



SLOVENSKI STANDARD

SIST EN 10028-6:2003

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Flat products made of steels for pressure purposes - Part 6: Weldable fine grain steels, quenched and tempered

Flacherzeugnisse aus Druckbehälterstählen - Teil 6: Schweißgeeignete Feinkornbaustähle, vergütet

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Produits plats en aciers pour appareils a pression - Partie 6: Aciers soudables a grains fins laminés trempés et revenus

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English version

Flat products made of steels for pressure purposes - Part 6: Weldable fine grain steels, quenched and tempered

Produits plats en aciers pour appareils à pression - Partie
6: Aciers soudables à grains fins laminés trempés et
revenus

Flacherzeugnisse aus Druckbehälterstählen - Teil 6:
Schweißgeeignete Feinkornbaustähle, vergütet

This European Standard was approved by CEN on 17 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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, 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 document EN 10028-6:2003 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of an identical text or by endorsement, at the latest by December 2003, and conflicting national standards shall be withdrawn at the latest by December 2003.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 supersedes EN 10028-6:1996.

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 European Standard consists of the following parts, under the general title *Flat products made of steels for pressure purposes*:

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- Part 1: General requirements **(standards.iteh.ai)**
- 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.

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 the requirements for flat products for pressure equipments made of quenched and tempered steels as specified in Table 1.

The requirements in 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 10020, *Definition and classification of grades of steels.*

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

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

3 Terms and definitions

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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

See EN 10028-1.

5 Calculation of mass

See EN 10028-1.

6 Classification and designation

6.1 Classification

6.1.1 This standard covers the steel grades given in Table 1 in four qualities:

- a) the basic series (P...Q);
- b) series with elevated temperature properties (P...QH);
- c) series with low temperature properties down to -40 °C (P...QL1);
- d) series with low temperature properties down to -60 °C (P...QL2).

6.1.2 In accordance with EN 10020 all the steels specified in this standard 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 is 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) mid thickness test pieces for the impact test (see clause 10);
- b) lower copper content and maximum tin content (see Table 1, footnote c);
- c) mechanical properties for thicknesses > 150 mm (see Table 3, footnote b);
- d) applicability of elevated temperature values for QL grades (see Table 5, footnote b).

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 P355QL2 and the number 1.8869 as specified in prEN 10028-6, inspection certificate 3.1B as specified in EN 10204:

10 plates – 50 x 2 000 x 10 000 – EN 10028-6 P355QL2 – Inspection certificate 3.1.B

or [SIST EN 10028-6:2003](https://standards.iteh.ai/SIST-EN-10028-6-2003)

10 plates – 50 x 2 000 x 10 000 – EN 10028-6 1.8869 – Inspection certificate 3.1.B-

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8 Requirements

8.1 Steelmaking process

See EN 10028-1.

8.2 Delivery condition

8.2.1 The products covered by this standard shall be supplied in the quenched and tempered condition.

8.2.2 The steels specified in this standard shall be suitable for welding processes in current use (see notes 1 to 3 to 8.2.3).

8.2.3 The manufacturer shall, if requested, provide the purchaser with data on suitable welding conditions determined on the basis of weld procedure tests.

NOTE 1 With increasing product thickness and strength level cold cracking can occur. Cold cracking is caused by the following factors in combination:

- the amount of diffusible hydrogen in the weld metal;
- brittle structure of the heat affected zone;
- tensile stress concentrations in the welded joint.

NOTE 2 When using recommendations as laid down, for example in EN 1011-1 and EN 1011-2, the recommended welding conditions and the various welding ranges of the steel grades can be determined depending on the product thickness, the applied welding energy, the design requirements, the electrode efficiency, the welding process and the weld metal properties.

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NOTE 3 Excessive post weld heat-treatment (PWHT) conditions can decrease the mechanical properties. It is therefore recommended that the purchaser seeks, at the time of enquiry and order, the advice of the manufacturer and considers, where appropriate, the verification of the mechanical properties on simulated post weld heat treated samples.

8.3 Chemical composition

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

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

8.4 Mechanical properties

The values given in Tables 3 to 5 apply (see also EN 10028-1 and clause 10).

8.5 Surface condition

See EN 10028-1.

8.6 Internal soundness

See EN 10028-1.

For possible verification of internal soundness, see also EN 10028-1.

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9 Inspection

9.1 Types of inspections and inspections documents

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See EN 10028-1.

9.2 Tests to be carried out

See EN 10028-1.

9.3 Retests

See EN 10028-1.

10 Sampling

See EN 10028-1.

For the impact test, deviating from EN 10028-1:2000 + A1:2002, Figure 2, footnote f, the preparation of test pieces taken from the mid thickness may be agreed at the time of enquiry and order. In this case, test temperatures and minimum impact energy values shall also be agreed.

11 Test methods

See EN 10028-1.

12 Marking

See EN 10028-1.

Table 1 — Chemical composition (cast analysis)^{a,b}

Steel grade		Maximum contents, % by mass														
name	number	C	Si	Mn	P	S	N	B	Cr	Mo	Cu ^c	Nb ^d	Ni	Ti ^d	V ^d	Zr ^d
P355Q	1.8866	0,16	0,40	1,50	0,025	0,015	0,015	0,005	0,30	0,25	0,30	0,05	0,50	0,03	0,06	0,05
P355QH	1.8867															
P355QL1	1.8868				0,020	0,010										
P355QL2	1.8869															
P460Q	1.8870	0,18	0,50	1,70	0,025	0,015	0,015	0,005	0,50	0,50	0,30	0,05	1,00	0,03	0,08	0,05
P460QH	1.8871															
P460QL1	1.8872				0,020	0,010										
P460QL2	1.8864															
P500Q	1.8873	0,18	0,60	1,70	0,025	0,015	0,015	0,005	1,00	0,70	0,30	0,05	1,50	0,05	0,08	0,15
P500QH	1.8874															
P500QL1	1.8875				0,020	0,010										
P500QL2	1.8865															
P690Q	1.8879	0,20	0,80	1,70	0,025	0,015	0,015	0,005	1,50	0,70	0,30	0,06	2,50	0,05	0,12	0,15
P690QH	1.8880															
P690QL1	1.8881				0,020	0,010										
P690QL2	1.8888															

^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 and other materials used in steelmaking of these elements which may adversely affect the mechanical properties and usability.

^b The manufacturer may add one or several alloying element(s) up to the maximum values specified in the order as a function of the product thickness and the steelmaking conditions in order to attain the specified properties. The chemical composition range for each manufacturer's analysis shall be given in the offer and confirmation of order.

^c •• For reasons of hot formability, a lower copper content and a maximum tin content may be agreed at the time of enquiry and order.

^d The percentage of grain refining elements shall be at least 0,015 %. Aluminium is also included in these elements. The minimum content of 0,015 % applies here to dissolved aluminium. This value is regarded as attained if the total aluminium content is at least 0,018 %; in cases of dispute, the dissolved aluminium content is to be determined.