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Steel pipes for pipelines for combustible fluids - Technical delivery condi-tions - Part 2: Pipes of requirement class B

Stahlrohre für Rohrleitungen für brennbare Medien - Technische Lieferbedingungen - Teil 2: Rohre der Anforderungsklasse B

Tubes en acier pour conduites de fluides combustibles - Conditions techniques de livraison - Partie 2 : Tubes de la classe de prescription B

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Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 2: Pipes of requirement class B

Tubes en acier pour conduites de fluides combustibles - Conditions techniques de livraison - Partie 2: Tubes de la classe de préscription B

Stahlrohre für Rohrleitungen für brennbare Medien - Technische Lieferbedingungen - Teil 2: Rohre der Anforderungsklasse B

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Foreword

This document (EN 10208-2:2009) has been prepared by Technical Committee ECISS/TC 29 “Steel tubes and fittings for steels tubes”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 10208-2:1996

This European Standard consists of the following parts, under the general title *Steel pipes for pipelines for combustible fluids — Technical delivery conditions:*

Part 1: Pipes of requirement class A

Part 2: Pipes of requirement class B

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

It was the intention, when preparing this document, to avoid specifying the quality of line pipe to be used for a particular application. However, it was recognized that there are several quality levels commonly used, and it was decided to reflect these in the standard by the differentiation between two quality levels.

Firstly, the need was recognized to provide a basic quality level. This is designated requirement class A and considered in EN 10208-1.

Secondly, many purchasers impose requirements additional to the basic standard, for instance concerning toughness and non-destructive inspection. This approach is common, for example, for transmission pipelines. Such enhanced requirements are addressed in requirement class B and considered in EN 10208-2.

For offshore applications and other applications outside the scope of EN 10208-1 and EN 10208-2, other standards may be applicable, e.g. ISO 3183 [1].

The Charpy impact energy requirements in this document have been derived from established data, in accordance with EPRG recommendations [2], and are intended to prevent the occurrence of long running shear fracture in pipelines transporting clean, dry natural gas. 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 additional testing to be carried out.

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 tubes.

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

NOTE This document combines a wide range of product types, dimensions and technical restrictions in accordance with the functional requirements for gas supply systems referred to in EN 1594 [3].

1 Scope

This European Standard specifies the technical delivery conditions for seamless and welded steel pipes for the on land transport of combustible fluids primarily in gas supply systems but excluding pipeline applications in the petroleum and natural gas industries. It includes more stringent quality and testing requirements than those in EN 10208-1.

NOTE 1 Steel pipes for pipeline transportation systems within the petroleum and natural gas industries are covered by ISO 3183 [1]. This standard specifies products with the same (and additional) strength levels and partly similar (but not identical) requirements as EN 10208-1 and EN 10208-2 and is with two additional annexes specifying deviating or additional requirements also published as API Spec 5L [4].

NOTE 2 This European Standard does not apply to cast steel pipe.

2 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.

EN 473, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

EN 910, *Destructive tests on welds in metallic materials — Bend tests*

EN 1011-1, *Welding — Recommendations for welding of metallic materials — Part 1: General guidance for arc welding*

EN 1011-2, *Welding — Recommendations for welding of metallic materials — Part 2: Arc welding of ferritic steels*

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10020:2000, *Definition and classification of grades of steel*

EN 10021, *General technical delivery conditions for steel products*

EN 10027-1, *Designation systems for steels — Part 1: Steel names*

EN 10027-2, *Designation systems for steels — Part 2: Numerical system*

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

EN 10052:1993, *Vocabulary of heat treatment terms for ferrous products*

EN 10079:2007, *Definition of steel products*

EN 10168, *Steel products — Inspection documents — List of information and description*

EN 10204, *Metallic products — Types of inspection documents*

EN 10220, *Seamless and welded steel tubes — Dimensions and masses per unit length*

EN 10246-3, *Non-destructive testing of steel tubes — Part 3: Automatic eddy current testing of seamless and welded (except submerged arc welded) steel tubes for the detection of imperfections*

EN 10246-5, *Non-destructive testing of steel tubes — Part 5: Automatic full peripheral magnetic transducer/flux leakage testing of seamless and welded (except submerged arc welded) ferromagnetic steel tubes for the detection of longitudinal imperfections*

EN 10246-7, *Non-destructive testing of steel tubes — Part 7: Automatic full peripheral ultrasonic testing of seamless and welded (except submerged arc welded) steel tubes for the detection of longitudinal imperfections*

EN 10246-8, *Non-destructive testing of steel tubes — Part 8: Automatic ultrasonic testing of the weld seam of electric welded steel tubes for the detection of longitudinal imperfections*

EN 10246-9, *Non-destructive testing of steel tubes — Part 9: Automatic ultrasonic testing of the weld seam of submerged arc welded steel tubes for the detection of longitudinal and/or transverse imperfections*

EN 10246-10, *Non-destructive testing of steel tubes — Part 10: Radiographic testing of the weld seam of automatic fusion arc welded steel tubes for the detection of imperfections*

EN 10246-14, *Non-destructive testing of steel tubes — Part 14: Automatic ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of laminar imperfections*

EN 10246-15, *Non-destructive testing of steel tubes — Part 15: Automatic ultrasonic testing of strip/plate used in the manufacture of welded steel tubes for the detection of laminar imperfections*

EN 10246-16, *Non-destructive testing of steel tubes — Part 16: Automatic ultrasonic testing of the area adjacent to the weld seam of welded steel tubes for the detection of laminar imperfections*

EN 10246-17, *Non-destructive testing of steel tubes — Part 17: Ultrasonic testing of tube ends of seamless and welded steel tubes for the detection of laminar imperfections*

EN 10256, *Non-destructive testing of steel tubes – Qualification and competence of level 1 and 2 non-destructive testing personnel*

EN 10266:2003, *Steel tubes, fittings and structural hollow sections — Symbols and definitions of terms for use in product standards*

EN 10274, *Metallic materials — Drop weight tear test*

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*

EN ISO 2566-1, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels (ISO 2566-1:1984)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method* (ISO 6506-1:2005)

EN ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (ISO 6508-1:2005)*

EN ISO 8492, *Metallic materials — Tube — Flattening test (ISO 8492:1998)*

EN ISO 14284, Steel and *iron — Sampling and preparation of samples for the determination of the chemical composition (ISO 14284:1996)*

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

CEN/TR 10261, *Iron and steel — Review of available methods of chemical analysis*

3 Terms and definitions

For the purposes of this document the following terms and definitions apply in addition to or deviating from those given in EN 10020:2000, EN 10052:1993, EN 10079:2007 and EN 10266:2003.

3.1
normalizing forming
[deviating from EN 10052:1993]
forming process in which the final deformation is carried out in 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

NOTE The abbreviated form of this delivery condition is N.

3.2
thermomechanical forming
[as in EN 10052:1992, but supplemented]
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

NOTE 1 Subsequent heating above 580 °C may lower the strength values.

NOTE 2 The abbreviated form of this delivery condition is M (included, where applicable, in the steel name).

NOTE 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.

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

3.3
quenching and tempering
heat treatment comprising of quench hardening followed by tempering, where quench hardening implies austenitization followed by cooling, under conditions such that austenite transforms more or less completely into martensite and possibly into bainite

NOTE 1 By tempering to specific temperatures (< Ac_1) one or more times or holding at these temperatures, followed by cooling at an appropriate rate, the properties are brought to the required level.

NOTE 2 The abbreviated form of this delivery condition is Q (in this document, included in the steel name).

3.4
cold forming
(in this context) the process by which a flat product is formed into a pipe without heating of the plate or strip

3.5
cold finishing
cold working operation (normally cold drawing) with a permanent strain greater than the maximum strain of 1,5 % which differentiates it from sizing operations specified in 7.5

3.6
pipe body
for seamless pipe, the entire pipe; for welded pipes, the entire pipe excluding weld(s) and heat affected zone (HAZ)

3.7
imperfection
irregularity in the wall or on the pipe surfaces detectable by methods described in this document

NOTE Imperfections with a size and/or population density complying with the acceptance criteria specified in this document are considered to have no practical implication on the intended use of the product.

3.8
defect
imperfection of a size and/or population density not complying with the acceptance criteria specified in this document

NOTE Defects are considered to adversely affect or limit the intended use of the product.

3.9
jointer
two lengths of pipe coupled or welded together by the manufacturer

3.10
by agreement/agreed
[as in EN 10266]
agreement between manufacturer and purchaser at the time of enquiry and order

4 Symbols and abbreviations

For symbols and abbreviations, see EN 10266:2003.

NOTE 1 EN 10266 includes definitions of types of pipe and their abbreviations.

NOTE 2 Symbols from EN 10266:2003 most frequently used in this document are:

D specified outside diameter;

D_{min} (specified) minimum outside diameter;

T specified wall thickness;

T_{min} (specified) minimum wall thickness.

5 Classification and designation

5.1 Classification

The steel grades specified in this document are non-alloy quality or non-alloy or alloy special steels. Their classification in accordance with EN 10020 is indicated in Table 1.

5.2 Designation

The specified steel grades are designated with steel names in accordance with EN 10027-1. The corresponding steel numbers have been allocated in accordance with EN 10027-2.

Table 1 — Classification and designation of the steel grades

Delivery condition	Classification in accordance with EN 10020	Steel name	Steel number
Normalized or normalizing formed	non-alloy quality steel	L245NB	1.0457
		L290NB	1.0484
		L360NB	1.0582
	alloy special steel	L415NB	1.8972
Quenched and tempered	non-alloy quality steel	L360QB	1.8948
	alloy special steel	L415QB	1.8947
		L450QB	1.8952
		L485QB	1.8955
		L555QB	1.8957
Thermomechanically rolled	non-alloy quality steel	L245MB	1.0418
		L290MB	1.0429
		L360MB	1.0578
	alloy special steel	L415MB	1.8973
		L450MB	1.8975
		L485MB	1.8977
		L555MB	1.8978

6 Information to be supplied by the purchaser

6.1 Mandatory information

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

a) quantity ordered (e.g. total tonnage or total length of pipe);

b) type of pipe (see Table 2, column 1);

c) product form (i.e. pipe);

d) pipe outside diameter and wall thickness in millimetres (see 8.6.1.2);

e) random length group or, if a fixed length is required, the length in millimetres (see 8.6.3.3 and Table 11);

f) number of this European Standard (EN 10208-2);

g) steel name or number (see Table 1);

h) which impact energy requirements, Table 6 or Table 7, shall apply;

i) type of inspection document required (see 9.1.1).

6.2 Options

A number of options are specified in this document and these are listed below. If the purchaser does not indicate a wish to implement any of these options at the time of enquiry and order, the pipe shall be supplied in accordance with the basic specification (see 6.1).

a) Mandatory agreement – options which shall be agreed when applicable

1) chemical composition of pipe with wall thickness T > 25 mm (see Table 3, footnote b);

2) mechanical properties of pipe with wall thickness T > 25 mm (see Table 5, footnote a);

3) impact and DWT test requirements for outside diameter D > 1 430 mm and/or wall thickness > 25 mm (see Tables 6 and 7, footnote b);

4) diameter tolerances for seamless pipe with wall thickness T > 25 mm (see Table 9, footnote b);

5) diameter and out-of-roundness tolerances for pipe with outside diameter D > 1 430 mm (see Table 9, columns 2 and 3);

6) party to issue the inspection document 3.2 (see 9.1.1).

b) Unless otherwise agreed – left to the discretion of the manufacturer

1) method of verification of dimensional and geometrical requirements (see 9.4.10.4);

2) timing of NDT of seamless and HFW pipe (see C.2.2);

3) radiographic inspection for the detection of longitudinal imperfections (see C.5.4 a);

c) Optional agreement – options which may be agreed

1) approval of the quality system and/or verification of the manufacturing procedure (see 7.1 and Annex A);

2) steelmaking process (see 7.2.1);

3) manufacture of SAWL pipe with two seams (see 7.3);

4) acceptance of strip end welds in SAWH/COWH pipe (see 7.6.1);

5) Mo content (see Table 3, footnote g);

6) lower CEV (see Table 3, footnote d);

7) DWT test (see Tables 6 and 7, footnote d);

8) weldability data or weld tests (see 8.4.2);

9) application of the diameter tolerance to the inside diameter (see Table 9, footnote c);

10) application of the diameter tolerance to the outside diameter (see Table 9, footnote d);

11) special bevel configuration (see 8.6.4.2);

12) offset of strip end welds (see Table 13, footnote a);

13) impact test for the heat affected zone (see 9.2.2);

14) test piece direction (see Table 18, footnote b);

15) use of circular test pieces (see 9.3.2.2, second paragraph);

16) use of flattened and heat treated test coupons (see 9.3.2.2, last paragraph);

17) impact test and DWT test temperatures other than 0 °C (see 9.4.3.1 and 9.4.4);

18) substitution of the macrographic examination of the weld by alternative test methods (see 9.4.7.1);

19) hardness test during production for seam heat treated HFW pipe (see 9.4.7.2);

20) hydrostatic test pressures greater than 250 bar or 500 bar and up to 100 % of specified minimum yield strength respectively (see 9.4.8.1);

21) use of special devices for measuring the pipe diameter (see 9.4.10.1);

22) use of (cold) die stamping (see 10.1.3);

23) special marking (see 10.2);

24) coating and lining (see Clause 11);

25) acceptance level U2/C or F2, respectively for NDT of seamless pipe (see C.3.1, C.3.2);

26) use of the flux leakage test (for seamless and HFW pipe) and of the eddy current test (for HFW pipe) (see C.3.2 and C.4.1.2);

27) acceptance level U2/C (U2) for NDT of HFW pipe (see C.4.1.1);

28) acceptance level F2 for NDT of HFW pipe (see C.4.1.2 a);

29) verification of quality requirement for laminar imperfections (see C.2.4; C.4.2 and C.4.3; C.5.2 and C.5.3);

30) use of fixed depth notches for equipment calibration (see C.5.1.1 d);

31) use of hole penetrameter instead of ISO wire penetrameter (see C.5.5.1 a);

32) use of fluoroscopic inspection (C.5.5.1 b).

6.3 Example of ordering

Orders shall be preferably presented as given in the example.

EXAMPLE 10 000 m longitudinally submerged arc welded pipe with an outside diameter of 610 mm, a wall thickness of 12,5 mm in a length according to random length group r2 (see Table 12), made of steel grade L415MB, impact properties in accordance with Table 7, with drop weight tear (DWT) tests and inspection certificate 3.2 in accordance with EN 10204:

10 000 m SAWL pipe – 610 x 12,5 x r2 – EN 10208-2 – L415MB – impact properties of Table 7, with DWT test, inspection certificate EN 10204:3.2

7 Manufacturing

7.1 General

The pipe manufacturer and the stockist, where products are supplied through a stockist, shall operate a quality system. An approval of the quality system may be agreed.

In special cases, the verification of the manufacturing procedure either by available data or in accordance with Annex A may also be agreed.

7.2 Steelmaking

7.2.1 The steels shall be made using the basic oxygen process or the electric furnace process.

Other equivalent steelmaking processes may be used by agreement.

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

7.3 Pipe manufacture

Acceptable types of pipe are 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 pipes shall be manufactured using strip with a width not less than 0,8 or more than 3,0 times the pipe outside diameter.

SAWL pipe may be manufactured with two seams by agreement.

7.4 Heat treatment condition

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

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

Type of pipe	Starting material	Pipe forming [a]	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			

[a] See 3.4 and 3.5.

7.5 Sizing

The pipes may be sized to their final dimensions by expanding or reducing. This shall not produce excessive permanent strain. Where no further heat treatment or only a heat treatment of the weld area is carried out, the sizing ratio s_r achieved by this cold working shall not exceed 0,015. It shall be calculated according to the formula:

$$s_r = \frac{|D_a - D_b|}{D} \quad (1)$$

where

D_a is the outside diameter after sizing;