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Manufacturer, Exporter, Stockiest, Supplier, Trader for Carbon Steel, Stainless Steel, Alloy Steel And High Nickel Alloy, Nickel Alloy Plate, Sheets And Coils. ICS 77.140.30; 77.140.50

EN 10028 - 1

Apd12000

Supersedes EN10028-1:1992

English version

## Flat products made of steel9 for pressure purposes - Part 1: General requirements

Produits plats en aciers pour appareils à pressiOn - Partie 1: Prescriptions générales Flacheizeugni5se aus DruckbehBlterstählen - Teil 1: Allgemeine Anforderungen

This European Standard was approved by CEN on 29 October 1999.

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 attention. 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.

This European Standard exists in three official versions (English, French, Geman). 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 Secretafiat tTbS the SaMe StBttJS as the official versio.ns.

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Page2 EN 10028-1:2000

## Contents

		Page
Forev	vord	4
1	Scope	5
2	Normative References	5
3	Definitions	6
4	Dimensions and tolermces on dimensions	7
5	Calculation of mass	8
<b>6</b> <b>6.1</b> 6.2	Classification and designation Classification Designation	8 8 8
<b>7</b> <b>7.1</b> 72	Information to be supplied by the purchaser Mandatory information Options	8 8 9
8 8.1 8.2 83 8.4 85 8.6	Requirements Steelmaking process Delivery condition Chemical composition Mechanical properties Surface condition Internal soundness	9 9 to to 10 i0 i0
<b>9</b> 9.1 92 9.3	Inspection Types of inspection and inspection documents Tests to be carried out Re-tests	10 10 12 12
10 1o.I 10.2	Sampling Frequency of testing Selection and preparation of samples and test pieces	12 12 13
<b>11</b> 11.1 11.2 11.3 11.4 <b>11.5</b>	Test methods Chemical analysis Tensile test at room temperature Tensile test at elevated temperature Impact test Other testing	14 14 14 15 15
12	Marking	16

Annex ZA (informative) Clauses of this European Standard addressing essential requirements or other provisions of EU Directives 21

Page 4 EN 10028-1:2000

#### Foreword

This European Standard 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 supersedes EN 10028—1:1992 considering further standards of the EN 10028 series.

The other parts of this European Standard are:

Part2:	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
Part5:	Weldable fine grain steels, thermomechanically rolled
Part 6:	Weldable fine grain steels, quenched and tempered
Part 7:	Stainless steels

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 October 2000, and conflicting national standards shall be withdrawn at the latest by October 2000.

This European Standard 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 standard.

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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, Iceland, Ireland, Italy, Luxembourg, Netherlands, I'Jorway, Portugal, Spain, 5weden, Switzerland and the United Kingdom.

NOTE: The clauses marked with a point (•) contain information relating to agreements which are to be made at the time of enquiry and order. The clauses marked witb two points (••) contain information relating to agreements which may be made at the time of enquiry and order.

#### 1 Scope

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This European Standard EN 10028-1 specifies the general technical delivery conditions for flat products used principally for the construction of pressure equipments.

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

2 Normative references

This European Standard incorporates by dated or mdated 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 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.

CR 10260	Designation systems for steel-Additional symbols for steel natnes (CEN Report)
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	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 10028-7	Flat. products made of steels for pressure purposes - Part 7: Stainless steels
EN 10029	Hot rolled plates 3 mm thick or above - Tolerances on dimensions, shape and <b>mass</b>
EN 10045-1	Metallic materials - Charpy impact test - Part 1: Method of test
EN 10048	Hot rolled narrow steel strip; tolerances on dimensions and shape
EN 10051	Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels - Tolerances on dimensions and shape
EN 10052	Vocabulary of heat keatment terms for ferrous products
EN 10079	Definitions of steel products
EN 10088-1	Stainless steels - Part 1: List of stainless steels

## Page 8 EN 10028-1:2000

NOTE: EN 10258 and EN 10259 contain options providing wider dimensional choice.

s Calculation of mass

A density of 7,85 kg/din° shall be used as the basis for the calculation of the nominal mass frcim the nominal dimensions of all steels of EN 10028-2 to EN 10028-6. For density of austenitic corrosion-resisting steels, see annex A of EN 10088-1. For density of austeoitic creep-resisting steels, see annex A of EN 10028-7.

6 Classification and designation

## 6.1 Classit"ication

6.1.1 The classification of the steel grades in accordance with EN 10020 is given in the specific parts of EN 10028.

6.1.2 Steels covered in EN 10028-7 are additionally classified according to their structure into

- feiritic steels,
- martensitic steels,
- austenitic steels,
- austenitic-ferritic steels.

NDTE: For more details see EN 10088-1.

## 6.2 Designation

The steel grades specified in the individual parts of EN 10028 are designated with steel names and steel numbers. The steel names have been allocated in accordance with EN 10027-1 and CR 10260. The corresponding steel numbers have been allocated in accordance with EN 10027-2.

7 Information to be supplied by the purchaser

## 7.1 Mandatory information

The following information shall be supplied by the purchaser at the time of enquiry and order:

- a) the quantity required;
- b) the type of flat product;

c) the European Standard specifying the tolerances on dimensions, shape and mass (see clause 4) and, if the relevant Europes Standard 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;

I) the steel name or number;

g) the delivery condition, if it differs from the usual condition specified in the individual parts of EN 10028; for stainless steels - the process route selected from the relevant table of EN 10028-7;

h) inspection document to be issued (see 9.1.1).

## 7.2 **Options**

A number of options are specified in this part of EN 10028 and listed below. If the purchaser does not indicate a wish to implement my of these options at the time of enquiry and order, the products shall be supplied in accordance with the basic specification (see 7.1).

- a) Deviating tolerance class (see 4.1);
- b) Specification of the steelmaking process (see 8.1.1);
- c) Mechanical properties after additional heat treatment (see 8.4.1);
- d) Specification of special classes for the reduction of area (see 8.4.2);
- e) Additional tests (see 9.2.2);
- I) Deviating frequency of testing (see 10.1.1 and 10.1.3);
- g) Deviating delivery condition (see 10.2.1.3);
- h) Use of longitudinal test pieces for the impact test (see 10.2.2.3);
- i) Specification of an analytical method (see 11.1);
- j) Temperature of the tensile test at elevated temperature (see 11.3);
- k) Deviating testing temperature for the impact test (see 11.4);
- I) Marking method (see 12.1);
- in)Specialmarking(see 12.2 and 12.3);
- n)Information to be given by marking (see table 1).

## 8 Requirements

## 8.1 Steelmaking process

8.1.1 •• Unless a special steelmaking process has been agreed at the time of enquiry and order, the steelmaking process for steels in accordance with this European Standard shall be at the discretion of the manufacturer.

8.1.2 Steels other than stainless steels shall be fully killed.

Page 10 EN 10028-1:2000

8.2 Delivery condition

See the individual parts of EN 10028 (see also 3.1 and 3.2).

## 8.3 Chemical composition

## 8.3.1 Cast analysis

The cast analysis reported by the steel producer shall apply and comply with the requirements of the individual parts of EN 10028.

## 8.3.2 Product analysis

The permissible product analysis tolerances on the limiting values given for the cast analysis **are** specified in the individual parts of EN 10028.

8.4 Mechanical properties

8.4.1 The values given in the individual parts of EN 10028 apply for test pieces taken and prepared in accordance with 10.2.2. The values relate to the nominal thicknesses (thicknesses on ordering) of the products and apply to the usual delivery conditions (see the specific parts of EN 10028).

•• Agreement shall be reached, where appropriate, at the time of enquiry md order about the mechanical properties to be adhered to after additional heat treatment.

8.4.2 •• For products (except products made of stainless steels) of thickness 15 mm and above, it may be agreed at the time of enquiry and order to meet the requirements of one of the quality classes Z15, Z25, 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 as specified in EN 10163-2 shall apply as follows:

a) For plates in accordance with EN 10028-2 to -6, class B2.

b) For plates in accordance with EN 10028-7, class B3.

## 86•• Intema4 soundnom

For the internal soundness, where appropriate, requirements together with the conditions of their verification (see 7.2.e and 11.5.3) may be specified at the time of enquiry and order.

#### 9 Inspection

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9.1 Types of inspection and inspection documents

9.1.1 • The compliance with the requirements of the order shall be verified for products in accordance with this European Standard by specific inspection.

The purchaser shall state the required type of inspection documents (3.1.A, 3.1.B, 3.1.C or 3.2) in accordance with EN 10204. If an inspection document 3.1.A, 3.1.C or 3.2 is ordered the purchaser shall notify the manufacturer of the name and the address of the organization or person who is to carry out the inspection and produce the inspection document. In the case of the inspection report 3.2 the party to issue the certificate shall be agreed.

9.1.2 The inspection document shall contain, in accordance with EN 10168, the following codes and information:

a) Information blocks A, B and Z; the tempering temperature shall also be given in the case of quenched and tempered or tempered products.

b) Results of the cast analysis in accordance with boxes C71 to C92.

c) Results of the tensile tests at room temperature in accor-dance with boxes COO to CO3 and C10 to C13.

d) Results of the impact test except for austeoitic steels of EN 10028-7 in accordance with boxes COO to C03 and C40 to C43.

e) Result of the visual examination of the products (see information block D).

I) If one or several of the following options have been agreed at the time of enquiry and order, the relevant information **on:** 

I) the steelmaking process (section C70),

2) the product analysis in accordance with boxes C71 to C92,

3) the results of the tensile test at elevated temperature (see 9.2.2) in accordance with boxes COO to CO3, C10 and CH,

4) the minimum reduction of area perpendicular to the product surface boxes in accordance with boxes COO to C03, CIO and C14 to C29,

5) the ultrasonic test for internal soundness (information block F),

6) impact properties of austenitic steels at room temperature in accordance with boxes COO to CO3 and C40 to C43,

7) impact properties of stainless steels at low temperature in accordance with boxes COO to C03 and C40 to C43,

8) resistance of stainless steels to intergranular corrosion in accordance with boxes C60 to C69.

Page 12 EN 10028-1:2000

#### 9.2 Tests to be carried out

9.2.1 The following tests shall be carried out:

- tensile test at room temperature;
- impact test (except for austenitic steels of EH 10028-7), but see **10.2.2.3**;
- dimensional test;
- visual examination of the surface condition.
- 9.2.2 •• The following tests may be agreed:
- product analysis;
- tensile test for verification of 0,27c proof strength at elevated temperature (except for steels of EN 10028-4 and EN 10028-5)i
- tensile test for (simultaneous) verification of one, all, or any combination of 0,27c proof skength, 1,09'» proof strength and tensile strength at elevated temperature for austenitic steels of EN 10028-7;
- tensile test perpendicular to the product surface (except for steels of EN 10028-7);
- impact tests for austenitic steels of EN 10028-7 at room temperature; impact tests for steels of EN 10028-7 (except ferritic steels) at low temperature;
- ultrasonic test for verification of internal soundness; determination of resistance to intergranular corrosion for steels of EN 10028-7.

## 9.3 Re-tests

See EN 10021.

10 Sampling

## **10.1 Frequency of testing**

10.1.1 •• For the 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 the relevant tables of the specific parts of EN 10028.

10.1.2 The test unit for products in accordance with EN 10028-2 to EN 10028-6 for the tensile test at room 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. One sample shall be taken for preparing the test pieces indicated in 10.2.2 from each test unit.

For stainless steels see EN 10028-7.

10.1.3 •• For tensile tests at elevated temperature, unless otherwise agreed, the test unit shall be the cast.

## 10.2 Selection and preparation of samples and test pieces

## 10.2.1 Sampling and sample preparation

10.2.1.1 Sampling and sample preparation shall be in accordance with the requirements of ENISO 377 and ISO 14284. In addition, the requirements in 10.2.1.2 and, if applicable, 10.2.1.3 shall apply for sampling and sample preparation for the mechanical tests.

10.2.1.2 The samples shall bé taken at Z4roduct width (see figure 1) for the tensile test at room temperature, the impact test and the tensile test at elevated temperature. In the case of strip, the samples shall be taken at a sufficient distance from the end of the strip.

NOTE: If samples have to be taken from the mid-width position in accordance with the requirements for through-thickness testing as specified in EN 10164, the samples to be taken as specified in 10.2.1.2 may also be taken from there exGept in casGS Of arbitration.

10.2.1.3 •• If, following agreement at the time of enquiry and order, the products are not to be delivered in the usual delivery condition, the samples shall be treated to the usual delivery condition prior to the test.

## 10.2.2 Preparation of test pieces

## 10.2.2.1 General

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The test pieces shall be prepared in accordance with figure 2 (products in accordance with EN 10028-2 to -6) or figure 3 (products in accordance with FAN 10028-7).

10.2.2.2 Test pieces for the tensile test

One test piece shall be prepared in accordance with EN 10002-1 for the tensile test from each test unit and this shall be a rectangular test piece, unless a round test piece may be used (see third paragraph).

At least one rolled surface shall be retained on rectangular test pieces. However, both rolled surfaces shall generally be retained on the test piece in the case of product thicknesses s 30 mm for products in accordance with EN 10028-2 to -6 or < 10 mm in the case of products in accordance with EN 10028-7. Additionally, rectangular test pieces for products in accordance with EN 10028-6, shall represent either the full product thickness or half of the product thickness retaining one rolled surface.

Round test pieces are permissible, but shall only be provided for product thicknesses :•30mm for products in accordance with EN 10028-2to-6or>10mm for products in accordance with EN 10028-7. Test piece diameters shall be at least 10mm for products in accordance with EN 10028-2to-6or at least 5 mm for products in accordance with EN 10028-7 respectively.

## 10.2.2.3 Test pieces for the impact test

 $Three \, kans verse \, standard \, V\text{-}notched \, test \, pieces \, shall \, be \, prepared \, from the \, samples \, for the \, impact \, test, \, in \, accordance \, with \, EN \, 10045\text{-}1.$ 

•• For products in accordance with EN 10028-3, EN 10028-4 and EN 10028-7 longitudinal test pieces may be agreed.

Page 16 EN 10028-1:2000

11.5.4 If agreed, the resistance to intergranular corrosion shall be tested in accordance with EN ISO 3651-2.

 $11.5.5\,The\,manufacturer\,shall\,take\,suitable\,measures\,to\,prevent\,materials\,becoming\,mixed\,up\,and\,to\,ensure\,traceability.$ 

12 Marking

12.1 The products shall be marked with the information given in table 1.

•• The method of marking and the material of marking shall, unless otherwise agreed, be at the option of the manufacturer.

Plates and sheets shall be marked by low stress stamping or stencilling or ink marking.

Sheets in bundles and strip in coil shall be marked on a securely attached label. If requested, this may also be applied to ground or polished plates.

For products in accordance with EN 10028-7, the quality of marking shall be such that it shall be durable for at least one year in untreated stomge under cover. Care must be taken that the corrosion resistance of those products is not impaired by the marking method.

12.2 •• If agreed at the time of enquiry and order, a mark applied by stamping shall have a coloured frame.

12.3 •• If any other marks are to be made, this shall be agreed upon at the time of enquiry and order.



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Figure 1: Position from which the samples are taken

#### Page 18 EN 10028-1:2000



<sup>69</sup> In the case of product thickness greater than 40 mm, the impact test piece shall be taken at quarter of the product thickness.

Figure 2: Position of test pieces for products in accordance with EN 10028-2 to EN 10028-6

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<sup>10</sup> In cases of doubt or dispute the gauge length shall be L<sub>o</sub> = 5,65 √S<sub>o</sub> for test pieces from products ≥ 3 mm thickness.

For products < 3 mm thickness, non-proportional test pieces with a gauge length of 80 mm and a width of 20 mm shall be used, but test pieces with a gauge length of 50 mm and a width of 12.5 mm may also be applied. For products with a thickness of 3 to 10 mm flat proportional test pieces with two rolled surfaces and a maximum width of 30 mm shall be used. For products with a thickness > 10 mm, one of the following proportional test pieces may be used:

 either a flat test piece with a maximum thickness of 30 mm; the thickness may be reduced to 10 mm by machining, but one rolled surface mus be preserved.

or a round test piece with a diameter of > 5 mm. the axis of which shall be located as near as possible to a plane in the outer third of half the
product thickness.

<sup>24</sup> The longitudinal axis of the notch shall always be perpendicular to the rolled surface of the product.

<sup>39</sup> For impact test pieces for plate thicknesses ≤ 10 mm. see 10.2.2.3.

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In the case of product thickness greater than 30 mm, the impact test piece may be taken at quarter of the product thickness,

Figure 3: Position of test pieces for products in accordance with EN 10028-7

Marking of	Symbol <sup>1)</sup>
Manufacturer's name, trade mark or logo	
	+
The number of this European	
Standard	(+)
Steel name or number	+
Type of finish	(+)
Identification number <sup>2)</sup>	+ <sup>4)</sup>
Direction of rolling <sup>3)</sup>	(+)
Nominal thickness	(+)
Nominal dimensions other than thickness	
	(+)
Inspector's mark	+ <sup>5)</sup>
Customer's order No.	(+)

#### **Table 1: Marking of the products**

<sup>1)</sup> The symbols mean:

+ = the marking shall be applied;

(+) = the marking shall be applied if so agreed, or at the manufacturer's discretion.

<sup>2)</sup> The numbers or letters used for identification shall allow the product(s) to be related to the relevant inspection certificate or inspection report.

<sup>3)</sup> The direction of rolling is normally obvious from the shape of the product and the position of the marking. Marking may either be longitudinally applied by roller stamping or it may be near to one end of the piece and transverse to the rolling direction.

A specific separate indication of the principal rolling direction will not normally be required, but may be requested by the customer.

<sup>4)</sup> This shall permit the traceability of the cast number.

<sup>5)</sup> The inspector's mark may be omitted if the relevant inspector can be identified in another way.

# Annex ZA (informative)

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## Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European Standard has been prepared under a mandate given to CEN by the European Commission and supports essential requirements of EU Directive 97/23/EC.

Warning: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this European Standard.

The clauses of this European Standard are likely to support the essential requirements of section 4 of annex 1, "Essential safety requirements" of the Pressure Equipment Directive 97/23/EC.

Compliance with this European Standard provides one means of conforming with the specific essential requirements of the Directive concerned.