TECHNICAL SPECIFICATION

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Petroleum and natural gas industries — Pipeline transportation systems — Recommended practice for pipeline life extension

Industries du pétrole et du gaz naturel — Systèmes de transport par conduites — Pratique recommandée pour une longue durée des conduites

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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/TS 12747 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*.

Introduction

Within ISO/TC 67/SC 2 there has been a series of discussions concerning both the needs and level of prescription required to address pipeline life extension issues. These have highlighted that

— operators are applying differing approaches, which leads to inefficient use of both operator and authority resources;

— the assessment and upgrading of existing facilities have been based on probabilistic or reliability-based methods;

— the level of detail delivered varies.

The purpose of this Technical Specification is to address the above concerns by providing a consistent approach to pipeline life extension assessment that can be applied by operators (or parties acting on their behalf) across the industry.

This Technical Specification is concerned with the proof of technical integrity of the pipeline system for the justification of extended operation. Integrity management is not covered in detail. However, the interface between a PIMS and the life extension process is considered because

— a PIMS, where present, forms an integral part of the integrity assessment of the pipeline system;

— a PIMS of some form is required for operation in extended life.

Factors affecting the future operability of the system but not the technical integrity, such as the loss of a control umbilical, are flagged as requiring assessment but are not addressed in full in this Technical Specification.

Whilst this Technical Specification is aimed primarily at the pipeline operators, it can also be of interest to other stakeholders such as

— regulators approving the life extension application;

— members of the public affected by the life extension application, such as landowners and developers.

In light of this, an overview of the life extension process and the key principles involved is given in Clause 5. The remainder of the document is intended to provide detailed guidance to those performing the life extension assessments.

All guidance is provided for use in conjunction with sound engineering practice and judgment. This Technical Specification is not intended for use as a design code.

Petroleum and natural gas industries — Pipeline transportation systems — Recommended practice for pipeline life extension

1 Scope

This Technical Specification gives guidance to follow, as a minimum, in order to assess the feasibility of extending the service life of a pipeline system, as defined in ISO 13623, beyond its specified design life. Pump stations, compressor stations, pressure-reduction stations and depots are not specifically addressed in this Technical Specification, as shown in Figure 1.

This Technical Specification applies to rigid metallic pipelines. It is not applicable to the following:

— flexible pipelines;

— pipelines constructed from other materials, such as glass reinforced plastics;

— umbilicals;

— topsides equipment;

— structures and structural components.

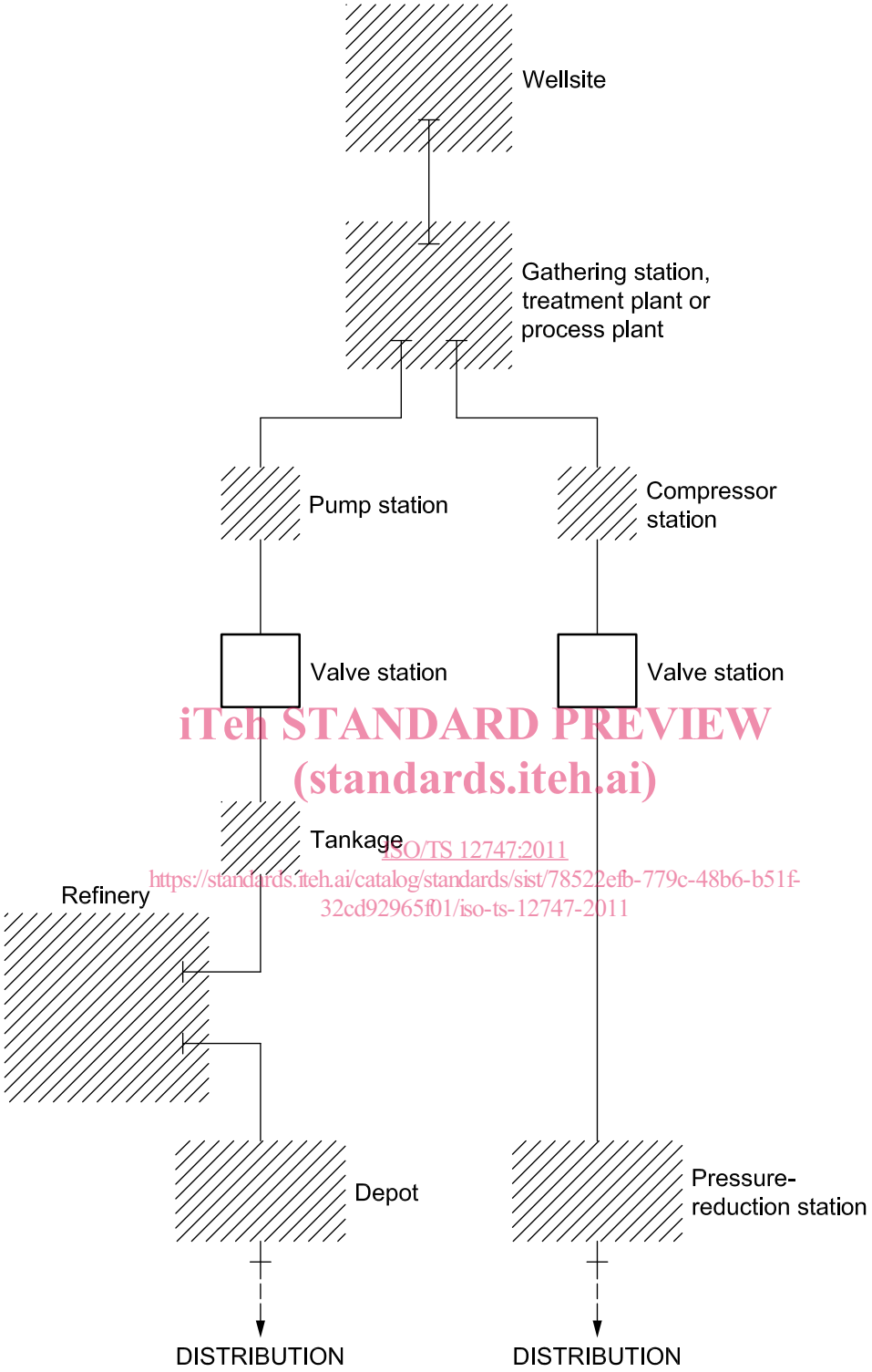
This Technical Specification is limited to life extension, which is an example of a change to the original design. Other changes, such as MAOP up-ratings, are excluded.

NOTE The assessment methodology is applicable to other changes to the design at the discretion of the user.

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



Key

pipeline systems covered by ISO/TS 12747

connection with other facilities

pipeline not covered by ISO/TS 12747

station/plant area or offshore installation not covered by ISO/TS 12747

station/plant area covered by ISO/TS 12747

Figure 1 — Extent of pipeline systems covered by this Technical Specification

3 Terms and definitions

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

3.1
acceptance criteria
specified indicators or measures employed in assessing the ability of a component, structure, or system to perform its intended function

3.2
anomaly
discrepancy or deviation of an element of the pipeline system from the established rules and limits

3.3
design life
period for which the design basis is planned to remain valid

[ISO 13623]

3.4
failure
event in which a component or system does not perform according to its operational requirements

3.5
flow assurance
ensuring successful and economical flow of fluid through the pipeline system

3.6
high integrity pressure protection system
mechanical overpressure protection system that rapidly isolates the pipeline if there is a risk of exceeding the maximum allowable operating pressure (MAOP)

3.7
life extension
additional period of time beyond the original design or service life (but within the assessed remnant life) for which permission to continue operating a pipeline system is granted by the regulatory bodies

NOTE Life extension is considered as a modification to the design basis.

3.8
location class
geographic area classified according to criteria based on population density and human activity

[ISO 13623]

3.9
maximum allowable operating pressure
maximum pressure at which the pipeline system, or parts thereof, is allowed to be operated

[Adapted from ISO 13623]

3.10
operation
activities involved with running and maintaining the pipeline system in accordance with the design premise

3.11
operator
party ultimately responsible for the operation and integrity of the pipeline system

3.12
pipeline integrity management system
management system designed to ensure the safe operation of a pipeline system in accordance with the design intent, by control of the physical condition of a pipeline, the operating conditions within the system and any changes made to the system

3.13
pipeline
those facilities through which fluids are conveyed, including pipe, pig traps, components and appurtenances, up to and including the isolating valves

[Adapted from ISO 13623]

3.14
pipeline
〈offshore〉 pipeline laid in maritime waters and estuaries seaward of the ordinary high water mark

[ISO 13623]

3.15
pipeline
〈onshore〉 pipeline laid on or in land, including lines laid under inland water courses

[ISO 13623]

3.16
pipeline system
pipelines, stations, supervisory control and data acquisition system (SCADA), safety systems, corrosion protection systems, and any other equipment, facility or building used in the transportation of fluids

[ISO 13623]

3.17
remnant life
assessed period of time (irrespective of the defined design life) for which a pipeline system can be operated safely, based on time-dependent degradation mechanisms such as corrosion and fatigue

3.18
required life
desired operational life of the pipeline, accounting for continued operation beyond the original pipeline design life

3.19
risk
qualitative or quantitative likelihood of an event occurring, considered in conjunction with the consequence of the event

3.20
risk management
policies, procedures and practices involved in the identification, assessment, control and mitigation of risks

3.21
service life
length of time over which the pipeline system is intended to operate

3.22
technical integrity
ability of the pipeline system to function in accordance with the design basis

3.23
threat
any activity or condition that can adversely affect the pipeline system if not adequately controlled

3.24
topsides
structures and equipment placed on a supporting structure (fixed or floating) to provide some or all of a platform's functions

4 Abbreviated terms

CP	Cathodic protection
ECA	Engineering critical assessment
ESD	Emergency shut-down
ESDV	Emergency shut-down valve
HIPPS	High integrity pressure protection system
ILI	In-line inspection
IP	Intelligent pig
MAOP	Maximum allowable operating pressure
PIMS	Pipeline integrity management system
QRA	Quantitative risk assessment
ROW	Right of way
SCADA	Supervisory control and data acquisition
VIV	Vortex-induced vibration

5 Life extension overview

5.1 General

The design life of a pipeline is derived to prevent failure during operation due to time-dependent degradation mechanisms such as corrosion and fatigue. However, the expiry of the design life does not automatically mean that the pipeline system is not fit-for-purpose because

— corrosion rates determined during the design process could have been conservative and/or corrosion defects could have been repaired;

— the anticipated operational fatigue damage could have been overestimated.

Extended operation beyond the pipeline design life can be desirable when recoverable oil and gas remain, or where additional operational assets are tied (or will be tied) into the pipeline system.

NOTE There are alternatives to pipeline life extension, such as installing a replacement pipeline. Therefore, a business case is required to determine the most suitable option by comparing the cost of the mitigation necessary to achieve the desired life extension with the cost of a new pipeline.

5.2 Assessment process

If the intention is to operate a pipeline system beyond its specified design life, a life extension assessment shall be performed. The aim of this assessment is to demonstrate that by extending the life of the pipeline system, the operator is not exposing society to unacceptable risk.

Figure 2 illustrates the pipeline system life extension assessment process. The shaded boxes highlight the distinct stages of the assessment and cross-references to the clause of this Technical Specification dealing with a particular stage are provided.

The process begins with a requirement for pipeline extension (item 1) and an assessment of the current integrity of the pipeline system (item 2). The life extension needs should then be defined (item 3), prior to commencement of the life extension assessment (item 4).

The life extension assessment shall consider conditions found during the normal operational life that were not considered in the design. Examples are time-dependent cracking mechanisms (e.g. SCC) and manufacturing flaws that can grow under the effect of cyclic loading. The requirements of the life extension assessment are discussed in more detail in 5.3.

Once an acceptable life extension has been determined, the assessment process shall be fully documented (item 5). If life extension is not possible (or if a replacement pipeline is the most economical solution), the pipeline should be decommissioned at the end of the design life as originally planned.

5.3 Assessment requirements

The life extension process illustrated in Figure 2 involves an assessment of the current pipeline system integrity and an assessment to determine the suitability of the pipeline system for life extension.

The assessment of the current integrity (item 2) shall include, but not be limited to, the following:

— review of the pipeline system operational history;

— detailed assessment of the current technical integrity of the pipeline system.

The life extension assessment (item 4) shall include, but not be limited to, the following:

a) risk assessment for extended operation;

b) review of the pipeline system design, including a gap analysis to identify the additional requirements of the current design codes;

c) assessment of the remnant life of the system, including the following:

   — corrosion assessment, accounting for both accumulated and future corrosion in combination with a defect assessment;

   — fatigue assessment, accounting for both accumulated and future fatigue damage;

   — coating breakdown and CP system degradation assessment;

   — identification and assessment of any other time-dependent degradation mechanism active in the pipeline;