



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

Flacherzeugnisse aus Druckbehälterstählen - Teil 3: Schweißgeeignete Feinkornbaustähle, normalgeglüht

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

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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 20 January 2003.

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 Management Centre 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 Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 10028-3:2003) 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of an identical text or by endorsement, at the latest by December 2003, and conflicting national standards shall be withdrawn at the latest by December 2003.

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 EU Directive(s).

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

This document supersedes EN 10028-3:1992.

EN 10028 consists of the following parts under the general title *Flat products made of steels for pressure purposes*:

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

Part 7: Stainless steels

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

Annex A is normative.

This document includes a bibliography.

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

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 Fine grain steels are understood as steels with a ferritic grain size of 6 or finer when tested in accordance with EURONORM 103.

The requirements and definitions 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 (including amendments).

EN 10028-1:2000 + A1:2002, *Flat products made of steels for pressure purposes – Part 1: General requirements.*

EN 10204, *Metallic products – Types of inspection documents.*

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

3 Terms and definitions

For the purposes of this European Standard the terms and definitions given in EN 10028-1 apply.

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4 Dimensions and tolerances on dimensions

See EN 10028-1.

5 Calculation of mass

See EN 10028-1.

6 Classification and designation

6.1 Classification

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

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

6.1.2 In accordance with EN 10020, the grades P275NH, P275NL1, P355N, P355NH and P355NL1 are non-alloy quality steels, the grades P275NL2 and P355NL2 are non-alloy special steels and the grades P460NH, P460NL1 and P460NL2 are alloy special steels.

6.2 Designation

See EN 10028-1.

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 standard 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 products shall be supplied in accordance with the basic specification (see also EN 10028-1).

- a) tests in the simulated normalized condition (see 8.2.2);
- b) delivery of products in the untreated condition (see 8.2.3);
- c) maximum carbon equivalent value (see 8.3.3);
- d) application of the $R_{p0,2}$ values of Table 5 for the corresponding P...NL1 and P...NL2 grade (see 8.4.2);
- e) HIC test in accordance with EN 10229 (see 8.7);
- f) mid thickness test pieces for the impact test (see clause 10);
- g) verification of impact energy for longitudinal test pieces (see clause 11);
- h) tensile properties for increased product thicknesses (see Table 4, footnote c);
- i) $R_{p0,2}$ values at elevated temperatures for increased product thicknesses (see Table 5, footnote b);
- j) use of test solution B for the HIC test with agreed acceptance criteria (see annex A).

7.3 Example for ordering

10 plates with nominal dimensions, thickness = 50 mm, width = 2000 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.B as specified in EN 10204:

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

or

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

8 Requirements

8.1 Steelmaking process

See EN 10028-1.

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 standard shall be supplied in the normalized condition.

For steels with a minimum yield strength ≥ 460 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 the steel grades P275NH, P275NL1, P275NL2, P355N, P355NH, P355NL1 and P355NL2 (see 3.1 in EN 10028-1:2000 + A1:2002). In this case, 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.

8.2.3 •• If so agreed at the time of enquiry and order, products covered by this standard 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).

NOTE Testing in a 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 welding is given in EN 1011-1 and EN 1011-2.

NOTE Excessive post weld heat treatment (PWHT) conditions can decrease the mechanical properties. When in stress relieving the intended time temperature parameter

$$P = T_s (20 + \lg t) \times 10^{-3},$$

where

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T_s is the stress relieving temperature in K and

t is the holding time in hours,

is exceeding the critical P value of $P_{crit.} = 17,3$, the purchaser should in his enquiry and order inform the manufacturer accordingly and, where appropriate, tests on simulated heat treated samples may be agreed to check whether after such a treatment the properties specified in this standard can still be regarded as valid.

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 upon at the time of enquiry and order.

Table 1 – Chemical composition (cast analysis) ^a

| Steel grade | | % by mass | | | | | | | | | | | | | | |
|-------------|--------|-----------|------|------------------------------|-------|-------|----------------------|-------|-------------------|-------------------|-------------------|------|------|------|------|-------------|
| name | number | C | Si | Mn | P | S | Al _{total} | N | Cr | Cu | Mo | Nb | Ni | Ti | V | Nb + Ti + V |
| | | max. | max. | | max. | max. | min. | max. | max. | max. | max. | max. | max. | max. | max. | max. |
| P275NH | 1.0487 | 0,16 | 0,40 | 0,80 ^b to 1,50 | 0,025 | 0,015 | 0,020 ^{c,d} | 0,012 | 0,30 ^e | 0,30 ^e | 0,08 ^e | 0,05 | 0,50 | 0,03 | 0,05 | 0,05 |
| P275NL1 | 1.0488 | | | | | | | | | | | | | | | |
| P275NL2 | 1.1104 | | | | 0,020 | 0,010 | | | | | | | | | | |
| P355N | 1.0562 | 0,18 | 0,50 | 1,10 to 1,70 | 0,025 | 0,015 | 0,020 ^{c,d} | 0,012 | 0,30 ^e | 0,30 ^e | 0,08 ^e | 0,05 | 0,50 | 0,03 | 0,10 | 0,12 |
| P355NH | 1.0565 | | | | | | | | | | | | | | | |
| P355NL1 | 1.0566 | | | | | | | | | | | | | | | |
| P355NL2 | 1.1106 | | | | 0,020 | 0,010 | | | | | | | | | | |
| P460NH | 1.8935 | 0,20 | 0,60 | 1,10 to 1,70 | 0,025 | 0,015 | 0,020 ^{c,d} | 0,025 | 0,30 | 0,70 ^f | 0,10 | 0,05 | 0,80 | 0,03 | 0,20 | 0,22 |
| P460NL1 | 1.8915 | | | | | | | | | | | | | | | |
| P460NL2 | 1.8918 | | | | 0,020 | 0,010 | | | | | | | | | | |

^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 product 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.