
**Stainless steels for general purposes —
Part 2:
Semi-finished products, bars, rods and
sections**

*Aciers inoxydables pour usage général —
Partie 2: Demi-produits, barres, fils machine et profils*
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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 16143-2 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*

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Stainless steels for general purposes —

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

1 Scope

This part of ISO 16143 specifies the technical delivery conditions for semi-finished products, hot or cold formed bars, rods and sections for general purposes made of the most important corrosion-resistant stainless steel grades.

NOTE Throughout this part of ISO 16143, the term “general purposes” means purposes other than the special purposes mentioned in the Bibliography.

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 the product forms listed in the first paragraph above with quality characteristics altered as a result of such further processing.

2 Normative references

[ISO 16143-2:2004](https://standards.iteh.ai/catalog/standards/sist/3a027d2b-75c9-4a75-b495-84e1245e786e/iso-16143-2:2004)

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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, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

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

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

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

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

ISO 6929, *Steel products — Definitions and classification*

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

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

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

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, Tables B.1 to B.5 and Table C.1 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 under this specification. Such requirements to be considered include, in the order listed but not limited to, the following:

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- a) the desired quantity;
 - b) the product form (e.g., square bar or round rod);
 - c) the number of the appropriate dimensional standard (see Annex A), the nominal dimensions, plus any choice of requirements;
 - d) the type of material (steel);
 - e) the number of this International Standard, i.e. ISO 16143-2;
 - f) the steel name;
 - g) if, for the relevant steel in the Tables 4 to 8 for the mechanical properties, more than one treatment condition is covered, the symbol for the desired heat treatment;
 - h) the desired process route (see symbols in Table 3);
 - i) if an inspection document is required, its designation in accordance with ISO 10474.

EXAMPLE 10 t round bar of a steel grade with the name X5CrNi18-9 as specified in ISO 16143-2 of 50 mm diameter with dimensional tolerances as specified in ISO 1035-4, in process route 3D, inspection certificate 3.1.B as specified in ISO 10474 is designated as follows:

10 t round bar ISO 1035-4-50
Steel ISO 16143-2 - X5CrNi18-9 + 3D
3.1.B

6 Classification of grades

Corrosion resistant stainless steels covered by 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 when 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 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 (see also Annex B).

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7.3 Chemical composition

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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 austenitic, austenitic-ferritic and ferritic steels the specifications in Tables 4 to 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 process route 3U (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 that 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.

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

7.7 Internal soundness

For internal soundness, where appropriate, any 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 listed in Annex A.

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 upon.

8.2 Inspection and testing procedures and types of inspection documents

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) a 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 (see 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 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 inspections agreed upon 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) and 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.

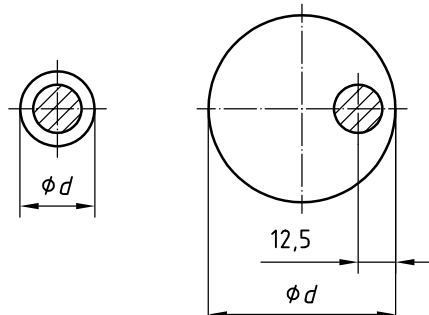
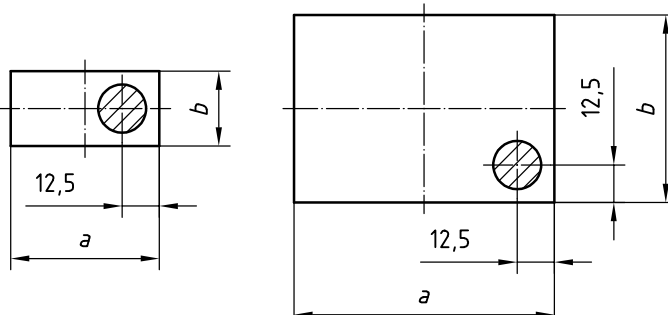
8.3.2.2 The samples for the tensile test shall be taken in accordance with Figures 1 and 2.

The samples shall be taken from products in the as-delivered condition. If agreed, samples from bars may be taken before straightening. For martensitic and precipitation-hardened grades being delivered in the annealed condition, a test to demonstrate the capability of further treatment to one of the specified conditions shall be conducted by the manufacturer on a sample taken from the product in the as-delivered condition and further treated in accordance with a listed production route. Unless specified in the order, that final condition and details of conditions of further treatment shall be at the option of the manufacturer.

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.

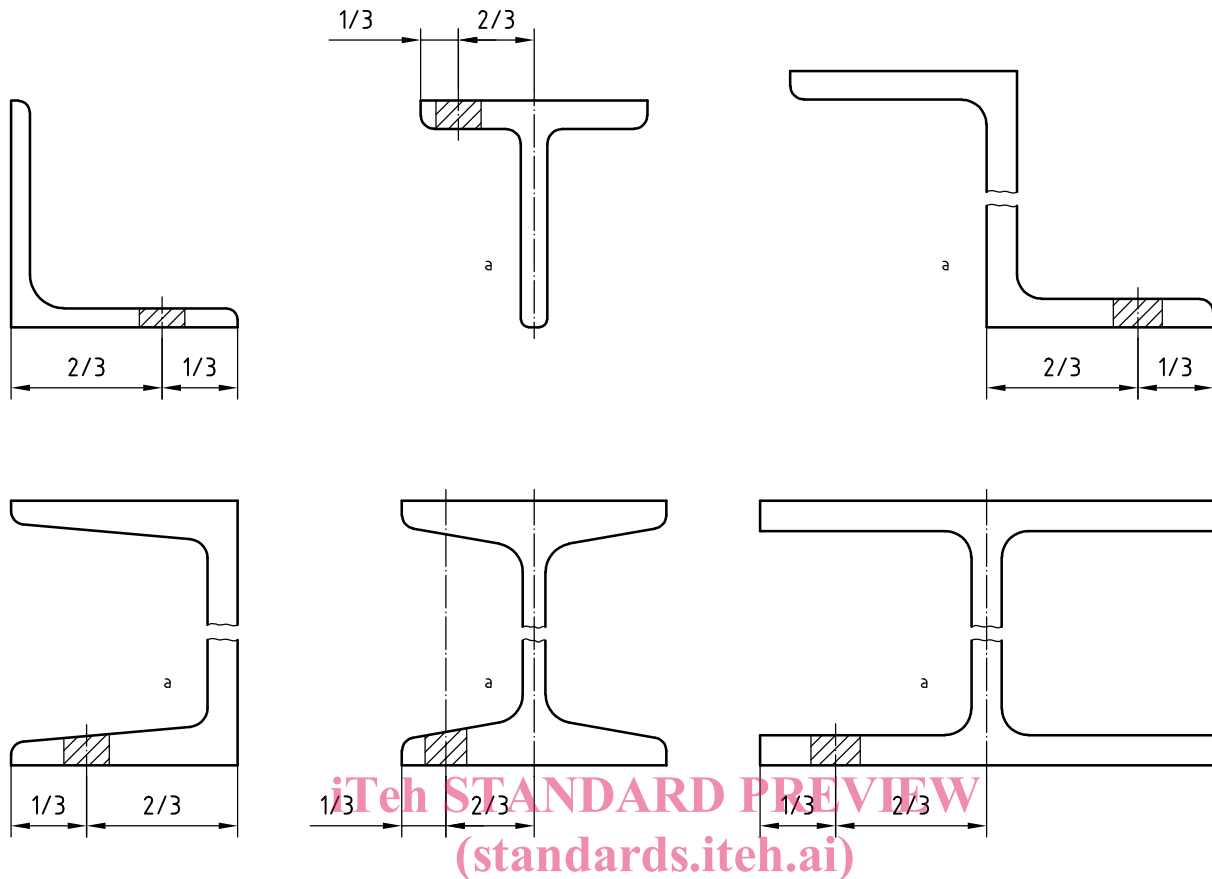
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Dimensions in millimeters

Type of test	Round cross-section products	Rectangular cross-section products
Tensile	$d \leq 25^a$ $25 < d \leq 160$ 	$b \leq 25$ $25 < b \leq 160$ $a \geq b$ $a \geq b$ 

^a Samples of product may alternatively be tested unmachined.

Figure 1 — Position of test pieces for steel bars and rods ≤ 160 mm diameter or thickness (longitudinal test pieces)



^a By agreement, the sample can be taken from the web, at a quarter of the total height.

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Figure 2 — Position of test pieces (hatched) for beams, channels, angles, T sections and Z sections

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8.4 Test methods

8.4.1 Unless otherwise agreed 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.

Unless otherwise agreed, the tensile strength and elongation after fracture shall be determined and, in addition, for ferritic, martensitic, precipitation-hardening, austenitic free-cutting and austenitic-ferritic steels, the 0,2 % proof strength, and for austenitic steels, the 0,2 % and 1 % proof strength.

For bars made of resulfurized grades it may be agreed upon to determine the hardness instead.

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

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

8.4.5 Dimensions and dimensional tolerances of the products shall be tested in accordance with the requirements of the relevant dimensional standards given in Annex A.

8.5 Retests

See ISO 404.

9 Marking

9.1 Marking shall be durable. If the marking is to be applied by inking or adhesive label, the inks or adhesives shall be especially selected, in order to avoid corrosion of the product.

9.2 Unless otherwise agreed, the requirements listed in Table 10 apply.

9.3 Unless otherwise agreed, the products shall be marked as follows:

- semifinished products, bars and sections by means of labels attached to the bundle or, by agreement at the time of enquiry and order, by inking, adhesive labels, electrolytic etching or stamping;
- rods by means of a label attached to the coil.

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Table 1 — Chemical composition (cast analysis)

Designation	Line No. of ISO/TS 15510:2003	% (mass fraction)									
Name		C	Si	Mn	P max.	S	N	Cr	Mo	Ni	Others
Austenitic steels											
X2CrNi18-9	1	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	17,5 to 19,5	—	8,0 to 10,0 (10,5) ^a	—
X2CrNi19-11	2	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	18,0 to 20,0	—	10,0 to 12,0 (13,0) ^a	—
X2CrNiN18-9	3	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,030	0,12 to 0,22	17,5 to 19,5	—	8,0 to 10,0	—
X5CrNi18-9	6	max. 0,07	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	17,5 to 19,5	—	8,0 to 10,5	—
X6CrNi18-12	8	max. 0,08	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	17,0 to 19,0	—	10,5 to 13,0	—
X5CrNiN19-9	10	max. 0,07	max. 1,00	max. 2,50	0,045	max. 0,030	0,10 to 0,16	18,0 to 20,0	—	8,0 to 11,0	—
X10CrNi18-8	11	0,05 to 0,15	max. 2,00	max. 2,00	0,045	max. 0,030	max. 0,11	16,0 to 19,0	max. 0,80	6,0 to 9,5	—
X1CrNi25-21	12	max. 0,020	max. 0,25	max. 2,00	0,025	max. 0,010	max. 0,11	24,0 to 26,0	max. 0,20	20,0 to 22,0	—
X10CrNiS18-9	14	max. 0,12	max. 1,00	max. 2,00	0,060	min. 0,15	max. 0,11	17,0 to 19,0	—	8,0 to 10,0	Cu: ^b
X3CrNiCu18-9-4	15	max. 0,04	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	17,0 to 19,0	—	8,0 to 10,5	Cu: 3,0 to 4,0
X6CrNiTi18-10	16	max. 0,08	max. 1,00	max. 2,00	0,045	max. 0,030	—	17,0 to 19,0	—	9,0 to 12,0 (13,0) ^a	Ti: 5 × C to 0,70
X6CrNiNb18-10	19	max. 0,08	max. 1,00	max. 2,00	0,045	max. 0,030	—	17,0 to 19,0	—	9,0 to 12,0 (13,0) ^a	Nb: 10 × C to 1,00
X2CrNiMo17-12-2	21	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	16,5 to 18,5	2,00 to 3,00	10,0 to 13,0 (14,5) ^a	—
X2CrNiMo17-12-3	22	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0 (14,5) ^a	—
X2CrNiMo18-14-3	23	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,015	max. 0,11	17,0 to 19,0	2,50 to 3,00	12,5 to 15,0	—
X2CrNiMoN17-12-3	26	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,030	0,12 to 0,22	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0 (14,0) ^a	—
X2CrNiMoN18-12-4	27	max. 0,030	max. 1,00	max. 2,00	0,045	max. 0,030	0,10 to 0,20	16,5 to 19,5	3,0 to 4,0	10,5 to 14,0 (15,0) ^a	—
X1CrNiMoN25-22-2	29	max. 0,020	max. 0,70	max. 2,00	0,025	0,010	0,10 to 0,16	24,0 to 26,0	2,00 to 2,50	21,0 to 23,0	—
X5CrNiMo17-12-2	30	max. 0,07	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	16,5 to 18,5	2,00 to 3,00	10,0 to 13,0	—
X3CrNiMo17-12-3	31	max. 0,05	max. 1,00	max. 2,00	0,045	max. 0,030	max. 0,11	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0 (14,0) ^a	—