INTERNATIONAL STANDARD

ISO 3183

Second edition
2007-03-15

Petroleum and natural gas industries — Steel pipe for pipeline transportation systems

Industries du pétrole et du gaz naturel — Tubes en acier pour les systèmes de transport par conduites

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Contents

Page

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 3183 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 of ISO 3183 cancels and replaces ISO 3183-1:1996, ISO 3183-2:1996 and ISO 3183-3:1999 which have been technically revised. It is the intent of TC 67 that the first and second edition of ISO 3183 shall both be applicable, at the option of the purchaser (as defined in 4.37), for a period of six months from the first day of the calendar quarter immediately following the date of publication of this second edition, after which period ISO 3183-1:1996, ISO 3183-2:1996 and ISO 3183-3:1999 will no longer be applicable.

Introduction

This International Standard is the result of harmonizing the requirements of the following standards:

— API Spec 5L;

— ISO 3183-1:1996;

— ISO 3183-2:1996;

— ISO 3183-3:1999.

In the preparation of this second edition of ISO 3183, the technical committee recognized that there are two basic levels of standard technical requirements for line pipe and, therefore, agreed to establish requirements for two product specification levels (PSL 1 and PSL 2). Level PSL 1 provides a standard quality level for line pipe. Level PSL 2 has additional mandatory requirements for chemical composition, notch toughness and strength properties and additional NDE. Requirements that apply to only PSL 1 or to only PSL 2 are so designated. Requirements that are not designated to a specific PSL designation apply to both PSL 1 and PSL 2. A table comparing this edition of ISO 3183 with the with the predecessor International Standard ISO 3183 (all parts) and API Spec 5L and used in the harmonization of these documents is given for information in Annex M.

The technical committee also recognized that the petroleum and natural gas industry often specifies additional requirements for particular applications. In order to accommodate such needs, optional additional requirements for special applications are available, as follows:

— PSL 2 pipe ordered with a qualified manufacturing procedure (Annex B);

— PSL 2 pipe ordered with resistance to ductile fracture propagation in gas pipelines (Annex G);

— PSL 2 pipe ordered for sour service (Annex H);

— pipe ordered as “Through the Flowline” (TFL) pipe (Annex I);

— PSL 2 pipe ordered for offshore service (Annex J).

The requirements of the annexe(s) apply only when it is (they are) specified on the purchase order.

When pipe is ordered for dual or multiple applications, the requirements of more than one annex for special applications can be invoked. In such instances, if a technical conflict arises due to applying the requirements of more than one annex for special applications, the most stringent requirement applicable to the intended service shall apply.

This International Standard does not provide guidance on when it is necessary to specify the above supplementary requirements. Instead, it is the responsibility of the purchaser to specify, based upon the intended use and design requirements, which, if any, of the supplementary requirements apply for a particular purchase order.

Since ISO 3183 is the result of harmonizing documents of different heritage, consideration has had to be given to traditional symbols (denoting mechanical or physical properties or their values, dimensions or test parameters) and the format of equations that have been widely used and which (in their traditional format) often maintain strong links with other widely used standards and specifications, and with the original scientific work that led to their derivation. Accordingly, although in some instances changes to established symbols and equations have been made to optimize alignment with the ISO/IEC Directives, Part 2, in other instances, some

symbols and equations, most specifically those in 9.2 and Clause F.4, have been retained in their traditional form to avoid causing confusion in this post-harmonization stage. Where changes have been made, care has been taken to ensure that the new symbol replacing the traditional one has been fully and clearly defined. Consideration for complete alignment with the ISO/IEC Directives, Part 2, will be given at the next revision of this International Standard.

Petroleum and natural gas industries — Steel pipe for pipeline transportation systems

1 Scope

This International Standard specifies requirements for the manufacture of two product specification levels (PSL 1 and PSL 2) of seamless and welded steel pipes for use in pipeline transportation systems in the petroleum and natural gas industries.

This International Standard is not applicable to cast pipe.

2 Conformity

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 space is used as the thousands separator.

2.2 Rounding

Unless otherwise stated in 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 ISO 31-0:1992, Annex B, Rule A.

NOTE For the purposes of this provision, the rounding method of ASTM E 29-04 [1] is equivalent to ISO 31-0:1992, Annex B, Rule A.

2.3 Compliance to this International Standard

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

NOTE ISO/TS 29001 [2] gives sector-specific guidance on quality management systems.

A contract can specify that 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) 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 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404, *Steel and steel products — General technical delivery requirements*

ISO 2566-1, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*

ISO 4885, *Ferrous products — Heat treatments — Vocabulary*

ISO 6506 (all parts), *Metallic materials — Brinell hardness test*

ISO 6507 (all parts), *Metallic materials — Vickers hardness test*

ISO 6508 (all parts), *Metallic materials — Rockwell hardness test*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

ISO 6929, *Steel products — Definitions and classification*

ISO 7438, *Metallic materials — Bend test*

ISO 7539-2, *Corrosion of metals and alloys — Stress corrosion testing — Part 2: Preparation and use of bent-beam specimens*

ISO 8491, *Metallic materials — Tube (in full section) — Bend test*

ISO 8492, *Metallic materials — Tube — Flattening test*

ISO 8501-1:1988, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 9303:1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Full peripheral ultrasonic testing for the detection of longitudinal imperfections*

ISO 9304:1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Eddy current testing for the detection of imperfections*

ISO 9305:1989, *Seamless steel tubes for pressure purposes — Full peripheral ultrasonic testing for the detection of transverse imperfections*

ISO 9402:1989, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Full peripheral magnetic transducer/flux leakage testing of ferromagnetic steel tubes for the detection of longitudinal imperfections*

ISO 9598:1989, *Seamless steel tubes for pressure purposes — Full peripheral magnetic transducer/flux leakage testing of ferromagnetic steel tubes for the detection of transverse imperfections*

ISO 9764:1989, *Electric resistance and induction welded steel tubes for pressure purposes — Ultrasonic testing of the weld seam for the detection of longitudinal imperfections*

ISO 9765:1990, *Submerged arc-welded steel tubes for pressure purposes — Ultrasonic testing of the weld seam for the detection of longitudinal and/or transverse imperfections*

ISO/TR 9769, *Steel and iron — Review of available methods of analysis*

ISO 10124:1994, *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes — Ultrasonic testing for the detection of laminar imperfections*

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

ISO 10543, *Seamless and hot-stretch-reduced welded steel tubes for pressure purposes — Full peripheral ultrasonic thickness testing*

ISO 11484, *Steel tubes for pressure purposes — Qualification and certification of non-destructive testing (NDT) personnel*

ISO 11496, *Seamless and welded steel tubes for pressure purposes — Ultrasonic testing of tube ends for the detection of laminar imperfections*

ISO 11699-1:1998, *Non-destructive testing — Industrial radiographic films — Part 1: Classification of film systems for industrial radiography*

ISO 12094:1994, *Welded steel tubes for pressure purposes — Ultrasonic testing for the detection of laminar imperfections in strips/plates used in the manufacture of welded tubes*

ISO 12095, *Seamless and welded steel tubes for pressure purposes — Liquid penetrant testing*

ISO 12096, *Submerged arc-welded steel tubes for pressure purposes — Radiographic testing of the weld seam for the detection of imperfections*

ISO 12135, *Metallic materials — Unified method of test for the determination of quasistatic fracture toughness*

ISO 13663:1995, *Welded steel tubes for pressure purposes — Ultrasonic testing of the area adjacent to the weld seam for the detection of laminar imperfections*

ISO 13664, *Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube ends for the detection of laminar imperfections*

ISO 13665, *Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube body for the detection of surface imperfections*

ISO 13678, *Petroleum and natural gas industries — Evaluation and testing of thread compounds for use with casing, tubing and line pipe*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ISO 15156-2:2003, *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low alloy steels, and the use of cast irons*

ISO 19232-1:2004, *Non-destructive testing — Image quality of radiographs — Part 1: Image quality indicators (wire type) — Determination of image quality value*

EN 10204:2004[1], *Metallic products — Types of inspection documents*

API Spec 5B [2], *Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads (US Customary Units)*

API RP 5A3, *Recommended Practice on Thread Compounds for Casing, Tubing, and Line Pipe*

API RP 5L3, *Recommended Practice for Conducting Drop-Weight Tear Tests on Line Pipe*

ASNT SNT-TC-1A [3], *Recommended Practice No. SNT-TC-1A — Non-Destructive Testing*

ASTM A 370 [4], *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A 435, *Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates*

ASTM A 578, *Standard Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications*

ASTM A 751, *Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products*

ASTM A 941, *Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys*

ASTM A 956, *Standard Test Method for Leeb Hardness Testing of Steel Products*

ASTM A 1038, *Standard Practice for Portable Hardness Testing by the Ultrasonic Contact Impedance Method*

ASTM E 8, *Standard Test Methods for Tension Testing of Metallic Materials*

ASTM E 18, *Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials*

ASTM E 92, *Standard Test Method for Vickers Hardness of Metallic Materials*

ASTM E 94, *Standard Guide for Radiographic Examination*

ASTM E 110, *Standard Test Method for Indentation Hardness of Metallic Materials by Portable Hardness Testers*

ASTM E 114, *Standard Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method*

ASTM E 165, *Standard Test Method for Liquid Penetrant Examination*

ASTM E 213, *Standard Practice for Ultrasonic Examination of Metal Pipe and Tubing*

ASTM E 273, *Standard Practice for Ultrasonic Examination of the Weld Zone of Welded Pipe and Tubing*

ASTM E 309, *Standard Practice for Eddy-Current Examination of Steel Tubular Products Using Magnetic Saturation*

ASTM E 570, *Standard Practice for Flux Leakage Examination of Ferromagnetic Steel Tubular Products*

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

2) American Petroleum Institute, 1220 L Street, N.W., Washington, DC 20005, USA.

3) American Society for Nondestructive Testing, 1711 Arlingate Lane, Columbus, OH 43228-0518, USA.

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

ASTM E 709, *Standard Guide for Magnetic Particle Examination*

ASTM E 747-04, *Standard Practice for Design, Manufacture and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology*

ASTM E 1290, *Standard Test Method for Crack-Tip Opening Displacement (CTOD) Fracture Toughness Measurement*

ASTM E 1806, *Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition*

ASTM E 1815-06, *Standard Test Method for Classification of Film Systems for Industrial Radiography*

ASTM G 39, *Standard Practice for Preparation and Use of Bent-Beam Stress-Corrosion Test Specimens*

NACE TM0177:2005 [5], *Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking and Stress Corrosion Cracking in H_2S Environments*

NACE TM0284:2003, *Standard Test Method — Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking*

4 Terms and definitions

For the purpose of this document, the terms and definitions

— in ISO 6929 or ASTM A 941 for steel products,

— in ISO 4885 or ASTM A 941 for heat treatment,

— in ISO 377, ISO 404, ISO 10474 or ASTM A 370, whichever is applicable, for the types of sampling procedures, inspection and inspection documents,

except as given in 4.1 to 4.53, shall apply.

4.1
as agreed
requirement to be as agreed upon by the manufacturer and the purchaser, and specified in the purchase order

NOTE Associated, for example, with items covered by 7.2 a).

4.2
as-rolled
delivery condition without any special rolling and/or heat-treatment

4.3
cold-expanded pipe
pipe that, while at ambient mill temperature, has received a permanent increase in outside diameter or circumference throughout its length, by internal hydrostatic pressure in closed dies or by an internal expanding mechanical device

4.4
cold-sized pipe
pipe that, after forming (including sizing on EW), while at ambient mill temperature, has received a permanent increase in outside diameter or circumference for all or part of its length, or permanent decrease in outside diameter or circumference for all or part of its length

5) NACE International, P.O. Box 201009, Houston, Texas 77216-1009, USA.

4.5
cold finishing
cold-working operation (normally cold drawing) with a permanent strain greater than 1,5 %

NOTE The amount of permanent strain generally differentiates it from cold expansion and cold sizing.

4.6
cold forming
process in which a strip or plate is formed into a pipe without heating

4.7
continuous welding
process of forming a seam by heating the strip in a furnace and mechanically pressing the formed edges together, wherein successive coils of strip had been joined together to provide a continuous flow of strip for the welding mill

4.8
COW pipe
tubular product having one or two longitudinal seams or one helical seam, produced by a combination of gas metal-arc and submerged-arc welding wherein the gas-metal arc weld bead is not completely removed by the submerged-arc welding passes

4.9
COWH pipe
tubular product having one helical seam produced by a combination of gas metal-arc and submerged-arc welding wherein the gas-metal arc weld bead is not completely removed by the submerged-arc welding passes

4.10
COWL pipe
tubular product having one or two longitudinal seams produced by a combination of gas metal-arc and submerged-arc welding wherein the gas-metal arc weld bead is not completely removed by the submerged-arc welding passes

4.11
COW seam
longitudinal or helical seam produced by a combination of gas metal-arc and submerged-arc welding wherein the gas-metal arc weld bead is not completely removed by the submerged-arc welding passes

4.12
CW pipe
tubular product having one longitudinal seam produced by continuous welding

4.13
defect
imperfection of a size and/or population density greater than the acceptance criteria specified in this International Standard

4.14
EW pipe
tubular product having one longitudinal seam produced by low- or high-frequency electric-welding

4.15
EW seam
longitudinal seam produced by electric welding

4.16
electric welding
EW
process of forming a seam by electric-resistance welding, wherein the edges to be welded are mechanically pressed together and the heat for welding is generated by the resistance to flow of electric current applied by induction or conduction

4.17
gas metal-arc welding
welding process that produces melting and coalescence of metals by heating them with an arc or arcs between a continuous consumable electrode and the work, wherein the arc and molten metal are shielded by an externally supplied gas or gas mixture

NOTE Pressure is not used and the filler metal is obtained from the electrode.

4.18
HFW pipe
EW pipe produced with a welding current frequency equal to or greater than 70 kHz

4.19
if agreed
requirement to be as prescribed, or more stringent than is prescribed, if agreed upon by the manufacturer and the purchaser and specified in the purchase order

NOTE Associated, for example, with items covered by 7.2 c).

4.20
imperfection
discontinuity or irregularity in the product wall or on the product surface that is detectable by inspection methods outlined in this International Standard

4.21
indication
evidence obtained by non-destructive inspection

4.22
inspection
activities, such as measuring, examining, testing, weighing or gauging one or more characteristics of a product, and comparing the results of such activities with the specified requirements in order to determine conformity

NOTE Adapted from ISO 404.

4.23
instrument standardization
adjustment of a non-destructive inspection instrument to an arbitrary reference value

4.24
jointer
two lengths of pipe coupled or welded together by the manufacturer

4.25
lamination
internal metal separation that creates layers, generally parallel to the pipe surface

4.26
laser welding
process of forming a seam by using a laser-beam keyhole welding technique to produce melting and coalescence of the edges to be welded, with or without preheating of the edges, wherein shielding is obtained from an externally supplied gas or gas mixture