SLOVENSKI STANDARD
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Prosto kovani jekleni izkovki za splošno tehnično uporabo - 4. del: Nerjavna jekla

Open die steel forgings for general engineering purposes - Part 4: Stainless steels

Freiformschmiedestücke aus Stahl für allgemeine Verwendung - Teil 4:Nichtrostende Stähle

Pièces forgées en acier pour usage général - Partie 4: Aciers inoxydables

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ICS:

77.140.20	Visokokakovostna jekla	Stainless steels
77.140.85	Železni in jekleni kovani izdelki	Iron and steel forgings

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Open die steel forgings for general engineering purposes - Part 4: Stainless steels

Pièces forgées en acier pour usage général - Partie 4 : Aciers inoxydables

Freiformschmiedestücke aus Stahl für allgemeine Verwendung - Teil 4: Nichtrostende Stähle

This European Standard was approved by CEN on 12 April 2021.

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 10250-4:2021) has been prepared by Technical Committee CEN/TC 459/SC 11 “Steel castings and forgings”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by November 2021, and conflicting national standards shall be withdrawn at the latest by November 2021.

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

This document supersedes EN 10250-4:1999.

In comparison with the previous edition, the following technical modifications have been made:

— addition of EN 10028-7 after EN 10088-3 in the note of the Scope;

— removal of EN 10021 and EN 10088-3 from the Normative references;

— addition of Clause 3, Terms and definitions;

— restructuration of Clause 4, Chemical composition;

— introduction of three steel grades in Table 2: X1CrNi25-21, X1CrNiSi18–15–4 and X2CrNiMnMoN25–18–6-5;

— alignment of silicon characteristics with EN 10088-3 in Table 4;

— addition of 2 columns on resistance to intergranular corrosion in Tables 6 and 7;

— introduction of footnotes in Tables of Annex A;

— deletion of Annex C, Elevated temperature proof strength.

The EN 10250 series, *Open die steel forgings for general engineering purposes*, consists of the following parts:

— *Part 1: General requirements*;

— *Part 2: Non-alloy quality and special steels*;

— *Part 3: Alloy special steels*;

— *Part 4: Stainless steels*.

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

1 Scope

This document specifies the technical delivery requirements for open die forgings, forged bars and products pre-forged and finished in ring rolling mills, manufactured from stainless steels with ferritic, martensitic, austenitic and austenitic-ferritic structures.

NOTE The majority of steels listed in this part of EN 10250 are identical to steels specified EN 10088-3 and EN 10028-7, and more extensive information on properties is given in these European Standards.

General information on technical delivery conditions is given in EN 10021.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 10250-1:1999, *Open die steel forgings for general engineering purposes - Part 1: General requirements*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at https://www.electropedia.org/

4 Chemical composition

4.1 Cast analysis

The chemical composition of the steel shall be determined by cast analysis and shall conform to the analysis given in Tables 1, 2 and 3 (see A.7, A.8, and A.11 of EN 10250-1:1999).

Elements not quoted in Tables 1, 2, and 3 shall not be added intentionally to the steel without the agreement of the purchaser, except for the purpose of finishing the heat. All reasonable measures should also be taken to prevent the addition from the scrap, or other material used in the manufacture of the steel, of such elements which affect the corrosion resistance, mechanical properties and applicability of the steel.

4.2 Product analysis

The product analysis shall not deviate from the specified cast analysis (see Tables 1, 2 and 3) by more than the values specified in Table 4 (see 9.2 of EN 10250-1:1999).

4.3 Chemical corrosion properties

Referring to resistance to intergranular corrosion as defined in EN ISO 3651-2, for austenitic, austenitic-ferritic and ferritic stainless steels the specifications in Tables 6 and 7 apply.

NOTE 1 EN ISO 3651-2 is not applicable for testing martensitic and precipitation hardening 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.

Table 1 — Steel grades and chemical composition - Ferritic and martensitic grades

Steel designation		C	Si max	Mn max	P max	S max	Cr	Mo	Ni	Others
Name	Number	%	%	%	%	%	%	%	%	%
X6CrAl13	1.4002	≤ 0,08	1,00	1,00	0,040	0,030 [a]	12,00 to 14,00	–	–	Al 0,10 to 0,30
X6Cr17	1.4016	≤ 0,08	1,00	1,00	0,040	0,030 [a]	16,00 to 18,00	–	–	–
X12Cr13	1.4006	0,08 to 0,15	1,00	1,50	0,040	0,030 [a]	11,50 to 13,50	–	≤ 0,75	–
X20Cr13	1.4021	0,16 to 0,25	1,00	1,50	0,040	0,030 [a]	12,00 to 14,00	–	–	–
X30Cr13	1.4028	0,26 to 0,35	1,00	1,50	0,040	0,030 [a]	12,00 to 14,00	–	–	–
X17CrNi16–2	1.4057	0,12 to 0,22	1,00	1,50	0,040	0,030 [a]	15,00 to 17,00	–	1,50 to 2,50	–
X3CrNiMo13–4	1.4313	≤ 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	N ≥ 0,020
X4CrNiMo16–5-1	1.4418	≤ 0,06	0,70	1,50	0,040	0,030 [a]	15,00 to 17,00	0,80 to 1,50	4,00 to 6,00	N ≥ 0,020
X5CrNiCuNb16–4	1.4542	≤ 0,07	0,70	1,50	0,040	0,030 [a]	15,00 to 17,00	≤ 0,60	3,00 to 5,00	Nb = 5xC to 0,45 Cu = 3,00 to 5,00

[a] For products to be machined a controlled sulfur content of 0,015 % to 0,030 % is recommended.

Table 2 — Steel grades and chemical composition - Austenitic grades

Steel designation		C max %	Si max %	Mn max %	P max %	S max %	N %	Cr %	Mo %	Ni %	Nb %	Ti %	Others %
Name	Number												
X2CrNi18–9	1.4307	0,030	1,00	2,00	0,045	≤ 0,030 [a]	≤ 0,11	17,50 to 19,50	–	8,00 to 10,00	–	–	–
X2CrNi19–11	1.4306	0,030	1,00	2,00	0,045	0,030 [a]	≤ 0,11	18,00 to 20,00	–	10,00 to 12,00 [b]	–	–	–
X2CrNiN18–10	1.4311	0,030	1,00	2,00	0,045	0,030 [a]	0,12 to 0,22	17,00 to 19,50	–	8,50 to 11,50	–	–	–
X5CrNi18–10	1.4301	0,07	1,00	2,00	0,045	0,030 [a]	≤ 0,11	17,00 to 19,50	–	8,00 to 10,50	–	–	–
X6CrNiTi18–10	1.4541	0,08	1,00	2,00	0,045	0,030 [a]	–	17,00 to 19,00	–	9,00 to 12,00 [b]	–	5xC to 0,70	–
X2CrNiMo17–12–2	1.4404	0,030	1,00	2,00	0,045	0,030 [a]	≤ 0,11	16,50 to 18,50	2,00 to 2,50	10,00 to 13,00 [b]	–	–	–
X2CrNiMoN17–11–2	1.4406	0,030	1,00	2,00	0,045	0,030 [a]	0,12 to 0,22	16,50 to 18,50	2,00 to 2,50	10,00 to 12,00	–	–	–
X5CrNiMo17–12–2	1.4401	0,07	1,00	2,00	0,045	0,030 [a]	≤ 0,11	16,50 to 18,50	2,00 to 2,50	10,00 to 13,00	–	–	–
X6CrNiMoTi17–12–2	1.4571	0,08	1,00	2,00	0,045	0,030 [a]	–	16,50 to 18,50	2,00 to 2,50	10,50 to 13,50 [b]	–	5xC to 0,70	–
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 14,00b	–	–	–
X3CrNiMo17–13–3	1.4436	0,05	1,00	2,00	0,045	0,030 [a]	≤ 0,11	16,50 to 18,50	2,50 to 3,00	10,50 to 13,00 [b]	–	–	–
X2CrNiMo18–14–3	1.4435	0,030	1,00	2,00	0,045	0,030 [a]	≤ 0,11	17,00 to 19,00	2,50 to 3,00	12,50 to 15,00	–	–	–

Steel designation		C max %	Si max %	Mn max %	P max %	S max %	N %	Cr %	Mo %	Ni %	Nb %	Ti %	Others %
Name	Number												
X1NiCrMoCu25–20–5	1.4539	0,020	0,70	2,00	0,030	0,010	≤ 0,15	19,00 to 21,00	4,00 to 5,00	24,00 to 26,00	–	–	Cu 1,20 to 2,00
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	–	9,00 to 12,00 [b]	10xC to 1,00	–	–
X1CrNiSi18–15–4	1.4361	0,015	3,7 to 4,5	2,00	0,025	0,010	≤ 0,10	16,5 to 18,5	0,20	14,0 to 16,0	–	–	–
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	–	–	Cu 0,70 to 1,50
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	6,00 to 7,00	17,500 to 18,50	–	–	Cu 0,50 to 1,00
X2CrNiMnMoN25–18–6-5	1.4565	0,030	1,00	5,00 to 7,00	0,030	0,015	0,30 to 0,60	24,00 to 26,00	4,00 to 5,00	16,00 to 19,00	≤ 0,15	–	–
X1NiMoCuN25–20–7	1.4529	0,020	0,50	1,00	0,030	0,010	0,15 to 0,25	19,00 to 21,00	6,00 to 7,00	24,00 to 26,00	–	–	–

[a] For products to be machined a controlled sulfur content of 0,015 % to 0,030 % is recommended.

[b] Where for special reasons, e.g. hot workability for fabrication where it is necessary to minimize the delta ferrite content, or with the aim of low permeability, the maximum Ni content may be increased by the following amounts:
– 0,50 %: 1.4571
– 1,00 %: 1.4306, 1.4429, 1.4436, 1.4541, 1.4550
– 1,50 %: 1.4404

Table 3 — Steel grades and chemical composition - Austenitic-ferritic grades

Steel designation		C max	Si max	Mn max	P max	S max	N	Cr	Mo	Ni	Others
Name	Number	%	%	%	%	%	%	%	%	%	%
X2CrNiN23–4	1.4362	0,030	1,00	2,00	0,035	0,015	0,05 to 0,20	22,00 to 24,00	0,10 to 0,60	3,50 to 5,50	Cu 0,10 to 0,60
X3CrNiMoN27–5-2	1.4460	0,05	1,00	2,00	0,035	0,030 [a]	0,05 to 0,20	25,00 to 28,00	1,30 to 2,00	4,50 to 6,50	–
X2CrNiMoN22–5-3	1.4462	0,030	1,00	2,00	0,035	0,015	0,10 to 0,22	21,00 to 23,00	2,50 to 3,50	4,50 to 6,50	–
X2CrNiMoCuN25–6-3	1.4507	0,030	0,70	2,00	0,035	0,015	0,15 to 0,30	24,00 to 26,00	2,70 to 4,00	5,50 to 7,50	Cu 1,00 to 2,50
X2CrNiMoN25–7-4	1.4410	0,030	1,00	2,00	0,035	0,015	0,20 to 0,35	24,00 to 26,00	3,00 to 4,50	6,00 to 8,00	–
X2CrNiMoCuWN25–7-4	1.4501	0,030	1,00	1,00	0,035	0,015	0,20 to 0,30	24,00 to 26,00	3,00 to 4,00	6,00 to 8,00	W 0,50 to 1,00 Cu 0,50 to 1,00

[a] For products to be machined a controlled sulfur content of 0,015 % to 0,030 % is recommended.

Table 4 — Permissible deviations between the product analysis and the limiting values given in Tables 1, 2 and 3 for the cast analysis

Element	Permissible maximum content in the cast analysis %		Permissible deviation %
Carbon		≤ 0,030	+0,005
	> 0,030	≤ 0,20	±0,01
	> 0,20	≤ 0,35	±0,02
Silicon		≤ 1,00	+0,05
	> 1,00	≤ 3,00	±0,10
	> 3,00	≤ 6,00	±0,15
Manganese		≤ 1,0	+0,03
	> 1,0	≤ 2,0	±0,04
Phosphorus		≤ 0,045	+0,005
Sulfur		≤ 0,015	+0,003
	> 0,015	≤ 0,030	+0,005
Nitrogen		≤ 0,35	±0,01
Aluminium	> 0,10	≤ 0,30	±0,05
Chromium	> 11,50	≤ 15,00	±0,15
	> 15,00	≤ 20,00	±0,20
	> 20,00	≤ 28,00	±0,25
Copper		≤ 1,00	±0,07
	> 1,00	≤ 5,00	±0,10
Molybdenum		≤ 0,60	±0,03
	> 0,60	≤ 1,75	±0,05
	> 1,75	≤ 7,00	±0,10
Nickel		≤ 1,00	+0,03
	> 1,00	≤ 5,00	±0,07
	> 5,00	≤ 10,00	±0,10
	> 10,00	≤ 20,00	±0,15
	> 20,00	≤ 32,00	±0,20
Titanium		≤ 0,70	±0,05
Niobium		≤ 1,00	±0,05
Tungsten		≤ 1,00	±0,05

5 Heat treatment

Heat treatment conditions are given in Tables A.1, A.2 and A.3 for guidance.

The grain size of the forgings shall be left to the discretion of the manufacturer.

If any straightening operation is carried out after the final heat treatment, the procedure shall be such that the forgings would be free from harmful residual stress. If with the agreement of the purchaser, this procedure includes a thermal stress relief this treatment shall also be applied to the test specimens either when still attached to the forging or after removal.