pipe-to-electrolyte potential at which the metal corrosion rate is acceptable

3.29

reference electrode

see Definition in ISO 8044 chapter 7.1.19

3.30

remote earth

part of the electrolyte in which no measurable voltages, caused by current flow, occur between any two points

Note 1 to entry: This condition generally prevails outside the zone of influence of an earth electrode, an earthing system, an anode groundbed, or a protected pipeline