



SLOVENSKI STANDARD SIST EN 10296-1:2003

01-november-2003

C_fc[`Yj Uf^ybY^Y`YbYWj]nUgffc`b]y]h c`]b`gd`cýbc`i dcfUVc`j`HΛ b_]`È`HΛ b] b] XcVUj b]dc[c^]È`%`XY.7 Yj]]n`bY^Y[]fUb] `]b`Y[]fUb] `^_Y

Welded circular steel tubes for mechanical and general engineering purposes - Technical delivery conditions - Part 1: Non-alloy and alloy steel tubes

Geschweißte kreisförmige Stahlrohre für den Maschinenbau und allgemeine technische Anwendungen - Technische Lieferbedingungen - Teil 1: Rohre aus unlegierten und legierten Stählen

(standards.iteh.ai)

Tubes ronds soudés en acier pour utilisation en mécanique générale et en construction mécanique - Conditions techniques de livraison - Partie 1 : Tubes en acier non allié et allié

Ta slovenski standard je istoveten z: EN 10296-1:2003

ICS:

77.140.75 Jeklene cevi in cevni profili za posebne namene Steel pipes and tubes for specific use

SIST EN 10296-1:2003

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 10296-1:2003

<https://standards.iteh.ai/catalog/standards/sist/96e81098-7443-45c1-bfef-4f6696dea562/sist-en-10296-1-2003>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10296-1

June 2003

ICS 77.140.75

English version

**Welded circular steel tubes for mechanical and general
engineering purposes - Technical delivery conditions - Part 1:
Non-alloy and alloy steel tubes**

Tubes ronds soudés en acier pour utilisation en mécanique
générale et en construction mécanique - Conditions
techniques de livraison - Partie 1: Tubes en acier non allié
et allié

Geschweißte kreisförmige Stahlrohre für den
Maschinenbau und allgemeine technische Anwendungen -
Technische Lieferbedingungen - Teil 1: Rohre aus
unlegierten und legierten Stählen

This European Standard was approved by CEN on 20 February 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	Page
Foreword.....	3
1 Scope	4
2 Normative references	4
3 Terms and definitions.....	5
4 Symbols	6
5 Classification and designation.....	6
5.1 Classification.....	6
5.2 Designation.....	6
6 Information to be supplied by the purchaser.....	6
6.1 Mandatory information	6
6.2 Options.....	7
6.3 Example of an order	7
7 Manufacturing process	7
7.1 Steelmaking process	7
7.2 Deoxidation process.....	8
7.3 Tube manufacture and delivery conditions	8
8 Requirements	9
8.1 General.....	9
8.2 Chemical composition.....	9
8.3 Mechanical properties.....	11
8.4 Appearance and soundness	13
8.5 Straightness	14
8.6 End preparation.....	14
8.7 Dimensions, masses, tolerances and sectional properties	14
9 Inspection	18
9.1 Types of inspection	18
9.2 Inspection documents.....	19
9.3 Summary of inspection and testing.....	20
10 Sampling.....	21
10.1 Frequency of tests	21
10.2 Preparation of samples and test pieces	22
11 Test methods.....	23
11.1 Tensile test on the parent material.....	23
11.2 Transverse tensile test on the weld.....	23
11.3 Flattening test.....	23
11.4 Drift Expanding Test.....	23
11.5 Bend test on full section tube.....	24
11.6 Weld Bend Test	24
11.7 Impact test	24
11.8 Leak tightness test	25
11.9 Dimensional inspection.....	25
11.10 Visual examination	25
11.11 Non-destructive testing of the weld.....	25
11.12 Retests, sorting and reprocessing.....	26
12 Marking	26
13 Protection	26
Annex A (informative) Typical range of dimensions for tube manufacturing processes	27
Annex B (normative) Formulae for calculation of nominal sectional properties	28
Bibliography	29

Foreword

This document (EN 10296-1:2003) has been prepared by Technical Committee ECISS/TC 29, "Steel tubes and fittings for steel 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 December 2003, and conflicting national standards shall be withdrawn at the latest by December 2003.

Another part of EN 10296 in course of preparation is :

— Part 2: Stainless steel tubes

Another European Standard series covering seamless steel tubes for mechanical and general engineering purposes is currently being prepared.

— EN 10297: Seamless circular steel tubes for mechanical and general engineering purposes — Technical delivery conditions.

Other European Standard series being prepared in this area are prEN 10294 for hollow bars for machining and prEN 10305 for steel tubes for precision applications.

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

<https://standards.iteh.ai/catalog/standards/sist/96e81098-7443-45c1-bfef-4f6696dea562/sist-en-10296-1-2003>

EN 10296-1:2003 (E)**1 Scope**

This Part of EN 10296 specifies the technical delivery conditions for electric welded, laser beam welded and submerged arc welded tubes of circular cross section made of non-alloy and alloy steels for mechanical and general engineering purposes.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

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

EN 10020, *Definition and classification of grades of steel.*

EN 10021, *General technical delivery requirements for steel and iron products.*

EN 10027-1, *Designation systems for steel - Part 1: Steel names, principal symbols.*

EN 10027-2, *Designation systems for steel - Part 2: Numerical system.*

EN 10045-1, *Metallic materials - Charpy Impact test - Part 1: Test method.*

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

prEN 10168¹⁾, *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 10232, *Metallic materials - Tube (in full section) - Bend test.*

EN 10233, *Metallic materials - Tube - Flattening test.*

EN 10234, *Metallic materials - Tube - Drift expanding test.*

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) steel tubes for the detection of longitudinal imperfections.*

1) In preparation; until this document is published as a European Standard, a corresponding national standard should be agreed at the time of enquiry and order.

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

CR 10260, *Designation systems for steel - Additional symbols.*

prEN 10266²⁾, *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 643, *Steels - Micrographic determination of the apparent grain size (ISO/DIS 643:2003).*

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

3 Terms and definitions

ITeh STANDARD PREVIEW
(standards.iteh.ai)

For the purposes of this Part of EN 10296, the terms and definitions given in EN 10020, EN 10021, EN 10052 and prEN 10266 and the following apply.

[SIST EN 10296-1:2003](https://standards.iteh.ai/catalog/standards/sist/96e81098-7443-45c1-bfef-4f6696dea562/sist-en-10296-1-2003)

3.1

<https://standards.iteh.ai/catalog/standards/sist/96e81098-7443-45c1-bfef-4f6696dea562/sist-en-10296-1-2003>

fine grain steel

steel having an austenitic/ferritic grain size equal to or finer than 6 when measured in accordance with EN ISO 643.

3.2

normalizing rolling

rolling 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 (+N)

3.3

thermomechanical rolling

rolling 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 The abbreviated form of this delivery condition is M.

NOTE 2 Subsequent heating above 580°C may lower the strength values. If temperatures above 580°C are needed reference should be made to the supplier.

NOTE 3 Thermomechanical rolling leading to the delivery condition M can include processes with an increasing cooling rate with or without tempering including self-tempering but excluding direct quenching and tempering.

3.4

hot reducing

process in which the outside diameter of a tube is reduced by a rolling and/or stretching process after heating into the austenitic region (i.e. above Ac3)

2) In preparation; until this document is published as a European Standard, a corresponding national standard should be agreed at the time of enquiry and order.

EN 10296-1:2003 (E)

NOTE The thickness can be increased or decreased during processing.

3.5**annealing**

heat treatment at a temperature slightly below Ac1 (+A)

3.6**employer**

organisation for which the person works on a regular basis

NOTE The employer may be either the tube manufacturer or a third party organisation providing non-destructive testing (NDT) services.

4 Symbols

For the purpose of this Part of EN 10296, the symbols given in prEN 10266 and CR 10260 apply.

5 Classification and designation**5.1 Classification**

In accordance with EN 10020 the grades in Table 2 and the grade E275K2 are non-alloy quality steels, grade E355K2 is an alloy quality steel, grade E460K2 and the grades in Table 4 are alloy special steels.

5.2 Designation

5.2.1 For tubes covered by this Part of EN 10296 the steel designation consists of :

— the number of this part of EN 10296 (EN 10296-1); <https://standards.iteh.ai/catalog/standards/sist/96e81098-7443-45c1-bfef-100296-1-2003>

plus either:

— the steel name in accordance with EN 10027-1 and CR 10260; or

— the steel number allocated in accordance with EN 10027-2;

The steel name is designated by:

— the capital letter E for engineering steels;

— the specified minimum yield strength (R_e) MPa for $T \leq 16$ mm;

NOTE The specified minimum yield strength varies with delivery condition and may be higher or lower than the designated value.

— the alphanumeric K2 for steels with specified impact energy of 40 J at - 20°C;

— the letter M when the strip or plate is produced by a thermomechanical rolling process.

6 Information to be supplied by the purchaser**6.1 Mandatory information**

The following information shall be supplied by the purchaser at the time of enquiry and order:

1) the quantity (mass or total length or number);

- 2) the term "tube";
- 3) the dimensions (outside diameter, wall thickness) (see 8.7);
- 4) the steel designation according to this Part of EN 10296 (see 5.2).

6.2 Options

A number of options are specified in EN 10296-1, and are listed below with appropriate clause references. In the event that the purchaser does not indicate his wish to implement any of these options at the time of enquiry and order the tube shall be supplied in accordance with the basic specification (see 6.1).

- 1) Process of tube manufacture (see 7.3.1);
- 2) delivery condition of EW (see 7.3.2);
- 3) tube shall be supplied descaled (see 7.3.2);
- 4) EW tubes shall be produced from pickled strip (see 7.3.2);
- 5) non-destructive testing of the weld (see 8.4.2);
- 6) a leak tightness test (see 8.4.2);
- 7) random lengths (see 8.7.2);
- 8) exact lengths (see 8.7.2);
- 9) restriction of the residual height of the internal weld bead of EW tube (see 8.7.3.1);
- 10) specific inspection and testing for tube made of non-alloy quality steel (see 5.1 and 9.1);
- 11) inspection document type 2.2 (see 9.2.1);
- 12) inspection document type 3.1.A, 3.1.C or 3.2 (see 9.2.1);
- 13) flattening test or drift expanding or bend test (whole tube) (see 9.3);
- 14) selection of leak tightness test method for EW tube (see 11.8.1);
- 15) special coating for transit and storage (see clause 13).

6.3 Example of an order

Fifteen tonnes of tube with specified outside diameter of 60,3 mm and a specified wall thickness of 3,6 mm made of steel in accordance with EN 10296-1 grade E275 supplied with specific inspection and testing.

15 t Tube 60,3 x 3,6 EN 10296-1 E275 Option 10

7 Manufacturing process

7.1 Steelmaking process

The steelmaking process is at the discretion of the manufacturer.

Elements not included in Tables 2, 3 or 4 for the relevant grade shall not be intentionally added to the steel without the agreement of the purchaser, except for elements which may be added for finishing the cast. All appropriate

EN 10296-1:2003 (E)

measures shall be taken to prevent the addition of undesirable elements from scrap or other materials used in the steelmaking process.

7.2 Deoxidation process

The steels shall be fully killed and additionally those grades in Tables 3 and 4 shall contain nitrogen-binding elements and are fine grain steels.

7.3 Tube manufacture and delivery conditions

7.3.1 Tubes shall be produced by an EW, EW hot reduced (EWHR), laser beam welded (LBW) or submerged arc welded (SAW) process. The process is at the discretion of the manufacturer unless option 1 is specified.

Option 1: The process of tube manufacture is specified by the purchaser from those mentioned in the above paragraph.

A Table of typical dimension ranges for the different manufacturing processes is given for information in annex A.

EW tubes shall not include welds used for joining lengths of the strip prior to forming the tube.

Laser beam welded and submerged arc welded tubes may be longitudinally or helically welded. Strip used for the manufacture of helically, laser beam welded (LBWH) or submerged arc-welded (SAWH) tubes shall have a width of not less than 0,8 times or more than 3,0 times the outside diameter of the tube. Longitudinal welded LBW or SAW tubes shall not include welds used for joining together lengths of the strip prior to forming. LBWH or SAWH tubes may include the weld joining together lengths of the strip prior to forming, provided this weld is subject to the same inspection and testing as the helical weld.

SAWL tubes may be cold sized by cold expanding (see Table 1).

7.3.2 Tubes shall be delivered in one of the delivery conditions shown in Table 1.

The delivery condition of EW tube including heat treatment is at the discretion of the manufacturer unless option 2 is specified.

Option 2 : The delivery condition of EW tube is specified by the purchaser from those shown in Table 1.

When option 3 is specified tube shall be supplied descaled . The amount of scale shall be agreed at the time of enquiry and order. The method is at the discretion of the manufacturer.

Option 3: Tubes shall be supplied descaled.

The starting material for tubes is at the discretion of the manufacturer unless option 4 is specified.

Option 4: EW tubes shall be produced from pickled strip.

7.3.3 All NDT activities shall be carried out by qualified and competent level 1, 2 and/or 3 personnel authorised to operate by the employer.

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 with EN 473 or at least an equivalent to it.

The operating authorisation issued by the employer shall be in accordance with a written procedure.

NDT operations shall be authorised 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.

Table 1 — Tube manufacturing process and delivery condition

Method of manufacture	Starting material	Forming operation	Delivery condition	Symbol for delivery condition
Electric welded (EW)	Hot rolled strip or Normalized/ Normalized rolled strip or Cold rolled strip (may be pickled)	Cold formed ^a	As welded ^{b c} As welded ^{b d} Annealed Full tube Normalized Normalized welded zone	+U +CR +A +N +NW
	Thermomechanically rolled strip ^e	Cold formed ^a	As welded ^b	None
EW Hot reduced (EWHR)	Hot rolled strip	Cold formed + hot reduced or Hot formed + hot reduced	Hot reduced	+U
Laser beam welded - longitudinal (LBWL) or - Helical (LBWH) seam	Hot rolled strip/plate or normalized rolled strip/plate	Cold formed or hot formed	As welded ^{c f}	+U
	Thermomechanically rolled strip/plate ^e	Cold formed ^a	As welded	None
Submerged arc-welded - longitudinal (SAWL) or - helical (SAWH) seam	Hot rolled strip/plate or normalized rolled strip/plate	Cold formed or Hot formed	As welded ^{c f}	+U
	Thermomechanically rolled strip/plate ^e	Cold formed ^a	As welded	None
<p>^a Includes cold sized/cold finished at manufacturers discretion.</p> <p>^b An appropriate heat treatment of the weld zone is permitted.</p> <p>^c An as welded product from which the +N properties can be achieved after heat treatment.</p> <p>^d An as welded product from which the +N properties may not be achieved after heat treatment.</p> <p>^e Only available in conjunction with steels from Table 4.</p> <p>^f Tubes may be supplied hot sized or cold sized (with or without heat treatment) at the discretion of the manufacturer.</p>				

8 Requirements

8.1 General

The tubes, when supplied in a delivery condition indicated in Tables 6, 7, 8 and 9 and inspected in accordance with clause 9 shall conform to the requirements of this Part of EN10296. In addition, the general technical delivery requirements specified in EN 10021 apply.

8.2 Chemical composition

The cast analysis reported by the steel producer shall apply and shall conform to the requirements of Table 2, 3 and 4.

EN 10296-1:2003 (E)

In case of dispute the permissible deviations of the product analysis from the specified analysis limits are given in Table 5

NOTE 1 The chemical analysis method used should be agreed between manufacturer and purchaser, taking into account CR 10261.

NOTE 2 When welding tubes, according to this part of EN 10296 are produced, account should be taken of the fact that the behaviour of the steel during and after welding is dependent not only on the steel and the delivery condition but also on the conditions of preparing for and carrying out the welding.

Table 2 — Chemical composition (cast analysis) non-alloy engineering steels in % by mass ^a

Steel grade		C max.	Si max.	Mn max.	P max.	S max.
Steel name	Steel number					
E155	1.0033	0,11	0,35	0,70	0,045	0,045
E190 ^b	1.0031	0,10	0,35	0,70	0,045	0,045
E195	1.0034	0,15	0,35	0,70	0,045	0,045
E220 ^b	1.0215	0,14	0,35	0,70	0,045	0,045
E235	1.0308	0,17	0,35	1,20	0,045	0,045
E260 ^b	1.0220	0,16	0,35	1,20	0,045	0,045
E275	1.0225	0,21	0,35	1,40	0,045	0,045
E320 ^b	1.0237	0,20	0,35	1,40	0,045	0,045
E355 ^c	1.0580	0,22	0,55	1,60	0,045	0,045
E370 ^{b c}	1.0261	0,21	0,55	1,60	0,045	0,045

^a See also 7.1.

^b For T > 6mm the C maximum value may be increased by 0,01%.

^c Additions of Nb, V and Ti are permitted at the discretion of the manufacturer, the content of these elements shall be reported.

Table 3 — Chemical composition (cast analysis) engineering steels with specified impact properties ,in % by mass ^a

Steel grade		C max.	Si max.	Mn		P max.	S max.	Al Total ^b min.	N max.	Cr max.	Cu ^c max.	Mo max.	Nb max.	Ni max.	Ti max.	V max.
Steel name	Steel number			min.	max.											
E275K2	1.0456	0,20	0,40	0,50	1,40	0,035	0,030	0,020	0,015	0,30	0,35	0,10	0,050	0,30	0,03	0,05
E355K2	1.0920	0,20	0,50	0,90	1,65	0,035	0,030	0,020	0,015	0,30	0,35	0,10	0,050	0,50	0,03	0,12
E460K2	1.8891	0,20	0,60	1,00	1,70	0,035	0,030	0,020	0,025	0,30	0,70	0,10	0,050	0,80	0,03	0,20

^a See also 7.1.

^b If sufficient other N-binding elements are present, the minimum total Al content does not apply.

^c If the copper content is greater than 0,30% then the nickel content shall be at least half of the copper content.