



SLOVENSKI STANDARD
SIST EN 10222-3:2000
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Steel forgings for pressure purposes - Part 3: Nickel steels with specified low temperature properties

Schmiedestücke aus Stahl für Druckbehälter - Teil 3: Nickelstähle mit festgelegten Eigenschaften bei tiefen Temperaturen

Pieces forgées en acier pour appareils a pression - Partie 3: Aciers au nickel avec caractéristiques spécifiées a basse température

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Ta slovenski standard je istoveten z: EN 10222-3:1998

ICS:

77.140.30	Jekla za uporabo pod tlakom	Steels for pressure purposes
77.140.85	Železni in jekleni kovani izdelki	Iron and steel forgings

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en

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EUROPEAN STANDARD

EN 10222-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 1998

ICS

Descriptors: iron and steel products, forgings, steels, nickel steels, pressure equipment, grades: quality, chemical composition, mechanical properties, heat treatment

English version

Steel forgings for pressure purposes - Part 3: Nickel steels with specified low temperature properties

Pièces forgées en acier pour appareils à pression - Partie 3: Aciers au nickel avec caractéristiques spécifiées à basse température

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This European Standard was approved by CEN on 8 November 1998.

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.

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

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Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 28 "Steel forgings", the secretariat of which is held by BSI.

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 May 1999, and conflicting national standards shall be withdrawn at the latest by May 1999.

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 Z, which is an integral part of this standard.

The titles of the other Parts of this European standard are:

- Part 1: General requirements for open die forgings.
- Part 2: Ferritic and martensitic steels with specified elevated temperature properties.
- Part 4: Weldable fine grain steels with high proof strength.
- Part 5: Martensitic, austenitic and austenitic - ferritic stainless steels.

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.

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1 Scope

This Part of this European Standard specifies the technical delivery conditions of forgings for pressure purposes, made of nickel steels, for use at low temperatures.

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

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 10021	General technical delivery requirements for steel and iron products
EN 10222-1:1998	Steel forgings for pressure purposes - Part 1: General requirements for open die forgings.

3 Chemical composition

3.1 Cast analysis

The chemical composition (cast analysis), determined in accordance with EN 10222-1 shall conform to the requirements of table 1 (see 9.1 of EN 10222-1:1998).

3.2 Product analysis

The product analysis shall not deviate from the specified cast analysis (see table 1) by more than the values specified in table 2 (see 9.2 of EN 10222-1:1998).

4 Heat treatment and mechanical properties

When heat treated in accordance with table 1, the mechanical properties of the forgings, determined in accordance with EN 10222-1 shall conform to the requirements of table 1 and table 3.

Table 1: Chemical composition, mechanical properties and heat treatment

Steel designation	Chemical composition (cast analysis) % ¹⁾										Mechanical properties at room temperature					Heat treatment				
	Name	Number	C max	Si max	Mn	P max	S max	Al total min	Ni	V	Others	Thickness of the rolling section t _k 2) mm	Yield strength R _{eH} 3) N/mm ² min	Tensile strength R _m N/mm ²	Elongation after fracture A ₅ 4) min %	Symbol 5)	Austenitizing or solution annealing Temperature °C	Cooling in °C	Tempering Temperature °C	Cooling in °C
13MnNi6-3		1.6217	0.16	0.50	0.85 to 1.70	0.025 to 0.035	0.015	0.020	0.30 to 0.85	≤ 0.05	Nb ≤ 0.05	t _k ≤ 35	285	420 to 610	22	NT	880 to 940	a	580 to 640	a
15NiA166		1.6228	0.18	0.35 to 0.80	0.80 to 1.50	0.025 to 0.035	0.015	-	1.30 to 1.70	≤ 0.05		t _k ≤ 35	355	470 to 640	20	N	850 to 900	a	-	-
12Ni14		1.5637	0.15	0.35 to 0.80	0.30 to 0.80	0.020 to 0.030	0.010	-	3.25 to 3.75	≤ 0.05		t _k ≤ 35	355	470 to 640	20	N	830 to 880	a	-	-
X12Ni5		1.5680	0.15	0.35 to 0.80	0.30 to 0.80	0.020 to 0.030	0.010	-	4.75 to 5.25	≤ 0.05		t _k ≤ 35	390	510 to 710	19	N	800 to 850	a	-	-
X8Ni9		1.5662	0.10	0.35 to 0.80	0.30 to 0.80	0.020 to 0.030	0.010	-	8.50 to 10.00	≤ 0.05	Mo ≤ 0.10	t _k ≤ 35	490	640 to 840	18	N + NT	880 to 930 + 680 to 800	a	540 to 600	a, o, w
												50 < t _k ≤ 70	470		QT	770 to 820	w, o			a, o, w

1) Elements not listed in this table shall not be intentionally added to the steel without the approval of the purchaser except for finishing the cast. All appropriate measures shall be taken to prevent the addition from scrap or other materials used in steelmaking of these elements which may adversely affect the mechanical properties and usability. The following elements shall not exceed the limits stated: chromium 0.30 % max., copper 0.30 % max., molybdenum 0.08 % max., niobium shall not exceed 0.30 %.

2) The thickness ranges given in this column apply for the as heat treated thickness of forgings with the rolling section. This is characterized by rectangular shape, a width to thickness ratio of ≥ 2 and a length to thickness ratio of ≥ 4. For forgings with other sections the equivalent thickness shall be determined according to annex B of EN 10222-1:1998 or be agreed at the time of enquiry and order.

3) Until the yield point criteria are harmonized in the various National Codes, determination of R_{eH} may be replaced by of R_m 3).

4) 1) - longitudinal t - transverse
 5) N - normalized NT - normalized and tempered QT - quenched and tempered
 6) a - air o - oil w - water
 7) Maximum nickel content for this steel may be increased to 2.00 % by agreement between purchaser and supplier.

Table 2: Permissible deviations of the product analysis from specified values of the cast analysis

Element	Specified value in the cast analysis according to table 1 %	Permissible deviations ¹⁾ of the product analysis %
C	≤ 0,18	± 0,02
Si	≤ 0,50	+ 0,05
Mn	≤ 1,00 > 1,00 ≤ 1,70	± 0,05 ± 0,10
P	≤ 0,025	+ 0,005
S	≤ 0,015	+ 0,003
Al	≥ 0,020	- 0,005
Mo	≤ 0,10	± 0,03
Nb	≤ 0,05	± 0,01
Ni	≤ 0,85 > 0,85 ≤ 3,75 > 3,75 ≤ 10,0	± 0,05 ± 0,07 ± 0,10
V	≤ 0,05	+0,01
¹⁾ If several product analyses are carried out for one cast and if, in this case, values for an individual element are established which fall outside the permitted range for the chemical composition, then it is only permissible that the values either exceed the maximum permitted value or fall short of the minimum permitted value. It is not acceptable for both to apply for one cast.		

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Table 3: Minimum impact properties

Steel designation		Heat treatment condition ^{1), 2)}	Thickness of the ruling section mm	Direction of test piece	Minimum KV notch impact energy in J at a test temperature of ³⁾ :										
Name	Number				20 °C	0 °C	-20 °C	-40 °C	-50 °C	-60 °C	-80 °C	-100 °C	-120 °C	-150 °C	-170 °C
13MnNi6-3	1.6217	NT	5	longitudinal	70	60	55	50	45	40	-	-	-	-	-
				transverse	45	40	40	35	30	27	-	-	-	-	-
15NiNi6 ⁴⁾	1.6228	N or NT or QT	5	longitudinal	65	65	65	60	50	50	40	-	-	-	-
				transverse	45	45	45	40	35	35	27	-	-	-	-
12Ni14	1.5637	N or NT or QT	10	longitudinal	65	60	55	55	50	50	45	40	-	-	-
				transverse	45	40	40	35	35	30	30	27	-	-	-
X12Ni5 ⁴⁾	1.5680	N or NT or QT	70	longitudinal	70	70	70	65	65	65	60	50	40	-	-
				transverse	50	50	50	45	45	40	40	30	27	-	-
X8Ni9	1.5662	N or NT or QT	50	longitudinal	70	70	70	70	70	70	70	70	60	50	40
				transverse	50	50	50	50	50	50	50	35	35	30	27

1) N = normalized
 2) For temperatures and cooling conditions, see table 1.
 3) Proof of the impact values shall be obtained at the lowest test temperature given in this table for the relevant steel grade.
 4) Maximum thickness of ruling section is 50 mm.