



SLOVENSKI STANDARD

SIST EN 10028-1:1996

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Ploščati izdelki iz jekel za tlačne posode - 1. del: Splošne zahteve

Flat products made of steels for pressure purposes - Part 1: General requirements

Flacherzeugnisse aus Druckbehälterstählen - Teil 1: Allgemeine Anforderungen

Produits plats en aciers pour appareils a pression - Partie 1: Prescriptions générales

Ta slovenski standard je istoveten z: **EN 10028-1:1992**

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ICS:

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EUROPEAN STANDARD

EN 10028-1:1992

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 1992

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

English version

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This European Standard was approved by CEN on 1992-12-21. 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.

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 28-85 '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 meetings in July and November 1990, ECISS/TC 22 approved this document. The following ECISS members were represented at the meetings:

Austria, 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 of EN 10028 specifies the general technical delivery conditions for flat products used principally for the construction of pressure vessels made of

- a) weldable non-alloy and alloy steels with elevated temperature properties as specified in EN 10028-2;
- b) normalized weldable fine-grain steels as specified in EN 10028-3; and
- c) nickel alloy steels with low temperature properties as specified in EN 10028-4.

NOTE. Other steels are used nationally for the same applications just as the steels for pressure purposes contained in Parts 2, 3 and 4 of this EN. These other steels should not be excluded from use by this EN given that they comply with the European or national standard for pressure vessel construction.

1.2 The general technical delivery conditions in EN 10021 also apply to products supplied in accordance with this European Standard.

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 10028-2	Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties
EN 10028-3	Flat products made of steels for pressure purposes — Part 3: Weldable fine-grain steels, normalized
EN 10028-4 ¹⁾	Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties
EN 10029	Hot rolled plates 3 mm thick or above — Tolerances on dimensions, shape and mass
EN 10045-1	Metallic materials — Charpy impact test — Part 1: Method of test
EN 10051	Continuously hot-rolled uncoated plate, sheet and strip of non-alloy steels — Tolerances on dimensions and shape
EN 10052 ¹⁾	Vocabulary of heat treatment terms for ferrous products
EN 10079	Definitions of steel products
EN 10163-2	Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 2: Plates and wide flats
EN 10164 ¹⁾	Steel products with improved deformation properties perpendicular to the surface of the product — Technical delivery conditions
EN 10002-1	Metallic materials — Tensile testing — Part 1: Method of test (at ambient temperature)
EN 10002-5	Metallic materials — Tensile testing — Part 5: Method of test at elevated temperatures
EN 10020	Definition and classification of grades of steel
EN 10021 ¹⁾	General technical delivery conditions for steel and steel products
EN 10027-1	Designation systems for steel — Part 1: Steel names, principal symbols
EN 10027-2	Designation systems for steel — Part 2: Numerical system
EN 10204	Metallic products — Types of inspection documents
EURONORM 18 ²⁾	Selection and preparation of samples and test pieces for steel and iron and steel products
EURONORM 48 ²⁾	Hot rolled narrow steel strip; tolerances on dimensions and shape
EURONORM 160 ²⁾	Ultrasonic testing of steel plate of thickness equal to or greater than 6 mm (reflection method)
EURONORM 168 ²⁾	Iron and steel products — Inspection document contents
ISO 2566-1	Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels

¹⁾ At present at the draft stage.

²⁾ ... Until this EURONORM is transformed into a European Standard, this EURONORM or a corresponding national standard may be applied, depending on the agreement at the time of ordering (see annex A).

3 Definitions

for the purposes of this European Standard, the following definitions apply.

3.1 Non-alloy and alloy steels, quality steel and special steel

The definitions given in EN 10020 apply for classification into non-alloy and alloy steels and into quality and special steels.

3.2 Product shapes

The definitions in EN 10079 apply for the various product shapes.

3.3 Types of heat treatment

3.3.1 The definitions in EN 10052 apply.

3.3.2 Normalizing rolling is a rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after normalizing.

The symbol for this delivery condition and for the normalized condition is N.

NOTE. In international publications, the term 'controlled rolling' is used both for normalizing rolling and for thermomechanical rolling. However in view of the different applicability of the products, a distinction between the terms is necessary.

4 . Dimensions and tolerances on dimensions

The nominal dimensions and tolerances on dimensions for the products shall be agreed at the time of ordering with reference to the dimensional standards listed below.

4.1 For hot-rolled sheet/plate, refer to EN 10029 or EN 10051.

4.2 For continuously hot-rolled coil (rolled width 600 mm or above) and hot-rolled slit coil in widths less than 600 mm, refer to EN 10051.

4.3 For hot-rolled narrow strip (rolled width less than 600 mm) refer to EURONORM 48.

4.4 . . Unless otherwise agreed at the time of ordering, class B as specified in EN 10029 applies to the tolerance on thickness of plates.

5 Calculation of mass

A density of 7,85 kg/dm³ shall be used as the basis for the calculation of the nominal mass from the nominal dimensions of all steels in EN 10028-2, EN 10028-3 and EN 10028-4.

6 Designation and ordering

6.1 Designation of the steel grades

The steel names (see EN 10028-2, EN 10028-3 and EN 10028-4) have been established in accordance with EN 10027-1.

The steel numbers (see EN 10028-2, EN 10028-3 and EN 10028-4) have been established in accordance with EN 10027-2.

6.2 Ordering

The complete order of a product as specified in this European Standard shall include the following information:

- a) the quality required;
- b) the type of flat product;
- c) the European Standard or EURONORM specifying the tolerances on dimensions, shape and mass (see clause 4) and, if the relevant European Standard or EURONORM permits the purchaser certain options, e.g. regarding edge finishes or tolerance classes, specific information on these aspects;
- d) the nominal dimensions of the product;
- e) the number of this European Standard;
- f) the name of the steel grade;
- g) the delivery condition, if it differs from the usual condition specified in EN 10028-2, EN 10028-3 and EN 10028-4.

At the time of enquiry and order, special agreements may be made regarding the subclauses marked with 2 points (. .).

7 Classification into grades

7.1 The information given in Parts 2, 3 and 4 of this European Standard applies with regard to classifying the steels into non-alloy and alloy steels, quality steels and special steels.

7.2 . The selection of steel is the responsibility of the purchaser.

8 Requirements

8.1 Steelmaking process

The steels shall be made using the basic oxygen process or by an electric furnace process or by technically equivalent processes. The steels shall be killed.

8.2 Delivery condition

See EN 10028-2, EN 10028-3 and EN 10028-4 (see also 3.3.2).

8.3 Chemical composition

See EN 10028-2, EN 10028-3 and EN 10028-4.

8.4 Mechanical properties

8.4.1 The values given in EN 10028-2, EN 10028-3 and EN 10028-4 apply for test pieces taken and prepared in accordance with 9.4.2. The values relate to the nominal thicknesses (thicknesses on ordering) of the products and apply to the usual delivery conditions (see EN 10028-2, EN 10028-3 and EN 10028-4).

.. Agreement may be reached at the time of ordering about the mechanical properties to be adhered to after additional heat treatment.

8.4.2 The impact values apply to transverse test pieces for the steel grades specified in EN 10028-2 and for longitudinal and transverse test pieces for the steel grades specified in EN 10028-3 and EN 10028-4.

8.4.3 If, as a result of products having insufficient thickness, the impact test can only be carried out using test pieces of width less than 10 mm, but not less than 5 mm, the minimum values given in EN 10028-2, EN 10028-3 and EN 10028-4 shall be reduced in proportion to the cross-sectional area of the test piece.

8.4.4 .. For products of thickness 15 mm and above, it may be agreed at the time of ordering to meet the requirements of one of the quality classes Z 15, Z 25 or Z 35 as specified in EN 10164 characterized by minimum values for the reduction of area perpendicular to the product surface.

8.5 Surface condition

For plates, the requirements of surface quality class B 2 as specified in EN 10163-2 shall apply.

8.6 .. Internal soundness

For plates of thicknesses 6 mm and above, special agreements may be made on the basis of EURONORM 160.

9 Testing

9.1 Type and content of inspection documents

9.1.1 . An inspection document covering specific tests as described in EN 10204 shall be made out for products complying with the requirements of this EN. The type of inspection document required shall be indicated at the time of ordering.

9.1.2 The inspection document shall contain the following information.

a) The information blocks A, B and Z of EURONORM 168, and the tempering temperature shall also be given in the case of quenched and tempered or tempered products.

b) The steelmaking process (section C 70 of EURONORM 168).

c) The results of the cast analysis in accordance with boxes C 71 to C 92 of EURONORM 168.

d) The results of the tensile tests at ambient temperature in accordance with boxes C 00 to C 03 and C 10 to C 13 of EURONORM 168.

e) For products from which V-notched test pieces ≥ 5 mm wide and 10 mm high may be taken from the impact test:

the results of these tests in accordance with boxes C 00 to C 03 and C 40 to C 43 of EURONORM 168.

f) The result of the visual examination of the products (see information block D of EURONORM 168).

g) If one of several of the following optional tests have been agreed at the time of ordering, the relevant information on:

g1) the product analysis (boxes C 71 to C 92 of EURONORM 168).

g2) verification of the 0,2 % proof stress at elevated temperature (boxes C 00 to C 03, C 10 and C 11 of EURONORM 168),

g3) verification of the minimum reduction of area perpendicular to the product surface (boxes C 00 to C 03, C 10 and C 14 to C 29),

g4) the ultrasonic test for internal soundness (information block D of EURONORM 168).

9.2 Tests to be carried out

The following tests shall be carried out:

- tensile test at ambient temperature;
- impact test at one test temperature;
- dimensional test;
- visual examination of the surface condition;
- tests specially agreed at the time of ordering, e.g. product analysis, tensile test at elevated temperature, tensile test in the thickness direction, ultrasonic test.

9.3 Number of tests

9.3.1 If it has been agreed at the time of ordering that the chemical composition shall be verified by product analysis, unless otherwise agreed, one test piece per cast shall be taken for determining the elements indicated with numerical values for the particular steel grade in table 1 of EN 10028-2, EN 10028-3 or EN 10028-4.

9.3.2 The test unit for the tensile test at ambient temperature and the impact test shall be as follows:

- for strip and sheet cut from strip: the coil;
- for sheet or plate: the rolled plate.

If a rolled plate or a coil is split up into several heat treatment batches for liquid quenching, then each individual heat treatment batch shall be regarded as a test unit. The requirements in figure 1 shall apply for the number of specimens to be taken per test unit.


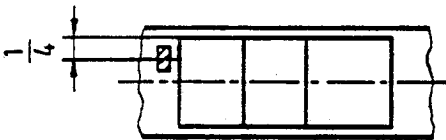
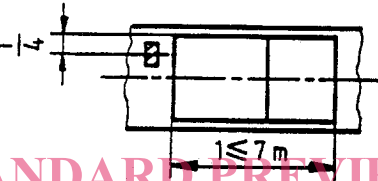
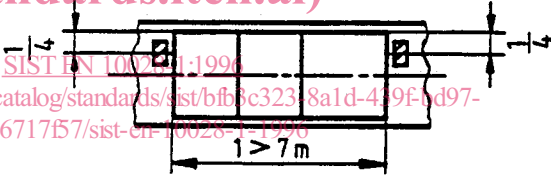
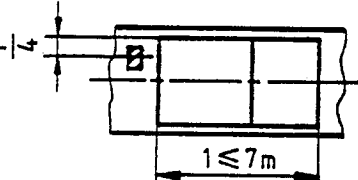
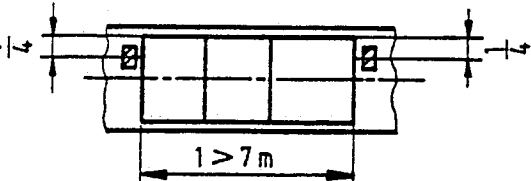
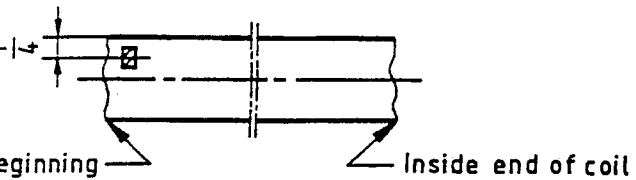
Products	Steel grade	Sheet/plate thickness mm	Product length supplied per rolled plate m	One specimen shall be taken for preparing the test pieces indicated in 9.4 from each test unit at the points marked 
Plate/sheet	Non-alloy	≤ 50	No limitation	
		> 50	≤ 7	
			> 7	
	Alloy	No limitation	≤ 7	
			> 7	
Strip	No distinction	No limitation	—	²⁾ 
¹⁾ The specimens may also be taken from the other side of the product. ²⁾ For the plate/sheet cut from strip, the strip remains the test unit as long as the plate/sheet is not liquid quenched.				

Figure 1. Position from which the specimens are taken

9.3.3 If agreed specially at the time of ordering, the 0,2 % proof stress shall be verified at elevated temperature. In this case, unless otherwise agreed, one test piece per cast shall be tested.

9.3.4 The manufacturer shall take suitable measures to prevent materials becoming mixed up.

9.3.5 The dimensions of the products shall be checked.

9.3.6 The surface condition of all products shall be checked.

9.4 Sampling and sample preparation

9.4.1 Sampling and sample preparation shall be in accordance with the requirements of EURONORM 18. In addition, the requirements in 9.4.2 shall apply to the mechanical tests.

9.4.2 The specimens shall be taken at $\frac{1}{4}$ product width (see figure 1) for the tensile test at ambient temperature, the impact test and the tensile test at elevated temperature. In the case of strip, the specimen shall be taken at a sufficient distance from the end of the strip.

NOTE. If specimens have to be taken from the mid-width position in accordance with the requirements for through-thickness testing as specified in EN 10164, the specimens to be taken as specified in 9.4.2 may also be taken from there except in cases of arbitration.

9.4.2.1 If, following agreement at the time of ordering, the products are not to be delivered in the usual delivery condition, the specimen shall be treated to the usual delivery condition prior to the test.

9.4.2.2 One transverse test piece shall be taken from each specimen for the tensile test at ambient temperature and this shall be a flat test piece unless a round test piece is used (see paragraph 2). At least one rolled surface shall be left on rectangular test pieces. However, both rolled surfaces shall generally be left on the test piece in the case of products up to 40 mm thick.

Round test pieces are permissible, but should only be provided for product thicknesses greater than 40 mm and then they shall have a diameter of at least 10 mm. These test pieces shall be taken so that their axes are located one quarter of the product thickness from the surface or as near as possible to that position.

9.4.2.3 Three transverse test pieces or – in the case of the steel grades specified in EN 10028-3 and EN 10028-4 – three longitudinal test pieces following agreement shall be taken from the specimens for the impact test. In the case of product thicknesses up to 40 mm, one side of the test piece shall be as close as possible to the rolled surface.

With product thicknesses greater than 40 mm, the test pieces shall be taken so that their longitudinal axis lies at a distance $\frac{1}{4}$ of the product thickness from the surface or as near as possible to this position.

The notch shall be perpendicular to the surface of the product.

9.4.2.4 For the tensile test at elevated temperature, one test piece shall be taken from one specimen per test unit (see 9.3.3) and shall be prepared in accordance with EN 10002-5.

9.5 Test procedures

9.5.1 Unless otherwise agreed at the time of ordering, the choice of a suitable physical or chemical analytical method for the product analysis shall be at the discretion of the manufacturer. In cases of dispute, the analysis shall be carried out by a laboratory approved by both parties. In this case, the analysis method to be used shall be agreed upon, if possible, with reference to the corresponding ENs or EURONORMs.

9.5.2 The tensile test at ambient temperature shall be carried out as described in EN 10002-1, generally using a proportional test piece of gauge length $L_0 = 5,65 \sqrt{S_0}$ (S_0 = Cross-sectional area of the test piece). Test pieces with a constant gauge length may be used; in this case, the elongation value shall be converted in accordance with ISO 2566-1. In cases of dispute, for products with a thickness ≥ 3 mm, test pieces with a gauge length $L_0 = 5,65 \sqrt{S_0}$ shall be used.

The yield point to be determined shall be the upper yield point (R_{eH}) or, if this is not pronounced, the 0,2 % proof stress ($R_{p0,2}$).

9.5.3 The impact test on V-notched test pieces shall be carried out as described in EN 10045-1. The specifications EN 10028-2, EN 10028-3 and EN 10028-4 shall apply.

The minimum impact values given in EN 10028-2, EN 10028-3 or EN 10028-4 apply for the mean of three test pieces. One individual value may be lower than the specified value provided that it is not less than 70 % of this value.

If the above conditions are not met, an additional set of three test pieces shall be taken from the same specimen and shall be tested. In order to regard the test unit as acceptable after testing the second set, the following requirements shall also be met:

- i) the mean value of six tests shall be greater than or equal to the specified minimum value;
- ii) not more than two of the six individual values shall be less than the specified minimum value;
- iii) not more than one of the six individual values shall be less than 70 % of the specified minimum value.