INTERNATIONAL STANDARD

ISO 9328-1

Third edition
2011-05-01

Steel flat products for pressure purposes — Technical delivery conditions —

Part 1: General requirements

Produits plats en acier pour service sous pression — Conditions techniques de livraison —

Partie 1: Exigences générales

Reference number
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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9328-1 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 10, *Steel for pressure purposes*.

This third edition cancels and replaces the second edition (ISO 9328-1:2003), which has been technically revised.

ISO 9328 consists of the following parts, under the general title *Steel flat products for pressure purposes — Technical delivery conditions*:

— *Part 1: General requirements*

— *Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

— *Part 3: Weldable fine grain steels, normalized*

— *Part 4: Nickel-alloy steels with specified low temperature properties*

— *Part 5: Weldable fine grain steels, thermomechanically rolled*

— *Part 6: Weldable fine grain steels, quenched and tempered*

— *Part 7: Stainless steels*

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

Steel flat products for pressure purposes — Technical delivery conditions —

Part 1: General requirements

1 Scope

This part of ISO 9328 specifies the general technical delivery conditions for steel flat products (plate/sheet and strip) used principally for the construction of pressure equipment.

The general technical delivery requirements in ISO 404 also apply to products supplied in accordance with this part of ISO 9328.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendment) applies.

EN 10204:2004, *Metallic products — Types of inspection documents*

ISO 148-1:2009, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 377:1997 *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404:1992, *Steel and steel products — General technical delivery requirements*

ISO 2566-1:1984, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*

ISO 2566-2:1984, *Steel — Conversion of elongation values — Part 2: Austenitic steels*

ISO 3651-2:1998, *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 4885:1996, *Ferrous products — Heat treatments — Vocabulary*

ISO 4948-1:1982, *Steels — Classification — Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition*

ISO 4948-2:1981, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics*

ISO/TS 4949, *Steel names based on letter symbols*

ISO 6892-1:2009, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6892-2:2011, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

ISO 6929:1987, *Steel products — Definitions and classification*

ISO 7452:2002, *Hot-rolled structural steel plates — Tolerances on dimensions and shape*

ISO 7778:1983, *Steel plate with specified through-thickness characteristics*

ISO 7788:1985, *Steel — Surface finish of hot-rolled plates and wide flats — Delivery requirements*

ISO 9034:1987, *Hot-rolled structural steel wide flats — Tolerances on dimensions and shape*

ISO 9328-2, *Steel flat products for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

ISO 9328-3, *Steel flat products for pressure purposes — Technical delivery conditions — Part 3: Weldable fine grain steels, normalized*

ISO 9328-4, *Steel flat products for pressure purposes — Technical delivery conditions — Part 4: Nickel-alloy steels with specified low temperature properties*

ISO 9328-5, *Steel flat products for pressure purposes — Technical delivery conditions — Part 5: Weldable fine grain steels, thermomechanically rolled*

ISO 9328-6, *Steel flat products for pressure purposes — Technical delivery conditions — Part 6: Weldable fine grain steels, quenched and tempered*

ISO 9328-7:2011, *Steel flat products for pressure purposes — Technical delivery conditions — Part 7: Stainless steels*

ISO 9444:2009 (all parts), *Continuously hot-rolled stainless steel — Tolerances on dimensions and form*

ISO 9445:2009 (all parts), *Continuously cold-rolled stainless steel — Tolerances on dimensions and form*

ISO 10474:1991, *Steel and steel products — Inspection documents*

ISO 14284:1996, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ISO 15510:2010, *Stainless steels — Chemical composition*

ISO 18286, *Hot-rolled stainless steel plates — Tolerances on dimensions and shape*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4885, ISO 4948-1, ISO 4948-2 and ISO 6929, as well as the following, apply.

In addition to the definitions for thermomechanical treatment and quenching and tempering in ISO 4885, the following should be noted.

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

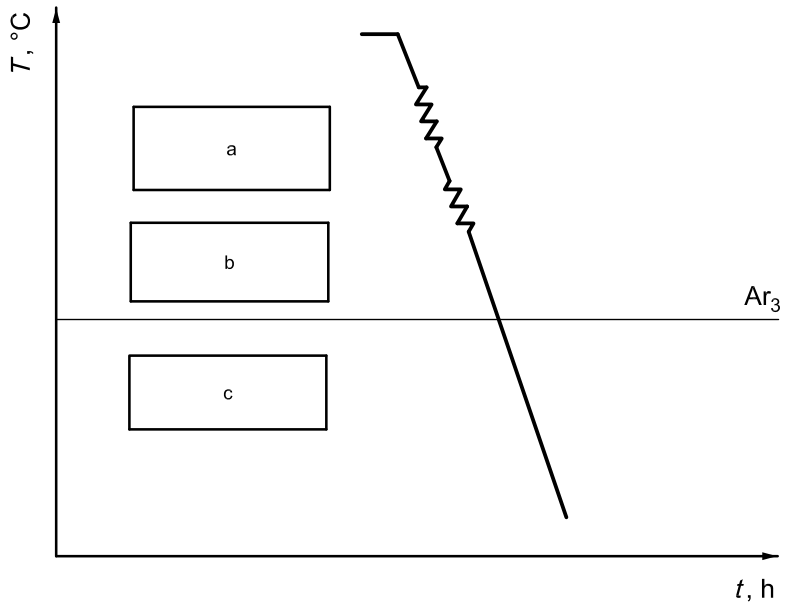
b) Quenching and tempering (symbol QT) also includes direct quenching plus tempering.

NOTE In international publications, for both normalizing and thermomechanical rolling, the expression “controlled rolling” can be found. However, in view of the different applications of the products, it is necessary to make a distinction between the terms.

3.1
nomalizing rolling
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

See Figure 1.

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



Key

T temperature, in degrees Celsius

t time, in hours

Ar_3 temperature at which ferrite starts to form on cooling

a Recrystallized austenite region.

b Non-recrystallized austenite region.

c Austenite plus ferrite region.

Figure 1 — Time-temperature scheme of normalizing rolling

3.2
purchaser
person or organization that orders products in accordance with this document

NOTE The purchaser is not necessarily, but may be, a manufacturer of pressure equipment.

4 Classification and designation

4.1 Classification

4.1.1 The classification of the steel grades in accordance with ISO 4948-1 and ISO 4948-2 is given in ISO 9328-2, ISO 9328-3, ISO 9328-4, ISO 9328-5, ISO 9328-6 and ISO 9328-7 depending on the steel grade's chemical composition and treatment condition.

4.1.2 Steels covered in ISO 9328-7 are additionally classified according to their structure into

— ferritic steels,

— martensitic steels,

— austenitic steels, and

— austenitic-ferritic steels.

For more details, see ISO 15510:2010.

4.2 Designation

The steel grades specified in the applicable part of ISO 9328 are designated with steel names in accordance with ISO/TS 4949.

5 Information to be supplied by the purchaser

5.1 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 International Standard specifying the tolerances on dimensions, shape and mass (see 6.7) and, if the relevant International 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 the applicable part of ISO 9328, i.e. ISO 9328-2, ISO 9328-3, ISO 9328-4, ISO 9328-5, ISO 9328-6 or ISO 9328-7;

f) the steel name;

g) the delivery condition, if it differs from the usual condition specified in the applicable part of ISO 9328; for stainless steels, the process route selected from the relevant table of ISO 9328-7;

h) whether impact testing is required, and the test direction, where applicable (see 6.4.3 and Table 1);

i) the type of inspection document to be issued (see 7.1).

5.2 Options

A number of options are specified in this part of ISO 9328 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 5.1).

a) specification of the steelmaking process (see 6.1.1);

b) mechanical properties after additional heat treatment (see 6.4.1);

c) specification of special classes for the reduction of area (see 6.4.2);

d) impact energy values and the relevant testing temperature (see 6.4.3);

e) surface conditions other than those specified in ISO 7788 (see 6.5);

f) verification of internal soundness (see 6.6);

g) one or several of the optional tests (see 7.2 and Table 1);

h) deviating frequency of testing (see 8.1.1 and 8.1.3);

i) deviating delivery condition (see 8.2.1.3);

j) permission to use circular test pieces for product thicknesses > 20 mm (see 8.2.2.2.3 and Table 3);

k) specification of an analytical method (see 9.1);

l) temperature of the tensile test at elevated temperature (see 9.3);

m) marking method (see 10.1);

n) special marking (see 10.2 and 10.3);

o) information to be given by marking (see Table 5).

6 Requirements

6.1 Steelmaking process

6.1.1 •• Unless a special steelmaking process has been agreed at the time of enquiry and order, the steelmaking process shall be left at the discretion of the manufacturer. If a special steelmaking process has been specified, this shall be reported in the inspection document.

6.1.2 Steels other than stainless steels shall be fully killed.

6.2 Delivery condition

See Clause 3 and 3.1 and the applicable part of ISO 9328.

6.3 Chemical composition

6.3.1 Cast (heat) analysis

The cast (heat) analysis reported by the steel producer shall apply and comply with the requirements of the applicable part of ISO 9328 and shall be included in the relevant inspection document.

6.3.2 Product analysis

The permissible product analysis tolerances on the limiting values given for the cast analysis are specified in the applicable part of ISO 9328.

6.4 Mechanical properties

6.4.1 •• The values given in the applicable part of ISO 9328 apply for test pieces taken and prepared in accordance with 8.2.2. The values relate to the nominal thicknesses (thicknesses on ordering) of the products and apply to the usual delivery conditions (see the applicable part of ISO 9328).

•• 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.

The minimum impact energy values, where specified in the relevant parts of ISO 9328, apply even if they are not to be verified in the case of product thicknesses < 6 mm (see 8.2.2.3).

6.4.2 •• 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 ISO 7778, characterized by minimum values for the reduction of area perpendicular to the product surface.

6.4.3 •• Impact energy values and the relevant testing temperature may be agreed when another testing temperature and/or another minimum impact energy value is/are required by the purchaser or when no impact energy values are specified.

6.5 Surface condition

For plates, the requirements of surface quality specified in ISO 7788 shall apply. Other surface condition standards may be used if agreed upon at the time of enquiry and order.

6.6 Internal soundness

•• Ultrasonic test requirements, together with the conditions of their verification (see Table 1 and 9.5.3), may be agreed at the time of enquiry and order.

6.7 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.

6.7.1 For hot-rolled (except stainless) flat products, see ISO 7452 for plates or ISO 9034 for wide flats. If agreed upon at the time of enquiry and order, EN 10029, ASTM A20/A20M, JIS G 3193, JIS G 3194 and other national standards may be used.

6.7.2 For stainless hot-rolled flat products, see ISO 9444 or ISO 18286.

6.7.3 For stainless cold-rolled sheet/plate and cut lengths, cold-rolled coil and slit coil, see ISO 9445.

NOTE ISO 9445 contains options providing a wider dimensional choice.

6.8 Calculation of mass

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 in ISO 9328-2 to ISO 9328-6. Calculations for density of stainless steels shall be based on density values given in ISO 9328-7:2011, Annex G.

7 Inspection

7.1 Types of inspection and inspection documents

Compliance with the requirements of the order shall be verified for products in accordance with the ISO 9328 series by specific inspection.

• The purchaser shall state the required inspection document, either 3.1.A, 3.1.B, 3.1.C or 3.2 in accordance with ISO 10474:1991, or 3.1 or 3.2 in accordance with EN 10204:2004.

If an inspection document 3.1/3.1.A, 3.1.C or 3.2 is ordered, the purchaser shall notify the manufacturer of the name and 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 upon.

7.2 Tests to be carried out

The mandatory and optional tests to be carried out and the extent of testing are specified in Table 1.

Table 1 — Summary of tests and extent of testing

Type of inspection and test			Extent of testing	Refer to
Mandatory tests	Cast (heat) analysis		1 per cast	6.3.1
	Tensile test at room temperature		1 per test unit	8.1.2, 8.2.1, 8.2.2.2 and 9.2
	Impact test (except for austenitic steels of ISO 9328-7)		1 per test unit	8.1.2, 8.2.1, 8.2.2.3 and 9.4
	Dimensional inspection		each product	9.5.1
	Visual inspection		each product	9.5.2
Optional tests	Product analysis		1 per cast	8.1.1 and 9.1
	Tensile test at elevated temperature for verification of $R_{p0,2}$	for steels of ISO 9328-2, ISO 9328-3 and ISO 9328-6	1 per cast	8.1.3, 8.2.1, 8.2.2.2 and 9.3
		for steels of ISO 9328-7 (except austenitic steels)	a	
	Tensile test for (simultaneous) verification of one, all, or any combination of $R_{p0,2}$ and $R_{p1,0}$ and R_m at elevated temperature for austenitic steels of ISO 9328-7		a	
	Tensile test perpendicular to the product surface for verification of corresponding minimum reduction of area (except for steels of ISO 9328-7)		1 per test unit	6.4.2 and 8.2.1.2
	Impact test for austenitic steels of ISO 9328-7 at room temperature		a	8.1.2, 8.2.1, 8.2.2.3 and 9.4
	Impact test for steels of ISO 9328-7 (except ferritic steels) at low temperature		a	
	Ultrasonic test for verification of internal soundness		each product	6.6 and 9.5.3
	Test for resistance to intergranular corrosion for steels of ISO 9328-7		a	9.5.4

$R_{p0,2}$: 0,2 % proof strength.

$R_{p1,0}$: 1,0 % proof strength.

R_m: tensile strength.

[a] See ISO 9328-7.

7.3 Retests

See ISO 404.

8 Sampling

8.1 Frequency of testing

8.1.1 •• For the product analysis, unless otherwise agreed, one test piece per cast (heat) shall be taken for determining the elements indicated with numerical values for the particular steel grade in the applicable part of ISO 9328.

8.1.2 The test unit for products in accordance with ISO 9328-2 to ISO 9328-6 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 applicable batch heat treated in the same condition shall be regarded as a test unit. One sample shall be taken from each test unit for preparing the test pieces indicated in 8.2.2.

For stainless steels, see ISO 9328-7.

8.1.3 •• For tensile tests at elevated temperature, unless otherwise agreed, the test unit shall be the cast (heat).

8.2 Selection and preparation of samples and test pieces

8.2.1 Sampling and sample preparation

8.2.1.1 Sampling and sample preparation shall be in accordance with the requirements of ISO 377 and ISO 14284. In addition, the requirements in 8.2.1.2 and, if applicable, 8.2.1.3 shall apply for sampling and sample preparation for the mechanical tests.

8.2.1.2 The samples shall be taken as near as practical to a point at quarter width (see Table 2) 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.

If samples have to be taken from the mid-width position in accordance with the requirements for through-thickness testing as specified in ISO 7778, the samples to be taken as specified in this subclause may also be taken from there, except in cases of arbitration.

8.2.1.3 •• 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 according to the usual delivery condition prior to the test.

8.2.2 Preparation of test pieces

8.2.2.1 General

The test pieces shall be prepared in accordance with Table 3 (products in accordance with ISO 9328-2 to ISO 9328-6) or Table 4 (products in accordance with ISO 9328-7).

8.2.2.2 Test pieces for the tensile test

8.2.2.2.1 One test piece from each test unit shall be prepared in accordance with ISO 6892-1 for the tensile test and this shall be a rectangular test piece, unless a circular test piece may be used (see 8.2.2.2.3).

8.2.2.2.2 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 $\leqslant$25 mm for products in accordance with ISO 9328-2 to ISO 9328-6 or $\leqslant$10 mm in the case of products in accordance with ISO 9328-7. Additionally, rectangular test pieces for products in accordance with ISO 9328-5 and ISO 9328-6 shall represent either the full product thickness or half of the product thickness, retaining one rolled surface.

8.2.2.2.3 •• Circular test pieces are permissible but shall only be provided for product thicknesses $>$25 mm ($>$20 mm if so agreed at the time of enquiry and order) for products in accordance with ISO 9328-2 to ISO 9328-6 or $>$10 mm for products in accordance with ISO 9328-7. Test piece diameters shall be at least 10 mm for products in accordance with ISO 9328-2 to ISO 9328-6 or at least 5 mm for products in accordance with ISO 9328-7.

8.2.2.3 Test pieces for the impact test

Standard V-notched test pieces shall be prepared from the samples for the impact test, in accordance with ISO 148-1.

In the case of nominal product thicknesses t, of 6 mm $\leqslant t \leqslant$11 mm, one of the following alternatives for the test piece width shall be used, at the discretion of the manufacturer:

a) 10 mm;

b) largest obtainable width between 5 mm and 10 mm;

c) 7,5 mm or 5 mm.

Test pieces shall not be machined for product thicknesses $<$6 mm.

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

9 Test methods

9.1 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 International Standards.

9.2 Tensile test at room temperature

9.2.1 For the steels of ISO 9328-2 to ISO 9328-6, the tensile test at room temperature shall be carried out in accordance with ISO 6892-1, generally using a proportional test piece of gauge length $L_0 = 5{,}65\sqrt{S_0}$ (S_0 is the original 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 for the steels of ISO 9328-2 to ISO 9328-6.

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, $R_{p0,2}$.

9.2.2 For the steels of ISO 9328-7, the tensile test at room temperature shall be carried out in accordance with ISO 6892-1, taking into account the additional or deviating conditions specified in Table 4. For

proportional test pieces, the gauge lengths specified in 9.2.1 shall be used. For non-proportional test pieces, the elongation values shall be converted in accordance with 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 8.2.2.2.3), the tensile test shall be carried out on circular test pieces.

9.3 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 ISO 6892-2. Verification, if required, shall be obtained at one of the temperatures given in the relevant table(s) of the applicable part of ISO 9328.

•• This temperature shall be agreed at the time of enquiry and order.

Unless a test temperature for which a value is specified for the relevant product has been agreed at the time of enquiry and order, the test shall be carried out at 300 °C, except for austenitic-ferritic steels of ISO 9328-7 for which the test shall be carried out at 250 °C.

9.4 Impact test

The impact test on V-notched test pieces shall be carried out in accordance with ISO 148-1. The specifications of the applicable part of ISO 9328 shall apply.

The specified impact energy values shall be verified for the test direction specified in the applicable part of ISO 9328.

Where minimum impact energy values are specified for several temperatures, verification of the impact energy 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.

Where subsidiary test pieces are used (see 8.2.2.3), the minimum impact energy values given in the applicable part of ISO 9328 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 applicable part of ISO 9328 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 retests shall be carried out on the remainder of the test unit.

9.5 Other testing

9.5.1 The dimensions of the products shall be checked in accordance with 6.7

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

9.5.3 If an ultrasonic test has been agreed for plate of thicknesses $\geqslant$6 mm for verification of internal soundness, the requirements shall also be agreed.

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

9.5.5 The manufacturer shall take suitable measures to prevent materials becoming mixed up and to ensure traceability.

10 Marking

10.1 The products shall be marked with the information given in Table 5.

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

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

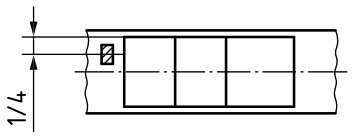
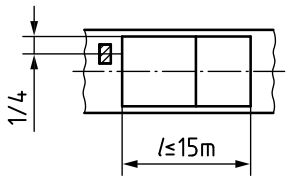
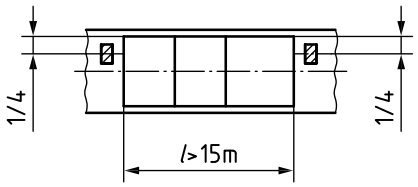
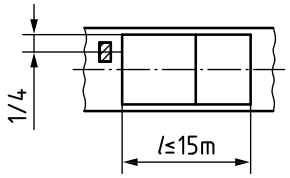
Sheets in bundles and strip in coil shall be marked on a label securely attached. If requested, this may also be applied to ground or polished plates.

For products in accordance with ISO 9328-7, the quality of marking shall be such that it is 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.

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

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

Table 2 — Position from which the samples are taken

<table>
<tr><th>Products</th><th>Steel grade</th><th>Sheet/plate thickness
mm</th><th>Product length supplied per rolled plate
m</th><th>Position of samples (plan view)
(▨)</th></tr>
<tr><td rowspan="4">Plate/sheet</td><td rowspan="2">Non-alloy steels</td><td>⩽50</td><td>No limitation</td><td>  </td></tr>
<tr><td rowspan="2">>50</td><td>⩽15</td><td>  </td></tr>
<tr><td>>15</td><td>a
  </td></tr>
<tr><td rowspan="2">Alloy steels</td><td rowspan="2">No limitation</td><td>⩽15</td><td>  </td></tr>
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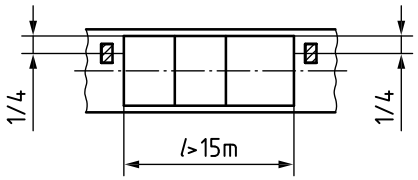
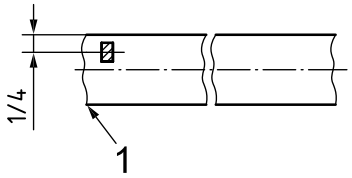
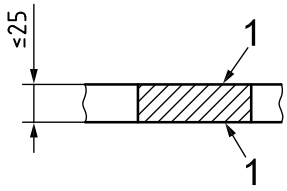
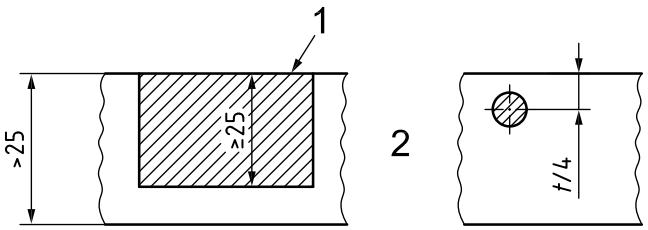
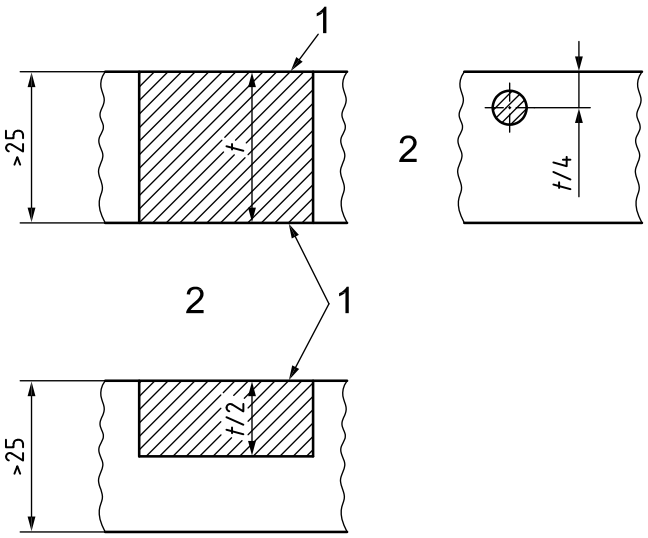
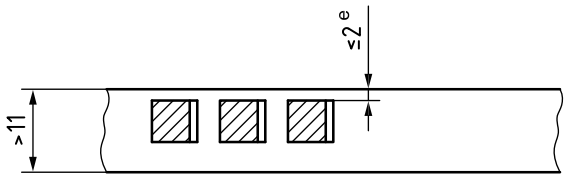
  </td></tr>
<tr><td>Strip</td><td>No distinction</td><td>No limitation</td><td></td><td>b
 
Key
1 outside end</td></tr>
</table>

[a] The samples may also be taken from the other side of the product. Only one sample is necessary if the product was continuously cast and if this is mentioned in the inspection document.

[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.

Table 3 — Position of test pieces for products in accordance with ISO 9328-2 to ISO 9328-6

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	⩽25	Transverse	
	>25		a  b 
Impact[c]	>11[d]	Transverse or longitudinal	

Key

1 rolled surface

2 alternative sampling

[a] For products in accordance with ISO 9328-2 to ISO 9328-4.

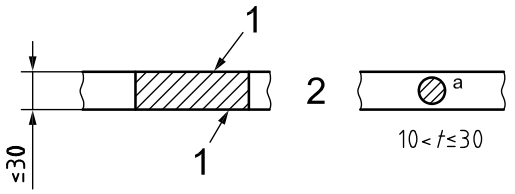
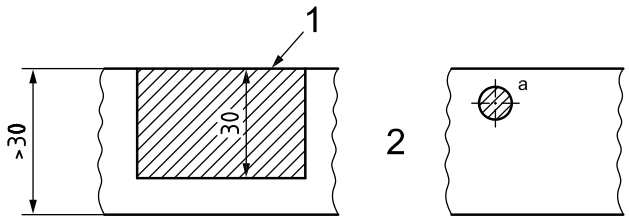
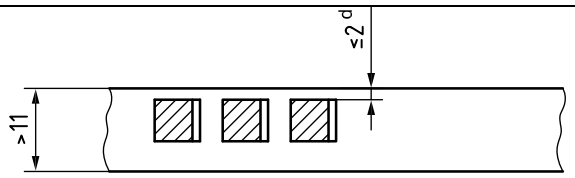
[b] For products in accordance with ISO 9328-5 and ISO 9328-6.

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

[d] For impact test pieces for $t \leqslant 11$ mm, see 8.2.2.3.

[e] In the case of $t > 25$ mm, the impact test piece shall be taken at a quarter of the product thickness.

Table 4 — Position of test pieces for products in accordance with ISO 9328-7

Type of test piece	Product thickness t	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	mm
Tensile[a]	⩽30	Longitudinal	Transverse	
	>30			
Impact[b]	>11[c]	Longitudinal	Transverse or longitudinal	

Key

1 rolled surface

2 alternative sampling

[a] In cases of doubt or dispute, the gauge length shall be $L_0 = 5{,}65\sqrt{S_0}$ for test pieces from products ⩾3 mm thick. For t <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 t >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 shall be preserved;
- or a circular test piece with a diameter ⩾5 mm, the axis of which shall be located as near as possible to a plane in the outer third of half of 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 product thicknesses ⩽11 mm, see 8.2.2.3.

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

Table 5 — Marking of the products

Marking	Symbol[a]
Manufacturer's name, trade mark or logo	+
The number of this International Standard	(+)
Steel name	+
Type of finish	(+)
Identification number[b]	+[d]
Direction of rolling[c]	(+)
Nominal thickness	(+)
Nominal dimensions other than thickness	(+)
Inspector's mark	+[e]
Purchaser's order No.	(+)

[a] The symbols mean:

+ the marking shall be applied;

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

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

[c] 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.

[d] This shall permit the traceability of the cast number.

[e] The inspector's mark may be omitted if the relevant inspector can be identified in another way.

Bibliography

[1] EN 10029, *Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

[2] ASTM A20/A20M, *Standard Specification for General Requirements for Steel Plates for Pressure Vessels*

[3] JIS G 3193, *Dimensions, mass and permissible variations of hot rolled steel plates, sheets and strips*

[4] JIS G 3194, *Dimensions, mass and permissible variations of hot rolled flat steel*

ICS 77.140.30; 77.140.50

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