INTERNATIONAL STANDARD

ISO 3183-2

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

Part 2:

Pipes of requirements class B

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

Partie 2: Tubes de la classe d'exigences B

Reference number
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Contents

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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.

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 3183-2 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries,* Subcommittee SC 1, *Line pipe.*

This second edition cancels and replaces the first edition (ISO 3183:1980).

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* (in preparation)

Annexes B, C and D form an integral part of this part of ISO 3183.

Annexes A and E 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 the main part of ANSI/API 5L [1]. This is designated requirement class A and considered in part 1 of ISO 3183.

Secondly, many purchasers impose requirements different from or additional to the basic standard, for instance concerning toughness and non-destructive testing. This approach is common, for example, for transmission pipelines. Such overall enhanced requirements are addressed in requirement class B and considered in this part 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 Charpy energy requirements for this part of ISO 3183 have been derived from established data to avoid long running shear fracture in pipelines transporting lean, dry natural gas in accordance with EPRG recommendations [2]. It is the responsibility of the designer to decide whether these energy requirements suffice for the intended application. For example, rich gas or two-phase fluids may require enhanced properties.

For pipes of requirement class B, a weld efficiency factor of 1,0 can be used in design calculations, due to the conditions specified for the manufacture of the pipes and for the testing of the welds.

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 standard gives no detailed guidelines. It is the ultimate responsibility of the user to select the appropriate requirement class for the intended application.

NOTE 1 This International Standard combines a wide range of product types, dimensions and technical restrictions. In some areas of application, the absence of a single international pipeline design standard has resulted in differing national regulations imposing conflicting requirements on the users, thus making technical harmonization difficult.

Consequently, it may be necessary to amend certain requirements of this International Standard to satisfy various national design codes. However, this International Standard remains the basic reference document. Such amendments should be specified at the time of enquiry and order. (See clause 5 and subclause 8.2.3.3.1, note 14.)

This International Standard is based mainly on a word-for-word adoption of the European Standard EN 10208-2 [3], in compliance with a recommendation of ISO/TC 67/SC 1. The differences between this part of ISO 3183 and EN 10208-2 [3] are mainly restricted to the following:

- normative references (see clause 2);
- steel numbers are not used in this International Standard;
- basis of the calculation of hydrostatic test pressure (by agreement - specified wall thickness; EN 10208-2 [3] only permits minimum wall thickness);
- additional requirements of EURONORM 168 [4] are not included in this International Standard.

The steel names given in table 1 were taken over from EN 10208-2 to avoid misunderstandings which could arise from different steel names for the same grade. Therefore, these steel names do not correspond with the regulations given in ISO/TR 4949 to form steel names.

Petroleum and natural gas industries – Steel pipe for pipelines – Technical delivery conditions –
Part 2: Pipes of requirement class B

1 Scope

This part of ISO 3183 specifies the technical delivery conditions for unalloyed and alloyed (except stainless) seamless and welded steel pipes. It includes quality and testing requirements overall higher than those specified in ISO 3183-1. This part of ISO 3183 applies for pipes which are normally used for the transmission of combustible fluids. It is not suitable for cast steel pipes.

In addition to the requirements of this part of ISO 3183 the general technical delivery conditions specified in ISO 404 apply.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition 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 148:1983, *Steel – Charpy impact test (V-notch).*

ISO 377:–[1] *Steel and steel products – Location of samples and test pieces for mechanical testing.*

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 3183-1:–[1] *Petroleum and natural gas industries – Steel pipe for pipelines – Technical delivery conditions – Part 1: Pipes of requirement class A.*

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

ISO 4885:–[1] *Ferrous products – Vocabulary – Heat treatments.*

[1] To be published.

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

ISO 4948-2:1981, *Steels – Classification – Part 2: Classification of steels into unalloyed and alloy steels according to main quality classes and main property or application characteristics.*

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

ISO 6506:1981, *Metallic materials – Hardness test – Brinell test.*

ISO 6508:1986, *Metallic materials – Hardness test – Rockwell test (scales A-B-C-D-E-F-G-H-K).*

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 7438:1985, *Metallic materials – Bend test.*

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

ISO 9002:1994, *Quality systems – Model for quality assurance in production, installation and servicing.*

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 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 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 9769:1991, *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 11484:1994, *Steel tubes for pressure purposes – Qualification and certification of non-destructive testing (NDT) personnel.*

ISO 11496:1993, *Seamless and welded steel tubes for pressure purposes – Ultrasonic testing of tube ends for the detection of laminar imperfections.*

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 12096:–[1] *Submerged arc-welded steel tubes for pressure purposes – Radiographic testing of the weld seam for the detection of imperfections.*

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 14284:–[1] *Steel and iron – Sampling and preparation of samples for the determination of chemical composition.*

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

3 Definitions

3.1 General

For the purpose of this part of ISO 3183 the definitions in 3.2 to 3.4 shall apply when additional to or differing from those given for the

- classification of steels in ISO 4948-1 and ISO 4948-2;
- definition of steel products in ISO 6929;
- heat treatment in ISO 4885;
- types of sampling procedures, inspection and inspection documents in ISO 377, ISO 404 and ISO 10474.

3.2 Types of pipes and welds

3.2.1 Seamless (S) pipe

Tubular product manufactured in a hot forming process which may be followed by sizing (see 6.5) or cold finishing (see 3.3.4) to produce the desired dimensions.

3.2.2 High frequency welded (HFW) pipe

Tubular product manufactured by forming from strip and welding the abutting edges without addition of filler metal. The longitudinal seam is generated by high frequency current applied by induction or conduction.

NOTE 2 High frequency implies in this part of ISO 3183 a frequency of at least 100 kHz.

3.2.3 Submerged arc-welded (SAW) pipe

Tubular product manufactured by forming from strip or plate and welding the abutting edges by addition of filler metal. The pipe having a longitudinal (SAWL) or helical (SAWH) seam is produced by the automatic submerged arc process (but see also 6.3). At least one pass is made on the inside and at least one pass on the outside of the pipe. An intermittent or continuous single pass tack weld made by the gas metal arc-welding process is permitted.

3.2.4 Combination gas metal arc and submerged arc-welded (COW) pipe

Tubular product manufactured by forming from strip or plate and welding the abutting edges by addition of filler metal. The pipe having one longitudinal (COWL) or one helical (COWH) seam is produced by a combination of gas metal arc-welding and submerged arc-welding. The gas metal arc-welding process is

[1] To be published.

continuous and first, and followed by the automatic submerged arc-welding process with at least one pass on the inside and at least one pass on the outside of the pipe.

3.2.5 Strip end weld

A weld that joins strip (skelp) ends together.

3.2.6 Jointer

Two pieces of pipe joined together by a circumferential weld.

3.2.7 Pipe body

For welded pipe the entire pipe excluding the weld(s) and heat affected zone(s); for seamless pipe the entire pipe.

3.3 Treatment condition

3.3.1 Normalizing forming

A forming process in which the final deformation is carried out within a certain temperature range leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after normalizing.

The abbreviated form of this delivery condition is N.

3.3.2 Thermomechanical forming

A forming process in which the final deformation is carried out in a certain temperature range leading to a material condition with certain properties which cannot be achieved or repeated by heat treatment alone. Subsequent heating above 580 °C may lower the strength values.

The abbreviated form of this delivery condition is M.

NOTES

3 Thermomechanical forming leading to the delivery condition M may include processes of increased cooling rates without or with tempering including self-tempering but excluding definitively direct quenching and quenching and tempering.

4 As a consequence of lower carbon content and carbon equivalent values material in the delivery condition M has improved weldability properties.

3.3.3 Quenching and tempering

A heat treatment consisting of quench hardening followed by tempering. Quench hardening implies austenitization followed by cooling, under conditions such that austenite transforms more or less completely into martensite and possibly into bainite. Tempering implies heating to a specific temperature ($< Ac_1$) one or more times or holding at this temperature, followed by cooling at an appropriate rate so that the structure is modified and the specified properties are achieved.

The abbreviated form of this delivery condition is Q.

3.3.4 Cold forming and cold finishing

In this context, cold forming is a process by which a flat product is formed to a pipe without heating. Cold finishing is a cold working operation (normally cold drawing) with a permanent strain greater than 1,5 %, which differentiates it from sizing operations specified in 6.5.

3.4 Imperfections and defects

3.4.1 Imperfections are irregularities in the wall or on the pipe surfaces detectable by methods described in this part of ISO 3183. Imperfections with a size and/or population density that are within the acceptance criteria defined in this part of ISO 3183 are considered to have no practical implication on the intended use of the product.

3.4.2 Defects are imperfections with a size and/or population density that are greater than the acceptance criteria defined in this part of ISO 3183. Defects are considered to adversely affect or limit the intended use of the product.

3.5 Agreement

Unless otherwise indicated "by agreement" means "by agreement between manufacturer and purchaser at the time of enquiry and order".

3.6 Margin symbols

The following symbols are used in the margin of pages or tables for indicating optional delivery conditions:

M Mandatory agreement [see 5.2 a)];

U Unless otherwise agreed left to the discretion of the manufacturer [see 5.2 b)];

O Optional agreement [see 5.2 c)].

4 Classification and designation

4.1 Classification

The steels specified in this part of ISO 3183 are non-alloy quality or alloy special steels. Their classification in accordance with ISO 4948-1 and ISO 4948-2 is indicated in table 1.

Table 1 – Classification and designation of the steels

Heat treatment condition	Steel class (in accordance with ISO 4948-1 and ISO 4948-2)	Steel name
Normalized or normalizing formed	non-alloy quality steel	L245NB
		L290NB
		L360NB
	alloy special steel	L415NB
Quenched and tempered	alloy special steel	L360QB
		L415QB
		L450QB
		L485QB
		L555QB
Thermomechanically rolled	non-alloy quality steel	L245MB
		L290MB
		L360MB
	alloy special steel	L415MB
		L450MB
		L485MB
		L555MB

4.2 Designation

The steels specified in this part of ISO 3183 are designated with steel names in connection with EN 10208-2 [3] given in table 1.

NOTE 5 A comparison of the basic steel names with those specified in ANSI/API 5L [1] using the basis of minimum yield strength, is given in annex A.

5 Information to be supplied by the purchaser

5.1 Mandatory information

The purchaser shall state in his enquiry and order the following minimum information:

1) quantity ordered (e.g. total tonnage or total length of pipe);
2) product form (pipe);
3) type of pipe (see table 2, column 1);
4) number of this part of ISO 3183;
5) steel name (see table 1);
6) pipe outside diameter and wall thickness, in millimetres (see 7.6.1.2);
7) random length group or, if a fixed length is required, the length in millimetres (see 7.6.3.3 and table 11);
8) which impact requirements, table 6 or table 7, shall apply;
9) type of inspection document (see 8.1).

5.2 Other information

This part of ISO 3183 offers to the purchaser and manufacturer the possibility to agree additional information (see note 9 under 7.3) or, in addition to the normally applicable delivery conditions, other conditions in accordance with items a) to c) as follows. The need for additional information or the options required shall be clearly indicated at the enquiry stage and stated in the order and in the confirmation of the order.

a) Mandatory agreement - option which shall be agreed if applicable (indicated in the margin by **M**)
   1) chemical composition of pipe with wall thickness > 25 mm (see table 3, footnote 2);
   2) mechanical properties of pipe with wall thickness > 25 mm (see table 5, footnote 1);
   3) impact and DWT test requirements for outside diameters > 1 430 mm and/or wall thickness > 25 mm (see tables 6 and 7, footnote 2);
   4) diameter tolerances for seamless pipe with wall thickness > 25 mm (see table 9, footnote 2);
   5) diameter tolerances for pipe with outside diameter > 1 430 mm (see table 9, columns 2/3);
   6) party to issue the inspection document 3.2 (see 8.1, note 11).

b) Unless otherwise agreed left to the discretion of the manufacturer (indicated in the margin by **U**)
   1) method of verification of dimensional and geometrical requirements (see 8.3.2.10.4);
   2) timing of NDT of seamless and HFW pipe (see D.2.2);
   3) radiographic inspection for the detection of longitudinal imperfections [see D.5.4 a)].

c) Optional agreement - option which may be agreed (indicated in the margin by **O**)

1) approval of the quality system or verification of the manufacturing procedure (see 6.1 and annex B);
2) steelmaking process (see 6.2.1);
3) manufacture of SAWL pipes with two seams (see 6.3);
4) acceptance of strip end welds in SAWH pipe (see 6.6.1);
5) Mo content (see table 3, footnote 7);
6) lower *CEV* (see table 3, footnote 4);
7) DWT test (see tables 6 and 7, footnote 4);
8) weldability data or weld tests (see 7.4.2);
9) application of the diameter tolerance to the inside diameter (see table 9, footnote 3);
10) application of the diameter tolerance to the outside diameter (see table 9, footnote 4);
11) special bevel configuration (see 7.6.4.2);
12) offset of strip end welds (see table 13, footnote 1);
13) impact test for the heat affected zone (see 8.2.1.2);
14) test piece direction (see table 18, footnote 2);
15) use of round test pieces (see 8.2.2.2.2);
16) use of flattened and heat treated test coupons (see 8.2.2.2.2);
17) impact and DWT test temperatures other than 0 °C (see 8.2.3.3.1 and 8.2.3.4);
18) substitution of the macrographic alignment examination by alternative test methods (see 8.2.3.7.1);
19) hardness test during production for seam heat treated HFW pipe (see 8.2.3.7.2);
20) hydrostatic test pressures greater than 250 bar[1] or 500 bar and up to 100 % of specified minimum yield strength respectively (see 8.2.3.8.1);
21) hydrostatic test pressure in accordance with ISO 3183-1 (see 8.2.3.8.3);
22) use of special devices for measuring the pipe diameter (see 8.2.3.10.1);
23) use of (cold) die stamping (see 9.1.3);
24) special marking (see 9.2);
25) coating and lining (see clause 10);
26) acceptance level L2/C or L2, respectively for NDT of seamless pipe (see D.3.1 and D.3.2);
27) use of the flux leakage test (for seamless and HFW pipe) and of the eddy current test (for HFW pipe) (see D.3.2 and D.4.1.2);
28) acceptance level L2/C for NDT of HFW pipe (see D.4.1.1);
29) acceptance level L2 for NDT of HFW pipe [see D.4.1.2 a)];
30) verification of quality requirement for laminar imperfections (see D.2.4; D.4.2 and D.4.3; D.5.2 and D.5.3);
31) use of fixed depth notches for equipment calibration [see 5.1.1 d)];
32) use of hole penetrameters instead of ISO Wire Penetrameter [see D.5.5.1 a)];

[1] 1 bar = 100 kPa.

33) use of fluoroscopic inspection [D.5.5.1 b)].

5.3 Example for ordering

The information should preferably be given in the way indicated in the following example of ordering:

10 000 m pipe SAWL **ISO 3183-2-L415MB-610x12,5-r2**,
impact properties in accordance with table 7, with DWT-test, inspection document ISO 10474, 3.1 C.

6 Manufacturing

6.1 General

6.1.1 The pipe manufacturer and the stockist, where products are supplied through a stockist, shall operate a quality system in accordance with ISO 9002 or at least an equivalent system.

O Approval of the quality system by one of the following parties may be agreed:

- the purchaser,
- the purchaser's representative,
- an independent third party,
- or a regulatory authority.

O NOTE 6 In special cases the verification of the manufacturing procedure either by available data or in accordance with annex B may also be agreed.

6.1.2 All non-destructive testing (NDT) operations referred to in this part of ISO 3183 shall be conducted by NDT personnel qualified and certified in accordance with ISO 11484.

6.2 Steelmaking

6.2.1 The steels covered by this part of ISO 3183 shall be made using the basic oxygen process or the electric furnace process.

O Other equivalent steelmaking processes may be used by agreement.

6.2.2 The steels shall be fully killed and shall be made according to fine grain practice.

6.3 Pipe manufacturing

Acceptable types of pipe are described in 3.2 and listed together with acceptable manufacturing routes in table 2. The type of pipe and the type of heat treatment as given in the steel name shall be specified by the purchaser.

SAWH pipe shall be manufactured using strip with a width not less than 0,8 or more than 3 times the pipe outside diameter.

O SAWL pipe may be manufactured with two seams by agreement.

Table 2 – Type of pipe and manufacturing route (starting material, pipe forming and heat treatment conditions)

Type of pipe	Starting material	Pipe forming[1)]	Heat treatment condition	Symbol for the heat treatment
Seamless (S)	Ingot or billet	Hot-rolling	Normalized or normalizing formed	N
			Quenched and tempered	Q
		Hot-rolling and cold finishing	Normalized	N
			Quenched and tempered	Q
High frequency welded (HFW)	Normalizing rolled strip	Cold forming	Normalized weld area	N
	Thermomechanically rolled strip		Heat treated weld area	M
	Hot-rolled or normalizing rolled strip		Normalized (entire pipe)	N
		Cold forming and hot stretch reducing under controlled temperature resulting in a normalized condition	–	N
Submerged arc welded (SAW) – longitudinal seam (SAWL) – helical seam (SAWH), Combination welded (COW) – longitudinal seam (COWL) – helical seam (COWH)	Normalized or normalizing rolled plate or strip	Cold forming	–	N
	Thermomechanically rolled plate or strip			M
	As rolled plate or strip	Normalizing forming	–	N
	Normalized or normalizing rolled plate or strip			

[1)] see 3.3.4

6.4 Heat treatment condition

The pipes shall be delivered in one of the forming and heat treatment conditions given in table 2.