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Petroleum and natural gas industries — Pipeline transportation systems

Industries du pétrole et du gaz naturel — Systèmes de transport par 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.

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 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 the following URL: 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*.

This third edition cancels and replaces the second edition (ISO 13623:2009), which has been technically revised.

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Introduction

Significant differences exist between member countries in the areas of public safety and protection of the environment, which cannot be reconciled into a single preferred approach to pipeline transportation systems for the petroleum and natural gas industries. Reconciliation was further complicated by the existence in some member countries of legislation that establishes requirements for public safety and protection of the environment. Recognizing these differences, ISO/TC 67/SC 2 concluded that this document should allow individual countries to apply their national requirements for public safety and the protection of the environment.

This document is not a design manual; rather, it is intended for use in conjunction with sound engineering practice and judgment. This document allows the use of innovative techniques and procedures, such as reliability-based limit state design methods, providing the minimum requirements of this document are satisfied.

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Petroleum and natural gas industries — Pipeline transportation systems

1 Scope

This document specifies requirements and gives recommendations for the design, materials, construction, testing, operation, maintenance and abandonment of pipeline systems used for transportation in the petroleum and natural gas industries.

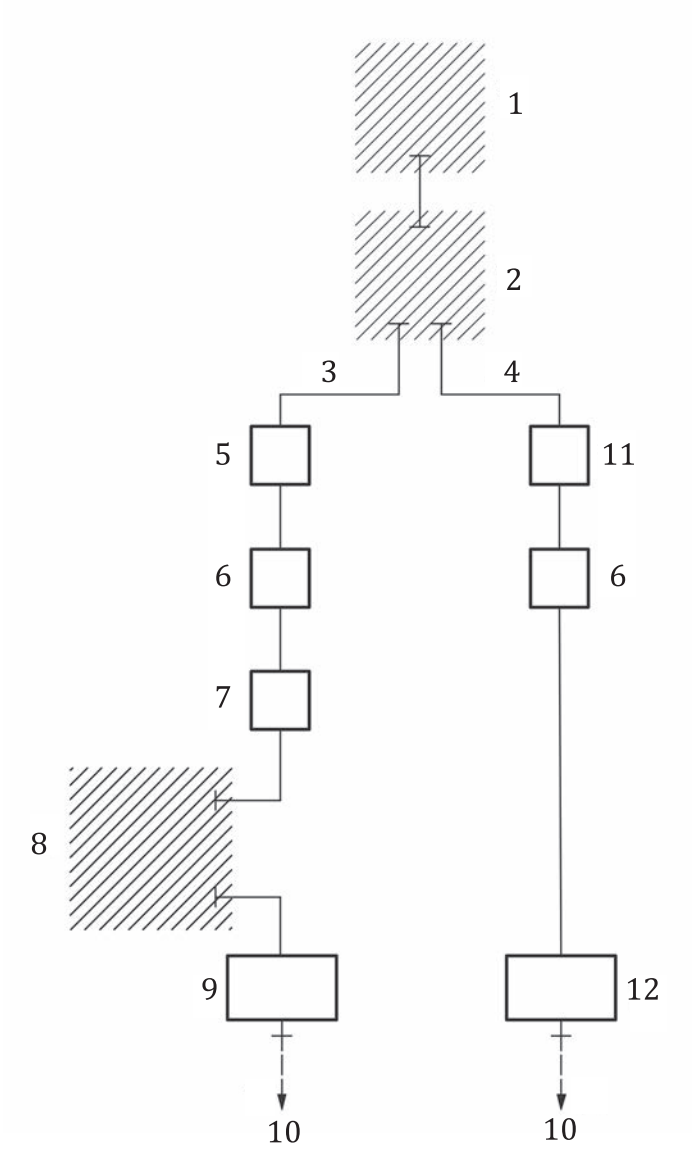
It applies to pipeline systems on-land and offshore, connecting wells, production plants, process plants, refineries and storage facilities, including any section of a pipeline constructed within the boundaries of such facilities for the purpose of its connection. The extent of pipeline systems covered by this document is illustrated in Figure 1.

This document applies to rigid, metallic pipelines. It is not applicable for flexible pipelines or those constructed from other materials, such as glass-reinforced plastics.

This document is applicable to all new pipeline systems and can be applied to modifications made to existing ones. It is not intended that it applies retroactively to existing pipeline systems.

It describes the functional requirements of pipeline systems and provides a basis for their safe design, construction, testing, operation, maintenance and abandonment.

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Key

1	wellsite	7	tankage
2	gathering station, treatment plant or process plant	8	refinery
3	liquid	9	depot
4	gas	10	distribution
5	pump station	11	compressor station
6	valve station	12	pressure-reduction station

pipeline elements covered by this document

connections with other facilities (the pipeline system should include an isolation valve at connections with other facilities and at branches)

pipeline elements not covered by this document

station/plant area 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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 3183:2012, *Petroleum and natural gas industries — Steel pipe for pipeline transportation systems*

ISO 3977 (all parts), *Gas turbines — Procurement*

ISO 10439 (all parts), *Petroleum, chemical and gas service industries — Axial and centrifugal compressors and expander-compressors*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 12736, *Petroleum and natural gas industries — Wet thermal insulation coatings for pipelines, flow lines, equipment and subsea structures*

ISO 13707, *Petroleum and natural gas industries — Reciprocating compressors*

ISO 13709, *Centrifugal pumps for petroleum, petrochemical and natural gas industries*

ISO 13710, *Petroleum, petrochemical and natural gas industries — Reciprocating positive displacement pumps*

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

ISO 14313, *Petroleum and natural gas industries — Pipeline transportation systems — Pipeline valves*

ISO 14723, *Petroleum and natural gas industries — Pipeline transportation systems — Subsea pipeline valves*

ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production*

ISO 15589 (all parts), *Petroleum, petrochemical and natural gas industries — Cathodic protection of pipeline systems*

ISO 15590-1:2009, *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems — Part 1: Induction bends*

ISO 15590-2, *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems — Part 2: Fittings*

ISO 15590-3, *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems — Part 3: Flanges*

ISO 15649, *Petroleum and natural gas industries — Piping*

ISO 16440, *Petroleum and natural gas industries — Pipeline transportation systems — Design, construction and maintenance of steel cased pipelines*

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

IEC 60034-1, *Rotating electrical machines — Part 1: Rating and performance*

IEC 60079-10, *Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas*

IEC 60079-14, *Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in hazardous areas (other than mines)*

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EN 12583, *Gas infrastructure — Compressor stations — Functional requirements*

API STD 620, *Design and Construction of Large, Welded, Low-Pressure Storage Tanks*

API STD 650, *Welded Steel Tanks for Oil Storage*

ASME B16.5, *Pipe Flanges and Flanged Fittings — NPS 1/2 Through NPS 24*

ASME *Boiler and Pressure Vessel Code, Section VIII, Division 1, Rules for Construction of Pressure Vessels (BPVC)*

MSS SP-25, *Standard Marking System for Valves, Fittings, Flanges and Unions*

MSS SP-44, *Steel Pipeline Flanges*

NFPA 30, *Flammable and Combustible Liquids Code*

NFPA 220, *Standard on Types of Building Construction*

3 Terms, definitions and symbols

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 www.iso.org/obp

— IEC Electropedia: available at www.electropedia.org

3.1.1
commissioning
activities associated with the initial filling of a *pipeline system* (3.1.16) with the *fluid* (3.1.6) being transported

3.1.2
design life
period for which the design basis is planned to remain valid

3.1.3
design pressure
maximum internal pressure of the pressure-containing components of the *pipeline system* (3.1.16) designed in compliance with this document

3.1.4
design strength
strength level to be used in design, based on material's specified minimum properties

3.1.5
fabricated assembly
grouping of pipe and components assembled as a unit and installed as a subunit of a *pipeline system* (3.1.16)

3.1.6
fluid
medium being transported through the *pipeline system* (3.1.16)

3.1.7
hot tapping
mechanical cutting of an *in-service pipeline* (3.1.8) or *piping* (3.1.17) to create a branch connection

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3.1.8
in-service pipeline
pipeline that has been commissioned for the transportation of *fluid* (3.1.6)

3.1.9
lay corridor
corridor in which an *offshore pipeline* (3.1.13) is being installed, usually determined prior to construction

3.1.10
location class
geographic area classified according to criteria based on population density and human activity

3.1.11
maintenance
activities designed to retain the *pipeline system* (3.1.16) in a state in which it can perform its required functions

Note 1 to entry: These activities include inspections, surveys, testing, servicing, replacement, remedial works and repairs.

3.1.12
maximum allowable operating pressure
MAOP
maximum internal pressure at which a *pipeline system* (3.1.16), or parts thereof, is allowed to be operated in compliance with this document

Note 1 to entry: The MAOP is established by the maximum pressure achieved during testing (see 6.7.3).

3.1.13
offshore pipeline
pipeline (3.1.15) laid in maritime waters and estuaries seaward of the ordinary high water mark

3.1.14
on-land pipeline
pipeline (3.1.15) laid on or in land, including lines laid under inland water courses

3.1.15
pipeline
those components of a *pipeline system* (3.1.16) connected together to convey *fluids* (3.1.6) between *stations* (3.1.24) and/or plants, including pipe, pig traps, components, appurtenances, spools, *risers* (3.1.20), isolating valves, and sectionalizing valves

Note 1 to entry: See Figure 1.

3.1.16
pipeline system
pipelines, *stations* (3.1.24), 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* (3.1.6)

3.1.17
piping
pipe, fittings and components inside *stations* (3.1.24) and terminals, but not part of the *pipeline* (3.1.15)

3.1.18
primary piping
piping conveying or storing the *fluid* (3.1.6) transported by the *pipeline* (3.1.15)

3.1.19
right-of-way
corridor of land within which the *pipeline* (3.1.15) operator has the right to conduct activities in accordance with the agreement with the land owner

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3.1.20
riser
part of an offshore *pipeline* (3.1.15) that extends from the sea bed to the pipeline termination point on an offshore installation

3.1.21
secondary piping
piping carrying *fluids* (3.1.6) other than those of the *primary piping* (3.1.18) and *pipeline* (3.1.15), such as fuel gas, water, or lube oil

3.1.22
specified minimum tensile strength
SMTS
minimum tensile strength required by the specification or standard under which the material is purchased

3.1.23
specified minimum yield strength
SMYS
minimum yield strength required by the specification or standard under which the material is purchased

3.1.24
station
facility for the purpose of increasing pressure, decreasing pressure, storage, metering, heating, cooling or isolating the transported *fluid* (3.1.6)

3.2 Symbols

A_i internal cross-sectional area of the pipe

A_s cross-sectional area of pipewall

D specified diameter (outside or inside)

D_{max} maximum measured diameter (outside or inside)

D_{min} minimum measured diameter (outside or inside)

D_o nominal outside diameter

E modulus of elasticity

F_{eq} equivalent stress design factor

f_h hoop-stress design factor, obtained from Table 2 for on-land pipelines and Table 3 for offshore pipelines

f_t material strength temperature

F pipe effective axial force

p_{id} design pressure

p_{od} minimum external hydrostatic pressure

O ovality or out-of-roundness

t_{min} specified minimum wall thickness

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