INTERNATIONAL STANDARD

ISO 13623

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13623 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*, Subcommittee SC 2, *Pipeline transportation systems*.

Annexes A and B form a normative part of this International Standard. Annexes C, D, E and F are for information only.

Introduction

Significant differences exist between member countries in the areas of public safety and protection of the environment, which could not 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 which establishes requirements for public safety and protection of the environment. Recognizing these differences, TC 67/SC 2 concluded that this International Standard, ISO 13623, should allow individual countries to apply their national requirements for public safety and the protection of the environment.

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

Petroleum and natural gas industries — Pipeline transportation systems

1 Scope

This International Standard 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 International Standard is illustrated in Figure 1.

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

This International Standard is applicable to all new pipeline systems and may be applied to modifications made to existing ones. It is not intended that it should apply 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.

2 Normative references

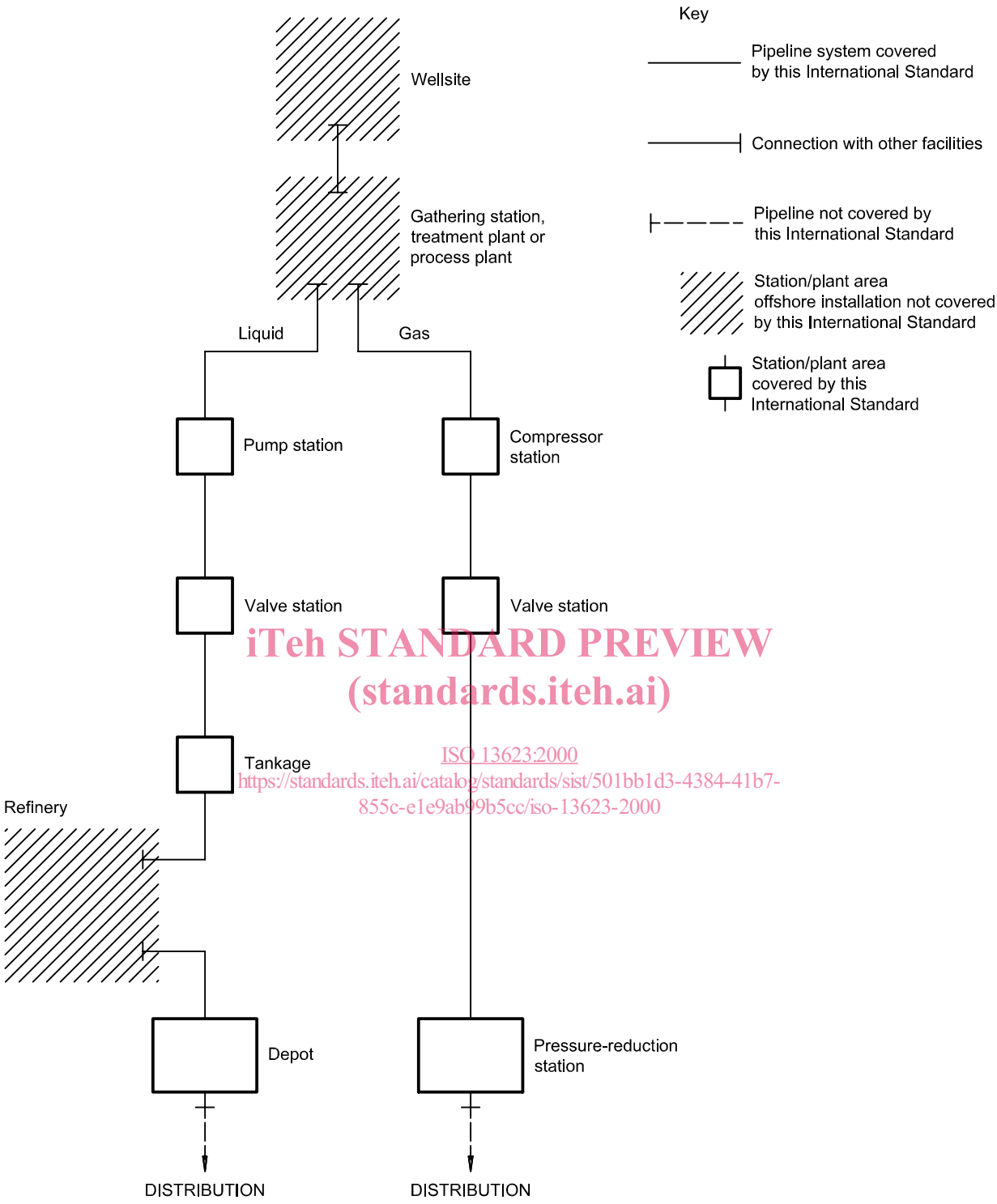
The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

NOTE Non-International Standards may be replaced, by agreement, with other recognized and equivalent national or industry standards.

ISO 148:1983, *Steel — Charpy impact test (V-notch).*

ISO 3183-1:1996, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 1: Pipes of requirement class A.*

ISO 3183-2:1996, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 2: Pipes of requirement class B.*



NOTE The pipeline system should include an isolation valve at connections with other facilities and at branches.

Figure 1 — Extent of pipeline systems covered by this International Standard

ISO 3183-3:1999, *Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions — Part 3: Pipes of requirement class C.*

ISO 7005-1:1992, *Metallic flanges — Part 1: Steel flanges.*

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

ISO 13847, *Petroleum and natural gas industries — Pipeline transportation systems — Field and shop 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.*

IEC 60079-10:1995, *Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas.*

IEC 60079-14:1996, *Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in hazardous areas (other than mines).*

API[1] Std 620:1996, *Design and construction of large, welded, low-pressure storage tanks.*

API Std 650:1993, *Welded steel tanks for oil storage.*

ASME[2] B16.5:1996, *Pipe flanges and flanged fittings — NPS 1/2 through NPS 24.*

ASME B31.3:1996, *Process piping.*

ASME Boiler and Pressure Vessel Code:1998, Section VIII, Division I, *Rules for construction of pressure vessels.*

ASTM[3] A193/A 193M:1998, *Standard specification for alloy-steel and stainless steel bolting materials for high-temperature service.*

ASTM A194/A 194M:1998, *Standard specification for carbon and alloy steel nuts for bolts for high pressure or high temperature service, or both.*

MSS[4] SP-25:1998, *Standard marking system for valves, fittings, flanges and unions.*

MSS SP-44:1996, *Steel pipeline flanges.*

NFPA[5] 30, *Flammables and combustible liquids code.*

NFPA 220, *Standard on types of building construction.*

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1) American Petroleum Institute, 1220 L Street, Northwest Washington, DC 20005-4070, USA.

2) American Society of Mechanical Engineers, 345 East 47th Street, NY 10017-2392, USA.

3) American Society for Testing and Materials, 100 Bar Harbor Drive, West Conshohocken, PA 19428-2959, USA.

4) Manufacturer's Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, VA 22180, USA.

5) National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101, USA.

3 Terms and definitions

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

3.1
commissioning
activities associated with the initial filling of a pipeline system with the fluid to be transported

3.2
fabricated assembly
grouping of pipe and components assembled as a unit and installed as a subunit of a pipeline system

3.3
fluid
medium to be transported through the pipeline system

3.4
hot tapping
tapping, by mechanical cutting, of a pipeline in service

3.5
in-service pipeline
pipeline that has been commissioned for the transportation of fluid

3.6
internal design pressure
maximum internal pressure at which the pipeline or section thereof is designed in compliance with this International Standard

3.7
lay corridor
corridor in which an offshore pipeline is to be installed, usually determined prior to construction

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

3.9
maintenance
all activities designed to retain the pipeline system in a state in which it can perform its required functions

NOTE These activities include inspections, surveys, testing, servicing, replacement, remedial works and repairs.

3.10
maximum allowable operating pressure
MAOP
maximum pressure at which a pipeline system, or parts thereof, is allowed to be operated

3.11
offshore pipeline
pipeline laid in maritime waters and estuaries seaward of the ordinary high water mark

3.12
pipeline
those facilities through which fluids are conveyed, including pipe, pig traps, components and appurtenances, up to and including the isolating valves

3.13
pipeline design life
period of time selected for the purpose of verifying that a replaceable or permanent component is suitable for the anticipated period of service

3.14
pipeline on land
pipeline laid on or in land, including lines laid under inland water courses

3.15
pipeline system
pipeline with compressor or pump stations, pressure control stations, flow control stations, metering, tankage, 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

3.16
right-of-way
corridor of land within which the pipeline operator has the right to conduct activities in accordance with the agreement with the land owner

3.17
riser
that part of an offshore pipeline, including subsea spool pieces, which extends from the sea bed to the pipeline termination point on an offshore installation

3.18
specified minimum yield strength
SMYS
minimum yield strength required by the specification or standard under which the material is purchased

4 General

4.1 Health, safety and the environment

The objective of this International Standard is that the design, material selection and specification, construction, testing, operation, maintenance and abandonment of pipeline systems for the petroleum and natural gas industries are safe and conducted with due regard to public safety and the protection of the environment.

4.2 Competence assurance

All work associated with the design, construction, testing, operation, maintenance and abandonment of the pipeline system shall be carried out by suitably qualified and competent persons.

4.3 Compliance

A quality system should be applied to assist compliance with the requirements of this International Standard.

NOTE ISO 9000-1 gives guidance on the selection and use of quality systems.

4.4 Records

Records of the pipeline system shall be kept and maintained throughout its lifetime to demonstrate compliance with the requirements of this International Standard. Annex F may be used for guidance or records which should be retained.

5 Pipeline system design

5.1 System definition

The extent of the pipeline system, its functional requirements and applicable legislation should be defined and documented.

The extent of the system should be defined by describing the system, including the facilities with their general locations and the demarcations and interfaces with other facilities.

The functional requirements should define the required design life and design conditions. Foreseeable normal, extreme and shut-in operating conditions with their possible ranges in flowrates, pressures, temperatures, fluid compositions and fluid qualities should be identified and considered when defining the design conditions.

5.2 Categorization of fluids

The fluids to be transported shall be placed in one of the following five categories according to the hazard potential in respect of public safety:

Category A	Typically non-flammable water-based fluids.
Category B	Flammable and/or toxic fluids which are liquids at ambient temperature and at atmospheric pressure conditions. Typical examples are oil and petroleum products. Methanol is an example of a flammable and toxic fluid.
Category C	Non-flammable fluids which are non-toxic gases at ambient temperature and atmospheric pressure conditions. Typical examples are nitrogen, carbon dioxide, argon and air.
Category D	Non-toxic, single-phase natural gas.
Category E	Flammable and/or toxic fluids which are gases at ambient temperature and atmospheric pressure conditions and are conveyed as gases and/or liquids. Typical examples are hydrogen, natural gas (not otherwise covered in category D), ethane, ethylene, liquefied petroleum gas (such as propane and butane), natural gas liquids, ammonia and chlorine.

Gases or liquids not specifically included by name should be classified in the category containing fluids most closely similar in hazard potential to those quoted. If the category is not clear, the more hazardous category shall be assumed.

5.3 Hydraulic analysis

The hydraulics of the pipeline system should be analysed to demonstrate that the system can safely transport the fluids for the design conditions specified in 5.1, and to identify and determine the constraints and requirements for its operation. This analysis should cover steady-state and transient operating conditions.

NOTE Examples of constraints and operational requirements are allowances for pressure surges, prevention of blockage such as caused by the formation of hydrates and wax deposition, measures to prevent unacceptable pressure losses from higher viscosities at lower operating temperatures, measures for the control of liquid slug volumes in multi-phase fluid transport, flow regime for internal corrosion control, erosional velocities and avoidance of slack line operations.

5.4 Pressure control and overpressure protection

Provisions such as pressure control valves or automatic shutdown of pressurizing equipment shall be installed, or procedures implemented, if the operating pressure can exceed the maximum allowable operating pressure anywhere in the pipeline system. Such provisions or procedures shall prevent the operating pressure exceeding MAOP under normal steady-state conditions.

Overpressure protection, such as relief or source isolation valves, shall be provided if necessary to prevent incidental pressures exceeding the limits specified in 6.3.2.1 anywhere in the pipeline system.

5.5 Requirements for operation and maintenance

The requirements for the operation and maintenance of the pipeline system shall be established and documented for use in the design and the preparation of procedures for operations and maintenance. Aspects for which requirements should be specified may include:

— requirements for identification of pipelines, components and fluids transported;

— principles for system control, including consideration of manning levels and instrumentation;

— location and hierarchy of control centres;

— voice and data communications;

— corrosion management;

— condition monitoring;

— leak detection;

— pigging philosophy;

— access, sectionalizing and isolation for operation, maintenance and replacement;

— interfaces with upstream and downstream facilities;

— emergency shut-in;

— depressurization with venting and/or drainage;

— shutdowns and restart;

— requirements identified from the hydraulic analysis.

5.6 Public safety and protection of the environment

National requirements which take precedence over the requirements in this International Standard shall be specified by the country in which the pipeline is located. The requirements in this International Standard for public safety and protection of the environment shall apply where no specific national requirements exist.

On-land pipeline systems for category D and E fluids should meet the requirements for public safety of annex B where specific requirements for public safety have not been defined by the country in which the pipeline is located.

6 Pipeline design

6.1 Design principles

The extent and detail of the design of a pipeline system shall be sufficient to demonstrate that the integrity and serviceability required by this International Standard can be maintained during the design life of the pipeline system.