



SLOVENSKI STANDARD
SIST EN 10028-7:2000
01-november-2000

D`cý Uĥ`Ÿ`Yb]`nXY`_]`nUĥU bY`dcgcXY!`+`"XY.`BYf`Uj bU`Ÿ``U

Flat products made of steels for pressure purposes - Part 7: Stainless steels

Flacherzeugnisse aus Druckbehälterstählen - Teil 7: Nichtrostende Stähle

Produits plats en aciers pour appareils a pression - Partie 7: Aciers inoxydables

Ta slovenski standard je istoveten z: EN 10028-7:2000

[SIST EN 10028-7:2000](https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000)

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

ICS:

77.140.20	Visokokakovostna jekla	Stainless steels
77.140.30	Jekla za uporabo pod tlakom	Steels for pressure purposes
77.140.50	Ú[[z aak \ ^ } aš a ^ \ aš] [ã á ^ \ ã	Flat steel products and semi-products

SIST EN 10028-7:2000

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 10028-7:2000

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10028-7

January 2000

ICS 77.140.20; 77.140.30

English version

Flat products made of steels for pressure purposes - Part 7: Stainless steels

Produits plats en aciers pour appareils à pression - Partie
7: Aciers inoxydables

Flacherzeugnisse aus Druckbehälterstählen - Teil 7:
Nichtrostende Stähle

This European Standard was approved by CEN on 3 September 1999.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

iTeh STANDARD PREVIEW
(standards.iteh.ai)



SIST EN 10028-7:2000

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents

	page
Foreword	4
1 Scope	4
2 Normative references	5
3 Definitions	5
4 Dimensions and tolerances on dimensions	5
5 Calculation of mass	5
6 Classification and designation	5
7 Information to be supplied by the purchaser	6
7.1 Mandatory information	6
7.2 Options	6
7.3 Example for ordering	6
8 Requirements	6
8.1 Steelmaking process	6
8.2 Delivery condition	6
8.3 Chemical composition and chemical corrosion properties	7
8.4 Mechanical properties	7
8.5 Surface condition	7
8.6 Internal soundness	8
8.7 Physical properties	8
8.8 Post weld heat treatment	8
9 Inspection	8
9.1 Types of inspection and inspection documents	8
9.2 Tests to be carried out	8
9.3 Re-tests	8
10 Sampling	8
10.1 Frequency of testing	8
10.2 Selection and preparation of samples and test pieces	8
11 Test methods	8
12 Marking	8
Annexes	
A (informative) Reference data on some physical properties of austenitic creep resisting steels	25

ITeH STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 10028-7:2000

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

B	(informative) Guidelines for further treatment (including heat treatment)	27
C	(informative) Post weld heat treatment	31
D	(informative) Reference data for the tensile strength of austenitic-ferritic steels at elevated temperature	33
E	(informative) Strength values for 1% (plastic) creep and creep rupture	34
F	(informative) Reference data on mechanical properties of austenitic steels at low temperatures	42
G	(informative) Bibliography	43
H	National A-deviations	44
ZA	(informative) Clauses of this European Standard addressing essential requirements or other provisions of EU Directives	45

NOTE: The clauses marked by two points (●●) contain information relating to agreements that may be made at the time of enquiry and order.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 10028-7:2000

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

Page 4
EN 10028-7:2000

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 22 “Steels for pressure purposes - Qualities”, the secretariat of which is held by DIN.

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 July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

The steel grades covered by this European Standard have been selected from EN 10088-1, additionally considering austenitic creep resisting steels.

Annex H contains national A-deviations specifying restrictions for the application of this European Standard in Sweden.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

The other parts of this European Standard are:

- Part 1 General requirements
- Part 2 Non-alloy and alloy steels with specified elevated temperature properties
- Part 3 Weldable fine grain steels, normalized
- Part 4 Nickel alloy steels with specified low temperature properties
- Part 5 Weldable fine grain steels, thermomechanically rolled
- Part 6 Weldable fine grain steels, quenched and tempered

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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

1 Scope

This EN 10028-7 specifies requirements for flat products for pressure purposes made of stainless steels, including austenitic creep resisting steels, in thicknesses as indicated in tables 6 to 9.

The requirements of EN 10028-1 also apply.

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.

EN 10028-1	Flat products made of steels for pressure purposes - Part 1: General requirements
EN 10029	Hot rolled plates 3 mm thick or above - Tolerances on dimensions, shape and mass
EN 10088-1	Stainless steels - Part 1: List of stainless steels
EN 10204	Metallic products - Types of inspection documents
EN ISO 3651-2	Determination of the resistance to intergranular corrosion of stainless steels - Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels - Corrosion test in media containing sulfuric acid
EURONORM 103	Microscopic determination of the ferritic or austenitic grain size of steels

3 Definitions

See EN 10028-1.

4 Dimensions and tolerances on dimensions

See EN 10028-1.

5 Calculation of mass

For density of corrosion-resisting steels, see annex A of EN 10088-1.

For density of austenitic creep-resisting steels, see annex A of this EN 10028-7.

6 Classification and designation

See EN 10028-1.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

SIST EN 10028-7:2000

Page 6
EN 10028-7:2000

7 Information to be supplied by the purchaser

7.1 Mandatory information

See EN 10028-1.

7.2 Options

A number of options are specified in this EN 10028-7 and listed below. Additionally the relevant options of EN 10028-1 apply. If the purchaser does not indicate a wish to implement any of these options at the time of enquiry and order, the supplier shall supply in accordance with the basic specification (see EN 10028-1).

- a) mechanical properties for increased product thicknesses (see table 7, footnote 5);
- b) higher $R_{p0,2}$ and $R_{p1,0}$ values for continuously hot rolled products (see table 9, footnote 4 and table 10, footnote 2);

7.3 Example for ordering

10 plates made of a steel grade with the name X5CrNi18-10 and the number 1.4301 as specified in EN 10028-7 with nominal dimensions, thickness = 8 mm, width = 2000 mm, length = 5000 mm; tolerances on dimensions, shape and mass as specified in EN 10029 with thickness tolerance class A and "normal" flatness tolerance in process route 1D (see table 6), inspection document 3.1.B as specified in EN 10204:

10 plates EN 10029 - 8A x 2000 x 5000
Steel EN 10028-7 - X5CrNi18-10+1D
Inspection document 3.1.B

or

10 plates EN 10029 - 8A x 2000 x 5000
Steel EN 10028-7 - 1.4301+1D
Inspection document 3.1.B

iTeh STANDARD PREVIEW
(standards.iteh.ai)

8 Requirements

8.1 Steelmaking process

See EN 10028-1.

[SIST EN 10028-7:2000](https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000)

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

8.2 Delivery condition

The products shall be supplied in the delivery condition specified in the order by reference to the process route given in table 6 and, where alternatives exist, to the treatment conditions given in tables 7 to 10. Guidelines for further treatment including heat treatment are given in Annex B.

8.3 Chemical composition and chemical corrosion properties

8.3.1 The chemical composition requirements given in tables 1 to 4 apply in respect of the chemical composition according to the cast analysis.

8.3.2 The product analysis may deviate from the limiting values for the cast analysis given in tables 1 to 4 by the values listed in table 5.

8.3.3 Referring to resistance to intergranular corrosion as defined in EN ISO 3651-2, for ferritic, austenitic and austenitic-ferritic steels the specifications in tables 7, 9 and 10 apply.

NOTE 1: EN ISO 3651-2 is not applicable for testing martensitic steels.

NOTE 2: The corrosion resistance of stainless steels is very dependent on the type of environment and can therefore not always be clearly ascertained through laboratory tests. It is therefore advisable to draw on the available experience of the use of the steels.

8.4 Mechanical properties

8.4.1 The tensile properties at room temperature and the impact energy at room and at low temperatures as specified in tables 7 to 10 apply for the relevant specified heat treatment condition.

NOTE: Austenitic steels are insensitive to brittle fracture in the solution annealed condition. Because they do not have a pronounced transition temperature, which is characteristic of other steels, they are also useful for application at cryogenic temperatures.

8.4.2 The values in tables 11 to 14 apply for the 0,2 % and 1,0 % proof strength at elevated temperatures. Additionally, the values in table 15 apply for the tensile strength at elevated temperatures.

Tensile strength values at elevated temperatures for austenitic-ferritic steels are given for guidance in Annex D.

SIST EN 10028-7:2000

<https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-2c1695210104/en-10028-7-2000>

8.4.3 Annex E gives mean values as preliminary data for the purchaser about creep strength and creep rupture. These data apply for the solution annealed condition only.

8.4.4 In Annex F preliminary data on mechanical properties at low temperatures of austenitic steels are listed.

8.5 Surface condition

See EN 10028-1 and table 6.

Page 8
EN 10028-7:2000

8.6 Internal soundness

See EN 10028-1.

8.7 Physical properties

Reference data on some physical properties of austenitic creep resisting steels are given in Annex A. For other stainless steels, see annex A of EN 10088-1.

8.8 Post weld heat treatment

Guidelines for the purchaser on post weld heat treatment are given in Annex C.

9 Inspection

9.1 Types of inspection and inspection documents

See EN 10028-1.

9.2 Tests to be carried out

See table 16 and EN 10028-1.

9.3 Re-tests

See EN 10028-1.

10 Sampling

10.1 Frequency of testing

See table 16 and EN 10028-1.

10.2 Selection and preparation of samples and test pieces

See EN 10028-1. <https://standards.iteh.ai/catalog/standards/sist/67382ad9-6a72-4e12-986f-cc4c78105276/sist-en-10028-7-2000>

11 Test methods

See EN 10028-1.

12 Marking

See EN 10028-1.

Table 1: Chemical composition (cast analysis)¹⁾ of ferritic steels

Steel designation name	Steel designation number	% by mass										
		C max.	Si max.	Mn max.	P max.	S max.	N max.	Cr	Mo	Nb	Ni	Ti
Standard grades												
X2CrNi12	1.4003	0,030	1,00	1,50	0,040	0,015	0,030	10,50 to 12,50			0,30 to 1,00	
X6CrNiTi12	1.4516	0,08	0,70	1,50	0,040	0,015		10,50 to 12,50			0,50 to 1,50	0,05 to 0,35
X3CrTi17	1.4510	0,05	1,00	1,00	0,040	0,015		16,00 to 18,00				[4 x(C+N) + 0,15], to 0,80 ²⁾
X2CrMoTi18-2	1.4521	0,025	1,00	1,00	0,040	0,015	0,030	17,00 to 20,00	1,80 to 2,50			[4 x(C+N) + 0,15], to 0,80 ²⁾
Special grades												
X2CrTi17	1.4520	0,025	0,50	0,50	0,040	0,015	0,015	16,00 to 18,00				0,30 to 0,60
X2CrTiNb18	1.4509	0,030	1,00	1,00	0,040	0,015		17,50 to 18,50		[3xC + 0,30], to 1,00		0,10 to 0,60

¹⁾ Elements not listed in this table may not be intentionally added to the steel without the agreement of the purchaser except for finishing of the cast. All appropriate precautions are to be taken to avoid the addition of such elements from scrap and other materials used in production which would impair mechanical properties and the suitability of the steel.

²⁾ The stabilisation may be made by 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, if additional stabilizing with niobium or zirconium is used, be the following:

$$Ti = \frac{7}{4} Nb = \frac{7}{4} Zr$$

Table 2: Chemical composition (cast analysis)¹⁾ of martensitic steels

Steel designation name	number	% by mass										N min.
		C max.	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni			
Standard grades												
X3CrNiMo13-4	14313	0,05	0,70	1,50	0,040	0,015	12,00 to 14,00	0,30 to 0,70	3,50 to 4,50	0,020		
X4CrNiMo16-5-1	14418	0,06	0,70	1,50	0,040	0,015	15,00 to 17,00	0,80 to 1,50	4,00 to 6,00	0,020		

¹⁾ Elements not quoted in this table may not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to be taken to avoid the addition of such elements from scrap and other materials used in production which would impair mechanical properties and the suitability of the steel.

Table 3: Chemical composition (cast analysis)¹⁾ of austenitic steels

Steel designation name	number	% by mass											Ti	Others	
		C	Si	Mn max.	P max.	S max.	N	Cr	Cu	Mo	Nb	Ni			
Standard grades															
X2CrNi18-7	1.4318	≤ 0,030	≤ 1,00	2,00	0,045	0,015	0,10 to 0,20	16,50 to 18,50				6,00 to 8,00			
X2CrNi18-9	1.4307	≤ 0,030	≤ 1,00	2,00	0,045	0,015	≤ 0,11	17,50 to 19,50				8,00 to 10,00			
X2CrNi19-11	1.4306	≤ 0,030	≤ 1,00	2,00	0,045	0,015	≤ 0,11	18,00 to 20,00				10,00 to 12,00			
X2CrNi18-10	1.4311	≤ 0,030	≤ 1,00	2,00	0,045	0,015	0,12 to 0,22	17,00 to 19,50				8,50 to 11,50			
X2CrNi18-10	1.4301	≤ 0,07	≤ 1,00	2,00	0,045	0,015	≤ 0,11	17,00 to 19,50				8,00 to 10,50			
X2CrNi19-9	1.4315	≤ 0,06	≤ 1,00	2,00	0,045	0,015	0,12 to 0,22	18,00 to 20,00				8,00 to 11,00			
X6CrNi18-10	1.4948	0,04 to 0,08	≤ 1,00	2,00	0,035	0,015	≤ 0,11	17,00 to 19,00				8,00 to 11,00			
X6CrNi18-10	1.4950	0,04 to 0,08	≤ 0,70	2,00	0,035	0,015	≤ 0,11	22,00 to 24,00				12,00 to 15,00			
X6CrNi25-20	1.4951	0,04 to 0,08	≤ 0,70	2,00	0,035	0,015	≤ 0,11	24,00 to 26,00				19,00 to 22,00			
X6CrNiTi18-10	1.4541	≤ 0,08	≤ 1,00	2,00	0,045	0,015		17,00 to 19,00				9,00 to 12,00	5 x C ₁ to 0,70		
X6CrNiTi18-10	1.4941	0,04 to 0,08	≤ 1,00	2,00	0,035	0,015		17,00 to 19,00				9,00 to 12,00	5 x C ₁ to 0,80	0,0015 to 0,0050 B	
X2CrNiMo17-12-2	1.4404	≤ 0,030	≤ 1,00	2,00	0,045	0,015	≤ 0,11	16,50 to 18,50		2,00 to 2,50		10,00 to 13,00			
X2CrNiMo17-11-2	1.4406	≤ 0,030	≤ 1,00	2,00	0,045	0,015	0,12 to 0,22	16,50 to 18,50		2,00 to 2,50		10,00 to 13,00			
X2CrNiMo17-12-2	1.4401	≤ 0,07	≤ 1,00	2,00	0,045	0,015	≤ 0,11	16,50 to 18,50		2,00 to 2,50		10,50 to 13,50			
X6CrNiMoTi17-12-2	1.4571	≤ 0,08	≤ 1,00	2,00	0,045	0,015	≤ 0,11	16,50 to 18,50		2,00 to 2,50		10,50 to 13,50			
X2CrNiMo17-12-3	1.4432	≤ 0,030	≤ 1,00	2,00	0,045	0,015	≤ 0,11	16,50 to 18,50		2,50 to 3,00		10,50 to 13,00			
X2CrNiMo18-14-3	1.4435	≤ 0,030	≤ 1,00	2,00	0,045	0,015	≤ 0,11	17,00 to 19,00		2,50 to 3,00		12,50 to 15,00			
X2CrNiMo17-13-5	1.4439	≤ 0,030	≤ 1,00	2,00	0,045	0,015	0,12 to 0,22	16,50 to 18,50		4,00 to 5,00		12,50 to 14,50			
X1NiCrMoCu25-20-5	1.4539	≤ 0,020	≤ 0,70	2,00	0,030	0,010	≤ 0,15	19,00 to 21,00	1,20 to 2,00	4,00 to 5,00	≤ 0,10	24,00 to 26,00			
X3NiCrAlTi31-20 (+RA)	1.4958	0,03 to 0,08	≤ 0,70	1,50	0,015	0,010	≤ 0,030	19,00 to 22,00	≤ 0,50			30,00 to 32,50	0,20 to 0,50	0,20 to 0,50 Al Al-Ti: ≤ 0,70 Ni-C: 30,00 to 32,50	
X8NiCrAlTi32-21	1.4959	0,05 to 0,10	≤ 0,70	1,50	0,015	0,010	≤ 0,030	19,00 to 22,00	≤ 0,50			30,00 to 34,00	0,25 to 0,65	0,25 to 0,65 Al ≤ 0,50 Co Ni-C: 30,00 to 34,00	
X3CrNiMoBNi7-13-3	1.4910	≤ 0,04	≤ 0,75	2,00	0,035	0,015	0,10 to 0,18	16,00 to 18,00		2,00 to 3,00		12,00 to 14,00			0,0015 to 0,0050 B
Special grades															
X1CrNi25-21	1.4335	≤ 0,020	≤ 0,25	2,00	0,025	0,010	≤ 0,11	24,00 to 26,00		≤ 0,20		20,00 to 22,00			
X6CrNiNb18-10	1.4550	≤ 0,08	≤ 1,00	2,00	0,045	0,015		17,00 to 19,00			10 x C ₁ to 1,00	9,00 to 12,00			
X8CrNiNb16-13	1.4961	0,04 to 0,10	0,30 to 0,60	1,50	0,035	0,015		15,00 to 17,00			≥ 10 x C ₁ to 1,20	12,00 to 14,00			
X1CrNiMoN25-22-2	1.4466	≤ 0,020	≤ 0,70	2,00	0,025	0,010	0,10 to 0,16	24,00 to 26,00		2,00 to 2,50		21,00 to 23,00			
X6CrNiMoNb17-12-2	1.4580	≤ 0,08	≤ 1,00	2,00	0,045	0,015		16,50 to 18,50		2,00 to 2,50	10 x C ₁ to 1,00	10,50 to 13,50			
X2CrNiMoN17-13-3	1.4429	≤ 0,030	≤ 1,00	2,00	0,045	0,015	0,12 to 0,22	16,50 to 18,50		2,50 to 3,00		11,00 to 14,00			
X3CrNiMo17-13-3	1.4436	≤ 0,05	≤ 1,00	2,00	0,045	0,015	≤ 0,11	16,50 to 18,50		2,50 to 3,00		10,50 to 13,00			
X2CrNiMoN18-12-4	1.4434	≤ 0,030	≤ 1,00	2,00	0,045	0,015	0,10 to 0,20	16,50 to 19,50		3,00 to 4,00		10,50 to 14,00			
X2CrNiMo18-15-4	1.4438	≤ 0,030	≤ 1,00	2,00	0,045	0,015	≤ 0,11	17,50 to 19,50		3,00 to 4,00		13,00 to 16,00			
X1NiCrMoCu31-27-4	1.4563	≤ 0,020	≤ 0,70	2,00	0,030	0,010	≤ 0,11	26,00 to 28,00		3,00 to 4,00		30,00 to 32,00			
X1CrNiMoCuN25-25-5	1.4537	≤ 0,020	≤ 0,70	2,00	0,030	0,010	0,17 to 0,25	24,00 to 26,00	0,70 to 1,50	3,00 to 4,00		24,00 to 27,00			
X1CrNiMoCuN20-18-7	1.4547	≤ 0,020	≤ 0,70	1,00	0,030	0,010	0,18 to 0,25	19,50 to 20,50	1,00 to 2,00	4,70 to 5,70		17,50 to 18,50			
X1NiCrMoCuN25-20-7	1.4529	≤ 0,020	≤ 0,50	1,00	0,030	0,010	0,15 to 0,25	19,00 to 21,00	0,50 to 1,00	6,00 to 7,00		24,00 to 26,00			

¹⁾ Elements not listed in this table may not be intentionally added to the steel without the agreement of the purchaser except for finishing of the cast. All appropriate precautions are to be taken to avoid the addition of such elements from scrap and other materials used in production which would impair mechanical properties and the suitability of the steel.