



SLOVENSKI STANDARD

SIST EN 10028-3:2017

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Nadomešča:
SIST EN 10028-3:2009

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 à 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

NORME EUROPÉENNE

EUROPÄISCHE NORM

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Supersedes EN 10028-3:2009

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

This European Standard was approved by CEN on 7 May 2017.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 10028-3:2017) has been prepared by Technical Committee ECISS/TC 107 “Steels for pressure purposes”, 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of an identical text or by endorsement, at the latest by January 2018 and conflicting national standards shall be withdrawn at the latest by January 2018.

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

This document supersedes EN 10028-3:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Directive 2014/68/EU.

For relationship with Directive 2014/68/EU, see informative Annex ZA, which is an integral part of this document.

A list of changes between this document and the previous version can be found in Annex C.

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

EN 10028-3:2017 (E)

1 Scope

This European Standard specifies requirements for flat products for pressure equipment made of weldable fine grain steels as specified in Table 1.

NOTE 1 Fine grain steels are understood as steels with a ferritic grain size of 6 or finer when tested in accordance with EN ISO 643.

The requirements and definitions of EN 10028-1:2017 also apply.

NOTE 2 Once this European Standard is published in the EU Official Journal (OJEU) under Directive 2014/68/EU, presumption of conformity to the Essential Safety Requirements (ESRs) of Directive 2014/68/EU is limited to technical data of materials in this European Standard (Part 1 and the other relevant part of the series) and does not presume adequacy of the material to a specific item of equipment. Consequently, the assessment of the technical data stated in this material standard against the design requirements of this specific item of equipment to verify that the ESRs of Directive 2014/68/EU are satisfied, needs to be done.

2 Normative references

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

EN 1011-1:2009, *Welding - Recommendations for welding of metallic materials - Part 1: General guidance for arc welding*

EN 1011-2:2001, *Welding - Recommendations for welding of metallic materials - Part 2: Arc welding of ferritic steels*

EN 10028-1:2017, *Flat products made of steels for pressure purposes - Part 1: General requirements*
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EN 10204:2004, *Metallic products - Types of inspection documents*

EN 10229:1998, *Evaluation of resistance of steel products to hydrogen induced cracking (HIC)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 10028-1:2017 apply.

4 Tolerances on dimensions

See EN 10028-1:2017.

5 Calculation of mass

See EN 10028-1:2017.

6 Classification and designation

6.1 Classification

6.1.1 The steel grades covered by this document are given in four qualities:

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

6.1.2 The grades P275NH to P355NL2 are alloy quality steels, the grades P275NL2 and the grades P420NH to P460NL2 are alloy special steels.

6.2 Designation

See EN 10028-1:2017.

7 Information to be supplied by the purchaser

7.1 Mandatory information

See EN 10028-1:2017.

7.2 Options

A number of options are specified in this document and listed below. Additionally the relevant options of EN 10028-1:2017 apply. If the purchaser does not indicate a wish to implement any of these options at the time of enquiry and order, the products shall be supplied in accordance with the basic specification (see also EN 10028-1:2017).

- 1) tests in the simulated normalized condition (see 8.2.2);
- 2) delivery of products in the untreated condition (see 8.2.3);
- 3) maximum carbon equivalent value (see 8.3.3);
- 4) no option, intentionally left blank;
- 5) modified values for R_{eH} and R_m for grades P460NH and P460NL1 (see Table 4, footnote a);
- 6) application of the $R_{p0,2}$ values of Table 5 for the corresponding P...NL1 and P...NL2 grade (see 8.4.2);
- 7) no option, intentionally left blank;
- 8) specification of a minimum impact energy of 40 J (see 8.4.1 and Table 6);
- 9) HIC test in accordance with EN 10229 (see 8.7);
- 10) mid thickness test pieces for the impact test (see Clause 10);
- 11) verification of impact energy for longitudinal test pieces (see Clause 11);
- 12) use of test solution B for the HIC test with agreed acceptance criteria (see Annex A);
- 13) limitation of copper and/or tin content (see Table 1, footnote g).

EN 10028-3:2017 (E)**7.3 Example for ordering**

10 plates with nominal dimensions, thickness = 50 mm, width = 2 000 mm, length = 10 000 mm, made of a steel grade with the name P275NL2 and the number 1.1104 as specified in EN 10028-3, to be delivered with inspection certificate 3.1 as specified in EN 10204:

10 plates – 50 × 2000 × 10000 – EN 10028-3 – P275NL2 – Inspection certificate 3.1.

or

10 plates – 50 × 2000 × 10000 – EN 10028-3 – 1.1104 – Inspection certificate 3.1.

8 Requirements**8.1 Steelmaking process**

See EN 10028-1:2017.

8.2 Delivery condition

8.2.1 Unless otherwise agreed at the time of enquiry and order (see 8.2.3), the products covered by this document shall be supplied in the normalized condition.

For steels with minimum yield strength ≥ 420 MPa, delayed cooling or additional tempering may be necessary for small product thicknesses and in special cases. If such a treatment is performed, this shall be noted in the inspection document.

8.2.2 Normalizing may, at the discretion of the manufacturer, be replaced with normalizing rolling for all steel grades covered by this standard. In this case, additional tests on simulated normalized samples with an agreed frequency of testing may be agreed at the time of enquiry and order to verify that the specified properties are complied with.

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8.2.3 If agreed at the time of enquiry and order, products covered by this document may also be delivered in the untreated condition.

In these cases, testing shall be carried out in the simulated normalized condition (but see 8.2.1).

8.2.4 Information on welding are given in Annex B of this standard.

8.3 Chemical composition

8.3.1 The requirements of Table 1 shall apply for the chemical composition according to the cast analysis.

8.3.2 The product analysis shall not deviate from the specified values for the cast analysis as specified in Table 1 by more than the values given in Table 2.

8.3.3 A maximum value for the carbon equivalent in accordance with Table 3 may be agreed at time of enquiry and order.

Table 1 — Chemical composition (cast analysis) ^a

Steel grade		% by mass															
Steel name	Steel number	C max.	Si max.	Mn	P max.	S max.	Al _{total} min.	N max.	Cr max.	Cu ^g max.	Mo max.	Nb max.	Ni max.	Ti max.	V max.	Nb + Ti + V max.	
P275NH	1.0487	0,16	0,40	0,80 ^b to 1,50	0,025	0,010	0,020 ^{cd}	0,012	0,30 ^e	0,30 ^e	0,08 ^e	0,05	0,50	0,03	0,05	0,05	
P275NL1	1.0488					0,008											
P275NL2	1.1104					0,020											0,005
P355N	1.0562	0,18	0,50	1,10 to 1,70	0,025	0,010	0,020 ^{cd}	0,012	0,30 ^e	0,30 ^e	0,08 ^e	0,05	0,50	0,03	0,10	0,12	
P355NH	1.0565					0,008											
P355NL1	1.0566					0,020											0,005
P355NL2	1.1106					0,010											0,005
P420NH	1.8932	0,20	0,60	1,10 to 1,70	0,025	0,010	0,020 ^{cd}	0,020	0,30 ^e	0,30 ^e	0,10 ^e	0,05	0,80	0,03	0,20	0,22	
P420NL1	1.8912					0,008											
P420NL2	1.8913					0,020											0,005
P460NH	1.8935	0,20	0,60	1,10 to 1,70	0,025	0,010	0,020 ^{cd}	0,025	0,30 ^e	0,30 ^e	0,10 ^e	0,05	0,80	0,03	0,20	0,22	
P460NL1	1.8915					0,008											
P460NL2	1.8918					0,020											0,005

^a Elements not listed in this table shall not be intentionally added to the steel without the agreement 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.

^b For nominal thicknesses < 6 mm, a minimum Mn content of 0,60 % is permitted.

^c The Al_{total} content may fall short this minimum if niobium, titanium or vanadium are additionally used for nitrogen binding.

^d If only aluminium is used for nitrogen binding, a ratio $\frac{Al}{N} \geq 2$ shall apply.

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

^f 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.

^g A lower maximum copper content and/or a maximum sum of copper and tin content, e.g. Cu + 6 Sn ≤ 0,33 %, may be agreed upon at the time of enquiry and order, e.g. with regard to hot formability.

Table 2 — Permissible deviations of the product analysis from the specified limits given in Table 1 for the cast analysis

Element	Specified limit of the cast analysis according to Table 1 % by mass	Permissible deviation ^a of the product analysis % by mass
C	≤ 0,20	+ 0,02
Si	≤ 0,60	+ 0,06
Mn	≤ 1,00	± 0,05
	> 1,00 to ≤ 1,70	± 0,10
P	≤ 0,025	+ 0,005
S	≤ 0,010	+ 0,003
Al	≥ 0,020	- 0,005
N	≤ 0,025	+ 0,002
Cr	≤ 0,30	+ 0,05
Mo	≤ 0,10	+ 0,03
Cu	≤ 0,30	+ 0,05
	> 0,30 to ≤ 0,70	+ 0,10
Nb	≤ 0,05	+ 0,01
Ni	≤ 0,80	+ 0,05
Ti	≤ 0,03	+ 0,01
V	≤ 0,20	+ 0,01

^a If several product analyses are carried out on one cast, and the contents of an individual element determined lie outside the permissible range of the chemical composition specified for the cast analysis, then it is only allowed to exceed the permissible maximum value or fall short of the permissible minimum value, but not both for one cast.

Table 3 — Maximum carbon equivalent value (CEV) based on cast analysis (if agreed at the time of enquiry and order) ^a

Steel grade		CEV ^b max. for nominal thicknesses <i>t</i> in mm		
Steel name	Steel number	<i>t</i> ≤ 60	60 < <i>t</i> ≤ 100	100 < <i>t</i> ≤ 250
P275NH	1.0487	0,40	0,40	0,42
P275NL1	1.0488			
P275NL2	1.1104			
P355N	1.0562	0,43	0,45	0,45
P355NH	1.0565			
P355NL1	1.0566			
P355NL2	1.1106			
P420NH	1.8932	0,48	0,48	0,52
P420NL1	1.8912			
P420NL2	1.8913			
P460NH	1.8935	0,53	0,54	0,54
P460NL1	1.8915			
P460NL2	1.8918			

NOTE The values for the carbon equivalent are based on the percentage by mass and relate to the mechanical properties according to this European Standard.

^a See 8.3.3.

$$\text{CEV} = C + \frac{\text{Mn}}{6} + \frac{\text{Cr} + \text{Mo} + \text{V}}{5} + \frac{\text{Ni} + \text{Cu}}{15}$$

^b

8.4 Mechanical properties

8.4.1 The values given in Tables 4 to 6 (see also EN 10028-1:2017 and Clauses 10 and 11) shall apply.

Optionally, a minimum impact energy value of 40 J may be specified for temperatures where lower minimum values are specified (see Table 6, footnote a).

8.4.2 If agreed at the time of enquiry and order, the minimum proof strength $R_{p0,2}$ values at elevated temperature specified in Table 5 for the P...NH grades may also apply to the P...NL1 and P...NL2 grades.

8.5 Surface condition

See EN 10028-1:2017.

8.6 Internal soundness

See EN 10028-1:2017.