INTERNATIONAL STANDARD

ISO 16143-1

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Stainless steels for general purposes —

Part 1: Flat products

Aciers inoxydables pour usage général —

Partie 1: Produits plats

Reference number
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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 16143-1 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

ISO 16143 consists of the following parts, under the general title *Stainless steels for general purposes*:

— *Part 1: Flat products*

— *Part 2: Semi-finished products, bars, rods and sections*

— *Part 3: Wire*

Stainless steels for general purposes —

Part 1:
Flat products

1 Scope

This part of ISO 16143 specifies the technical delivery conditions for hot- or cold-rolled sheet/plate and strip for general purposes made of the most important corrosion-resistant stainless steel grades.

NOTE In the text, under the term “general purposes”, purposes other than the special purposes mentioned in the bibliographic references [1] — [4] are understood.

In addition to this part of ISO 16143, the general technical delivery requirements of ISO 404 are applicable.

This part of ISO 16143 does not apply to components manufactured by further processing of the product forms listed in paragraph 1 where quality characteristics are altered as a result of such processing.

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 amendments) applies.

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 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/TS 4949:2003, *Steel names based on letter symbols*

ISO 6506-1:1999, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1:1997, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1:1999, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6892:1998, *Metallic materials — Tensile testing at ambient temperature*

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

ISO 9444:2002, *Continuously hot-rolled stainless steel strip, plate/sheet and cut lengths — Tolerances on dimensions and form*

ISO 9445:2002, *Continuously cold-rolled stainless steel narrow strip, wide strip, plate/sheet and cut lengths — Tolerances on dimensions and form*

ISO/TR 9769:1991, *Steel and iron — Review of available methods of analysis*

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/TS 15510:2003, *Stainless steels — Chemical composition*

ISO 18286:2004, *Hot-rolled stainless steel plates — Tolerances on dimensions and shape*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
corrosion-resistant stainless steels
steels, with at least 10,5 % (mass fraction) Cr and a maximum of 1,2 % (mass fraction) C, for which resistance to corrosion is of primary importance

3.2
product forms
See ISO 6929

4 Designation

The steel names given in Tables 1, 4, 5, 6, 7 and 8 are allocated in accordance with ISO/TS 4949.

5 Information to be supplied by the purchaser

It shall be the responsibility of the purchaser to specify all requirements that are necessary for products covered by this specification. Such requirements to be considered include, but are not limited to, the following:

a) the desired quantity;

b) the product form (strip or sheet/plate);

c) the number of the appropriate dimensional standard (see ISO 9444, ISO 9445 and ISO 18286), the nominal dimensions, plus any choice of requirements;

d) the type of material (steel);

e) the number of this International Standard, i.e. ISO 16143-1;

f) the steel name;

g) if, for the relevant steel in Tables 4 to 8, more than one treatment condition is covered, the symbol for the desired heat treatment;

h) the desired process route (see Table 3);

i) if an inspection document is required, its designation in accordance with ISO 10474.

EXAMPLE 5 t of cold-rolled narrow strip in accordance with ISO 9445 with a specified thickness of 0,25 mm, precision thickness tolerance (P), with a specified width of 250 mm, precision tolerance on width (P) and with restricted tolerances on edge camber (R) made of steel grade X5CrNi18-9 as specified in ISO 16143-1, in process route 2D and inspection certificate 3.1.B as specified in ISO 10474 is designated as follows:

5 t cold-rolled narrow strip ISO 9445 — 0,25P × 250P — R
Steel ISO 16143-1-X5CrNi18-9 + 2D
3.1 B

6 Classification of grades

Corrosion-resistant stainless steels covered in this part of ISO 16143 are classified according to their structure into:

— austenitic steels;

— austenitic-ferritic steels;

— ferritic steels;

— martensitic steels;

— precipitation-hardening steels.

7 Requirements

7.1 Manufacturing process

Unless a special steelmaking process is agreed upon at the time of ordering, the steelmaking process shall be at the discretion of the manufacturer. When he so requests, the purchaser shall be informed what steelmaking process is being used.

7.2 Delivery condition

The products shall be supplied in the delivery condition agreed upon in the order, by reference to the process route given in Table 3 and, where different alternatives exist, to the treatment conditions given in Tables 4 to 8 (also see Annex A).

7.3 Chemical composition

7.3.1 The chemical composition requirements given in Table 1 apply with respect to the chemical composition of the cast analysis.

7.3.2 The product analysis may deviate from the limiting values for the cast analysis given in Table 1 by the values listed in Table 2.

7.4 Susceptibility to intergranular corrosion

Referring to resistance to intergranular corrosion as defined in ISO 3651-2, for ferritic, austenitic and austenitic-ferritic steels the specification in Tables 4, 5 and 6 apply.

NOTE The susceptibility of stainless steels to intergranular corrosion is dependent on the type of environment and therefore cannot always be clearly ascertained through standard laboratory tests. The selection of the test or tests to be agreed upon should be based on experience with the use of the selected grade of steel in the intended environment.

7.5 Mechanical properties

The mechanical properties at room temperature as specified in Tables 4 to 8 apply for the relevant specified heat-treatment condition. This does not apply to the process route 1U (hot rolled, not heat-treated, not descaled). If, by agreement at the time of ordering, the products are to be supplied in a non-heat-treated condition, the mechanical properties specified in Tables 4 to 8 shall be obtainable from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

NOTE Austenitic steels are insensitive to brittle fracture in the solution-annealed condition. Because they do not have a pronounced transition temperature, which is characteristic of other steels, they are also useful for application at cryogenic temperatures.

7.6 Surface quality

The general surface appearance with respect to soundness and surface finish shall be consistent with good production practice, for the grade and quality ordered, as determined by visual inspection. When products are delivered in coil form, the degree and extent of imperfections may be expected to be greater, due to the impracticability of removing short lengths of coil.

Where necessary, precise requirements on surface quality may be agreed upon at the time of enquiry and order.

7.7 Internal soundness

For the internal soundness, where appropriate, requirements together with the conditions for their verification may be agreed upon at the time of enquiry and order.

7.8 Dimensions, tolerances on dimensions and shape

The dimensions and the tolerances on dimensions and shape are to be agreed upon at the time of enquiry and order, as far as possible with reference to the dimensional standards ISO 9444, ISO 9445 and ISO 18286.

7.9 Calculation of mass and tolerance of mass

7.9.1 The density values of the relevant grades for calculating the nominal mass of the products shall be taken from Annex B of ISO/TS 15510:2003.

7.9.2 If the tolerances on mass are not specified in the dimensional standards mentioned in 7.8, they may be agreed upon at the time of enquiry and order.

8 Inspection, testing and conformance of products

8.1 General

The manufacturer shall carry out appropriate process control, inspection and testing to assure himself that the delivery complies with the requirements of the order.

This includes the following:

— a suitable frequency of verification of the dimensions of the products;

— an adequate intensity of visual examination of the surface quality of the products;

— an appropriate frequency and type of test to ensure that the correct grade of steel is delivered.

The nature and frequency of these verifications, examinations and tests are determined by the manufacturer, based on the degree of consistency that has been determined by the evidence of his quality system. In view of this, verifications by specific tests for these requirements are not necessary, unless otherwise agreed.

8.2 Inspection and testing procedures and types of inspection document

8.2.1 For each delivery, the issue of any inspection document in accordance with ISO 10474 may be agreed upon at the time of enquiry and order.

8.2.2 If, in accordance with the agreements made at the time of enquiry and order, a test report is to be provided, this shall cover:

a) the statement that the material complies with the requirements of the order;

b) the results of the cast analysis for all elements specified for the type of steel supplied.

8.2.3 If, in accordance with the agreements in the order, an inspection certificate 3.1.A, 3.1.B or 3.1.C or an inspection report 3.2 of ISO 10474:1991 is to be provided, the specific inspections and tests described in 8.3 shall be carried out and their results shall be certified in the document.

In addition to 8.2.2 a) and b) the document shall cover

a) the results of the mandatory tests marked in the second column of Table 9 by an “m”;

b) the results of any optional test or inspection agreed when ordering, marked in the second column of Table 9 by an “o”.

8.3 Specific inspection and testing

8.3.1 Extent of testing

The tests to be carried out, either mandatorily (m) or by agreement (o), the composition and size of the test units, and the number of sample products, samples and test pieces to be taken are given in Table 9.

8.3.2 Selection and preparation of samples and test pieces

8.3.2.1 The general conditions for selection and preparation of samples and test pieces shall be in accordance with ISO 377 and ISO 14284.

8.3.2.2 The test samples for the tensile test shall be taken in accordance with Figure 1 in such a way that they are located halfway between the centre and a longitudinal edge.

The samples shall be taken from products in the delivery condition. If agreed, the samples may be taken before flattening. For samples to be given a simulated heat treatment, the conditions for annealing shall be agreed.

8.3.2.3 Samples for the hardness test and for the resistance to intergranular corrosion test, where requested, shall be taken from the same locations as those for the mechanical tests. For direction of bending the test piece in the resistance to intergranular corrosion test, see Figure 2.

8.4 Test methods

8.4.1 Unless otherwise agreed upon when ordering, the choice of a suitable physical or chemical method of analysis to determine the product analysis is at the discretion of the manufacturer. In cases of dispute, the analysis shall be carried out by a laboratory approved by the two parties. In these cases, the reference method of analysis shall be agreed upon, where possible, with reference to ISO/TR 9769.

8.4.2 The tensile test at room temperature shall be carried out in accordance with ISO 6892 taking into account the additional or deviating conditions specified in footnote [a] of Figure 1.

Unless otherwise agreed upon, the tensile strength and elongation after fracture shall be determined and, additionally, for ferritic and austenitic-ferritic steels, the 0,2 % proof strength, and for austenitic steels, the 0,2 % and 1 % proof strengths shall be determined.

8.4.3 The Brinell hardness test shall be carried out in accordance with ISO 6506-1. The Vickers hardness test shall be carried out in accordance with ISO 6507-1. The Rockwell hardness test shall be carried out in accordance with ISO 6508-1.

8.4.4 The resistance to intergranular corrosion shall be tested in accordance with ISO 3651-2, unless otherwise agreed upon.

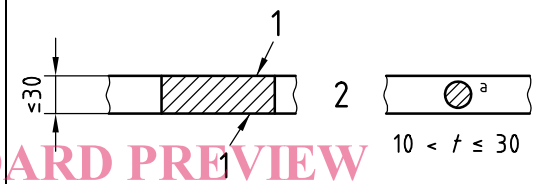
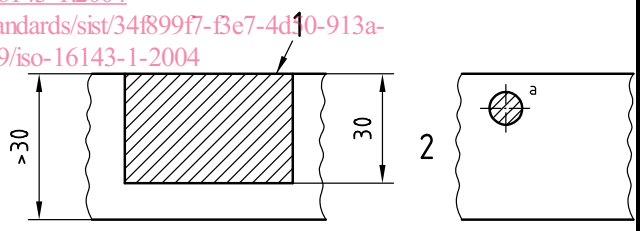
8.4.5 Dimensions and dimensional tolerances of the products shall be verified in accordance with the requirements of the relevant dimensional standards (see 7.8).

8.5 Retests

See ISO 404.

9 Marking

The products shall be marked with the manufacturer's symbol, the steel grade, and, if so agreed upon when ordering, with the cast number. When specific inspection is carried out, the products are to be provided additionally with an identification number which enables the test pieces to be related to the cast and product from which they stem.

Type of test piece	Product thickness	Direction of the longitudinal axis of the test piece in relation to the principal direction of rolling at a product width of		Distance of the test piece from the rolled surface
	mm	< 300 mm	⩾ 300 mm	mm
Tensile [a]	⩽ 30	Longitudinal	Transverse	 **Key** 1 rolled surface 2 flat or round test piece may be used
	> 30			 **Key** 1 rolled surface 2 flat or round test piece may be used

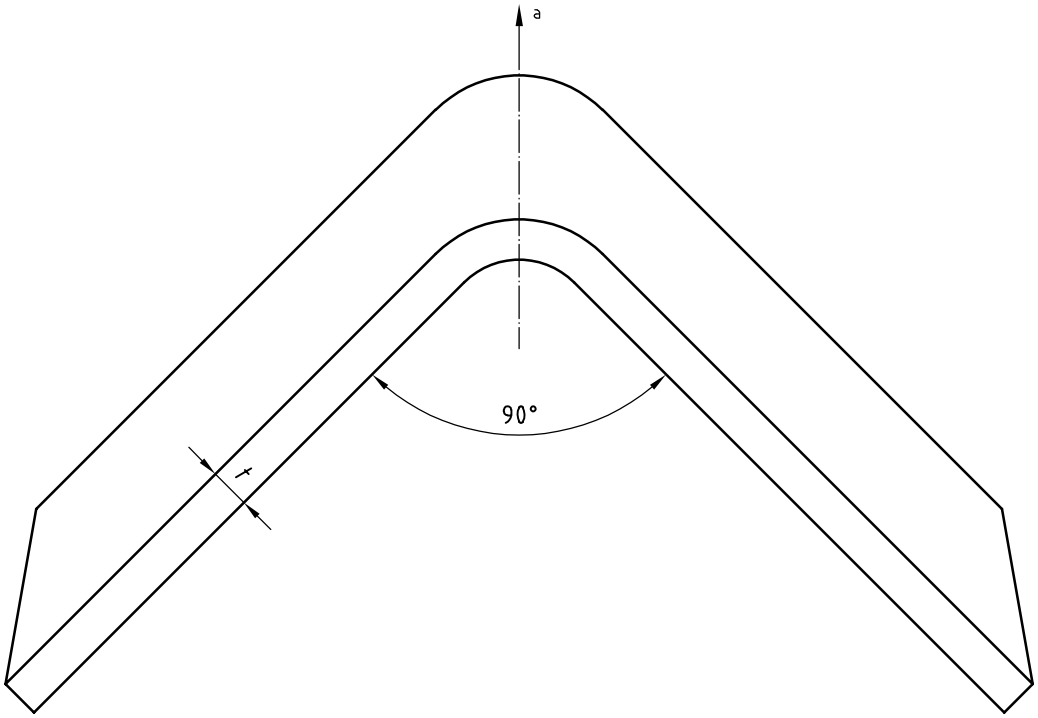
[a] In cases of doubt or dispute, the gauge length shall be $L_o = 5,65\sqrt{S_o}$ for test pieces from products ⩾ 3 mm.

For products < 3 mm in 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 mm to 10 mm, flat proportional test pieces with two rolled surfaces and a maximum width of 30 mm shall be used. For products with 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 shall be preserved;

— or a round 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 the product thickness.

Figure 1 — Position of test pieces for flat products



a Rolling direction.

Figure 2 — Direction of bending the test piece in relation to the rolling direction in the resistance to intergranular corrosion test.