



# SLOVENSKI STANDARD

## SIST EN 10297-2:2006

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Seamless circular steel tubes for mechanical and general engineering purposes -  
Technical delivery conditions - Part 2: Stainless steel

Nahtlose kreisförmige Stahlrohre für den Maschinenbau und allgemeine technische  
Anwendungen - Technische Lieferbedingungen Teil 2: Rohre aus nichtrostenden  
Stählen

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Tubes sans soudure de section circulaire en acier pour utilisation en mécanique  
générale et en construction mécanique - Conditions techniques de livraison - Partie 2:  
Tubes en acier inoxydable

**Ta slovenski standard je istoveten z: EN 10297-2:2005**

### **ICS:**

77.140.75	Jeklene cevi in cevni profili za posebne namene	Steel pipes and tubes for specific use
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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 10297-2**

December 2005

ICS 77.140.75

English Version

## Seamless steel tubes for mechanical and general engineering purposes - Technical delivery conditions - Part 2: Stainless steel

Tubes sans soudure en acier pour utilisation en mécanique générale et en construction mécanique - Conditions techniques de livraison - Partie 2: Tubes en acier inoxydable

Nahtlose kreisförmige Stahlrohre für den Maschinenbau und allgemeine technische Anwendungen - Technische Lieferbedingungen - Teil 2: Nichtrostender Stähle

This European Standard was approved by CEN on 25 March 2005.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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

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

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## Foreword

This document (EN 10297-2:2005) 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 June 2006, and conflicting national standards shall be withdrawn at the latest by June 2006.

Another part of EN 10297 is:

Part 1: Non-alloy and alloy steel tubes

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

EN 10296-2 Welded circular steel tubes for mechanical and general engineering purposes — Technical delivery conditions – Part 2: Stainless steel.

Other series of European Standards being prepared in this area are prEN 10294 - hollow bars for machining and EN 10305 - 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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## Introduction

The European Committee for Standardisation (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents applied to steel grades 1.4362, 1.4410, 1.4477 and 1.4854, the compositions of which are given in Tables 3 and 4.

CEN takes no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured CEN that they are willing to negotiate licences, under reasonable and non-discriminatory terms and conditions, with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with CEN. Information may be obtained from:

Grades 1.4362, 1.4410 and 1.4477

Sandvik AB

SE-811 81 SANDVIKEN

Sweden

Grade 1.4854

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Attention is drawn to the possibility that some of the elements within this document may be the subject of patent rights other than those indicated above. CEN shall not be responsible for identifying any or all such patent rights.

## 1 Scope

This European Standard specifies the technical delivery conditions for seamless tubes, of circular cross section, made from stainless steels, for mechanical and general engineering purposes.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 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 10021:1993, *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 10052:1993, *Vocabulary of heat treatment terms for ferrous products*

EN 10088-1, *Stainless steels – Part 1: List of stainless steels*

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

EN 10204, *Metallic products – Types of inspection documents*  
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EN 10246-2, *Non-destructive testing of steel tubes – Part 2: Automatic eddy current testing of seamless and welded (except submerged arc-welded) austenitic and austenitic-ferritic 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*

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*

CR 10260:1998, *Designation system for steel – Additional symbols*

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

EN ISO 1127, *Stainless steel tubes – Dimensions, tolerances and conventional masses per unit length (ISO 1127:1992)*

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EN ISO 2566-2, *Steel – Conversion of elongation values – Part 2: Austenitic steels (ISO 2566-2:1984)*.

EN ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels – Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels – Corrosion test in media containing sulfuric acid (ISO 3651-2:1998)*

**3 Terms and definitions**

For the purposes of this European Standard, the terms and definitions given in EN 10020:2000, EN 10021:1993, EN 10052:1993 and EN 10266:2003 together with the following apply.

**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 purposes of this European Standard, the symbols given in EN 10266:2003 and CR 10260:1998 apply.

Not applicable.

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**5 Classification and designation****5.1 Classification**

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In accordance with the classification system in EN 10020, the steel grades listed in Tables 1, 2, 3 and 4 are stainless steels.

**5.2 Designation**

For tubes covered by this document the steel designation consists of:

— number of this document (EN 10297-2);

plus either:

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

— or steel number allocated in accordance with EN 10027-2.

**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:

- a) quantity (mass or total length or number);
- b) term "tube";
- c) dimensions (outside diameter **D**, wall thickness **T**) (see 8.7.1);



- d) steel designation according to this document (see 5.2);
- e) delivery condition, where necessary (see 7.2.2).

## 6.2 Options

A number of options are specified in this document and these are listed below with appropriate clause references. In the event that the purchaser does not indicate a 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 route and/or surface condition (see 7.2.1);
- 2) controlled sulphur content (see Tables 1, 2, and 3);
- 3) non-destructive testing (see 8.4.2);
- 4) leak tightness test (see 8.4.2);
- 5) straightness (see 8.5);
- 6) exact lengths (see 8.7.2);
- 7) outside diameter and thickness tolerances (see 8.7.3.1);
- 8) specific inspection and testing (see 9.1);
- 9) test report 2.2 (see 9.2.1);
- 10) inspection certificate, 3.2 (see 9.2.1);
- 11) leak tightness test method (see 11.2.1);

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## 6.3 Example of an order

Twenty five tonnes of seamless steel tubes with a specified outside diameter of 60,3 mm, a specified wall thickness of 3,6 mm, in accordance with EN 10297-2, made from steel grade 1.4016, and with a test report 2.2 (option 9) in accordance with EN 10204.

25 t - tube - 60,3 x 3,6 - EN 10297-2 – 1.4016 - Option 9

## 7 Manufacturing process

### 7.1 Steelmaking process

The steelmaking process is at the discretion of the manufacturer.

### 7.2 Tube manufacturing and delivery conditions

**7.2.1** Tubes shall be manufactured by a seamless process, and may be hot finished or cold finished. The terms “hot finished “ and “ cold finished “ apply to the condition of the tube before it is heat treated in accordance with 7.2.2. Acceptable process routes and surface conditions are given in Table A.1. The choice of process route and surface condition is left to the discretion of the manufacturer, unless Option 1 is specified.

**Option 1:** *The process route and/or surface condition is specified by the purchaser from those in Table A.1.*

**7.2.2** Tubes shall be supplied in the delivery conditions given in Tables 6, 7, 8 or 9, as applicable. Possible delivery conditions are annealed (+A) for ferritic steels, quenched and tempered (+QT) for martensitic steels and

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solution annealed (+AT) for austenitic and austenitic-ferritic steels. (See Annex B for guidance on heat treatment following fabrication and further processing.)

For steel grade 1.4006, the purchaser shall specify the delivery condition, either QT 550 or QT 650. The process route and surface condition for this grade shall be at the discretion of the manufacturer unless Option 1 (see 7.2.1) is specified.

Solution heat treatment shall consist of heating the tubes uniformly to the appropriate required temperature and then cooling rapidly. The solution treatment may be omitted if the conditions during hot working and subsequent cooling are such that the mechanical properties of the product can be met and the requirements for resistance to intergranular corrosion as defined in EN ISO 3651-2 can be obtained. See Annex B for guidance on heat treatment during fabrication and hot working as part of further processing.

**7.2.3** 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 the appropriate standards, e.g. EN 473 and EN 10256.

**8 Requirements****8.1 General**

Tubes, when supplied in a delivery condition in accordance with 7.2.2, using a process route and to a surface condition given in Table A.1 and inspected in accordance with Clause 9, shall comply with the requirements of this document.

In addition, the general technical delivery requirements specified in EN 10021 shall apply.

Grades additional to those in Tables 1, 2, 3 and 4 may be supplied by agreement; the chemical analysis and the mechanical properties for these shall be agreed at the time of enquiry and order.

**8.2 Chemical composition**

The cast analysis reported by the steel producer shall apply and shall conform to the requirements in Tables 1, 2, 3 or 4, as appropriate.

Elements not included in Tables 1, 2, 3 and 4 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 measures shall be taken to prevent the addition of undesirable elements from scrap or other materials used in the steelmaking process.

The permissible deviations of a product analysis from the specified limits of the cast analysis are given in Table 5.

NOTE When subsequently welding tubes produced according to this document, 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 conditions of preparing for and carrying out the welding. Some of the steels specified in this document cannot be welded unless specialised techniques are employed by specialist welders.

Table 1 — Chemical composition (cast analysis) for tubes made from ferritic and martensitic corrosion resistant steels, in % by mass

Steel grade		C		Si	Mn	P	S	Cr		Ni	Ti		Others	
Steel name	Steel number	min.	max.	max.	max.	max.	max.	min.	max.	max.	min.	max.	min.	max.
Ferritic steels														
X2CrTi12	1.4512		0,030	1,00	1,00	0,040	0,015	10,5	12,5		6 x (C + N)	0,65		
X6CrAl13	1.4002		0,08	1,00	1,00	0,040	0,015 <sup>a</sup>	12,0	14,0				Al0,10	Al 0,30
X6Cr17	1.4016		0,08	1,00	1,00	0,040	0,015 <sup>a</sup>	16,0	18,0					
X3CrTi17	1.4510		0,05	1,00	1,00	0,040	0,015 <sup>a</sup>	16,0	18,0		[4 x (C+N) + 0,15] <sup>b</sup>	0,80 <sup>b</sup>		
Martensitic steel														
X12Cr13	1.4006	0,08	0,15	1,00	1,50	0,040	0,015 <sup>a</sup>	11,5	13,5	0,75				
<p><sup>a</sup> <b>Option 2</b> a controlled sulphur content of 0,015 % to 0,030 % is specified.</p> <p><sup>b</sup> Stabilisation may be applied by the use of titanium or niobium or zirconium. According to the atomic number of these elements and the content of carbon and nitrogen, the equivalence shall be the following: <math>Ti \approx \frac{7}{4} Nb \approx \frac{7}{4} Zr</math></p>														

Table 2 — Chemical composition (cast analysis) for tubes made from austenitic corrosion resistant steels, in % by mass

Steel grade		C		Si		Mn	P	S		Cr		Mo		Ni		Cu		N		Others	
Steel name	Steel number	min.	max.	min.	max.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
X2CrNi18-9	1.4307		0,030		1,00	2,00	0,045		0,015 <sup>a</sup>	17,5	19,5			8,0	10,5				0,11		
X2CrNi19-11	1.4306		0,030		1,00	2,00	0,045		0,015 <sup>a</sup>	18,0	20,0			10,0	12,0				0,11		
X2CrNiN18-10	1.4311		0,030		1,00	2,00	0,045		0,015 <sup>a</sup>	17,0	19,5			8,5	11,5,			0,12	0,22		
X5CrNi18-10	1.4301		0,07		1,00	2,00	0,045		0,015 <sup>a</sup>	17,0	19,5			8,0	10,5				0,11		
X8CrNiS18-9	1.4305		0,10		1,00	2,00	0,045	0,15	0,35	17,0	19,0			8,0	10,0		1,00		0,11		
X6CrNiTi18-10	1.4541		0,08		1,00	2,00	0,045		0,015 <sup>a</sup>	17,0	19,0			9,0	12,0 <sup>b</sup>					Ti	Ti
																				5 x C	0,70
X6CrNiNb18-10	1.4550		0,08		1,00	2,00	0,045		0,015	17,0	19,0			9,0	12,0 <sup>b</sup>					Nb	Nb
																				10 x C	1,00
X1CrNi25-21	1.4335		0,020		0,25	2,00	0,025		0,010	24,0	26,0		0,20	20,0	22,0				0,11		
X2CrNiMo17-12-2	1.4404		0,030		1,00	2,00	0,045		0,015 <sup>a</sup>	16,5	18,5	2,00	2,50	10,0	14,5				0,11		
X5CrNiMo17-12-2	1.4401		0,07		1,00	2,00	0,045		0,015 <sup>a</sup>	16,5	18,5	2,00	2,50	10,0	13,0				0,11		
X1CrNiMoN25-22-2	1.4466		0,020		0,70	2,00	0,025		0,010	24,0	26,0	2,00	2,50	21,0	23,0			0,10	0,16		
X6CrNiMoTi17-12-2	1.4571		0,08		1,00	2,00	0,045		0,015 <sup>a</sup>	16,5	18,5	2,00	2,50	10,5	14,0					Ti	Ti
																				5 x C	0,70
X6CrNiMoNb17-12-2	1.4580		0,08		1,00	2,00	0,045		0,015	16,5	18,5	2,00	2,50	10,5	13,5					Nb	Nb
																				10 x C	1,00
X2CrNiMoN17-13-3	1.4429		0,030		1,00	2,00	0,045		0,015	16,5	18,5	2,50	3,00	11,0	15,0			0,12	0,22		
X3CrNiMo17-13-3	1.4436		0,05		1,00	2,00	0,045		0,015 <sup>a</sup>	16,5	18,5	2,50	3,00	10,5	14,0				0,11		
X2CrNiMo18-14-3	1.4435		0,030		1,00	2,00	0,045		0,015 <sup>a</sup>	17,0	19,0	2,50	3,00	12,5	15,0				0,11		
X2CrNiMoN17-13-5	1.4439		0,030		1,00	2,00	0,045		0,015	16,5	18,5	4,0	5,0	12,5	14,5			0,12	0,22		
X1NiCrMoCu31-27-4	1.4563		0,020		0,70	2,00	0,030		0,010	26,0	28,0	3,0	4,0	30,0	32,0	0,70	1,50		0,11		
X1NiCrMoCu25-20-5	1.4539		0,020		0,70	2,00	0,030		0,010	19,0	21,0	4,0	5,0	24,0	26,0	1,20	2,00		0,15		
X1CrNiMoCuN20-18-7	1.4547		0,020		0,70	1,00	0,030		0,010	19,5	20,5	6,0	7,0	17,5	18,5	0,50	1,00	0,18	0,25		