BRITISH STANDARD

BS EN 10028-1:2000
Incorporating Amendment No. 1

Flat products made of steels for pressure purposes —

Part 1: General requirements

The European Standard EN 10028-1:2000, with the incorporation of amendment A1:2002, has the status of a British Standard

ICS 77.140.30

BSI British Standards

National foreword

This British Standard is the official English language version of EN 10028-1:2000, including amendment A1:2002. It supersedes BS EN 10028-1:1993 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1⟩ ⟨A1]. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1⟩ ⟨A1].

The UK participation in its preparation was entrusted by Technical Committee ISE/73, Steels for pressure purposes, to Subcommittee ISE/73/2, Steel plates and bars for pressure purposes, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 July 2000

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Amendments issued since publication

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EUROPEAN STANDARD

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EN 10028-1

April 2000

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Supersedes EN 10028-1:1992

English version

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

(includes amendment A1:2002)

Produits plats en aciers pour appareils à pression - Partie 1: Prescriptions générales
(inclut l'amendement A1:2002)

Flacherzeugnisse aus Druckbehälterstählen - Teil 1: Allgemeine Anforderungen
(enthält Änderung A1:2002)

This European Standard was approved by CEN on 29 October 1999. Amendment A1 was approved by CEN on 16 October 2002.

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.

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 Central Secretariat 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, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

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 and takes into consideration further standards of the EN 10028 series.

The other parts of this European Standard are:

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.

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.

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, Norway, Portugal, Spain, Sweden, 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 with two points (••) contain information relating to agreements which may be made at the time of enquiry and order.

Foreword to amendment A1

This document EN 10028-1:2000/A1:2002) has been prepared by Technical Committee ECISS/TC 22, Steels for pressure purposes — Qualities, the Secretariat of which is held by DIN.

This amendment to the European Standard EN 10028-1:2000 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2003, and conflicting national standards shall be withdrawn at the latest by May 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).

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

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 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 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 names (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 mass.
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 treatment terms for ferrous products.
EN 10079	Definitions of steel products.
EN 10088-1	Stainless steels - Part 1: List of stainless steels.
EN 10160	Ultrasonic testing of steel flat product of thickness equal to or greater than 6 mm (reflection method).

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 Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions.

EN 10168[1] Iron and steel products - Inspection documents - List and description of the information.

EN 10204 Metallic products - Types of inspection documents (includes amendment A1:1995).

EN 10258 Cold-rolled stainless steel narrow strip and cut lengths - Tolerances on dimensions and shape.

EN 10259 Cold-rolled stainless steel wide strip and plate/sheet - Tolerances on dimensions and shape.

EN ISO 377 Steel and steel products - Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997).

EN ISO 3651-2 Determination of resistance to intergranular corrosion of stainless steels - Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels - Corrosion test in media containing sulfuric acid (ISO 3651-2:1998).

EN ISO 2566-1 Steel - Conversion of elongation values - Part 1: Carbon and low alloy steels (ISO 2566-1:1984).

EN ISO 2566-2 Steel - Conversion of elongation values - Part 2: Austenitic steels (ISO 2566-2:1984).

ISO 14284 Steel and iron - Sampling and preparation of samples for the determination of chemical composition.

3 Definitions

For the purpose of this European Standard the definitions in:

- EN 10020 for classification of steels;
- EN 10079 for product forms; and
- EN 10052 for types of heat treatment apply.

3.1 deviates from EN 10052, and 3.2 is additional to EN 10052. The following are defined.

[1] In preparation; until this document is published as a European Standard a corresponding national standard should be agreed at the time of enquiry and order.

3.1 Normalizing rolling is a rolling process in which the final deformation process 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.

3.2 Additional to the definitions for thermomechanical treatment, quenching and tempering the following should be noted.

NOTE 1: Thermomechanical rolling (symbol M) may include processes of increased cooling rates with or without tempering including self-tempering but excluding definitively direct quenching and tempering.

NOTE 2: Quenching and tempering (symbol QT) also includes direct hardening plus tempering.

3.3 Purchaser, the person or organization that orders products in accordance with this standard. The purchaser is not necessarily, but may be, a manufacturer of pressure equipment in accordance with the EU Directive listed in annex ZA. Where a purchaser has responsibilities under this EU Directive, this standard will provide a presumption of conformity with the essential requirements of the directive so identified in annex ZA

4 Dimensions and tolerances on dimensions

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

4.1 For non-continuously hot-rolled flat products, refer to EN 10029.

•• Unless otherwise agreed at the time of enquiry and order, class B as specified in EN 10029 applies to the tolerance on thickness of plates.

4.2 For continuously hot-rolled coil or sheet/plate cut from coils (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 EN 10048.

4.4 For stainless cold-rolled sheet/plate, cold-rolled coil and slit coil (rolled width 600 mm or above), refer to EN 10259 and for stainless cold-rolled coil and slit coil in rolled widths less than 600 mm, refer to EN 10258.

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

5 Calculation of mass

[A1]
A density of 7,85 kg/dm^3 shall be used as the basis for the calculation of the nominal mass from the nominal dimensions of all steels of EN 10028-2 to EN 10028-6. For density of corrosion-resisting steels, see annex A of EN 10088-1. For density of austenitic creep-resisting steels, see annex A of EN 10028-7. [A1]

6 Classification and designation

6.1 Classification

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:

- ferritic steels;
- martensitic steels;
- austenitic steels;
- austenitic-ferritic steels.

NOTE: 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 European 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;

f) 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 any 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);

f) 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);

l) Marking method (see 12.1);

m) Special marking (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.

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 and 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 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 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.

8.6 •• Internal soundness

▌A1⟩
The products shall be sound and free from defects that preclude their intended use.

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.

For possible verification of internal soundness see 9.2.2. ⟨A1▐

9 Inspection

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 accordance with boxes C00 to C03 and C10 to C13.

d) Results of the impact test except for austenitic steels of EN 10028-7 in accordance with boxes C00 to C03 and C40 to C43.

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

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

1) 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 C00 to C03, C10 and C11;

4) the minimum reduction of area perpendicular to the product surface boxes in accordance with boxes C00 to C03, C10 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 C00 to C03 and C40 to C43;

7) impact properties of stainless steels at low temperature in accordance with boxes C00 to C03 and C40 to C43;

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

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 EN 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 0,2 % proof strength at elevated temperature (except for steels of EN 10028-4 and EN 10028-5);
- tensile test for (simultaneous) verification of one, all, or any combination of 0,2 % proof strength, 1,0 % 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 EN ISO 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 be taken at ¼ product 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 except in cases 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

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 EN 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 ≤ 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 > 30 mm for products in accordance with EN 10028-2 to -6 or > 10 mm for products in accordance with EN 10028-7. Test piece diameters shall be at least 10 mm for products in accordance with EN 10028-2 to -6 or at least 5 mm for products in accordance with EN 10028-7 respectively.

10.2.2.3 Test pieces for the impact test

Three transverse standard V-notched test pieces shall be prepared from the samples for the impact test, in accordance with EN 10045-1.

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

In the case of nominal product thicknesses (t) of 6 mm ≤ t ≤ 10 mm subsidiary size test pieces of widths of 7,5 mm or 5 mm shall be machined. Test pieces shall not be machined for product thicknesses < 6 mm.

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

11 Test methods

11.1 •• Chemical analysis

Unless otherwise agreed at the time of enquiry and order, 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 European Standards or EURONORMs.

11.2 Tensile test at room temperature

11.2.1 For the steels of EN 10028-2 to EN 10028-6 the tensile test at room temperature shall be carried out in accordance with 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 EN ISO 2566-1 for the steels of EN 10028-2 to EN 10028-6.

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

11.2.2 For the steels of EN 10028-7 the tensile test at room temperature shall be carried out in accordance with EN 10002-1 taking into account the additional or deviating conditions specified in Figure 3. For non-proportional test pieces, the elongation values shall be converted in accordance with EN ISO 2566-2. The tensile strength and elongation after fracture shall be determined and additionally

for ferritic, martensitic and austenitic-ferritic steels the 0,2 % proof strength and for austenitic steels the 0,2 % and 1,0 % proof strength.

In cases of dispute, and where permitted (see 10.2.2.2, third paragraph), the tensile test shall be carried out on round test pieces.

11.3 Tensile test at elevated temperature

The 0,2 % proof strength, the 1,0 % proof strength and the tensile strength at elevated temperature shall be determined in accordance with EN 10002-5. Verification if required, shall be obtained at one of the temperatures given in the relevant table of the individual parts of EN 10028.

•• This temperature should be agreed at the time of enquiry and order; otherwise the test shall be carried out at 300 °C except for austenitic-ferritic steels of EN 10028-7 for which the test shall be carried out at 250 °C.

11.4 Impact test

The impact test on V-notched test pieces shall be carried out in accordance with EN 10045-1. The specifications of the individual parts of EN 10028 shall apply.

•• Where minimum impact energy values are specified for several temperatures, verification of the impact energy, unless otherwise agreed, shall be carried out at the temperature for which the value of 27 J is specified.

Where the minimum impact energy value specified at the lowest temperature is higher than 27 J this higher value shall be verified.

The impact energy values apply to transverse test pieces for the steel grades specified in EN 10028-2, EN 10028-5 and EN 10028-6 and for longitudinal and/or transverse test pieces for the steel grades specified in EN 10028-3, EN 10028-4 and EN 10028-7.

Where subsidiary test pieces are used (see 10.2.2.3), the minimum impact energy values given in the specific parts of EN 10028 shall be reduced in proportion to the cross-sectional area of the test piece. For product thicknesses < 6 mm, the impact test shall not be carried out.

The minimum impact values given in the individual parts of EN 10028 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 sample and shall be tested. In order to regard the test unit as acceptable after testing the second set, the following requirements shall be met:

a) the mean value of six tests shall be greater than or equal to the specified minimum value;

b) not more than two of the six individual values shall be less than the specified minimum value;

c) not more than one of the six individual values shall be less than 70 % of the specified minimum value.

If these requirements are not met, the sample product shall be rejected and re-tests shall be carried out on the remainder of the test unit.

11.5 Other testing

11.5.1 The surface condition of the products shall be checked by visual examination without optical aids.

11.5.2 The dimensions of the products shall be checked.

11.5.3 If an ultrasonic test has been agreed for plate of thicknesses ≥ 6 mm for verification of internal soundness, the requirements of EN 10160 shall apply.

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.

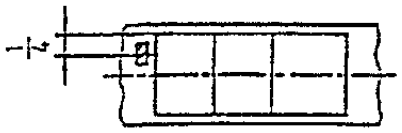
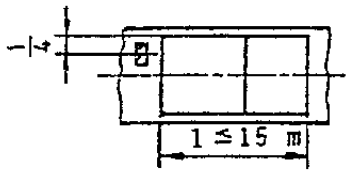
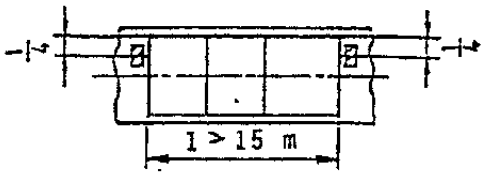
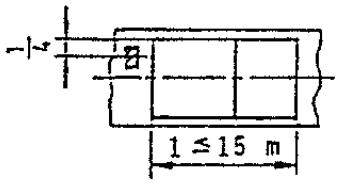
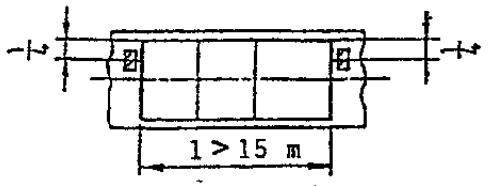
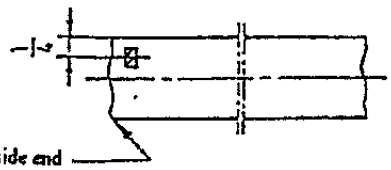
Plates and sheets shall be marked by low stress stamping or stencilling or ink marking.

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 storage 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.

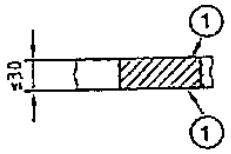
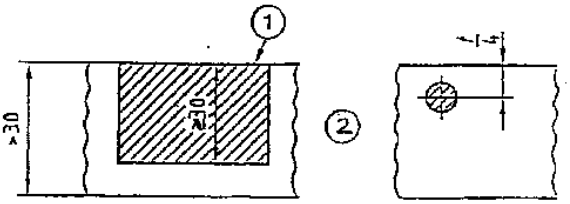
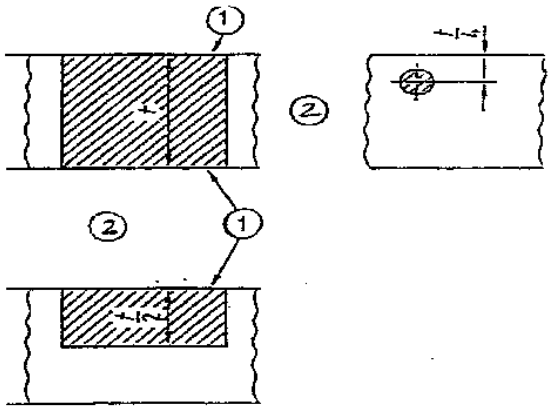
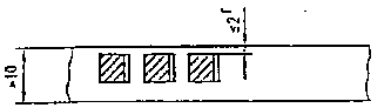
12.3 •• If any other marks are to be made, this shall be agreed upon at the time of enquiry and order.

Products	Steel grade	Sheet/ plate thickness mm	Product length supplied per rolled plate m	Position of samples (plan view) (▨)
Plate- sheet	Non-alloy steels	≤ 50	No limitation	
		> 50	≤ 15	
			> 15	[a] 
	Alloy steels	No limitation	≤ 15	
			> 15	[a] 
Strip	No distinction	No limitation	-	[b] 

[a] The samples may also be taken from the other side of the products.
[b] For the plate/sheet cut from strip, the strip remains the test unit as long as the plate/sheet is not quenched and tempered.

Figure 1 — Position from which the samples are taken

A1

Type of test piece	Product thickness t mm	Direction of the longitudinal axis of the test piece in relation to the principal direction of rolling	Distance of the test piece from the rolled surface mm
Tensile	≤ 30	Transverse	
	> 30		a 
			b 
Impact[c]	> 10[d]	Transverse[e]	

a For products in accordance with EN 10028-2 to EN 10028-4.
b For products in accordance with EN 10028-5 and EN 10028-6.
c The longitudinal axis of the notch shall always be perpendicular to the rolled surface of the product.
d For impact test pieces for plate thickness ≤ 10 mm, see 10.2.2.3.
e Unless longitudinal test pieces are agreed (see 10.2.2.3).
f In the case of product thicknesses > 40 mm, the impact test piece shall be taken at quarter of the product thickness.

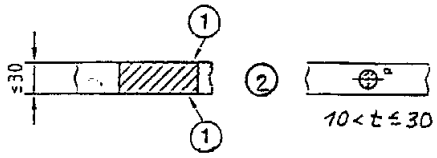
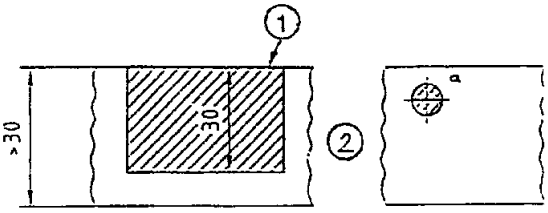
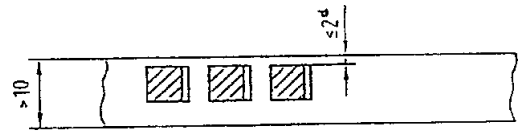
Key

1 Rolled surface
2 Alternatives

A1

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

A1

Type of test piece	Product thickness t mm	Direction of the longitudinal axis of the test piece in relation to the principal direction of rolling at a product width		Distance of the test piece from the rolled surface mm
		< 300 mm	≥ 300 mm	
Tensile [a]	≤ 30	Longitudinal	Transverse	
	> 30			
Impact [b]	> 10 [c]	Longitudinal	Transverse	 [d]

[a] In cases of doubt or dispute the gauge length shall be $L_o = 5{,}65\sqrt{S_o}$ for test pieces from products ≥ 3mm thickness.
For product thicknesses < 3 mm, 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 product thicknesses 3 mm ≤ t ≤ 10 mm flat proportional test pieces with two rolled surfaces and a maximum width of 30 mm shall be used. For product thicknesses > 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 must 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.

[b] The longitudinal axis of the notch shall always be perpendicular to the rolled surface of the product.

[c] For impact test pieces for plate thicknesses ≤ 10 mm, see 10.2.2.3.

[d] In the case of product thicknesses > 30 mm, the impact test piece may be taken at quarter of the product thickness.

Key

1 Rolled surface
2 Alternatives

A1

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

Table 1: Marking of the products

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

1) The symbols mean:

+ = the marking shall be applied;

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

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

3) 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.

4) This shall permit the traceability of the cast number.

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

Annex ZA
(informative)

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.

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