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Part 2: Full-life cycle integrity management for offshore pipeline

Industries du pétrole et du gaz naturel — Systèmes de transport par conduites — Spécification de gestion de l'intégrité des conduites —

Partie 2: Gestion de l'intégrité des conduites en mer pendant leur cycle de vie complet

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document 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*.

A list of all parts in the ISO 19345 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document addresses the integrity of petroleum and natural gas pipelines through their entire life-cycle, from design to eventual abandonment. For this reason, considerations relating to design, construction and abandonment have been included. This approach supports the development and implementation of a holistic and integrated pipeline integrity management program that bridges between life-cycle elements and thereby avoids compartmentalizing of the pipeline life-cycle into essentially independent data and functional silos, which has traditionally been the case. The integrated approach was developed on the basis of extensive research and examination of best practices and results from pipeline integrity audits world-wide.

This document is intended to be used by companies that have not yet developed an official program or are developing a program for new pipelines. This document can also be used to guide continual improvement of existing programs by both operating companies and regulators to evaluate integrity management program effectiveness.

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Petroleum and natural gas industry — Pipeline transportation systems — Pipeline integrity management specification —

Part 2:
Full-life cycle integrity management for offshore pipeline

1 Scope

This document specifies requirements and gives recommendations on the management of integrity of a pipeline system throughout its life cycle, which includes design, construction, commissioning, operation, maintenance and abandonment.

This document is applicable to offshore pipelines for transporting petroleum and natural gas. It is applicable to rigid steel pipelines. It is not applicable to flexible pipelines, dynamic risers or those constructed from other materials, such as glass-reinforced plastics.

NOTE 1 An offshore pipeline system extends to:

— the first valve, flange or connection above water on platform or subsea mechanical connector with subsea structure (i.e. manifold or dynamic riser);

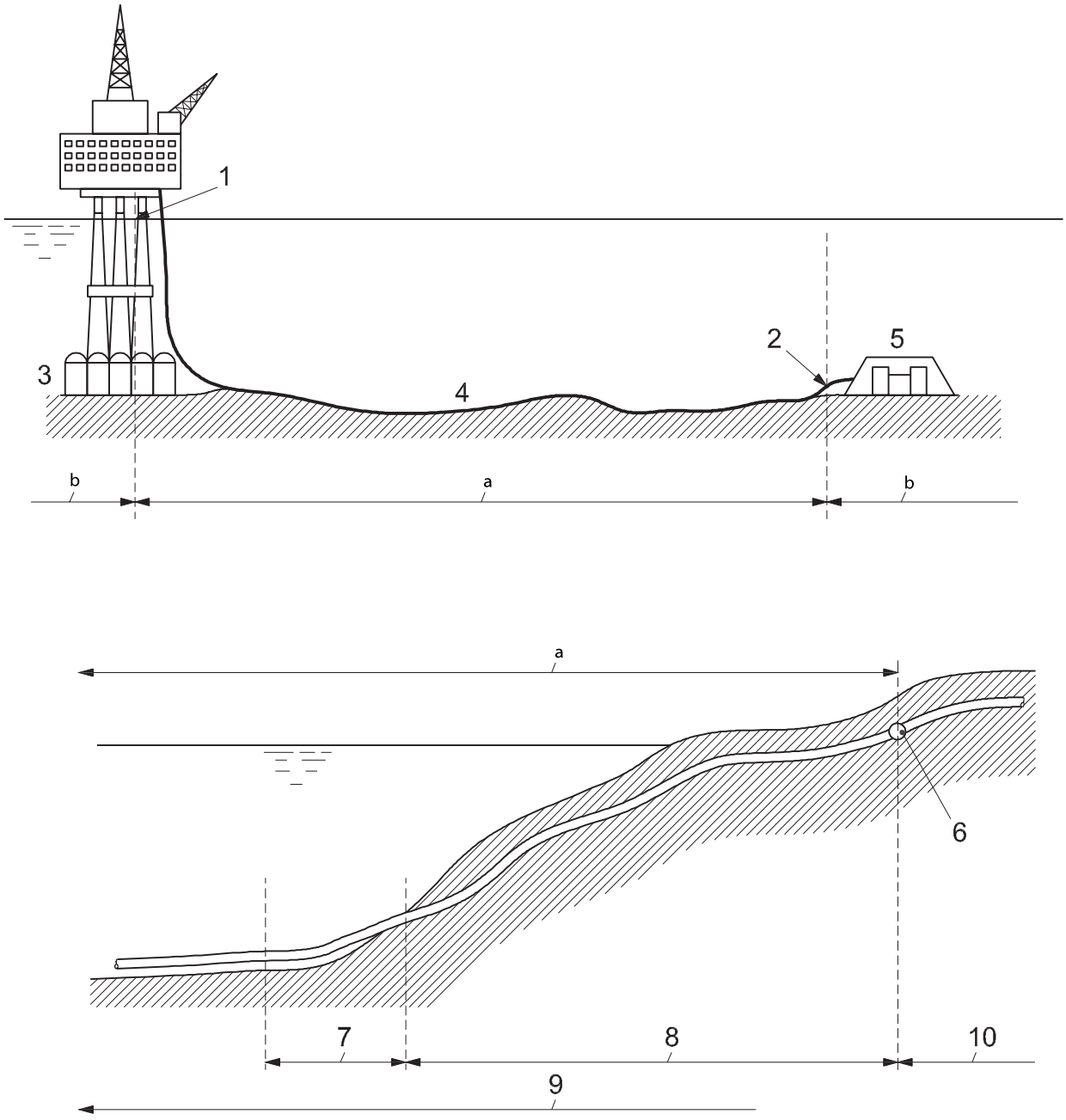
— the connection point to the offshore installation (i.e. piping manifolds are not included);

— the first valve, flange, connection or isolation joint at a landfall, unless otherwise specified by the onshore legislation.

NOTE 2 The components mentioned above (valve, flange, connection, isolation joint) include also any pup pieces, i.e. the offshore pipeline system extends to the weld beyond the pup piece, see Figure 1.

This document is used for integrity management, which is initiated at the design and construction stage of the pipeline. Where requirements of a design and construction standard (e.g. ISO 13623) are different, the provisions of this document will enhance the design and construction from an integrity perspective.

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Key

1	first valve, flange, connection or isolation joint	7	nearshore section
2	connector point to subsea piping	8	shore approach
3	topside	9	offshore section
4	pipeline system	10	onshore section
5	pipeline subsea structure	a	covered by this document
6	first valve, flange, connection or isolation joint	b	not covered by this document

Figure 1 — Extent of pipeline systems covered by this document

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 13623, *Petroleum and natural gas industries — Pipeline transporting system*

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

ISO 31000, *Risk management — Guidelines*

IEC 31010, *Risk assessment techniques*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
abandonment
activities associated with taking a pipeline permanently out of operation

Note 1 to entry: An abandoned pipeline cannot be returned to operation.

Note 2 to entry: Depending on the legislation abandonment can require cover or removal.

3.1.2
anomaly
possible deviation from pipe material or weld soundness

Note 1 to entry: The identification of an indication of an anomaly can be generated by non-destructive inspection, such as in-line inspection.

3.1.3
baseline assessment
first integrity assessment prior to or after operation

3.1.4
cathodic protection
corrosion control technique to prevent or reduce the external corrosion of metal pipelines by transferring an electrical current onto the pipe to achieve increased negative electrical potentials

3.1.5
corrosion
deterioration of a material, usually a metal that results from an electrochemical reaction with its environment

3.1.6
crack
planar flaw, or linear discontinuity, with a sharp tip radius

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3.1.7
critical consequence area
location where a pipeline release might have a significant adverse effect on public safety, property and the environment

Note 1 to entry: The pipeline segments in CCAs are of particular interest in risk assessment and integrity assessment evaluations and prioritizations.

3.1.8
deactivation
removal of a pipeline from service, though the pipeline might be returned to service after a proper assessment

Note 1 to entry: Also defined as decommissioning or suspension.

3.1.9
deformation
change in shape of the pipe or component, such as a bend, buckle, *dent* (3.1.11), ovality, ripple, wrinkle, or any other change that affects the roundness of the pipe or original cross-section or straightness of the pipe or component

3.1.10
defect
imperfection of a type or magnitude exceeding acceptable criteria

3.1.11
dent
depression which produces a disturbance in the curvature of the pipe wall, caused by contact with a foreign body resulting in plastic deformation of the pipe wall

3.1.12
design life
period for which the design basis is planned to remain valid

[SOURCE: ISO 13623:2017, 3.1.2]

3.1.13
failure
event in which a component or system does not perform according to its operational requirements

3.1.14
fitness for purpose
quantitative engineering evaluation that is performed to demonstrate the structural integrity of an in-service component that can contain an imperfection, *defect* (3.1.10) or damage

3.1.15
gouge
surface damage to a pipeline caused by contact with a foreign object that has scraped (gouged) material out of the pipe, resulting in a metal loss defect or imperfection

3.1.16
incident
unintentional release of gas or liquid due to the *failure* (3.1.13) of a pipeline

Note 1 to entry: Some regulatory authorities define “incident” as an event occurring on a pipeline for which the operator is required to make a report to the concerned regulatory authority.

3.1.17
in-line inspection
inspection of a pipe wall from the interior of the pipe using specialized tools

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3.1.18
integrity assessment
process that includes the inspection and testing of a pipeline in order to determine physical characteristics and assess its integrity condition by combination of an analysis of data, use of reliability assessment methodologies of the structure and an evaluation of the safety state of the pipeline

3.1.19
integrity management program
documented program that specifies the practices used by the operating company to proactively manage the safe, environmentally responsible, and reliable service of a pipeline system throughout its lifecycle and which incorporates a continuous improvement process

3.1.20
life extension
additional period of time beyond the original design or *service life* (3.1.36) (but within the assessed remnant life) for which permission to continue operating a pipeline system is granted by the regulatory bodies

Note 1 to entry: Life extension is considered as a modification to the design basis.

[SOURCE: ISO/TS 12747:2011, 3.7]

3.1.21
magnetic flux leakage
type of in-line inspection technology in which a magnetic field is induced in the pipe wall between two poles of a magnet

Note 1 to entry: Anomalies affect the distribution of the magnetic flux in the wall. The magnetic flux leakage pattern is used to detect and characterize anomalies.

3.1.22
management of change
process that systematically recognizes and communicates to the necessary parties changes of a technical, physical, procedural or organizational nature that can impact system integrity

3.1.23
manufacturing defect
defect (3.1.10) in the pipe body or coating created during the pipe or component manufacturing or coating processes

3.1.24
maximum allowable operating pressure
maximum internal pressure at which a pipeline system, or parts thereof, is allowed to be operated

Note 1 to entry: The MAOP is established by the maximum pressure achieved during testing (see ISO 13623).

3.1.25
metal loss
pipe anomaly in which metal has been removed

Note 1 to entry: Metal loss is usually the result of corrosion, but gouging, manufacturing defects erosion, or mechanical damage can also result in metal loss.

3.1.26
non-destructive testing
wide group of analysis techniques used to evaluate the properties of a material, component or system without causing damage

Note 1 to entry: “Non-destructive inspection” (NDI) and “non-destructive evaluation” (NDE) are also commonly used to describe this technology.

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3.1.27
offshore pipeline
part of a pipeline system that, except for pipeline risers, is laid on the seabed or below it inside a trench

Note 1 to entry: The pipeline might be resting wholly or intermittently on, or buried below, the seabed.

3.1.28
operator
person or organization who owns or operates a pipeline system or facilities who is ultimately responsible for the operation and integrity of the pipeline system

3.1.29
pipeline integrity management
set of processes and procedures that proactively assures incident-free safe and environmentally responsible transportation of fluids through a pipeline system

3.1.30
pipeline integrity management program
continuous improvement closed-loop system using information technology to realize functions such as data acquisition and integration, integrity and *risk assessment* (3.1.33), mitigation and repair activity and maintenance decisions, with comprehensive management of change and continual review and improvement processes

3.1.31
pressure test
means of assessing the integrity of a new or existing pipeline that involves filling the pipeline with water and pressurizing to a level in excess of the MAOP of the pipeline to demonstrate that the pipeline is fit for service at the MAOP for a given time frame dependent on the identified integrity hazards

Note 1 to entry: See ISO 13623:2017, 6.7.

3.1.32
risk
measure of loss, either qualitative or quantifiable, in terms of both the likelihood of incident occurrence and the magnitude of the consequences of the incident occurrence

3.1.33
risk assessment
systematic, analytical process in which potential hazards from the pipeline system are proactively identified, and the likelihood and consequences of potential adverse events are determined

3.1.34
risk management
coordinated activities to direct and control an organization with regard to *risk* (3.1.32)

[SOURCE: ISO Guide 73:2009, 2.1]

3.1.35
safe operating pressure
pressure, calculated using the appropriate analysis and mathematical formulas for the specific type of *defect* (3.1.10) identified

EXAMPLE For corrosion defects using recognized remaining strength of corroded pipeline formulas, where all corroded regions will withstand a calculated safe operating pressure.

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3.1.36
service life
length of time over which the pipeline system is intended to operate

[SOURCE: ISO/TS 12747:2011, 3.21]

Note 1 to entry: Service life is considered the actual operational life to date, but can include any planned future use of the line. Service life can be less or longer than design life.

3.1.37
sizing accuracy
accuracy with which an anomaly dimension or characteristic is reported

Note 1 to entry: Typically, accuracy is expressed by tolerance and certainty.

EXAMPLE Depth sizing accuracy for metal loss using NDT methods, such as an ILI tool, is commonly expressed as +/−10 % of the wall thickness (the tolerance) and 80 % of the time (the certainty).

3.1.38
third-party damage
damage done to the pipeline as a result of activities by personnel not associated with the pipeline

3.1.39
threat
activity or condition than can adversely affect the pipeline system if not adequately controlled

[SOURCE: ISO/TS 12747:2011, 3.23]

3.2 Abbreviated terms

AC	alternating current
CP	cathodic protection
CCA	critical consequence area
CoF	consequence of failure
DA	direct assessment
ECDA	external corrosion direct assessment
FFP	fitness for purpose
GIS	geographic information system
HIC	hydrogen-induced cracking
ICDA	internal corrosion direct assessment
ILI	in-line inspection
IMP	integrity management program
MAOP	maximum allowable operating pressure
MFL	magnetic flux leakage
NDT	non-destructive testing
PIM	pipeline integrity management

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