INTERNATIONAL STANDARD

ISO 3183-1

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Petroleum and natural gas industries — Steel pipe for pipelines — Technical delivery conditions —

Part 1:
Pipes of requirement class A

Industries du pétrole et du gaz naturel — Tubes en acier pour conduites — Conditions techniques de livraison —

Partie 1: Tubes de la classe d'exigences A

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Contents

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Annexes

Foreword

ISO (International Organization for Standardization) is a worldwide federation of national standard 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.

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.

International Standard ISO 3183-1 was prepared by Technical Committee ISO/TC 67 *Materials, equipment and offshore structures for petroleum and natural gas industries,* Subcommittee SC 1, *Line pipe,* on the basis of the American National Standard ANSI/API Spec. 5L [1], structured in accordance with the ISO rules and aligned with ISO 3183, part 2 as far as possible.

It replaces partly ISO 3183:1980 of which it constitutes a technical revision.

ISO 3183 consists of the following parts under the general title

Petroleum and natural gas industries – Steel pipe for pipelines – Technical delivery conditions

- *Part 1: Pipes of requirement class A*
- *Part 2: Pipes of requirement class B*
- *Part 3: Pipes of requirement class C*

Annexes A to G form an integral part of this part of ISO 3183.

Annexes H to K are for information only.

Introduction

In the preparation of this International Standard the competent committee was unanimous in seeking to avoid specifying the quality of line pipe to be used for a particular application. However, the committee recognized that there are several broad quality levels commonly used, and has differentiated between these quality levels as follows:

Firstly, the committee recognized the need to provide a basic quality level which corresponds to that specified in ANSI/API Spec. 5L [1]. This is designated requirement class A and considered in this part of ISO 3183. The main differences between ANSI/API Spec. 5L and ISO 3183-1 are listed in annex J.

Secondly, many purchasers impose requirements different from, or additional to, the basic standard. This approach is common, for example, for transmission pipelines. Such overall enhanced requirements are addressed in requirement class B and considered in Part 2 of ISO 3183.

Thirdly, there are certain particularly demanding applications where very stringent requirements on quality and testing are imposed. Such requirements are reflected in requirement class C and considered in Part 3 of ISO 3183.

The selection of the requirement class depends on many factors. The properties of the fluid to be conveyed, the service conditions, design code and any statutory requirements should all be taken into consideration. Therefore, this International Standard gives no detailed guidelines. It is the ultimate responsibility of the user to select the appropriate requirement class for the intended application.

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Petroleum and natural gas industries – Steel pipe for pipelines – Technical delivery conditions –
Part 1: Pipes of requirement class A

1 Scope

This part of ISO 3183 specifies the technical delivery conditions for seamless and welded pipe of non-alloy and alloy (except stainless) steels with the basic quality and testing requirements (level A), which are intended for the transmission and distribution of combustible and non-combustible fluids (including water) in the petroleum and natural gas industries.

This part of ISO 3183 includes threaded and extra-strong threaded line pipe; and plain-end, regular-mass plain-end, special plain-end, extra-strong plain-end and double-extra-strong plain-end pipe; as well as bell and spigot pipe.

Dimensional requirements on threads and thread gauges, stipulations on gauging practice, gauge specifications and certification, as well as instruments and methods for inspection of threads are given in ISO 10422 and are applicable to products covered by this part of ISO 3183.

Grades covered by this part of ISO 3183 are L175, L210, L245, L290, L320, L360, L390, L415, L450, L485, L555, grades intermediate to the grades L290 and higher, listed in table 2.

For regular-mass and special plain-end pipe (special mass) as shown in tables 8 and 9 and for threaded pipe larger than nominal size 12 (see table 6) the size designations used herein are outside-diameter sizes. For all other pipe, the size designations are nominal pipe sizes. Where pipe size limits (or size ranges) are given, these are outside-diameter sizes except when it is stated that they are nominal. These outside-diameter size limits and ranges apply also to the corresponding nominal sizes (see 7.6).

NOTE 1 Attention is drawn to the definition for seamless pipe in 3.2.2.1.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 3183. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 3183 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 404:1992, *Steel and steel products – General technical delivery requirements.*

ISO 1027:1983, *Radiographic image quality indicators for non-destructive testing – Principles and identification.*

ISO 2566-1:1984, *Steel – Conversion of elongation values – Part 1: Carbon and low alloy steels.*

ISO 4200:1991, *Plain end steel tubes, welded and seamless – General tables of dimensions and masses per unit length.*

ISO 4948-1:1982, *Steels – Classification – Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition.*

ISO/TR 4949:1989, *Steel names based on letter symbols.*

ISO 6761:1981, *Steel tubes – Preparation of ends of tubes and fittings for welding.*

ISO 6892:1984, *Metallic materials – Tensile testing.*

ISO 6929:1987, *Steel products – Definitions and classification.*

ISO 7500-1:1986, *Metallic materials – Verification of static uniaxial testing machines – Part 1: Tensile testing machines.*

ISO 8491:1986, *Metallic materials – Tube (in full section) – Bend test.*

ISO 8492:1986, *Metallic materials – Tube – Flattening test.*

ISO 10422:1993, *Petroleum and natural gas industries – Threading, gauging and thread inspection of casing, tubing and line pipe threads – Specification.*

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

API Bull 5A2-1992, *Bulletin on thread compounds for casing, tubing, and line pipe.*

API RP 5L3-1996, *Recommended practice for conducting drop-weight tear tests on line pipe.*

API Std 1104-1994, *Welding of pipelines and related facilities.*

ASTM A 29, *Recommended practice for indicating which places of figures are to be considered significant in specified limiting values.*

ASTM A 370:1989, *Test methods and definitions for mechanical testing of steel products.*

ASTM A 751:1990, *Test methods, practices and terminology for chemical analysis of steel products.*

ASTM E 4:1989, *Practices for load verification of testing machines.*

ASTM E 83:1990, *Method of verification and classification of extensometers.*

ASME, *Boiler and pressure vessel code, Section IX.*

3 Definitions

3.1 General

For the purpose of this part of ISO 3183 the definitions in 3.2 shall apply when additional to or differing from those given in ISO 6929 for steel products.

Moreover, within this part of ISO 3183:

- The term *manufacturer* refers to the firm, company or corporation responsible for marking the product to warrant that the product conforms to the standard. The *manufacturer* may be either a pipe mill, a processor, a maker of couplings or a threader as applicable. The *manufacturer* is responsible for compliance with all of the applicable provisions of the standard.
- The term *pipe mill* refers to the firm, company or corporation that operates pipe making facilities.
- The term *processor* refers to the firm, company or corporation that operates facilities capable of heat treating pipe made by a pipe mill.

3.2 Welding processes, pipes and welds

3.2.1 Welding process

3.2.1.1 Without filler metal

(a) **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 steel for the welding mill. (This process is a type of butt-welding.)

(b) **electric-welding:** Process of forming a seam by electric-resistance or electric-induction 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.

3.2.1.2 With filler metal

(a) **submerged arc-welding:** Welding process that produces coalescence of metals by heating them with an arc or arcs between bare metal consumable electrode or electrodes and the work. The arc and molten metal are shielded by a blanket of granular, fusible material on the work. Pressure is not used, and part or all of the filler metal is obtained from the electrode(s).

(b) **gas metal arc-welding:** Welding process that produces coalescence of metals by heating them with an arc or arcs between a continuous consumable electrode and the work. Shielding is obtained entirely from an externally supplied gas or gas mixture. Pressure is not used, and the filler metal is obtained from the electrode.

3.2.2 Types of pipe

3.2.2.1 seamless pipe: Tubular product without a welded seam, manufactured in a hot forming process which may be followed by cold finishing to obtain the desired shape, dimensions and properties.

NOTE 2 Cast pipes are not covered by ISO 3183.

3.2.2.2 continuous welded pipe: Pipe having one longitudinal seam produced by the continuous welding process defined in 3.2.1.1 (a). (This type of pipe is a type of butt-welded pipe.)

3.2.2.3 electric-welded pipe: Pipe having one longitudinal seam produced by the electric-welding process defined in 3.2.1.1 (b).

3.2.2.4 longitudinal seam submerged arc-welded pipe: Pipe having one longitudinal seam produced by the automatic submerged arc-welding process defined in 3.2.1.2 (a).

3.2.2.5 gas metal arc-welded pipe: Pipe having one longitudinal or helical seam produced by the continuous gas metal arc-welding process defined in 3.2.1.2 (b).

3.2.2.6 combination gas metal arc- and submerged arc-welded pipe: Pipe having one longitudinal or helical seam produced by a combination of the welding processes defined in 3.2.1.2 (a) and 3.2.1.2 (b)

3.2.2.7 double seam submerged-arc welded pipe: Pipe having two longitudinal seams produced by the automatic submerged-arc welding process defined in 3.2.1.2 (a).

3.2.2.8 double seam gas metal arc-welded pipe: Pipe having two longitudinal seams produced by the gas metal arc-welding process defined in 3.2.1.2 (b).

3.2.2.9 double seam combination gas metal arc- and submerged arc-welded pipe: Pipe having two longitudinal seams produced by a combination of the welding processes defined in 3.2.1.2 (a) and 3.2.1.2 (b).

3.2.2.10 helical seam submerged arc-welded pipe: Pipe having one helical seam produced by the automatic submerged arc-welding process defined in 3.2.1.2 (a). (This type of pipe is also known as spiral weld pipe.)

3.2.3 Types of seam welds

3.2.3.1 electric-weld: Longitudinal seam weld produced by the electric-welding process defined in 3.2.1.1 (b).

3.2.3.2 submerged arc-weld: Longitudinal or helical seam weld produced by the submerged arc-welding process defined in 3.2.1.2 (a).

3.2.3.3 gas metal arc-weld: Longitudinal seam weld produced in whole or in part by the continuous gas metal arc-welding process defined in 3.2.1.2 (b).

3.2.3.4 strip/skelp end weld: Seam weld that joins plate or strip ends together.

3.2.3.5 jointer weld: Circumferential seam weld that joins two pieces of pipe together.

3.2.3.6 tack weld: Seam weld used to align the abutting edges until the final seam welds are produced.

3.2.4 Imperfections and defects

3.2.4.1 An "imperfection" is a discontinuity or irregularity in the product detected by methods outlined in this part of ISO 3183.

3.2.4.2 A "defect" is an imperfection of sufficient magnitude to preclude acceptance of the product in accordance with this part of ISO 3183.

4 Designation

The steels specified in this part of ISO 3183 are designated as shown in table 2 differing from ISO/TR 4949.

NOTE 3 In annex H a comparison of these steel designations with those specified in ANSI/API Spec 5L [1] is given.

5 Information to be supplied by the purchaser

In placing orders for line pipe to be manufactured in accordance with this part of ISO 3183 the purchaser should specify the following on the purchase order:

Specification	ISO 3183-1
Quantity	
Grade or class	tables 2 and 3
Type of pipe	3.2.2
Size	
Nominal size	
Threaded pipe	table 6
Extra-strong threaded pipe	table 7
Plain-end pipe	table 8
Extra-strong plain-end pipe	table 8
Double-extra-strong plain-end pipe	table 8
Outside diameter	
Regular-mass plain-end pipe	table 8
Special plain-end pipe	table 8
Mass per metre or wall thickness	7.6.1, 7.6.3
Nominal length	7.6.5
End finish	7.6.9
Delivery date and shipping instructions	

The purchaser should also state on the purchase order his requirements concerning the following stipulations, which are optional:

Document of compliance	8.1.1
Chemical analysis test reports	8.1.2
Acceptance and maximum allowable length requirements on jointers	7.6.7
Jointers for threaded pipe	7.6.7
Threaded ends, extra-strong pipe	7.6.9.1
Alternative bevel, plain-end pipe with outside diameter ≥ 60,3 mm	7.6.9.3
Special coupling pipe ends	7.6.9.5
Power-tight make-up	7.6.9.2
Special non-destructive inspection for laminations	G.3.9
Defect repair procedures	G.6, G.7, G.8
Bare pipe - special coatings	10
Method of welding jointers	annex A
Purchaser inspection	annex F

Attention is called to the following stipulations which are subject to agreement between the interested parties:

Strip end welds	6.5
Chemical composition	7.2.1
Intermediate grades	1, 7.2.1, 7.3.2, table B.1
Flattening test orientation	8.5.2.2, figure 3
Intermediate diameters	7.6.2
Intermediate wall thickness	7.6.3
Supplementary requirements	annex D

NDT electric welds	8.9, SR7
NDT seamless pipe	8.9, SR2
Supplementary hydrostatic test	8.10.9.4
Hydrostatic test pressure	8.10.9.3
Lengths applied to carloads	7.6.8.6, table 11
Nonstandard length and length tolerances	7.6.5
Welded couplings	C.1
Thread protectors	7.6.9
Repair of welds of electric-welded pipe	8.10.11.3.4, G.5 b)
Marking requirements	9.2, 9.3, 9.7

This information should preferably be given in the way indicated in the following example.

EXAMPLE

Delivery of 1 500 m regular-mass plain-end pipe of grade L290 with an outside diameter of 457,0 mm, a wall thickness of 10,3 mm and a nominal length of 12 m (see table 11), with document of compliance.

Designation in the order:

1 500 m pipe **ISO 3183-1-L290-457,0x10,3x12**-with document of compliance.

6 Manufacturing

6.1 Pipe manufacturing

Pipe complying with this part of ISO 3183 shall be subject to the limitations specified in table 1.

6.1.1 Electric-welded pipe in grades higher than L290, the weld seam and the entire heat affected zone shall be heat treated so as to simulate a normalizing heat treatment (see note 4), except that, by agreement between the interested parties, alternative heat treatments or combinations of heat treatment and chemical composition may be substituted. Where such substitutions are made, the manufacturer shall demonstrate the effectiveness of the method selected using a mutually agreed upon procedure, which may include, but is not necessarily limited to, hardness-testing, microstructural evaluation, or mechanical testing. For grades L290 and lower, the weld seam shall be similarly heat treated, or the pipe shall be processed in such a manner that no untempered martensite remains.

NOTE 4 During the manufacture of electric-welded pipe, the product is in motion through the surrounding air. Normalizing is usually defined as "cooling in still air", hence, the phrase "to stimulate a normalizing heat treatment" is used.

6.1.2 Longitudinal seam submerged arc-welded pipe, at least one pass shall be on the inside and at least one pass shall be on the outside.

6.1.3 Combination gas metal arc- and submerged arc-welded pipe, the gas metal arc-welding process shall be continuous and first, and followed by the automatic submerged arc-welding process with, at least, one pass on the inside and one pass on the outside.

6.1.4 Double seam submerged arc-welded pipe, the seams shall be approximately 180° apart. For each seam, at least one pass shall be on the inside and at least one pass shall be on the outside.

6.1.5 Double seam gas metal arc-welded pipe, the seams shall be approximately 180° apart. For each seam, at least one pass shall be on the inside and at least one pass shall be on the outside.

6.1.6 Double seam combination gas metal arc- and submerged arc-welded pipe, the seams shall be approximately 180° apart. For each seam, the gas metal arc-welding shall be continuous and first, and followed by the automatic submerged arc-welding process with at least one pass on the inside and one pass on the outside.

6.1.7 Tack welds shall be made by manual or semi-automatic submerged arc-welding; electric-welding; gas metal arc-welding; flux cored arc-welding; or shielded metal arc-welding using low hydrogen electrodes. Tack welds shall be removed by machining or remelted during subsequent welding of the seam.

6.1.8 Helical seam submerged arc-welded pipe, at least one pass shall be on the inside and at least one pass shall be on the outside.

6.2 Cold expansion

Pipe complying with this part of ISO 3183, except continuous welded, shall be either non-expanded or cold expanded at the option of the manufacturer unless otherwise specified on the purchase order. Suitable provision shall be incorporated to protect the weld from contact with the internal expander during mechanical expansion.

6.3 Material

The width of plate or strip used to manufacture helical seam pipe shall be not less than 0,8 or more than 3 times the pipe outside diameter.

6.4 Heat treatment

The heat treating process shall be performed in accordance with a documented procedure. Pipe complying with this part of ISO 3183 may be as rolled, normalized, normalized and tempered, subcritically stress-relieved, or subcritically age-hardened; and grades L290 and higher may be quenched and tempered. (See clause 9 for applicable marking requirements.)

6.5 Strip end welds - helical seam pipe

Junctions of strip end welds and helical seam welds in finished pipe shall be permitted only at distances greater than 304,8 mm from the pipe ends. By agreement between the interested parties, strip end welds shall be permitted at the pipe ends, provided there is a circumferential separation of at least 152,4 mm between the strip end weld and the helical seam weld at the applicable pipe ends. Strip end welds in finished pipe shall be properly prepared for welding and shall be made by automatic submerged arc-welding, automatic gas metal arc-welding, or a combination of such welding procedures.

6.6 Traceability

The manufacturer shall establish and follow procedures for maintaining cast and/or lot identity until all required cast and/or lot tests are performed and conformity with standard requirements has been shown.

Table 1 – Process of manufacture

Type of pipe	Grade	
	L175	L210 to L555
Seamless	X	X
Continuous welded	X	
Electric-welded	X	X
Longitudinal seam submerged arc-welded		X
Gas metal arc-welded		X
Combination gas metal arc- and submerged arc-welded		X
Double seam submerged arc-welded[1)]		X
Double seam gas metal arc-welded[1)]		X
Double seam combination gas metal arc- and submerged arc-welded[1)]		X
Helical seam submerged arc-welded[2)]		X

1) Double seam pipe is limited to outside diameter ≥ 914,0 mm.
2) Helical seam pipe is limited to outside diameter ≥ 114,3 mm.

7 Requirements

7.1 General

The requirements specified in this part of ISO 3183 apply under the conditions that the relevant specifications for sampling, test piece preparation and test methods given in 8.5.2 and 8.10 are complied with.

Pipe manufactured as grade L415 or higher shall not be substituted for pipe ordered for grade L360 or lower without purchaser's approval.

7.2 Chemical composition

7.2.1 The composition of pipe complying with this part of ISO 3183, as determined by cast analysis for pipe other than grade L555, shall conform to the chemical requirements specified in table 2, except that, by agreement between the purchaser and the manufacturer, carbon contents higher than those specified may be used. The composition of intermediate grades (higher than L290) shall conform to chemical requirements agreed upon between the interested parties, and such requirements shall be consistent with the requirements specified in table 2 for the applicable type of pipe. For grades L290 and higher, by agreement between the purchaser and the manufacturer, elements other than niobium, vanadium, and titanium may be used; however, caution should be exercised in the determination of the quantity that may be present for any particular size and thickness of pipe, because the addition of such otherwise desirable elements may alter the weldability of the pipe.

NOTE 5 Class II steel is rephosphorized and probably has better threading properties than Class I but may be somewhat more difficult to bend.

Table 2 – Chemical requirements for cast analysis[9], % by mass

Type of pipe	Grade and class	Carbon	Manganese		Phosphorus		Sulfur
		max.[1]	min.	max.	min.	max.	max.
Seamless							
Non-expanded or cold expanded	L175, Cl I	0,21	0,30	0,60	-	0,030	0,030
Non-expanded or cold expanded	L175, Cl II[2]	0,21	0,30	0,60	0,045	0,080	0,030
Non-expanded or cold expanded	L210	0,22	-	0,90	-	0,030	0,030
Non-expanded or cold expanded	L245[3]	0,27	-	1,15	-	0,030	0,030
Non-expanded	L290[5]	0,29	-	1,25	-	0,030	0,030
Non-expanded	L320[5], L360[5]	0,31	-	1,35	-	0,030	0,030
Cold expanded	L290[5], L320[5], L360[5]	0,29[4]	-	1,25	-	0,030	0,030
Non-expanded or cold expanded	L390[5][6], L415[5][6]	0,26	-	1,35	-	0,030	0,030
Non-expanded or cold expanded	L450, L485, L555	(By agreement between the interested parties.)					
Welded							
Electric-welded or continous welded only	L175, Cl I	0,21	0,30	0,60	-	0,030	0,030
Electric-welded or continous welded only	L175, Cl II[2]	0,21	0,30	0,60	0,045	0,080	0,030
Non-expanded or cold expanded	L210	0,21	-	0,90	-	0,030	0,030
Non-expanded or cold expanded	L245[3]	0,26	-	1,15	-	0,030	0,030
Non-expanded or cold expanded	L290[5]	0,28	-	1,25	-	0,030	0,030
Non-expanded	L320[5], L360[5]	0,30	-	1,25	-	0,030	0,030
Cold expanded	L320[5], L360[5]	0,28	-	1,25	-	0,030	0,030
Non-expanded or cold expanded	L390[5][6], L415[5][6]	0,26	-	1,35	-	0,030	0,030
Non-expanded or cold expanded	L450[5][7]	0,26	-	1,40	-	0,030	0,030[2]
Non-expanded or cold expanded	L485[6]	0,23[8]	-	1,60[8]	-	0,030	0,030
Non-expanded or cold expanded	L555[9]	0,18[8][9]	-	1,80[8][9]	-	0,030[9]	0,030[9]

1) For grades L290 to L450 for each reduction of 0,01 % below the specified maximum carbon content, an increase of 0,05 % above the specified maximum manganese content is permissible, up to a maximum of 1,45 % for L360 and lower and up to a maximum of 1,60 % for grades higher than L360.
2) Class II steel is rephosphorized. (See 7.2.1 for note on bending and threading properties.)
3) Niobium, vanadium, titanium, or combinations thereof, may be used by agreement between the interested parties.
4) For cold expanded seamless pipe with ≥ 508 mm outside diameter, the maximum carbon content shall be 0,28 %.
5) Niobium, vanadium, titanium, or combinations thereof, may be used at the discretion of the manufacturer.
6) Other chemical compositions may be furnished by agreement between the interested parties.
7) For grade L450 welded pipe with ≥ 406,4 mm outside diameter with a wall thickness of 12,7 mm or less, the chemical composition shall be as shown or as agreed upon between the interested parties; for all other outside diameters and wall thicknesses of such pipe, the chemical composition shall be as agreed upon between the interested parties.
8) For each reduction of 0,01 % below the specified maximum carbon content, an increase of 0,05 % above the specified maximum manganese content is permissible, up to a maximum of 2,00 %.
9) For grade L555, limits are for product analysis only, thereby eliminating the need for product analysis tolerances in 7.2.2.