INTERNATIONAL STANDARD

ISO 14313

Second edition
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Petroleum and natural gas industries — Pipeline transportation systems — Pipeline valves

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

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 14313 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 second edition cancels and replaces the first edition (ISO 14313:1999), which has been technically revised, principally by the following.

— Clause 2, on the requirements for conformity to this International Standard, has been added for clarification.

— Clause 7, on the requirements for allowable stresses and allowable deflection on design, has been revised and clarified.

— Clause 8, on material, has been revised to align the requirements with global industry practice for carbon content and carbon equivalent for pressure-containing, pressure-controlling, welding ends and parts requiring welding.

— New requirements on repairs and NDE of welding repairs have been added to Clause 9 on Welding.

— A new table (Table D.2) has been added to Annex D (informative) to provide more guidance for those requirements listed in the text as requiring agreement between the manufacturer/purchaser.

Introduction

This International Standard is the result of harmonizing the requirements of ISO 14313:1999 and API Spec 6D-2002[5].

The revision of ISO 14313 is developed based on input from both ISO/TC67/SC2 WG2 and API 6D TG technical experts. The technical revisions have been made In order to accommodate the needs of industry and to move this International Standard to a higher level of service to the petroleum and natural gas industry.

Users of this International Standard should be aware that further or differing requirements can be needed for individual applications. This International Standard is not intended to inhibit a manufacturer from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the manufacturer should identify any variations from this International Standard and provide details.

Petroleum and natural gas industries — Pipeline transportation systems — Pipeline valves

1 Scope

This International Standard specifies requirements and provides recommendations for the design, manufacturing, testing and documentation of ball, check, gate and plug valves for application in pipeline systems meeting the requirements of ISO 13623 for the petroleum and natural gas industries.

This International Standard is not applicable to subsea pipeline valves, as they are covered by a separate International Standard (ISO 14723).

This International Standard is not applicable to valves for pressure ratings exceeding PN 420 (Class 2 500).

2 Conformance

2.1 Units of measurement

In this International Standard, data are expressed in both SI units and USC units. For a specific order item, unless otherwise stated, only one system of units shall be used, without combining data expressed in the other system.

For data expressed in SI units, a comma is used as the decimal separator and a space is used as the thousands separator. For data expressed in USC units, a dot (on the line) is used as the decimal separator and a comma is used as the thousands separator.

2.2 Rounding

Except as otherwise required by this International Standard, to determine conformance with the specified requirements, observed or calculated values shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of ISO 31-0:1992, Annex B, Rule A.

2.3 Compliance to standard

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

NOTE ISO/TS 29001 gives sector-specific guidance on quality management systems.

The manufacturer shall be responsible for complying with all of the applicable requirements of this International Standard. It shall be permissible for the purchaser to make any investigation necessary in order to be assured of compliance by the manufacturer and to reject any material that does not comply.

3 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, corrigendum, and maintenance agency output) applies.

ISO 31-0,1992, *Quantities and units — Part 0: General principles*

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 5208:1993, *Industrial valves — Pressure testing of valves*

ISO 7268, *Pipe components — Definition of nominal pressure*

ISO 9606-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

ISO 9712, *Non-destructive testing — Qualification and certification of personnel*

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

ISO 10497, *Testing of valves — Fire type-testing requirements*

ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO 15609 (all parts), *Specification and qualification of welding procedures for metallic materials — Welding procedure specification*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 23277, *Non-destructive testing of welds — Penetrant testing of welds — Acceptance levels*

ISO 23278, *Non-destructive testing of welds — Magnetic particle testing of welds — Acceptance levels*

ASME B1.20.1[1)], *Pipe Threads, General Purpose, Inch*

ASME B16.5-1996, *Pipe Flanges and Flanged Fittings : NPS 1/2 through 24*

ASME B16.10-2000, *Face-to-Face and End-to-End Dimensions of Valves*

ASME B16.34-2004, *Valves, Flanged, Threaded, and Welding End*

ASME B16.47-2006, *Large Diameter Steel Flanges : NPS 26 Through NPS 60 Metric/Inch Standard*

ASME B31.4-2006, *Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids*

ASME B31.8-2003, *Gas Transmission and Distribution Piping Systems*

ASME Boiler and Pressure Vessel Code, Section V: *Nondestructive Examination*

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

ASME Boiler and Pressure Vessel Code — Section VIII: *Rules for Construction of Pressure Vessels* Division 1, *Rules for Construction of Pressure Vessels*

ASME Boiler and Pressure Vessel Code — Section VIII: *Rules for Construction of Pressure Vessels* Division 2: *Alternative Rules*

ASME Boiler and Pressure Vessel Code — Section IX: *Welding and Brazing Qualifications*

ASNT SNT-TC-1A[2)], *Recommended Practice No. SNT-TC-1A — Personnel Qualification and Certification in Non-Destructive Testing*

ASTM A320[3)], *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service*

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A388, *Standard Practice for Ultrasonic Examination of Heavy Steel Forgings*

ASTM A435, *Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates*

ASTM A577, *Standard Specification for Ultrasonic Angle-Beam Examination of Steel Plates*

AWS QC1[4)], *Standard for AWS Certification of Welding Inspectors*

EN 287-1[5)], *Qualification test of welders — Fusion welding — Part 1: Steels*

EN 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 10204:2004, *Metallic products — Type of inspection documents*

MSS SP-44, *Steel Pipeline Flanges*

MSS SP-55, *Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities*

NACE TM0177-2005, *Standard test method. Laboratory testing of metals for resistance to specific forms of environmental cracking in* H_2S *environments*

NACE TM0284, *Standard Test Method — Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking*

2) American Society of Non-Destructive Testing, P.O. Box 28518, 1711 Arlingate Lane, Columbus, OH 43228-0518, USA.

3) ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.

4) The American Welding Society, 550 NW LeJeune Road, Miami, FL 33126, USA.

5) CEN, European Committee for Standardization, Central Secretariat, Rue de Stassart 36, B-1050, Brussels, Belgium.

4 Terms and definitions

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

4.1
ASME rating class
numerical pressure design class defined in ASME B16.34 and used for reference purposes

NOTE The ASME rating class is designated by the word "class" followed by a number.

4.2
bi-directional valve
valve designed for blocking the fluid in both downstream and upstream directions

4.3
bleed
drain or vent

4.4
block valve
gate, plug or ball valve that blocks flow into the downstream conduit when in the closed position

NOTE Valves are either single- or double-seated, bi-directional or uni-directional.

4.5
breakaway thrust
breakaway torque
maximum thrust or torque required to operate a valve at maximum pressure differential

4.6
by agreement
agreed between manufacturer and purchaser

4.7
double-block-and-bleed valve
DBB
single valve with two seating surfaces that, in the closed position, provides a seal against pressure from both ends of the valve with a means of venting/bleeding the cavity between the seating surfaces

NOTE This valve does not provide positive double isolation when only one side is under pressure. See **double-isolation-and-bleed valve** (4.8).

4.8
double-isolation-and-bleed valve
DIB
single valve with two seating surfaces, each of which, in the closed position, provides a seal against pressure from a single source, with a means of venting/bleeding the cavity between the seating surfaces

NOTE This feature can be provided in one direction or in both directions.

4.9
drive train
all parts of a valve drive between the operator and the obturator, including the obturator but excluding the operator

4.10
flow coefficient
K_v
volumetric flow rate of water at a temperature between 5 °C (40 °F) and 40 °C (104 °F) passing through a valve and resulting in a pressure loss of 0,1 MPa (1 bar; 14.5 psi)

NOTE K_v is expressed in SI units of cubic metres per hour.

NOTE K_v is related to the flow coefficient C_v , expressed in USC units of US gallons per minute at 15,6 °C (60 °F) resulting in a 1 psi pressure drop as given by Equation (1):

$$K_v = \frac{C_v}{1{,}156} \quad (1)$$

4.11
full-opening valve
valve with an unobstructed opening, not smaller than the internal bore of the end connections

4.12
handwheel
wheel consisting of a rim connected to a hub, for example by spokes, and used to manually operate a valve requiring multiple turns

4.13
locking device
part or an arrangement of parts for securing a valve in the open and/or closed position

4.14
manual actuator
manual operator
wrench (lever) or hand-wheel with or without a gearbox

4.15
maximum pressure differential
MPD
maximum difference between the upstream and downstream pressure across the obturator at which the obturator may be operated

4.16
nominal pipe size
NPS
numerical imperial designation of size which is common to components in piping systems of any one size

NOTE Nominal pipe size is designated by the abbreviation “NPS” followed by a number.

4.17
nominal pressure class
PN
numerical pressure design class as defined in ISO 7268 and used for reference purposes

NOTE Nominal pressure (PN) class is designated by the abbreviation “PN” followed by a number.

4.18
nominal size
DN
numerical metric designation of size that is common to components in piping systems of any one size

NOTE Nominal size is designated by the abbreviation “DN” followed by a number.

4.19
obturator
closure member
part of a valve, such as a ball, clapper, disc, gate or plug that is positioned in the flow stream to permit or prevent flow

4.20
operator
device (or assembly) for opening or closing a valve

4.21
packing gland
component used to compress the stem packing

4.22
position indicator
device to show the position of the valve obturator

4.23
piggability
capability of a valve to permit the unrestricted passage of a pig

4.24
powered actuator
powered operator
electric, hydraulic or pneumatic device bolted or otherwise attached to the valve for powered opening and closing of the valve

4.25
pressure class
numerical pressure design class expressed in accordance with either the nominal pressure (PN) class or the ASME rating class

NOTE In this International Standard, the pressure class is stated by the PN class followed by the ASME rating class between brackets.

4.26
pressure-containing parts
parts, whose failure to function as intended results in a release of contained fluid into the environment

4.27
pressure-controlling parts
parts, such as seat and obturator, intended to prevent or permit the flow of fluids

4.28
process-wetted parts
parts exposed directly to the pipeline fluid

4.29
reduced-opening valve
valve with the opening through the obturator smaller than at the end connection(s)

4.30
seating surfaces
contact surfaces of the obturator and seat which ensure valve sealing

4.31
stem
part that connects the obturator to the operator and which can consist of one or more components

4.32
stem extension assembly
assembly consisting of the stem extension and the stem extension housing

4.33
support ribs or legs
metal structure that provides a stable footing when the valve is set on a fixed base

4.34
through-conduit valve
valve with an unobstructed and continuous cylindrical opening

4.35
uni-directional valve
valve designed for blocking the flow in one direction only

4.36
unless otherwise agreed
⟨modification of the requirements of this International Standard⟩ unless the manufacturer and purchaser agree on a deviation

4.37
unless otherwise specified
⟨modification of the requirements of this International Standard⟩ unless the purchaser specifies otherwise

4.38
venturi plug valve
valve with a substantially reduced opening through the plug and a smooth transition from each full-opening end to the reduced opening

5 Symbols and abbreviated terms

5.1 Symbols

C_v flow coefficient in USC units

K_v flow coefficient in metric units

t thickness

5.2 Abbreviated terms

BM base metal

CE carbon equivalent

DBB double-block-and-bleed

DIB double isolation-and-bleed

DN nominal size

HAZ heat-affected zone

HBW Brinell hardness, tungsten ball indenter

HRC Rockwell C hardness

HV Vickers hardness

MPD maximum pressure differential

MT magnetic-particle testing

NDE non-destructive examination

NPS nominal pipe size

PN nominal pressure

PQR (weld) procedure qualification record

PT penetrant testing

PWHT post-weld heat treatment

RT radiographic testing

SMYS specified minimum yield strength

USC United States Customary (units)

UT ultrasonic testing

WM weld metal

WPS weld procedure specification

WPQ welder performance qualification

6 Valve types and configurations

6.1 Valve types

6.1.1 Gate valves

Typical configurations for gate valves with flanged and welding ends are shown, for illustration purposes only, in Figures 1 and 2.

Gate valves shall have an obturator that moves in a plane perpendicular to the direction of flow. The gate can be constructed of one piece for slab-gate valves or of two or more pieces for expanding-gate valves.

Gate valves shall be provided with a back seat or secondary stem sealing feature in addition to the primary stem seal.

6.1.2 Lubricated and non-lubricated plug valves

Typical configurations for plug valves with flanged and welding ends are shown, for illustration purposes only, in Figure 3.

Plug valves shall have a cylindrical or conical obturator that rotates about an axis perpendicular to the direction of flow.

6.1.3 Ball valves

Typical configurations for ball valves with flanged or welding ends are shown, for illustration purposes only, in Figures 4, 5 and 6.

Ball valves shall have a spherical obturator that rotates on an axis perpendicular to the direction of flow.

6.1.4 Check valves

Typical configurations for check valves are shown, for illustration purposes only, in Figures 7 to 13. Check valves can also be of the wafer, axial flow and lift type.

Check valves shall have an obturator which responds automatically to block fluid in one direction.

6.2 Valve configurations

6.2.1 Full-opening valves

Full-opening flanged-end valves shall be unobstructed in the fully opened position and shall have an internal bore as specified in Table 1. There is no restriction on the upper limit of valve bore sizes.

Full-opening through-conduit valves shall have a circular bore in the obturator that allows a sphere to pass with a nominal size not less than that specified in Table 1.

Welding-end valves can require a smaller bore at the welding end to mate with the pipe.

Valves with a non-circular opening through the obturator shall not be considered full opening.

6.2.2 Reduced-opening valves

Reduced-opening valves with a circular opening through the obturator shall be supplied with a minimum bore as follows, unless otherwise specified:

— valves DN 300 (NPS 12) and below: one size below nominal size of valve with bore according to Table 1;

— valves DN 350 (NPS 14) to DN 600 (NPS 24): two sizes below nominal size of valve with bore according to Table 1;

— valves above DN 600 (NPS 24): by agreement.

EXAMPLE A DN 400 (NPS 16) – PN 250 (class 1500) reduced-opening ball valve has a minimum bore of 287 mm.

Reduced-opening valves with a non-circular opening through the obturator shall be supplied with a minimum opening by agreement.