Reliable

Steel Distributors

AN ISO 9001:2008 CERTIFIED COMPANY

PED Certified | OHSAS 18001:2007 | ISO 9001 : 2008 | ISO 14001:2004 |
Govt. Recog. Export House.

**Manufacturer, Exporter, Stockiest, Supplier, Trader for Carbon Steel, Stainless Steel, Alloy Steel for Seamless, Welded, ERW, LSAW, DSAW, HSAW, HFI, EFW Pipes.**

**EN 10208-1 replaced by EN ISO 3183: Consequences and proposal for solution**

| | |
|---|---|
| Date of document | 2013-05-02 |
| Expected action | Next Meeting |
| Due Date | 2013-05-14 |

**Background**

## Withdrawal of EN 10208-1 with publication of EN ISO 3183:2013 - Evaluation of the consequences for the gas distribution sector

### Introduction

By ISO/CEN parallel voting **ISO 3183 "Petroleum and natural gas industries - Steel pipe for pipeline transportation systems"** became a European standard. It replaces the **EN 10208 series "Steel pipes for pipelines for combustible fluids - Technical deliveryconditions":**

- **Part 1: Pipes of requirement class A"and "**
- **Part 2: Pipes of requirement class B"**

As the gas industry was not aware of this intention to withdraw EN 10208-1, the gas distribution industry was not involved in the elaboration of ISO 3183. An evaluation by CEN/TC 234 WG 2 showed concerns about the withdrawal, specifically regarding intermediate grades of pipes and limits for chemical compositions for PSL1 steelgrades (see Doc N 574).

With reference to CEN/TC 234 Doc N 574 and CEN/TC 234 Resolution 06/2012 "CEN/TC 234 position on withdrawal of EN 10208-1 and -2", CEN/TC 234 Secretariat organized a CEN/TC 234 WG 2 Task Group carrying out a detailed comparison of the document (see below) and got in contact with ECISS/TC 110 and CCMC aiming at a postponement of the withdrawal of EN 10208-1 until the issue would reliably clarified.

Even if there was the agreement of ECISS/TC 110 expressed in a letter to CCMC and even if an informal confirmation by CCMC was given, the postponement failed, the withdrawal will be nationally in force by November 2013.

**The result of the CEN/TC 234 WG 2 Task Group evaluation (see below) will show that there are raisonable solutions for the concern.**

**Outcome of the CEN/TC 234 Task Group meeting, 2012-04-10:**
After some starting discussions it became clear, that there is no more possibility to retain EN 10208-1 as such.
However, a comparison of the documents EN ISO 3183 and EN 10208-1 clause by clause showed that the most of the requirements of EN 10208-1 are covered in EN ISO 3183; some paragraphs are identical, others are covered by another wording.

A limited number of requirements are not covered and have to be dealt with in some way (e.g. L 235GA) (see enclosed document: EN 10208-1 commented according to the TG reflections).

**CEN/TC 234 Task Group Recommendations for procedure:**
Considering the fact that EN ISO 3183 is a product standard for all sectors and not a design standard the CEN/TC 234 WG 2 Task group recommends to integrate the remaining EN 10208-1 specifications required for the gas distribution system into the relevant functional standard EN 12007-3.

Note: prEN 12007-3 is in Public Enquiry at the moment; deadline 2013-09-04.

This action would be carried out in active liaison with ECISS/TC 110 WG 1. ISO/TC 69 SC 2 WG 16 should be informed about the development.

**Annotation:**
During the CEN/TC 234 WG 2 Task Group meeting it was assumed that PSL* 1 pipes comply with those defined in EN 10208-1. Following to the CEN/TC 234 WG 2 Task Group meeting also a comparison of the technical details for PSL 1 and PSL 2 pipes given in EN ISO 3183 with those defined in EN 10208-1 was carried out. It was stated that PSL 2 pipes (without the European Annex M "PSL 2 pipe ordered for European onshore natural gas transmission pipelines") would rather comply with those defined in EN 10208-1 than PSL 1 pipes. CEN/TC 234 WG 2 should, therefore, also check the option to introduce references to EN ISO 3183 PSL 2 pipes. The corresponding technical comparison will be communicated to CEN/TC 234 WG 2. (*PSL = Pipe Specification Level)

**CEN/TC 234 Secretariat proposal for realisation of work**
If the approach of integration of the remaining requirements into prEN 12007-3 is accepted by CEN/TC 234 WG 2 and Plenary:

1. A corresponding comment would be placed in the public enquiry comments by CEN/TC 234 Secretariat (DIN).
2. CEN/TC 234 WG 2 should be asked to carry out the detailed preparatory work for the integration.

CEN/TC 234 Secretariat proposes to start this as soon as possible, independently of the running enquiry, aiming to have a text proposal for EN

12007-3 already at the enquiry comments treatment in autumn 2013.

**CEN/TC 234 Plenary DECISION needed!**

**For further information:**
**Task Group participants have been:**

Günter Briefs, DIN NA Iron and Steel, ECISS/TC 110
Malcolm Howe, Convenor CEN/TC WG 2
Detlef Jagodzinski, DIN NA Gas, TC 234 WG 2 Member
Manfred Keller, Convenor ECISS /TC 110 WG 1
Jürgen Kocks, DIN NA Gas
Hendrik Löbbe, ECISS/TC 110
Jim Parley, ECISS/TC 110
Hiltrud Schülken, DIN NA Gas, CEN TC 234 Secretary
John Tsiblakis, CEN/TC WG 2 Member

The issue will be presented to CEN/TC 234 Plenary at the forthcoming meeting (2013-05-14/15).

Kind regards

Hiltrud Schülken

**CEN/TC 234/SC 2**

Date: 2013-04

**TC 234 WI**

CEN/TC 234

Secretariat: DIN

# Steel pipes for pipelines for combustible fluids — Technical delivery conditions for pipes of requirement class A (gas distribution) — (EN 10208-1 with cross-out and markings for requirements not (fully) covered in EN ISO 3183:2013)

*Stahlrohre für Rohrleitungen für brennbare Medien — Technische Lieferbedingungen für Rohre der Anforderungsklasse A (Gasverteilung) — (EN 10208-1 mit Streichungen und Markierungen bez. der Abdeckung in EN ISO 3183:2013)*

*Tubes en acier pour conduites de fluides combustibles ——*

ICS: 23.040.10 ; 75.200

Descriptors:

Document type: European Standard
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Document stage: Working Document
Document language: E

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# Foreword

This document (TC 234 WI ) has been prepared by Technical Committee CEN/TC 234 “Gas infrastructure”, the secretariat of which is held by DIN.

This document is a working document.

This document contains the text of EN 10208-1:2009 and is aligned with EN ISO 3183 according to discussions of the dedicated CEN/TC 234 Task Group. Background of the treatment of this document is the withdrawal of EN 10208 with the publication of EN ISO 3183 which has been aligned for the inclusion of EN 10208-2 requirements (gas transmission pipes) but not for the inclusion of EN 10208-1 (gas distribution purposes).

In this document all requirements given in EN 10208-1:2009:

- which are covered in EN ISO 3183 are crossed out with reference to the corresponding EN ISO 3183 clause.
- which have still to be checked in detail are marked and commented accordingly.

Even for the requirements which are crossed out, it is recommended to do a cross-check of the actual requirements in EN ISO 3183, as there might be/are:

- differences in wordings and
- additional issues treated in the referenced clauses, which are not relevant for the gas distribution industry or which need further specifications for the purposes of the gas industry.

In some clauses of EN 10208-1 the whole text is deleted. It shall be discussed if the headlines/titles should also be deleted or if it is useful to keep them making reference to EN ISO 3183.

Finally, it is to discuss in CEN/TC 234 WG 2 and to be decided in CEN/TC 234 Plenary if the remaining requirements can be integrated in EN 12007-3 or if an alone-standing document is necessary.

NOTE EN 12007-3 is in public enquiry at present. Deadline is 2013-09-04.

# 1 Scope

This document describes specific requirements for steel pipes used in gas distribution systems (<= 16 bar) in addition to the requirements given in EN ISO 3183.

NOTE EN ISO 3183 gives general requirements for steel pipes (PSL 1 and PSL 2).

# 2 Normative references

To be updated.

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 287-1, *Qualification test of welders — Fusion welding — Part 1: Steels*~~

~~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 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 10246-1, *Non-destructive testing of steel tubes — Part 1: Automatic electromagnetic testing of seamless and welded (except submerged arc welded) ferromagnetic steel tubes for verification of hydraulic leak tightness*~~

~~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) 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 weld seam of automatic fusion arc welded steel tubes for the detection of 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 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)*~~

~~EN ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607:2003)*~~

~~EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding* (ISO 15609-1:2004)~~

~~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

All terms and definitions in the following list are given in EN ISO 3183. The most of them in the same wording. (EN ISO 3183 Clause 4).

~~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 (in this document for special marking).~~

~~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 temperature (< $Ac_1$) 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 for special marking).~~

**~~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

Exhausting list given in EN ISO 3183. Additional need to be identified at the end of the process.

~~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

EN ISO 3183 Clause 6 Pipe grade, steel grade and delivery conditions.

### 5.1 ~~Classification~~

~~The steel grades specified in this document are non-alloy quality steels in accordance with EN 10020.~~

### 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.~~

## 6 Information to be supplied by the purchaser

All crossed out indents are listed in EN ISO 3183, Clause 7 "Information to be supplied by the purchaser

### 6.1 Mandatory information (equivalent to EN ISO 3183, 7.1)

Note: Even if the options are given in ISO, it is proposed to keep the listing below to facilitate the use for the gas distribution industry.

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 (seamless (S) or welded (W));~~ (much more detailed in ISO 3183 table 2)

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 8);~~

f) number of this European Standard (xy);

NOTE additionally to EN ISO 3183);

g) ~~steel name or number (see Table 2 or 4);~~

h) ~~type of inspection document required (see 9.1.1)~~. (EN ISO 3183 as additional information 7.2 (17))

## 6.2 Options (equivalent to EN ISO 3183 7.2 Additional information)

Note: List in ISO much more detailed. Even if the options are given in ISO, it is proposed to keep the listing below to facilitate the use for the gas distribution industry.

~~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) diameter tolerances for seamless pipe with wall thickness $T$ > 25 mm (see Table 6, footnote b);~~

~~2) diameter and out-of-roundness tolerances for pipe with outside diameter $D$ > 1 430 mm (see Table 6, columns 2 and 3);~~

~~3) party to issue the inspection document 3.2 (see 9.1.1).~~

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

~~1) process of manufacture for welded pipe (see 7.3);~~

~~2) choice of the heat treatment condition (see 7.4);~~

~~3) choice of the welding process for jointers (see A.1);~~

~~4) radiographic inspection for the detection of longitudinal imperfections (see C.4.2 a).~~

~~c) **Optional agreement – options which may be agreed:**~~

~~1) approval of the quality system (see 7.1);~~

~~2) manufacture of SAWL pipe with two seams (see 7.3);~~

~~3) delivery of jointers (see 7.7);~~

~~4) application of the diameter tolerance to the inside diameter (see Table 6, footnote c);~~

~~5) application of the diameter tolerance to the outside diameter (see Table 6, footnote d);~~

~~6) special bevel configuration (see 8.6.4.2);~~

~~7) threaded ends or belled ends (see 8.6.4.3);~~

~~8) offset of strip end welds (see Table 10, footnote a);~~

~~9) test piece direction (see Table 13, footnote b);~~

~~10) use of circular test pieces (see 9.3.2.2, second paragraph);~~

~~11) use of flattened and heat treated test coupons (see 9.3.2.2, last paragraph)~~

~~12) non-destructive leak-tightness test instead of hydrostatic test (see 9.4.6.4);~~

~~13) use of special devices for measuring the pipe diameter (see 9.4.8.1);~~

~~14) use of (cold) die stamping (see 10.1.3);~~

~~15) special marking (see 10.2);~~

~~16) coating and lining (see Clause 11);~~

~~17) degree of staggering of pipe weld seams in jointers (see A.1);~~

~~18) verification of quality requirement for laminar imperfections (see C.2.3);~~

~~19) use of fixed depth notches for equipment calibration (see C.4.1.1 d);~~

~~20) use of hole penetrameter instead of ISO wire penetrameter (see C.4.3.1 a);~~

~~21) use of fluoroscopic inspection (C.4.3.1 b).~~

### 6.3 Example of ordering (no equivalence in EN ISO 3183 found)

Orders shall be preferably presented as given in the example.

EXAMPLE 1 000 m welded pipe with an outside diameter of 219,1 mm, a wall thickness of 6,3 mm in a length according to random length group r2 (see Table 8), made of steel grade L235GA, with test report 2.2 in accordance with EN 10204:

1 000 m W pipe – 219,1 x 6,3 x r2 – EN 10208-2 – L235GA –
test report EN 10204 – 2.2

## 7 Manufacturing

### 7.1 General

**EN ISO 3183, 8.3.1 requires quality system only for supplying steel and rolling mills)**

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.

### 7.2 ~~Steelmaking~~ (ISO 3183 gives clear requirements on this issue.

~~The steel making process is left to the discretion of the manufacturer.~~

### 7.3 Pipe manufacture

Processes are described in the ISO 3183, Clause 8.1 to be introduced. Detailed evaluation of the requirements necessary.

Note: Jim Parley, UK, proposes to delete SAW pipe requirement as pipe producer do not use submerged arc welding process. This is to be considered.

~~Acceptable types of pipe are listed together with acceptable manufacturing routes in Table 1. Unless otherwise agreed, the process of manufacture (type of pipe) for welded pipe is left to the discretion of the manufacturer. For all types of pipe, the choice of the process route in accordance with Table 1 is left to the discretion of the manufacturer.~~

SAWH pipe 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 (EN ISO 3183, 8.1 only for PSL 2)

Clause and table to be kept (but appropriately revised), EN ISO 3183 refers to only PSL 2 pipes.

The pipes shall be delivered in one of the forming and heat treatment conditions given in Table 1. Unless otherwise agreed, the choice of the heat treatment condition is left to the discretion of the manufacturer.

**Table 1 — 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 |
|---|---|---|---|
| Seamless (S) | Ingot or billet | Hot rolling | — (as rolled) |
| | | | Normalizing or normalizing formed |
| | | | Quenched and tempered |
| | | Hot rolling and cold finishing | Normalized |
| | | | Quenched and tempered |
| Electric welded (EW) | Normalizing rolled strip | Cold forming | — [b] |
| | | | Stress relieved (weld area)[b] |
| | | | Normalized (weld area) |
| | | Cold forming and cold finishing | Normalized (entire pipe) |
| | Thermomechanically rolled strip | Cold forming | Heat treated (weld area) |
| | Hot rolled or normalizing rolled strip | Cold forming | Normalized (entire pipe) |
| | | Cold forming and hot stretch reducing under controlled temperature resulting in a normalized condition | — |

| | | | |
|---|---|---|---|
| Submerged arc-welded (SAW)<br>– longitudinal seam (SAWL)<br>– helical seam (SAWH),<br>Combination welded (COW)<br>– longitudinal seam COWL)<br>– helical seam (COWH) | Normalized or normalizing rolled plate or strip | Cold forming | — |
| | Thermomechanically rolled plate or strip | | |
| | As rolled plate or strip | Normalizing forming | — |
| | Normalized or normalizing rolled plate or strip | | |
| | As rolled plate or strip | Cold forming | — [d] |
| Continuous welded (BW)[c] | Hot rolled or normalizing rolled strip | Hot forming | —<br>(as welded; normalized if necessary) |

[a] See 3.4 and 3.5.
[b] Steel grades L210GA, L235GA, L245GA and L290GA only.
[c] Steel grades L210GA and L235GA and $D \leq 114{,}3$ mm for distribution pipelines only.
[d] Steel grades L210GA, L235GA and L245GA only.

## 7.5 Sizing (equivalent EN ISO 3183, 8.9.1 + 8.9.3)

In ISO 8.9.2 other agreements permitted, therefore to be checked.

~~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:~~

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

~~where~~

~~$D_a$ is the outside diameter after sizing;~~

~~$D_b$ is the outside diameter before sizing;~~

~~$D$ is the specified outside diameter.~~

## 7.6 Strip end welds (EN ISO 3283, 8.10)

Check EN ISO 3183, 8.10.3 – 8.10.4 for relevance.

**7.6.1** (EN ISO 3183, 8.10.2) ~~For helical seam welded pipe, the strip end weld shall be located at least 200 mm from the pipe end.~~

**7.6.2** (EN ISO 3183, 8.10.1) ~~For welded pipe with a longitudinal seam, strip end welds are not permitted in the pipe.~~

## 7.7 Jointers (EN ISO 3183, 8.11 + Annex A)

All requirements are covered in ISO 3183; some additional issues are given in ISO, to be checked..

Furthermore, it is to check if reference to European/international standards for welders' qualification and welding procedure shall be stipulated in European requirements, e.g. EN 287-1. There are no references in the ISO standard. (EN 10208-1 Annex A).

~~The delivery of jointers is permitted by agreement provided the lengths of pipe used have fulfilled the requirements of this document and the special requirements in Annex A are complied with.~~

### 7.8 General requirements for non-destructive testing (EN ISO 3183 10.2.10 + Annex E)

ISO stipulates further requirements, to be checked when referencing.

~~All NDT activities shall be carried out by qualified and competent level 1, 2 and/or 3 personnel authorized to operate by the employer.~~ (ISO E.1.2)

(ISO 3183 E.1.1 gives reference to ISO 9712, ISO 11484 or ASNT… )The qualification shall be in accordance with EN 10256 or, at least, an equivalent to it. It is recommended that the level 3 personnel be certified in accordance to EN 473 or, at least an equivalent to it.

(ISO 3183 E.1.3 requires 2 or 3 level personnel for authorisation) The operating authorization issued by the employer shall be in accordance with a written procedure. NDT operations shall be authorized by a level 3 NDT individual approved by the employer.

NOTE The definition of level 1, 2 and 3 can be found in appropriate standards, e.g. EN 473 and EN 10256.

## 8 Requirements

### 8.1 General

The requirements specified in this document apply on condition that the relevant specifications for test piece selection, test piece preparation and test methods given in 9.3 and 9.4 are complied with.

NOTE Table 12 gives a survey on the tables and clauses containing requirements and specifications for testing.

### 8.2 Chemical composition (EN ISO 3183, 9.2)

#### 8.2.1 Cast analysis

The cast analysis reported by the steel producer shall apply and comply with the requirements of Table 2.

All Steel grades besides L 235GA are covered in EN ISO 3183 (Table 4). But the values of the components of the steel grades differ from the ISO standard (table 4) (see red values in table 2 below)– to be checked

As L235GA is considered necessary for the European gas distribution industry this requirement will be retained with reference to EN 10217-1 (to be checked) anyway.

**Table 2 — Chemical composition [a] of the cast analysis**

| Steel grade | | Maximum content, % by mass | | | | | |
|---|---|---|---|---|---|---|---|
| Steel name | Steel number | C | Si | Mn | P | S | Others |
| L210GA | 1.0319 | 0,21 0.22 | 0,40 | 0,90 | 0,030 | 0,030 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L235GA | 1.0458 | 0,16 (error? 0,26) | 0,40 | 1,20 | 0,030 | 0,030 | b |
| L245GA | 1.0459 | 0,20 0,28 | 0,40 | 1,15 | 0,030 | 0,030 | |
| L290GA | 1.0483 | 0,20 0,28 | 0,40 | 1,40 | 0,030 | 0,030 | c |
| L360GA | 1.0499 | 0,22 0,28 | 0,55 | 1,45 | 0,030 | 0,030 | |

[a] The steels shall be fully killed with 0,015 % ≤ $Al_{total}$ < 0,060 %.

[b] Other elements shall not be added intentionally. (Note: Here may be conflict with EN 10217-1?)

[c] V, Nb, Ti and combinations thereof may be added at the discretion of the manufacturer. The sum of these elements shall not exceed 0,15 %.

#### 8.2.2 Product analysis (to be checked in relation with revised 8.2.1 of this standard)

The product analysis shall not deviate from the limiting values for the cast analysis as specified in Table 2 by more than the values given in Table 3.

**Table 3 — Permissible deviations of the product analysis from the specified limits on cast analysis given in Table 2**

| Element | Limiting value for the cast analysis according to Table 2<br>% by mass | | Permissible deviation of the product analysis<br>% by mass |
|---|---|---|---|
| C | ≤ 0,22 | | + 0,02 |
| Si | ≤ 0,55 | | + 0,05 |
| Mn | ≤ 1,45 | | + 0,10 |
| P | ≤ 0,030 | | + 0,005 |
| S | ≤ 0,030 | | + 0,005 |
| Al | ≥ 0,015 | < 0,060 | ± 0,005 |
| V + Nb + Ti | ≤ 0,15 | | + 0,02 |

### 8.3 Mechanical properties (EN ISO 3183 table 6)

The clause shall be retained at least for L235GA.

In ISO the **hydostatic test** is not covered, so also the consequences for the other steel grades to be checked.

The pipe shall, as applicable (see Table 12, column 2), comply with the requirements given in Table 4.

NOTE In case of hot forming and/or subsequent field heat treatment of pipes delivered in the quenched and tempered or thermomechanically rolled condition, an adverse change of mechanical properties can occur (see for example 3.2). Where appropriate, the purchaser should contact the manufacturer for more detailed information.

**Table 4 — Requirements for the result of tensile and bend test and for the hydrostatic test**

| Steel grade | Pipe body (seamless and welded pipes) | Weld seam (pipe) | | Entire pipe |
|---|---|---|---|---|
| | | EW, BW, SAW, COW | SAW, COW | |

| Steel name | Steel number | Yield strength $R_{t0,5}$ MPa | Tensile strength $R_m$ MPa min. | Elongation [a] $A$ % min. | Tensile strength $R_m$ MPa min. | Diameter of the mandrel for bend test [b] (see 9.4.3) | Hydrostatic test (see 9.4.6) |
|---|---|---|---|---|---|---|---|
| L210GA | 1.0319 | 210 | 335 to 475 | 25 | The same values as for the pipe body apply. | 2 $T$ | Each length of pipe shall withstand the test without showing leak-age or visible deformation |
| L235GA | 1.0458 | 235 | 370 to 510 | 23 | | | |
| L245GA | 1.0459 | 245 | 415 to 555 | 22 | | 3 $T$ | |
| L290GA | 1.0483 | 290 | 415 to 555 | 21 | | | |
| L360GA | 1.0499 | 360 | 460 to 620 | 20 | | 4 $T$ | |

[a] These values apply to transverse specimens taken from the pipe body. When longitudinal specimens are tested (see Table 13), the values of elongation shall be 2 units higher.

[b] $T$ specified wall thickness of the pipe.

## 8.4 Weldability (covered in EN 12007-3, to be aligned)

(EN ISO 3183 seems to cover only weldability of PSL 2 pipes, 9.15)

In view of the processes for the manufacture of pipes and of pipe lines, the requirements for the chemical composition of the steels have been selected to insure that the steels delivered in accordance with this document are weldable.

However, account should be taken of the fact that the behaviour of the steel during and after welding is dependent not only on the steel, but also on the welding consumables used and on the conditions of preparing for and carrying out the welding.

## 8.5 Appearance and soundness (EN ISO 3183, 9.10)

The most of requirements mentioned below are covered in ISO, but there are many additional requirements on the issue. Therefore, a check and evaluation of relevance of the EN ISO 3183 clauses is necessary.

**8.5.1** (ISO 9.10.1.1) ~~The pipes shall be free from defects in the finished condition.~~

**8.5.2** The internal and external surface finish of the pipes shall be typical of the manufacturing process and the heat treatment employed. The surface condition shall be such that any surface imperfections requiring dressing can be identified.

**8.5.3** (ISO 9.10.7) ~~Surface imperfections disclosed by visual inspection shall be investigated, classified and treated as follows:~~

~~a) imperfections with a depth equal to or less than 12,5 % of the specified wall thickness, and which do not encroach on the specified minimum wall thickness, shall be classified as acceptable imperfections and treated in accordance with B.1;~~

~~b) imperfections with a depth greater than 12,5 % of the specified wall thickness, but which do not encroach on the specified minimum wall thickness, shall be classified as defects and shall either be dressed-out by grinding in accordance with B.2 or treated in accordance with B.3 as appropriate;~~

~~c) imperfections which encroach the specified minimum wall thickness shall be classified as defects and treated in accordance with B.3.~~

**8.5.4** (ISO 9.10.5.1 values differ slightly, to be checked) ~~Geometric deviations for the normal cylindrical contour of the pipe which occur as a result of the pipe forming process or manufacturing operations (e.g. dents, flat spots, peaks) shall not exceed the following values:~~

~~a) 3 mm (flat spots, peaks and cold formed dents with sharp bottom gouges);~~

~~b) 6 mm (other dents).~~

~~These limits refer to the gap between the extreme point of the deviation and the prolongation of the normal contour of the pipe.~~

(ISO 9.10.2.8.4) ~~For the measurement of flat spots and peaks, see 9.4.8.3.~~

(ISO 9.10.5.2) ~~For dents, the length in any direction shall not exceed one half of the pipe outside diameter.~~

**8.5.5** (to be checked: ISO 3183, 9.10.2 + Annex C) ~~For undercuts disclosed by visual inspection of~~ SAW ~~and~~ COW ~~pipes, the acceptance criteria given in C.4.3.2 d)~~ to C.4.3.2 f (not covered in ISO?) apply.

**8.5.6** (to be checked: ISO 3183, 9.10.7 and Annex C/D – "machining is not mentioned") Surface imperfections may be removed, but only by grinding or machining. The tube thickness in the dressed area shall not be less than the specified minimum wall thickness. All dressed areas shall blend smoothly into the contour of the tube.

**8.5.7** (ISO 3183, 9.10.6 ) ~~Any hard spot exceeding 50 mm in any direction shall have a hardness value less than 35 HRC (327 HB) (see 9.4.7 in ISO 3183: 10.2.7 visual examination).~~

**8.5.8** (ISO 3183, 9.10.1.3 + Annex E ) ~~The acceptance criteria for imperfections detected by non-destructive testing, as required by 9.4.10, are specified in Annex C.~~

## 8.6 Dimensions, masses and tolerances (EN ISO 3183, 9.11)

### 8.6.1 Dimensions (EN ISO 3183 Table 9)

**8.6.1.1** (EN ISO 3183 Table 10 and 11)~~The pipes shall be delivered to the dimensions specified in the enquiry and order, within the tolerances given in 8.6.3 to 8.6.6.~~

**8.6.1.2** Where appropriate, the preferred outside diameters $D$ and wall thicknesses $T$ given in Table 5 and selected from those in EN 10220 should be ordered.

**8.6.1.3** For the length of pipes, see 8.6.3.3, and for the execution of the pipe ends, see ~~8.6.4.~~ EN ISO 3183, 9.12

### 8.6.2 Masses (equivalent EN ISO 3183, 9.11.2)

When making reference to ISO 9.11.2 text is to be checked as additional issues are treated.

~~The mass per unit length may be calculated by the formula~~

$$\cancel{M = (D - T) \times T \times 0{,}0246615 \text{ kg/m}} \qquad \cancel{(2)}$$

~~where~~

~~$M$ is the mass per unit length,~~

~~$D$ is the specified outside diameter in mm,~~

~~$T$ is the specified wall thickness in mm.~~

~~The formula is based on density equal to 7,85 kg/dm$^3$.~~

**Table 5 — Preferred outsides diameters and wall thickness**
(indicated by the shadowed field)

Not treated in ISO 3183

Dimensions in mm

| Qutside diameter $D$ | Wall thickness $T$ | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2,3 | 2,6 | 2,9 | 3,2 | 3,6 | 4 | 4,5 | 5 | 5,6 | 6,3 | 7,1 | 8 | 8,8 | 10 | 11 | 12,5 | 14,2 | 16 | 17,5 | 20 | 22,2 | 25 | 28 | 30 | 32 | 36 | 40 |
| 33,7 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42,4 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 48,3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60,3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 88,9 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 114,3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 168,3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 219,1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 273 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 323,9 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 355,6 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 406,4 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 457 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 508 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 559 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 610 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 660 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 711 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 762 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 813 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 864 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 914 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 016 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 067 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 118 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 168 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 219 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 321 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 422 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 524 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 626 | | | | | | | | | | | | | | | | | | | | | | | | | | | |

### 8.6.3 Tolerances on the pipe

#### 8.6.3.1 Diameter and out-of-roundness

~~The outside diameters and the out-of-roundness of the pipes as defined in 9.4.8.2 shall be within the tolerance limits given in Table 6.~~

**~~Table 6 — Tolerance on diameter and out-of-roundness~~**

To 8.6.3 table 6 to be deleted, reference to EN ISO 3183 Table 10 to be introduced, the ISO version is more comprehensive

| ~~Outside diameter $D$ mm~~ | ~~Diameter tolerance~~ [a] | | | | ~~Out-of-roundness~~ [a] | |
|---|---|---|---|---|---|---|
| | ~~Pipe except the end~~ | | ~~Pipe end~~ [b] | | | |
| | ~~Seamless pipe~~ | ~~Welded pipe~~ | ~~Seamless pipe~~ | ~~Welded pipe~~ | Pipe except the ~~end~~ | ~~Pipe end~~ [b,e] |
| ~~$D \leq 60$~~ | ~~± 0,5 mm or ± 0,75 % $D$ (whichever is the greater)~~ | ~~± 0,5 mm or ± 0,75 % $D$ (whichever is the greater), but max. ± 3 mm~~ | ± 0,5 mm or ± 0,5 % $D$ [c] ~~(whichever is the greater), but max. ± 1,6 mm~~ | | ~~(included in the diameter tolerance)~~ | |
| ~~$60 < D \leq 610$~~ | | | | | ~~2,0 %~~ | ~~1,5 %~~ |
| ~~$610 < D \leq 1\,430$~~ | ~~± 1 % $D$~~ | ~~± 0,5 % $D$ but max. ± 4 mm~~ | ~~± 2,0 mm~~ [d] | ~~± 1,6 mm~~ [d] | ~~1,5 % (but max. 15 mm) for $\frac{D}{T} \leq 75$;~~ | ~~1,0 % for $\frac{D}{T} \leq 75$; 1,5 % for $\frac{D}{T} > 75$~~ |
| ~~$D > 1\,430$~~ | ~~as agreed~~ | | ~~as agreed~~ [d] | | ~~2,0 % for $\frac{D}{T} > 75$~~ | ~~as agreed~~ [d] |

~~[a] The pipe end shall be considered to include a length of 100 mm at the pipe extremities.~~

~~[b] For seamless pipe, the values apply for wall thicknesses $T \leq 25$ mm; for greater thicknesses by agreement.~~

~~[c] Subject to agreement, the tolerance may be applied to the inside diameter for outside diameters $D > 210$ mm.~~

~~[d] Unless otherwise agreed, the diameter tolerance applies to the inside diameter.~~

[e] ~~When the diameter tolerance is applied to the inside diameter, the inside diameter shall also be the basis for the out-of-roundness requirements.~~

### 8.6.3.2 Wall thickness

~~The wall thickness shall be within the tolerances given in Table 7.~~

**~~Table 7 — Tolerances on wall thickness~~**

To 8.6. table 7 requirements for seamless pipes are equal to (EN ISO 3183 Table 11, the requirements for welded pipes are stricter in ISO. Proposed to delete table 7 in favour of ISO (Acceptance to be checked.)

| ~~Wall thickness $T$ mm~~ | ~~Permissible tolerance~~ |
|---|---|
| ~~Seamless pipe~~ [a] | |
| ~~$T \leq 4$~~ | ~~+ 0,6 mm / – 0,5 mm~~ |
| ~~$4 < T < 25$~~ | ~~+ 15 % / – 12,5 %~~ |
| ~~$T \geq 25$~~ | ~~+ 3,75 mm/ – 3,0 mm or ± 10 % (whichever is the greater)~~ |

| ~~Welded pipe~~ | |
|---|---|
| ~~$T \leq 10$~~ | ~~+ 1,0 mm / – 0,5 mm~~ |
| ~~$10 < T < 20$~~ | ~~+ 10 % / – 5 %~~ |
| ~~$T \geq 20$~~ | ~~+ 2,0 mm / – 1,0 mm~~ |
| ~~a For outside diameters $D \geq 355,6$ mm, it is permitted to exceed the upper wall thickness locally by further 5 % of the specified wall thickness. However, the mass tolerance in 8.6.6 applies.~~ | |
| | |

**8.6.3.3 Length (to be kept)**

**8.6.3.3.1** Depending on the order the pipes are to be delivered in random lengths or in fixed lengths.

**8.6.3.3.2** Random lengths shall be delivered in accordance with the requirements of the specified length groups (see Table 8).

**8.6.3.3.3** Fixed lengths shall be delivered with a tolerance of ± 500 mm.

**Table 8 — Requirements for random length groups (to be kept (but clarified), even if there is EN ISO 3183 table 12)**

Dimensions in metres

| Length group | Length range for 90 % of order item [a] | Minimum average length of order item | Shortest length of order item |
|---|---|---|---|
| r1 | 6 to 11 | 8 | 4 |
| r2 | 9 to 14 | 11 | 6 |
| r3 | 10 to 16 | 13 | 7 |
| r4 | 11 to 18 | 15 | 8 |
| [a] The upper limit applies as an absolute maximum value for the length of each individual pipe. | | | |

**8.6.3.4 Straightness (**equivalent to EN ISO 3183, 9.11.3.4**)**

~~The total deviation from a straight line shall be ≤ 0,2 % of the whole pipe length. Any local deviation in straightness shall be < 4 mm/m.~~

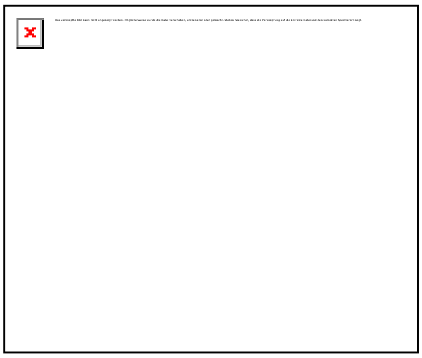
**8.6.4 Finish of pipe ends** (EN ISO 3183, 9.12 do not deal with the appropriate steel grades for with PSL 1)

**8.6.4.1** Unless otherwise agreed (see 8.6.4.3), the pipe shall be delivered with plain ends. All pipe ends shall be cut square and be free from harmful burrs.

The out-of-squareness (see Figure 1) shall not exceed:

a) 1 mm for outside diameters $D \leq 220$ mm;

b) 0,005 $D$, but max. 1,6 mm, for outside diameters $D > 220$ mm.



**Key**

1 out-of-squareness

**Figure 1 — Out-of-squareness (to be kept)**

**8.6.4.2** (EN ISO 3183, 9.12.5) ~~The end faces of pipes with a wall thickness greater than 3,2 mm shall be bevelled for welding. The angle of the bevel measured from a line drawn perpendicular to the axis of the pipe shall be 30° with a tolerance of $^{+5}_{\ 0}$°. The width of the root face of the bevel shall be 1,6 mm with a tolerance of ± 0,8 mm.~~

~~Other bevel preparations may be agreed.~~

~~Where internal machining or grinding is carried out, the angle of the internal taper, measured from the longitudinal axis, shall be not greater than:~~

~~a) as given in Table 9 (for seamless pipe);~~

~~b) 7° (for welded pipe, outside diameter $D$ > 114,3 mm).~~

Equivalent ISO EN 3183 Table 13 ~~**Table 9 — Maximum angle of internal taper for seamless pipe**~~

| ~~Specified wall thickness $T$~~<br>~~mm~~ | ~~Maximum angle of taper~~<br>~~degrees~~ |
|---|---|
| ~~$T$ < 10,5~~ | ~~7~~ |
| ~~10,5 ≤ $T$ < 14~~ | ~~9,5~~ |
| ~~14 ≤ $T$ < 17~~ | ~~11~~ |
| ~~$T$ ≥ 17~~ | ~~14~~ |

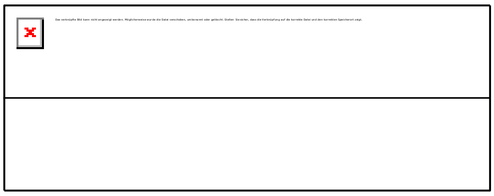
**8.6.4.3** **(EN ISO 3183, 9.12.5)** ~~By agreement, the pipe may be delivered with threaded ends or with belled ends.~~

~~NOTE Threaded and belled end pipes are in general only applicable for distribution pipelines and/or under less critical service conditions.~~

### 8.6.5 Tolerances of the weld seam (equivalent EN ISO 3183, 9.13 besides tables – see below – to be checked)

#### ~~8.6.5.1 **Radial offset of plate or strip edges**~~

~~**8.6.5.1.1** In the case of EW pipe, the radial offset of strip edges shall not cause the remaining wall thickness at the weld to be less than the specified minimum wall thickness (see Figure 2a).~~



~~**Key**~~

~~1 remaining wall thickness at the weld~~

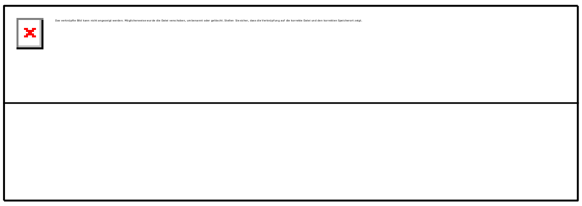
~~a) Radial offset of strip edges (EW pipe)~~

~~**Key**~~

~~1, 4 outside/inside radial offset~~

~~2, 3 outside/inside height of the weld bead~~

~~b) Radial offset and height of the weld beads of plate/strip edges (SAW and COW pipe)~~



~~**Key**~~

~~1 misalignment~~

~~c) Misalignment of the weld beads (SAW and COW pipe)~~

~~**Figure 2 — Possible dimensional deviations of the weld seam**~~

~~**8.6.5.1.2** In the case of SAW and COW pipes the maximum radial offset (see Figure 2b) of the strip/plate edges shall be as given in Table 10.~~

**Table 10 — Maximum permissible offset of SAW and COW pipes (**
(EN ISO 3183, table 14 similar – values differ, to be checked)

Dimensions in mm

| Specified wall thickness $T$ | Maximum permissible radial offset [a] |
|---|---|
| $T \leq 10$ | 1,0 |
| $10 < T \leq 20$ | 0,1 $T$ |
| $T > 20$ | 2,0 |
| [a] For strip and welds other requirements may be agreed. | |

### ~~8.6.5.2~~ Height of the flash or weld bead/weld reinforcement (EN ISO 3183 9.13.2 – to be checked)

**8.6.5.2.1** (EN ISO 3183, 9.13.2.1 – to be checked wording equivalent but values different (ISO 9.13.2.1 b) The outside flash of EW pipe shall be trimmed to an essentially flush condition. The inside flash of EW and BW pipe shall not extend above the contour of the pipe by more than 0,5 mm + 0,05 $T$. When trimming EW pipe, the wall thickness shall not be reduced below the minimum specified.

**8.6.5.2.2** The inside weld bead of SAW and COW pipe (see Figure 2b) shall be ground flush with a tolerance of $^{+0,5}_{0}$ mm for a distance of 100 mm from each pipe end.

The height of the weld bead of the remainder of the pipe shall not exceed the applicable value given in Table 11.

**Table 11 — Maximum permissible weld bead of SAW and COW pipes**
**(EN ISO 3183, table 16 differ in values – to be checked)**

Dimensions in mm

| Specified wall thickness $T$ | Maximum height of the weld bead |
|---|---|
| $T \leq 12,7$ | 3 |
| $T > 12,7$ | 4,8 |

**8.6.5.2.3** The weld beads shall blend in smoothly with the parent metal and shall for SAW and COW pipe not come below the contour of the pipe, except that dressing out of undercuts is permitted (see C.4.3.2 d).

### 8.6.5.3 Misalignment of the weld beads (EN ISO 3183, 9.13.3 differ seems to be more consitent – to be checked)

Any misalignment of the weld beads of SAW and COW pipes (see Figure 2c) shall not be cause for rejection provided complete penetration and complete fusion have been achieved (see C.4.3.2 a).

### 8.6.6 Mass tolerance (EN ISO 3183, 9.14 c appropriate – to be checked in detail)

~~The mass of any individual pipe shall not deviate from the nominal mass determined in accordance with 8.6.2 by more than + 10 % or – 3,5 %.~~

## 9 Inspection

Specific inspection is properly covered in EN ISO 3183 Clause 10. For non-specific inspection (9.1 and 9.2) the users should be consulted if item is necessary.

## 9.1 Types of inspection and inspection documents

**9.1.1** The compliance with the requirements of the order shall be checked for products in accordance with this document either by non-specific or by specific inspection.

The purchaser shall specify the required type of inspection and the inspection document in accordance with EN 10204.

In the case of non-specific inspection, a test report 2.2 shall be issued. In the case of specific inspection, an inspection certificate (3.1 or 3.2) shall be issued.

Note: Reference is made to ISO 10474:1991 and EN 10204:2004.

If an inspection certificate 3.2 is specified, the purchaser shall notify the manufacturer of the name and address of the organization or person who is to carry out the inspection and produce the inspection document. It shall also be agreed which party shall issue the certificate.

**9.1.2** The inspection document shall include, in accordance with EN 10168, the following codes and information:

A commercial transactions and parties involved;

~~B description of products to which the inspection certificate applies;~~

~~C01 to C02 location of sample and direction of the test piece;~~

~~C10 to C13 tensile test;~~

C50 to C69 bend or flattening test;

~~C71 to C92 cast analysis and – in the case of specific inspection – product analysis;~~

D01 marking and dimensional checking and verification of the surface appearance;

~~D02 to D99 non-destructive testing and hydrostatic test;~~

~~Z validation.~~

## 9.2 Summary of inspection and testing

The tests to be carried out and the frequency of testing are given in 9.3.2.2 Table 13:

a) for non-specific inspection and testing, in columns 2, 3 and 4; and

~~b) for specific inspection and testing, in columns 2, 3 and 5.~~

## 9.3 Selection and preparation of samples and test pieces

### ~~9.3.1 **Samples and test pieces for the product analysis**~~

~~The samples and test pieces shall be taken and prepared in accordance with EN ISO 14284. At the discretion of the pipe manufacturer, they shall be taken either from plate/strip or pipe.~~

**Table 12 — Survey of tests and requirements**

**Content of table seems to be covered in EN ISO 3183 Table 17 + 18 inspection frequency (to be checked)**

| 1 | 2 | | | | 3 | 4 | 5 | | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | The specifications in columns 3 to 8 apply for [a] | | | | Type of test or requirement | Frequency of testing | | | Sampling conditions see | Test method see | Requirements see |
| | Seamless pipe | EW, BW | SAW, COW pipe: longitudinal seam | SAW, COW pipe: helical seam | | Non-specific inspection | Specific inspection | | | | |
| a1 | x | x | x | x | Cast analysis | x [b] | 1 analysis/cast | | Left to the discretion of the manufacturer. | | Table 2 |
| a2 | x | x | x | x | Product analysis | – | 1 analysis/cast | | 9.3.1 | 9.4.1 | Table 3 |
| | | | | | Tensile test | | Except for strip end weld testing, the test units shall consist only of pipes of | Test pieces per sample | | | |
| b1 | x | x | x | x | – on the pipe body | x [b] | – the same heat treatment condition<br>– the same dimension | 1 | 9.3.2.2 and Table 13 | 9.4.2 | Table 4 |
| b2 | | x | x | x | – on the weld seam ($D \geq$ 210 mm) | x [b] | and of<br>– 400 pipes ($D \leq$ 141,3 mm)<br>– 200 pipes (141,3 mm < $D \leq$ 323,9 mm) | 1 | | | |
| b3 | | | | x | – on the strip end weld seam ($D \geq$ 210 mm) | x [b] | – 100 pipes ($D$ > 323,9 mm).<br>For strip end welds, the test unit shall consist of not more than 50 pipes containing strip end welds per order item. | 1 | | | |
| | | | | | Bend test | | | | | | |
| e1 | | | x | x | – on the weld seam | x [b] | One sample shall be taken per test unit. | 2 | 9.3.2.3 and Table 13 | 9.4.3 | 9.4.5.2, Table 4 and Figure 5 |
| e2 | | | | x | – on the strip end weld seam | x [b] | | 2 | | | |
| f | | x | | | Flattening test | x [b] | 4 tests per coil; plus 2 tests in the case of a weld stop. | | 9.3.2.4 and Figure 4 | 9.4.4 | 9.4.4.2 and Figure 4 |

**Table 12** *(continued)*

| 1 | 2 | | | | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | The specifications in columns 3 to 8 apply for [a] | | | | Type of test or requirement | Frequency of testing | | Sampling conditions see | Test method see | Requirements see |
| | Seam-less pipe | EW, BW pipe | SAW, COW pipe longitudinal seam | SAW, COW pipe helical seam | | Non-specific inspection | Specific inspection | | | |
| g1 | | | x | x | Macro- and metallographic examination<br>– Macrography | Once per shift or when pipe size is changed. | | 9.3.2.5 | 9.4.5.1 | 8.6.5.3 |
| g2 | | x [c] | | | – Metallography | Once per shift or when size or steel grade of the pipe is changed. | | | 9.4.5.2 | 9.4.5.2 |
| h | | x | x | x | Hardness test | In cold formed pipe any hard spot exceeding 50 mm in any direction shall be tested. | | – | 9.4.7 | 8.5.7 |
| i | x | x | x | x | Hydrostatic testing | Each pipe shall be tested. | | – | 9.4.6 | 9.4.6 and Table 4 |
| j | x | x | x | x | Visual examination | Each pipe shall be examined. | | | 9.4.7 | 8.5 |
| k1 | x | x | x | x | Dimensional testing<br>– outside or inside diameter and out-of-roundness of pipe ends | X [b] | Dimensions of each pipe shall be verified. | – | 9.4.8 | 8.6.3.1 |
| k2 | x | x | x | x | – wall thickness of pipe ends | Dimensions of each pipe shall be verified. | | | | 8.6.3.2 and Table 7 |
| k3 | x | x | x | x | – other dimensional characteristics | X [b] | At random testing.<br>In the case of specific testing, the details are left to the discretion of the inspector. 8.6.5 | | | 8.6.3.3, 8.6.3.4, 8.6.4 |
| k4 | | x | x | x | – weld seam | | | | | |
| l | x | x | x | x | Weighing | Each pipe or lot shall be weighed. | | | 9.4.9 | 8.6.6 |
| m | x | x | x | x | Non-destructive testing | See Table C.1 | | | | |

[a] EW Electric welded; BW Continuous welded; SAW Submerged arc welded; COW Combination welded.

[b] Frequency of testing in accordance with the manufacturer's procedure.

[c] Only applicable for EW pipe with heat treated weld area

**Table 13 — Number, direction and location of the test pieces to be taken per sample for the mechanical tests**

| Type of pipe[a] | | Test | Test pieces to be taken from | Outside diameter in mm < 210 | ≥ 210 < 500 | ≥ 500 | For further information see |
|---|---|---|---|---|---|---|---|
| | | | | Number, direction and location of the test pieces (see explanation of the symbols in Figure 3) | | | |
| Seamless (see Figure 3a) | | Tensile | pipe body | 1L | 1L [b] | 1L [b] | 9.3.2.2 |
| Longitudinal seam (see Figure 3b) | EW, BW, SAW, COW | Tensile | pipe body | 1L90 | 1T90 | 1T90 | 9.3.2.2 |
| | | Tensile | seam[b] | – | 1W | 1W | |
| | SAW, COW | Bend | seam[b] | 2W | 2W | 2W | 9.3.2.3 |
| | HFW | Flattening | See Figure 4 | | | | 9.3.2.4 |
| Helical seam (see Figure 3c) | SAW, COW | Tensile | pipe body | 1L, $a$/4 [c] | 1T, $a$/4 [c] | 1T, $a$/4 [c] | 9.3.2.2 |
| | | | seam[b] | – | 1W | 1W | 9.3.2.2 |
| | | Bend | seam[b] | 2W | 2W | 2W | 9.3.2.3 |
| | | Tensile | strip end weld | – | 1WS | 1WS | 9.3.2.2 |
| | | Bend | | 2WS | 2WS | 2WS | 9.3.2.3 |

[a] EW Electric welded ; BW Continuous welded; SAW Submerged arc welded; COW Combination welded.

[b] If, by agreement (see 7.2), pipes with two seams are delivered, both seams are to be subjected to the tests.

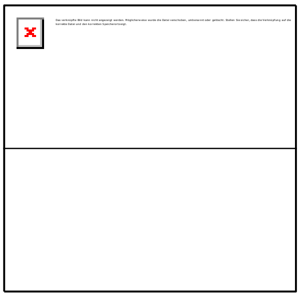
[c] By agreement 1T instead of 1L.

### ~~9.3.2~~ Samples and test pieces for the mechanical tests (covered by EN ISO 3183, same figures, same requirements in other wording)

#### ~~9.3.2.1 **General**~~

~~The samples and test pieces for the specified tests shall be taken and the corresponding test pieces prepared in accordance with the general conditions of EN ISO 377, as far as applicable.~~

~~Samples for the various types of test shall be taken from pipe ends in accordance with Figures 3 and 4 and Table 13 taking into account the supplementary details specified in 9.3.2.2 to 9.3.2.4.~~

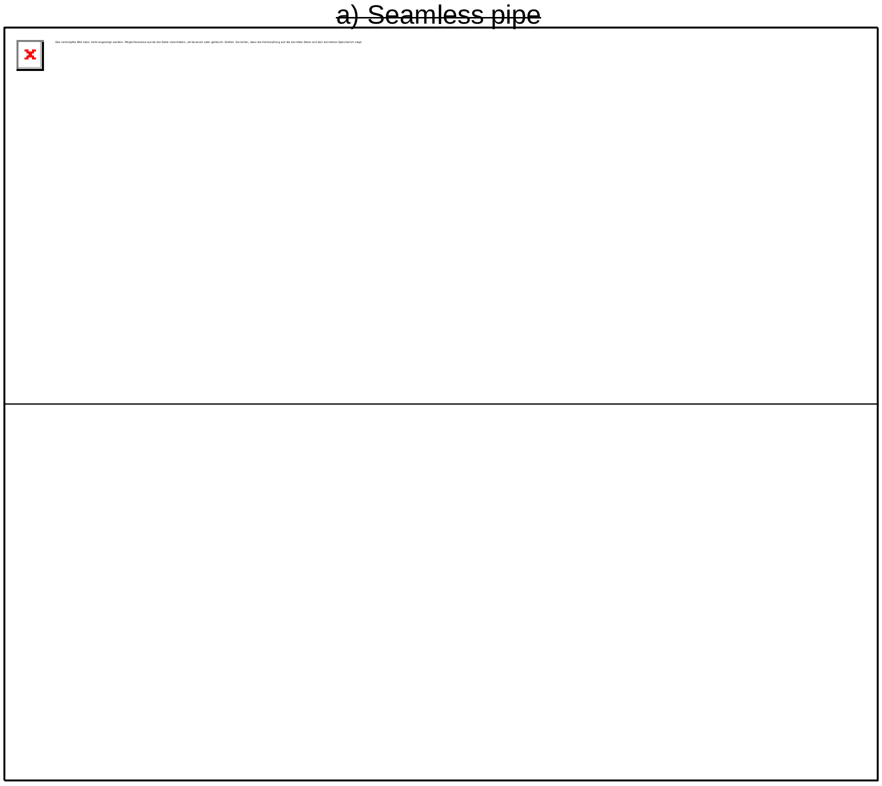


~~**Key**~~

~~1 L — longitudinal sample~~

~~2 T — transverse sample~~

~~a) Seamless pipe~~



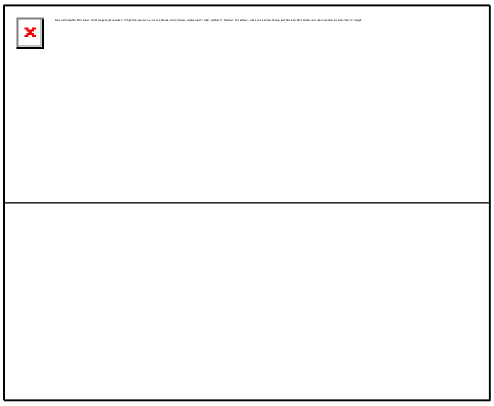
~~**Key**~~

~~1 W — transverse sample, centred on the weld~~

~~2 T90 — transverse sample, centred ≈ 90° from the longitudinal weld~~

~~3 L90 — longitudinal sample, centred ≈ 90° from the longitudinal weld~~

~~b) HFW, SAWL and COWL pipe~~



~~**Key**~~

~~1 W — transverse sample, centred on the helical seam weld~~

~~2 L — longitudinal sample, centred at least *a*/4 in the longitudinal direction from the helical seam weld~~

~~3 T — transverse sample, centred at least *a*/4 in the longitudinal direction from the helical seam weld~~

~~4 strip/plate end weld, with length *a*~~

~~5 WS — transverse sample, centred at least *a*/4 from the junctions of the helical seam weld and the strip/plate end weld~~

~~c) SAWH and COWH pipe~~

~~**Figure 3 — Sample position and explanation of the symbols applied in Table 13 for specifying the test piece direction and position**~~

~~**Key**~~

~~1 welding~~

~~2 coil end~~

~~3 one test piece from each coil end~~

~~4 weld stop~~

~~5 two test pieces, one from each side of the weld stop~~

~~**Figure 4 — Flattening test – sampling and testing (schematically)**~~
~~(see further details in 9.4.4.1)~~

### ~~9.3.2.2~~ Tensile test pieces (EN ISO 3183 Clause 10.2.3.2 (more detailed) and Tables 19-21 (to be checked)

~~Rectangular test pieces representing the full wall thickness of the pipe shall be taken in accordance with EN 10002-1 and Figure 3. Transverse test pieces shall be flattened.~~

~~Circular test pieces machined from an unflattened sample may be used by agreement.~~

~~At the manufacturer's discretion, for testing the pipe body of pipes with outside diameter $D \leq 210$ mm, a full pipe test piece may be used.~~

~~Weld beads shall be ground flush, local imperfections may be removed, but mill scale should not be removed from the test pieces.~~

~~If the pipes are to be heat treated, test coupons may, by agreement, be taken and flattened before the heat treatment. The flattened test coupon shall then undergo the same heat treatment as the pipe.~~

~~9.3.2.3~~ **Test pieces for the bend test (see EN ISO 3183 Clause 10.2.3.6 and figure 8)**

~~The test pieces shall be taken in accordance with EN 910 and Figure 5. For pipes with a wall thickness T> 20 mm (ISO 19 mm)the test pieces may be machined to provide a rectangular cross section having a thickness of 19 mm (ISO 18 mm). Full wall thickness curved section test pieces are mandatory for pipe with a wall thickness T≤ 20 mm.~~

~~The weld reinforcement shall be removed from both faces.~~

~~Dimensions in mm~~

**~~Key~~**

~~1 long edges machined or oxygen cut, or both~~
~~2 weld~~
~~3 wall thickness~~

**~~Figure 5 — Test piece for the bend test~~**

~~9.3.2.4~~ **Test pieces for the flattening test (EN ISO 3183, 10.2.3.7 identical text)**

~~The test pieces shall be taken in accordance with EN ISO 8492.~~

~~Minor surface imperfections may be removed by grinding.~~

~~9.3.2.5~~ **Samples for macrographic and metallographic tests (EN ISO 3183, 10.2.5, much more detailed, no reference to EN ISO 377)**

~~The samples including the weld cross-section shall be taken and prepared in accordance with EN ISO 377, as far as applicable.~~

## 9.4 Test methods

### 9.4.1 Chemical analysis (product analysis) (EN ISO 3183, 10.2.4.1, reference to ISO)

Note: ISO standards for tensile, chemical .... tests available

Note: reference to ISO standards instead of responsibility to the manufacturer.

The elements specified in Table 2 shall be determined.

~~Unless otherwise agreed at the time of enquiry and order, the choice of a suitable physical or chemical analytical method for the product analysis shall be at the discretion of the manufacturer. In cases of dispute, the analysis shall be carried out by a laboratory approved by both parties. In this case, the analysis method to be used shall be agreed taking into account the relevant~~ existing European Standards. The list of available European Standards is given in CEN/TR 10261. (ISO TR 769)

### 9.4.2 Tensile test (covered in EN ISO 3183 but details to be checked)

**9.4.2.1** The tensile test shall be carried out in accordance with EN 10002-1 (**reference to ISO 6892-1 or ASTM A 370)**.

The tensile strength $R_m$, the yield strength for 0,5 % total elongation $R_{t0,5}$ and the percentage elongation after fracture $A$ shall be determined on the pipe body.

The percentage elongation after fracture shall be reported with reference to a gauge length of $5{,}65\ \sqrt{S_0}$ where $S_0$ is the initial cross section of the gauge length. If other gauge lengths are used, the elongation referred to a gauge length of $5{,}65\ \sqrt{S_0}$ shall be determined in accordance with EN ISO 2566-1. (same reference, but other numeric values)

NOTE The $R_{t0,5}$ value is considered to be approximately equivalent to the $R_{eH}$ or $R_{p0,2}$ value within the normal scatter band of test results.

**9.4.2.2** In the tensile test transverse to the weld, only the tensile strength $R_m$ shall be determined.

### 9.4.3 Bend test (EN ISO 3183 10.2.4.6 "guided bend test", ISO describes additionally the"full section bend test")

**9.4.3.1** ~~The bend test shall be carried out in accordance with EN 910. The mandrel dimension shall be as indicated in Table 4 for the appropriate steel grade. Both test pieces shall be bent through approximately 180°, one with the root of the weld, the other with the face of the weld, directly under the mandrel.~~

**9.4.3.2** The specimens shall not: (not mentioned in EN ISO 3183)

a) fracture completely; nor

b) reveal any crack or rupture in the weld metal greater than 3 mm in length regardless of depth; nor

c) reveal any crack or rupture in the parent metal, the heat affected zone or the fusion line longer than 3 mm and deeper than 12,5 % of the specified wall thickness. Cracks that occur at the edges of the specimen and that are less than 6 mm in length shall not be cause for rejection in b) or c) regardless of depth.

If a fracture or crack in a test piece is caused by imperfections, the test piece may be discarded and a new test piece substituted.

#### 9.4.4 Flattening test (EN ISO 3183 10.2.4.7 and figure 6, same reference, figure more detailed, details different, EN version more specific to be checked)

**9.4.4.1** The flattening test shall be carried out in accordance with EN ISO 8492 and Figure 4.

When a weld stop occurs, flattening tests with the weld in the 3 o'clock position shall be made from crop ends resulting from each side of the weld stop and may be substituted for the intermediate flattening tests.

**9.4.4.2** The flattening test shall be carried out in three steps with following acceptance criteria:

a) flatten to 2/3 of the original outside diameter; no weld opening shall occur;

b) flatten to 1/3 of the original outside diameter; no crack or break shall occur other than in the weld;

c) flatten until opposite walls of the pipe meet.

The presence of laminar imperfections or burnt metal shall not become apparent during the entire test.

#### 9.4.5 Macrographic and metallographic examination (EN ISO 3183 10.2.5, more detailed)

~~**9.4.5.1** For SAW and COW pipes, the alignment of internal and external seams (see Figure 2c) shall be verified by macrographic examination.~~

~~**9.4.5.2** For EW pipe with seam heat treatment (see Table 1), it shall be verified by metallographic examination that the entire heat affected zone has been heat treated over the full wall thickness.~~

#### 9.4.6 Hydrostatic test (EN ISO 3183, 10.2.6, to be checked)

**9.4.6.1** The hydrostatic test pressure shall be calculated in accordance with 9.4.6.2.

**9.4.6.2** For calculation of the test pressure, the following formula shall apply:

$$p = \frac{20 \times S \times Tmin}{D} \tag{3}$$

where

$p$ is the hydrostatic test pressure in bar;

$D$ is the specified outside diameter in mm;

$S$ is the stress in MPa, equal to the percentage of the minimum yield strength specified for the steel grade concerned (see Table 14);

$T_{min}$ is the specified minimum wall thickness in mm.

The test pressure shall be limited to a maximum of 207 bar.

**Table 14 — Percentage of specified minimum yield strength (SMYS) for calculation of S**

| Steel grade/specified pipe outside diameter | Percentage of SMYS for calculation of S |
|---|---|
| L 210GA, L 235GA, L 245GA | 60 [a] |
| L 290GA, L 360GA | |
| — $D \leq 114{,}3$ mm | 60 |
| — $114{,}3 \text{ mm} < D \leq 219{,}1$ mm | 75 |
| — $219{,}1 \text{ mm} < D < 508$ mm | 85 |
| — $D \geq 508$ mm | 90 |
| [a] all pipe sizes | |

**9.4.6.3** The test pressure shall be held for not less than:

a) 5 s for pipes of outside diameter $D \leq 457$ mm and

b) 10 s for pipes of outside diameter $D > 457$ mm.

In the case of pipes with outside diameters $D \geq 114{,}3$ mm, the test pressure, the test pressure versus time shall be recorded. This record shall be available for examination by the inspection representative.

**9.4.6.4** For pipes with outside diameters less than 500 mm, a non-destructive leak-tightness test according to EN 10246-1 may be agreed instead of the hydrostatic testing.

MISSING IN ISO - could be taken over (check reference to EN 10246-1)

### 9.4.7 Visual examination **equivalent to ISO 10.2.7 with slight differences in visual inspection**

~~Each pipe shall be visually examined over the entire external surface. (~~ISO allows exemption 10.2.7.1./2~~)~~

The internal surface shall be visually examined:

Note: in ISO no precise numbers only requirement " if necessary"

a) from each end for pipe outside diameters $D$ < 610 mm;

b) over the entire internal surface for pipe outside diameters $D \geq 610$ mm.

~~The examination shall be carried out under sufficient lighting conditions by trained personnel with satisfactory visual acuity to verify the conformity of the pipes with the requirements of 8.5.~~

NOTE The light level should be of the order of 300 Lux.

~~The surface of cold formed welded pipe shall be examined to detect geometric deviations in the contour of the pipe. When this examination fails to disclose mechanical damage as the cause of the irregular surface, but indicates that the irregular surface may be attributed to a hard spot, the dimensions of the area and, if necessary (see 8.5.7), the hardness in this area shall be determined in accordance with EN ISO 6506-1 or EN ISO 6508-1. The choice of the test method is left to the discretion of the manufacturer. If dimensions and hardness exceed the acceptance criteria given in 8.5.7, the hard spot shall be removed.~~

#### 9.4.8 Dimensional testing ( EN IS0 3183, 10.2.8 more detailed)

EN 10021 - small tickness all kind of steel

in ISO all retest procedures for PSL 1 and PSL 2 tubes are included

to be checked wether requirements are sufficient instead of reference to EN 10021.

**9.4.8.1** The diameter of pipes shall be measured. At the discretion of the manufacturer, a circumferential tape or a caliper gauge may be used. By agreement, other approved measuring devices may be used (in ISO more detailed, indication of frequency)

**9.4.8.2** The out-of-roundness $O$ in percent shall be calculated by the formula (in ISO only written text, no formula 10.2.8.2)

$$O = \frac{D_{max} - D_{min}}{D} 100 \qquad (4)$$

where

$D_{max}$ is the greatest outside (or inside) diameter;

$D_{min}$ is the smallest outside (or inside) diameter;

$D$ is the specified outside diameter (or inside diameter calculated from the specified outside diameter and wall thickness).

~~To calculate the out-of-roundness of the pipe body, the greatest and smallest outside or inside diameter depending on the requirements of Table 6 shall be measured in the same cross-sectional plane.~~ The determination of out-of-roundness of pipe ends shall be based on corresponding measurements of the inside or outside diameters depending on the manufacturing process.

**9.4.8.3** **(ISO 10.2.8.4)** The greatest deviation of flat spots or peaks from the normal contour of the pipe shall be measured:

a) in the case of longitudinally welded pipe with a template located transverse to the pipe axis;

b) in the case of helically welded pipe with a template parallel to the pipe axis.

The templates shall have a length of a quarter of the specified outside diameter but max. 200 mm.

**9.4.8.4** **(ISO 10.2.8.7)**~~For the verification of other dimensional and geometrical requirements specified in 8.6 suitable methods shall be used. The methods to be used are left to the discretion of the manufacturer, unless otherwise agreed.~~

#### 9.4.9 ~~Weighing (EN ISO 3183, 10.2.9)~~

~~Each length of pipe with outside diameter $D \geq 141{,}3$ mm shall be weighed separately. Lengths of pipe with outside diameters $D < 141{,}3$ mm shall be weighed either individually or in convenient lots, at the discretion of the manufacturer.~~

#### 9.4.10 Non-destructive testing (EN ISO 3183, 10.2.10 making reference to Annex E)

~~For non-destructive testing, see Annex C.~~

### 9.5 Retests, sorting and reprocessing (EN ISO 3183 10.2.12, detailed subclauses for retesting and reprocessing)

For retests, sorting and reprocessing the requirements of EN 10021 apply.

## 10 Marking of the pipes (EN ISO 3183 – Clause 11 – much more detailed, to be checked)

### 10.1 General marking (EN ISO 3183 11.2.2)

**10.1.1** Pipe marking shall include the following minimum information:

~~a) the name or mark of the manufacturer of the pipe (X);~~

b) the number of this part of this European Standard;

~~c) the steel name (see also 10.2);~~

~~d) the type of pipe (S or W);~~

~~e) if an inspection certificate 3.1 or 3.2 in accordance with EN 10204 shall be issued~~

~~i. the mark of the inspection representative (Y);~~

~~ii. an identification number which permits the correlation of the product or delivery unit with the related inspection document (Z).~~

~~EXAMPLE X EN 10208-1 L360GA S Y Z~~

**10.1.2** ~~Unless die stamping is agreed (see 10.1.3), the mandatory markings which shall be applied indelibly shall be as follows.~~

a) ~~For pipe with outside diameter $D \leq 48{,}3$ mm:~~
~~marked on a tag fixed to the bundle or painted on the straps or banding clips used to tie the bun-~~

~~dle.~~ Alternatively, at the discretion of the manufacturer, each pipe may be paint stencilled on one end.

b) For seamless pipe in all other sizes and welded pipe with outside diameter $D$ < 406,4 mm: paint stencilled on the outside surface starting at a point between 450 mm and 750 mm from one end of the pipe.

c) For welded pipe with outside diameter $D \geq$ 406,4 mm: paint stencilled on the inside surface starting at a point no less than 150 mm from one end of the pipe.

Note: in ISO only > than 48,3 not metion of <406…

**10.1.3** ~~Die stamping may be used by agreement within 150 mm of the pipe end and at least 25 mm from the weld.~~

~~Cold die stamping (at temperatures lower than 100 °C) of plate/strip or pipe not subsequently heat treated is only permitted if especially agreed and shall, in this case, be done with rounded or blunt dies.~~

**ISO 11.2.3**~~**10.1.4** If a protective coating is applied, marking shall be legible after coating.~~

## 10.2 Special marking (to be checked if useful)

For pipes delivered in the quenched and tempered (Q) or thermomechanically treated (M) condition a letter „Q" or „M" respectively shall be added to the steel name (e.g. L360GA + Q or L360GA + M).

Any requirements for additional marking or for special locations or methods of marking are subject to agreement.

# 11 Coating for temporary protection (EN ISO 3183 Clause 12.1 – to be clarified meaning the same but…..vica versa )

Unless otherwise ordered, the pipe shall be delivered with an external coating to protect it from rusting in transit.

If unprotected pipe or special coating and/or lining is required, this shall be agreed upon at the time of enquiry and order.

# Annex A
# (EN ISO 3183, Annex A, to be checked)
# (normative)

# Specification of welded jointers

## A.1 Welding

Pieces of pipe used in making a jointer shall have a minimum length of 1,5 m. ~~Pipe weld seams shall be staggered by between 50 mm and 200 mm unless otherwise agreed~~. The pipe lengths shall be welded by the manufacturer.

Welding shall be performed by approved and qualified welders (see EN 287-1) and in accordance with approved and qualified welding procedures (see EN ISO 15607 and EN ISO 15609-1).

Unless otherwise agreed, the choice of the welding process shall be at the discretion of the manufacturer.

The completed jointers shall be straight within the limits of 8.6.3.4.

## A.2 Testing (here more detailed than in EN ISO 3183 A4)

**A.2.1** Jointers shall be tested with a frequency of one out of a maximum of 50 jointers as specified for the strip end weld in Table 12 and Table 13.

**A.2.2** Each jointer shall be submitted to a hydrostatic test in accordance with 9.4.6.

**A.2.3** The circumferential weld of jointers shall be completely radiographically inspected in accordance with EN 10246-10 to image quality class R1. Welds failing to pass this test may be repaired in accordance with an approved and qualified weld repair procedure and re-radiographed as above.

## A.3 Marking (A.3)

Each jointer shall in addition to the requirements in Clause 10 be marked using paint stencil to identify the welder.

# Annex B
# (EN ISO 3183 Annex C
# (normative)

# Treatment of imperfections and defects disclosed by visual examination

## B.1 Treatment of surface imperfections (see 8.5.3 a)

~~At the manufacturer's discretion, such imperfections not classified as defects are permitted to remain in the pipe without repair. Cosmetic grinding, however, is permitted.~~

## B.2 Treatment of dressable surface defects (see 8.5.3 b) ( ISO identical text + one last phrase)

~~All dressable surface defects shall be dressed-out by grinding. Grinding shall be carried out in such a way that the dressed area blends in smoothly with the contour of the pipe. Complete removal of defects shall be verified by local visual inspection, aided where necessary by suitable NDT methods.~~ After grinding, the remaining wall thickness in the dressed area shall be checked for compliance with 8.6.3.2.

## B.3 Treatment of non-dressable surface defects (see 8.5.3 c) (ISO C3 Identical)

~~Pipe containing non-dressable surface defects shall be given one of the following dispositions:~~

~~a) weld defects in SAW and COW pipes in the non-cold expanded condition shall be repaired by welding in accordance with B.4;~~

~~b) the section of the pipe containing the surface defect shall be cut off, within the limits of the requirement on minimum pipe length;~~

~~c) the entire pipe length shall be rejected.~~

## B.4 Repair of defects by welding (ISO C.4 – reference to PSL 1 and 2, to be checked)

Repair by welding is only permitted for the weld of SAW and COW pipes. In the case of cold expanded SAW and COW pipes, repair subsequent to the cold expansion operation is not permitted. The total length of repaired zones on each pipe weld is limited to 5 % of the total weld length. Weld defects separated by less than 100 mm shall be repaired as a continuous single weld repair. Each single repair shall be carried out with a minimum of two layers/passes over a minimum length of 50 mm.

The weld repair work shall be performed using an approved and qualified procedure which, in the case of normalized or quenched and tempered steels, may be based on the recommendations given in EN 1011-1 and EN 1011-2.

After weld repair, the total area of the repair shall be ultrasonically inspected in accordance with C.4.1.1 or radiographically inspected in accordance with C.4.3.

In addition after repair, each repaired pipe length shall be hydrostatically tested in accordance with 9.4.6.

# Annex C
EN ISO 3183 Annex E, completely other structure, to be checked!
(normative)

# Non-destructive testing

## C.1 Scope

This annex specifies non-destructive testing (NDT) requirements and acceptance levels. A survey on the tests is given in Table C.1.

**Table C.1 — Survey of non-destructive tests**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| No. | NDT operation | Test status [a] | Types of test and requirements, acceptance level | Reference |
| Seamless and welded pipe | | | | |
| 1 | Laminar imperfections at the pipe ends | o | Ultrasonic test EN 10246-17, acceptance limit: 6 mm max. circumferentially | C.2.3 |
| Electric and continuous welded (EW and BW) pipe | | | | |
| 2 | Longitudinal imperfections in the weld (including the pipe ends, where applicable – see C.2.4) | m | Ultrasonic test EN 10246-7 or EN 10246-8, acceptance level U3/C (U3) | C.3.1 |
| 3 | | | or (at the manufacturer's discretion for $T$ < 10 mm) Flux leakage test EN 10246-5, acceptance level F3 | C.3.2 a) |
| 4 | | | or (at the manufacturer's discretion for $D$ < 250 mm; $T$ < 6 mm; $\frac{T}{D}$ < 0,18) Eddy current test EN 10246-3, acceptance level E3 | C.3.2 b) |
| Submerged arc and combination welded (SAW and COW) pipe | | | | |
| 5 | Longitudinal/transverse imperfections in the weld | m | Ultrasonic test EN 10246-9, acceptance level U2/U2H or „two lambda“ calibration method (also for the strip end weld of helically welded pipe) | C.4.1 |
| 6 | | | Radiographic inspection EN 10246-10, image quality class R1, acceptance limits as per C.4.3, for T-joints of helically welded pipe | C.4.1.2 |
| 7 | NDT of the weld seam at pipe ends (untested ends)/repaired areas | m | Ultrasonic test EN 10246-9 to requirements of C.4.1.1 on longitudinal imperfections, acceptance level U2/U2H | C.4.2, C.4.3 |
| 8 | | | or (unless otherwise agreed) Radiographic inspection EN 10246-10, image quality class R1 (see C.4.3) on longitudinal imperfections | |
| 9 | | | and Ultrasonic test EN 10246-9 or radiographic test EN 10246-10 on transverse imperfections, acceptance limits as per C.4.3 | |

[a] m mandatory, o optional test for mandatory requirement

## C.2 General NDT requirements and acceptance criteria

### C.2.1 NDT personnel (EN ISO 3183, E.1, similar to 7.8)

~~For NDT personnel, see 7.8.~~

### C.2.2 Timing of NDT operations (not covered in ISO)

The sequence of all specified NDT operations shall be at the discretion of the manufacturer, as appropriate.

### C.2.3 Laminar imperfections at the pipe ends

Laminar imperfections ≥ 6 mm in the circumferential direction are not permitted within 25 mm of each end of the pipe.

The verification of compliance with this requirement shall only be carried out by agreement. In such a case, an ultrasonic test in accordance with EN 10246-17 shall be used.

### C.2.4 Untested pipe ends

It is emphasized that in many of the automatic NDT operations specified in this document, there may be a short length at both pipe ends which cannot be tested. In such cases, either:

a) the untested ends shall be cropped off; or

b) in the case of seamless or EW or BW pipe, the untested ends shall be subjected to a manual/semi-automatic test using the same technique, test sensitivity, test parameters, etc. as specified in the relevant clause of this document, where for manual testing, the scanning speed shall not exceed 150 mm/s; or

c) in the case of SAW and COW pipe, the provisions of C.4.2 shall apply.

### C.2.5 Suspect pipe

In all cases, pipes giving rise to indications producing a trigger/alarm condition as a result of the specified NDT operation(s) shall be deemed suspect.

Suspect pipe shall be dealt with in accordance with the clause ‘Acceptance’ as given in the relevant European Standard for NDT of pipe, except where otherwise stated in this document. Repair by welding is only permitted on the weld of SAW and COW pipe, provided that the provisions of B.4 are fulfilled.

Where dressing is carried out, it shall be verified by any appropriate NDT method that the imperfections have been completely removed.

Any manual NDT applied to local suspect areas (dressed or not) shall use the same test sensitivity, test parameters and acceptance level (reference notch depth) as used during the test which originally deemed the pipe suspect. For manual ultrasonic testing, the scanning speed shall not exceed 150 mm/s.

## C.3 Non-destructive testing of the weld seam of EW and BW pipe

**C.3.1** The full length of the weld seam of EW and BW pipe shall be ultrasonically inspected for the detection of longitudinal imperfections or, at the discretion of the manufacturer, in accordance with EN 10246-7 or EN 10246-8 to acceptance level U3/C or U3 respectively.

**C.3.2** Alternatively, at the discretion of the manufacturer, the full length of the weld seam shall be inspected using one of the following methods.

a) For pipes with a specified wall thickness $T$ < 10 mm:

the flux leakage method in accordance with EN 10246-5 to acceptance level F3.

b) For pipes with an outside diameter $D$ < 250 mm, a wall thickness $T$ < 6 mm and a ratio $T/D$ < 0,18:

the eddy current method (concentric or segment coil technique) in accordance with EN 10246-3 to acceptance level E3H.

## C.4 NDT of SAW and COW pipe

### C.4.1 Ultrasonic testing for longitudinal and transverse imperfections in the weld seam

**C.4.1.1** The full length of the weld seam of SAW and COW pipe shall be ultrasonically inspected for the detection of longitudinal and transverse imperfections in accordance with EN 10246-9 to acceptance level U2/U2H, with the modifications given in a) to e) below.

a) The maximum notch depth shall be 2,0 mm.

b) The use of internal and external longitudinal notches located on the centre of the weld seam for equipment calibration purposes is not permitted.

c) As an alternative to the use of the reference hole for equipment calibration for the detection of transverse imperfections, it is permitted to use acceptance level U2 internal and external notches, lying at right-angles to and centred over the weld seam. In this case, both internal and external weld reinforcements shall be ground flush to match the parent pipe contour in the immediate area and on both sides of the reference notches. The notches shall be sufficiently separated from each other in the longitudinal direction and from any remaining reinforcement, to give clearly identifiable separate ultrasonic signal responses. The full signal amplitude from each of these notches shall be used to set the trigger/alarm level of the equipment.

d) As an alternative to the use of acceptance level U2 notches for equipment calibration, it is permitted, by agreement, to use a fixed depth internal and external notch and increase the test sensitivity by electronic means (i.e. increase in dB). In this case (known as the "two lambda" method), the depth of the notches shall be twice the wavelength at the ultrasonic frequency in use, given by:

$$Wavelength = \frac{Ultrasonic\ velocity(tr)}{Ultrasonic\ frequency}$$

(for example: at 4 MHz test frequency, wavelength = 0,8 mm, i. e.notch depth = 1,6 mm)

The required increase in test sensitivity shall be based on pipe thickness and the manufacturer shall demonstrate to the satisfaction of the purchaser that the test sensitivity achieved is essentially equivalent to that when using acceptance level U2 notches.

e) The manufacturer may use one of the methods described in C.4.2 to re-test suspect areas.

**C.4.1.2** For helically welded pipe, the full length of the strip end weld shall be subjected to an ultrasonic test using the same ultrasonic test sensitivity and the same ultrasonic parameters as used on the primary helical weld seam in accordance with C.4.1.1.

In addition, the T-joints where the extremities of the strip end weld meet the primary weld seam, shall be subjected to radiographic inspection in accordance with C.4.3 and the acceptance limits given there.

### C.4.2 NDT of the weld seam at the pipe ends/repaired areas

The length of the weld seam at the pipe ends which cannot be inspected by the automatic ultrasonic equipment and repaired areas of the weld seam (see B.4), shall be subjected to the following:

a) for the detection of longitudinal imperfections, a manual or semi-automatic ultrasonic test using the same test parameters and test sensitivity as specified in C.4.1.1 or, unless otherwise agreed, radiographic inspection in accordance with C.4.3;

b) for the detection of transverse imperfections, at the discretion of the manufacturer, either a manual/semi-automatic ultrasonic test using the same test parameters and test sensitivity as specified in C.4.1.1 or radiographic inspection or C.4.3.

When manual ultrasonic testing is carried out, the scanning speed shall not exceed 150 mm/s.

### C.4.3 Radiographic inspection of the weld seam

**C.4.3.1** Where applicable, radiographic inspection of the weld seam shall be conducted in accordance with EN 10246-10 to image quality class R1, with the conditions given in a) to c) below:

a) the sensitivity requirements, given in Table C.2 established on the base material shall be verified by use of the ISO Wire Penetrameter according to ISO 19232-1 or, if so agreed, by use of an equivalent hole penetrameter;

b) only X-ray radiation, using fine-grain, high-contrast direct film with lead screen, shall be used. By agreement, fluoroscopic methods are permitted, but only when the manufacturer can demonstrate equivalence to the X-ray film technique;

c) the density of the radiograph shall not be less than 2,0 and shall be chosen so that the density through the thickest portion of the weld seam is not less than 1,5 and that maximum contrast for the type of film used is achieved.

**Table C.2 — Sensitivity requirements for the radiographic inspection, image quality class R1, in accordance with EN 10246-10**

Dimensions in mm

| Wall thickness | | Visibility required | |
|---|---|---|---|
| above | up to | of the hole with a diameter | of the wire with a diameter |
| 4,5 | 10 | 0,40 | 0,16 |
| 10 | 16 | 0,50 | 0,20 |
| 16 | 25 | 0,63 | 0,25 |
| 25 | 32 | 0,80 | 0,32 |
| 32 | 40 | 1,00 | 0,40 |

**C.4.3.2** The acceptance limits for radiographic inspection of the weld seam shall be as given in a) to f) below.

a) Cracks, incomplete penetration and lack of fusion are not acceptable.

b) Individual circular slag inclusions and gas pockets up to 3,0 mm or $T/3$ in diameter ($T$ = specified wall thickness), whichever is the smaller, are acceptable.

The sum of the diameters of all such permitted individual imperfections in any 150 mm or 12 $T$ of weld length, whichever is the smaller, shall not exceed 6,0 mm or 0,5 $T$ whichever is the smaller, where the separation between individual inclusions is less than 4 $T$.

c) Individual elongated slag inclusions up to 12,0 mm or 1 $T$ in length, whichever is the smaller, or up to 1,6 mm in width are acceptable.

The maximum accumulated length of such permitted individual imperfections in any 150 mm or 12 $T$ of weld length, whichever is the smaller, shall not exceed 12,0 mm, where the separation between individual inclusions is less than 4 $T$.

d) Individual undercuts of any length having a maximum depth of 0,4 mm are acceptable.

Individual undercuts of a maximum length of $T/2$ having a maximum depth of 0,8 mm and not exceeding 10 % of the specified wall thickness are acceptable provided that there are not more than two such undercuts in any 300 mm of the weld length, and all such undercuts are dressed out.

e) Any undercuts exceeding the above limits shall be repaired (see B.4) or the suspect area shall be cropped off or the pipe shall be rejected.

f) Any undercuts on the inside and outside weld of any length and depth which are coincident in the longitudinal direction on the same side of the weld are not acceptable.

# Bibliography

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[3] EN 1594, *Gas supply systems — Pipelines for maximum operating pressure over 16 bar — Functional requirements*

[4] API Spec 5L, *Specification for line pipe,* 44th edition, October 1, 2007

[1] Available by mail order from American Gas Association, Order and Billing Department, 1515 Wilson Boulevard, Arlington, Virginia, 22209 USA