



SLOVENSKI STANDARD

SIST EN 10028-3:1997

01-maj-1997

Ploščati jekleni izdelki za tlačne posode - 3. del: Variva drobnozrnata jekla, normalizirana

Flat products made of steels for pressure purposes - Part 3: Weldable fine grain steels, normalized

Flacherzeugnisse aus Druckbehälterstählen - Teil 3: Schweißgeeignete Feinkornbaustähle, normalgeglüht

Produits plats en aciers pour appareils a pression - Partie 3: Aciers soudables a grains fins, normalisés

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ICS:

77.140.30	Jekla za uporabo pod tlakom	Steels for pressure purposes
77.140.50	Ploščati jekleni izdelki in polizdelki	Flat steel products and semi-products

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EUROPEAN STANDARD

EN 10028-3:1992

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 1992

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Descriptors: Iron and steel products, metal plates, strips, steels, welded, construction, pressure equipment, designation, specifications, delivery condition

English version

Flat products made of steels for pressure purposes - Part 3: Weldable fine grain steels, normalized

Produits plats en aciers pour appareils à pression - Partie 3: Aciers soudables à grains fins, normalisés

Flacherzeugnisse aus Druckbehälterstählen - Teil 3: Schweißgeeignete Feinkornbaustähle, normalgeglüht

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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.

The European Standards exist 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

Foreword

This European Standard has been prepared by ECISS/TC 22 'Steels for pressure purposes — Qualities', the Secretariat of which is held by Normenausschuß Eisen und Stahl (FES) im DIN.

Within the framework of the ECISS (European Committee for Iron and Steel Standardization) programme of work, TC 22 was allocated the task of revising EURONORM 28-58 'Steel plate, sheet and strip with elevated temperature properties — Technical delivery conditions' and (where relevant to pressure vessel fabrication) EURONORM 113-72 'Weldable fine-grain structural steels' and replacing them with a European Standard.

At its meeting in January 1991, ECISS/TC 22 approved this document. The following ECISS members were represented at the meeting:

Austria, Belgium, Finland, France, Germany, Italy, Norway, Sweden, United Kingdom.

This European Standard was adopted and in accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

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 1993, and conflicting national standards shall be withdrawn at the latest by June 1993.

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NOTE. The clauses marked with a point (.) contain information relating to agreements which are to be made at the time of ordering. The clauses marked with two points (..) contain information relating to agreements which may be made at the time of ordering.



1 Scope

1.1 This Part 3 of EN 10028 specifies requirements for flat products for pressure purposes made of weldable fine grain steels as listed in table 1.

NOTE. 'Fine grain steels' are understood to mean steels which have a ferritic grain size of 6 and smaller when tested in accordance with EURONORM 103.

1.2 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.

EURONORM 103 ¹⁾	Microscopic determination of the ferritic and austenitic grain size of steels
EN 10020	Definition and classification of grades of steel
EN 10028-1	Flat products made of steels for pressure purposes — Part 1: General requirements

3 Definitions

See EN 10028-1.

4 Dimensions and tolerances on dimensions

See EN 10028-1.

5 Calculation of mass

See EN 10028-1.

6 Designation and ordering

See EN 10028-1.

7 Classification into grades

7.1 This European Standard covers the steel grades given in table 4 in 4 qualities:

- a) the basic quality (P ... N),
- b) the elevated temperature quality (P ... NH),
- c) the low temperature quality (P ... NL1),
- d) the special low temperature quality (P ... NL2).

7.2 In accordance with EN 10020, grades P275N, P275NH, P275NL1, P355N, P355NH, P355NL1 are non-alloy quality steels, grades P275NL2 and P355NL2 are non-alloy special steels and the other steel grades are alloy special steels.

8 Requirements

8.1 Steelmaking process

See EN 10028-1.

8.2 Delivery condition

8.2.1 . . Unless otherwise agreed at the time of ordering, the products covered by this European Standard shall be supplied in the normalized condition.

In the case of steels with a minimum yield point ≥ 460 N/mm², delayed cooling or additional tempering may be necessary for small product thicknesses and in special cases.

8.2.2 Normalizing may be replaced by normalizing rolling. This means that the requirements shall be met again even after subsequent normalizing.

8.2.3 . . If specially agreed, products covered by this European Standard may also be delivered in the untreated condition.

In these cases, testing shall be carried out on test pieces in the usual delivery condition as indicated in table 4.

NOTE. This testing of test pieces in the simulated heat treated condition does not discharge the processor from the obligation of providing proof of the specified properties in the finished product.

8.2.4 Information on processing is given in Information Circular No. 2 — Weldable fine grain steels — Information for processing, particularly for welding; this document is currently being revised by CEN/TC 121 and will then be published with a different number.

NOTE. An Information Circular with information on advisable stress relief annealing is being prepared (see document ISO/TC 17/SC 10 N 495).

8.3 Chemical composition

8.3.1 The chemical composition determined from the cast analysis is given in table 1.

8.3.2 The product analysis may deviate from the specified values of the cast analysis as specified in table 1 by the values given in table 2.

8.3.3 . . It may be agreed at the time of ordering that the maximum value for the carbon equivalent given in table 3 shall apply.

¹⁾ . . Until this EURONORM is transformed into a European Standard, this EURONORM or a corresponding national standard may be applied, if agreed at the time of ordering.

Table 1. Chemical composition (cast analysis)

Steel grade	Material number	Classification ¹⁾	% by mass														
			C	Si	Mn	P	S	Al	Cr	Cu	Mo	N	Nb	Ni	Ti	V	Nb + Ti + V
			max.	max.		max.	max.	max.	min.	max.	max.	max.	max.	max.	max.	max.	max.
P275N	1.0486	UQ	0,18		0,50 to 1,40	0,030	0,025										
P275NH	1.0487	UQ		0,40					0,020 ²⁾	0,30 ³⁾	0,30 ³⁾	0,08 ³⁾	0,020				0,05
P275NL1	1.0488	UQ				0,030	0,020										
P275NL2	1.1104	UE	0,16		0,50 to 1,50	0,025	0,015										
P355N	1.0562	UQ				0,030	0,025										
P355NH	1.0565	UQ	0,20														
P355NL1	1.0566	UQ		0,50	0,90 to 1,70	0,030	0,020		0,20 ²⁾	0,30 ³⁾	0,30 ³⁾	0,08 ³⁾	0,020				0,12
P355NL2	1.1106	UE	0,18			0,025	0,015										
P460N	1.8905	LE															
P460NH	1.8935	LE				0,030	0,025										
P460NL1	1.8915	LE	0,20	0,60	1,00 to 1,70	0,030	0,020		0,020 ²⁾	0,30	0,70 ⁴⁾	0,10	0,025				0,20
P460NL2	1.8918	LE				0,025	0,015										

1) UQ = non-alloy quality steel; UE = non-alloy special steel; LE = alloy special steel.

2) If nitrogen is additionally fixed by niobium, titanium or vanadium, the minimum aluminium content specification does not apply.

3) The sum of the percentages by mass of the three elements chromium, copper and molybdenum shall not exceed 0,45 %.

4) If the percentage by mass of copper exceeds 0,30 %, the percentage by mass of nickel shall be at least half the percentage by mass of copper.

Table 2. Permissible deviations in the results of the product analysis from specified values applicable to the cast analysis (see table 1)

Element	Specified value in the cast analysis according to table 1	Permissible deviations ¹⁾ of the product analysis from the specified values listed in table 1 for the cast analysis
	% by mass	% by mass
C	≤ 0,20	+ 0,02
Si	≤ 0,60	+ 0,05
Mn	≤ 1,70	+ 0,10 - 0,05
P	≤ 0,030	+ 0,005
S	≤ 0,015	+ 0,003
	> 0,015 to ≤ 0,025	+ 0,005
Al	≥ 0,020	- 0,005
Cr	≤ 0,30	+ 0,05
Cu	≤ 0,30	+ 0,05
	> 0,30 to ≤ 0,70	+ 0,07
Mo	≤ 0,10	+ 0,03
N	≤ 0,025	+ 0,002
Nb	≤ 0,05	+ 0,01
Ni	≤ 0,80	+ 0,05
Ti	≤ 0,03	+ 0,01
V	≤ 0,20	+ 0,02

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.

Table 3. .. Maximum carbon equivalent ¹⁾ value (if agreed at the time of ordering, see 8.3.3 and the note to 8.4.1)

Steel grade Name	Carbon equivalent max. for nominal thicknesses in mm		
	≤ 63	> 63 to ≤ 100	> 100 to ≤ 150
P275N P275NH P275NL1 P275NL2	0,40	0,40	0,42
P355N P355NH P355NL1 P355NL2	0,43	0,45	0,45
P460N ²⁾ P460NH ²⁾ P460NL1 ²⁾ P460NL2 ²⁾	—	—	—

1) Carbon Equivalent:

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{16}$$

2) .. If agreed at the time of ordering, the following requirements is applicable instead of the carbon equivalent:
 $V + Nb + Ti \leq 0,22\%$; $Mo + Cr \leq 0,30\%$.

8.4 Mechanical properties

8.4.1 The values given in tables 4 to 6 shall apply (see also EN 10028-1).

NOTE. It should be noted that the values for the carbon equivalent relate to the mechanical properties specified for the delivery condition.

8.4.2 . . . If agreed at the time of ordering, the minimum 0,2 % proof stress values at elevated temperatures given in table 5 for the elevated temperature quality steels may also be applied to the low temperature quality and special low temperature quality steels.

8.5 Surface condition

See EN 10028-1.

8.6 Internal soundness

See EN 10028-1.

9 Testing

See EN 10028-1.

9.1 Type and content of inspection documents

See EN 10028-1.

9.2 Tests to be carried out

See EN 10028-1.

9.3 Number of tests

See EN 10028-1.

9.4 Sampling and sample preparation

9.4.1 See EN 10028-1.

9.4.2 . . . As a deviation from EN 10028-1, it may be agreed that the impact test shall be carried out on longitudinal test pieces instead of transverse test pieces.

9.5 Test procedure

9.5.1 See EN 10028-1.

9.5.2 Proof of the impact values given in table 6 may be obtained at the temperatures given in the table.

. . . The impact test shall be carried out at a temperature to be agreed upon at the time of ordering and for one direction of the test piece (transverse test pieces unless otherwise agreed). Unless otherwise agreed, the proof of the values shall be obtained at - 20 °C for the basic quality and the elevated temperature quality and at - 50 °C for the low temperature quality and special low temperature quality.

9.6 Re-tests

See EN 10028-1.

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10 .. Marking

See EN 10028-1.

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Table 4. Mechanical properties at ambient temperatures

Steel grade		Usual delivery condition	Yield point $R_{eH}^{1)}$ for product thickness in mm					Tensile strength R_m for product thickness in mm		Elongation A after fracture ($L_0 = 5,65\sqrt{S_0}$) for product thickness in mm					
Name	Material number		≤ 16	> 16 to ≤ 35	> 35 to ≤ 50	> 50 to ≤ 70	> 70 to ≤ 100	> 100 to ≤ 150	≤ 70	> 70 to ≤ 150	> 150				
P275N P275NH P275NL1 P275NL2	1.0486 1.0487 1.0488 1.1104	normalized ²⁾	275	275	265	255	235	225	3)	390 to 510	370 to 490	350 to 470	24	23	3)
P355N P355NH P355NL1 P355NL2	1.0562 1.0565 1.0566 1.1106	normalized ²⁾	355	355	345	325	315	295	3)	490 to 630	470 to 610	450 to 590	22	21	3)
P460N P460NH P460NL1 P460NL2	1.8905 1.8935 1.8915 1.8918	normalized ⁴⁾	460	450	440	420	400	380	3)	570 to 720 ⁵⁾	540 to 710	520 to 690	17	16	3)

¹⁾ Until the yield point criteria are harmonized in the various national codes, determination of R_{eH} may be replaced by determination of $R_{p0.2}$. In this case, the $R_{p0.2}$ values are 10 N/mm² for R_{eH} values up to 355 N/mm² and 15 N/mm² lower for R_{eH} values greater than 355 N/mm².

²⁾ See 8.2.2.

³⁾ . . . On agreement.

⁴⁾ See 8.2.1.

⁵⁾ For thicknesses up to 16 mm, a maximum value of 730 N/mm² is permitted.