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Steels for cold heading and cold extruding — Technical delivery conditions —

Part 2: Stainless steels

Aciers pour transformation à froid et extrusion à froid — Conditions techniques de livraison —

Partie 2: Aciers inoxydables

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

This first edition of ISO 4954-2, together with ISO 4954-1 cancels and replaces ISO 4954:2022, which has been technically revised.

The main changes are as follows:

— new Annex B was added for the comparison with steel grades mentioned in ISO 3506.

A list of all parts in the ISO 4954 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Steels for cold heading and cold extruding — Technical delivery conditions —

Part 2: Stainless steels

1 Scope

This document specifies requirements for stainless steels that are intended for cold heading or cold extruding and are delivered as wire rods, wire or bars. It lists specific requirements for steels with diameters of 0,8 mm up to 50 mm for austenitic steels, up to 25 mm for ferritic steels and up to 100 mm for martensitic steels.

This document is applicable to the properties of cold-headed or cold-extruded parts which have been subjected to a subsequent heat treatment.

NOTE Non-alloy and alloy steels for cold heading and cold extruding are covered by ISO 4954-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 643, *Steels — Micrographic determination of the apparent grain size*

ISO 1035-1, *Hot-rolled steel bars — Part 1: Dimensions of round bars*

ISO 1035-2, *Hot-rolled steel bars — Part 2: Dimensions of square bars*

ISO 1035-3, *Hot-rolled steel bars — Part 3: Dimensions of flat bars*

ISO 1035-4, *Hot-rolled steel bars — Part 4: Tolerances*

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 4885, *Ferrous materials — Heat treatments — Vocabulary*

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

ISO 4948-2, *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, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6929, *Steel products — Vocabulary*

ISO 9934-1, *Non-destructive testing — Magnetic particle testing — Part 1: General principles*

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

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

ISO 15549, *Non-destructive testing — Eddy current testing — General principles*

ISO 16124, *Steel wire rod — Dimensions and tolerances*

ISO 16143-2, *Stainless steels for general purposes — Part 2: Corrosion-resistant semi-finished products, bars, rods and sections*

ISO 16143-4, *Stainless steels for general purposes — Part 4: Bright products*

ISO 22034-2, *Steel wire and wire products — Part 2: Tolerances on wire dimensions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 377, ISO 4885, ISO 4948-1, ISO 4948-2, ISO 6929, ISO 14284, ISO 16143-2, ISO 16143-4 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
bright steel product
drawn or peeled/turned bar with smoother surface quality and better dimensional accuracy in comparison with a hot-rolled bar

3.2
drawn product
product of various cross-sectional shapes obtained, after descaling, by cold drawing of hot-rolled bars or wire rod, on a drawing bench (cold deformation without removing material)

Note 1 to entry: This operation gives the product special features with respect to shape, dimensional accuracy and surface finish. Products in lengths are delivered straightened, products of small cross-section may also be supplied in coils.

3.3
peeled/turned bar
steel bar of circular cross-section having the same features of *drawn products* (3.2) concerning shape, dimensional accuracy and bright surface finish but without work hardening

Note 1 to entry: They are produced by peeling on a peeling machine usually followed by straightening and by polishing. The removal of metal by peeling is carried out in such a way that the bright product is generally free from surface defects and decarburization coming from the hot-rolling process.

3.4
stainless steels
steel with at least 10,5 % (mass fraction) Cr and maximum1,2 % (mass fraction) C

[SOURCE: ISO 15510:2014, 3.1]

4 Classification and designation

4.1 Classification

The classification of the relevant steel grades shall be in accordance with ISO 4948-1 and ISO 4948-2.

All steel grades mentioned in this document are special steels in accordance with ISO 4948-2.

The stainless steel grades are classified according to their microstructures.

4.2 Designation

For the steel grades covered by this document, the steel names as given in the relevant tables shall be allocated in accordance with ISO/TS 4949.

Annex C provides a list of steels given in this document and the comparable grades covered in various designation systems.

5 Information to be supplied by the purchaser

5.1 Mandatory information

The manufacturer shall obtain the following information from the purchaser at the time of enquiry and order:

a) the quantity to be delivered (mass, length);

b) the product form (round bar, wire rod, wire);

c) the nominal diameter and the tolerances on dimensions and shape of the product with reference to the relevant International Standard;

d) for bars, the length; and for wire rod and wire, the dimensions, i.e. inner diameter and mass of the coils;

e) a reference to this document, i.e. ISO 4954-2;

f) the designation of the steel grade given in Tables 5;

g) if applicable, the symbol for the required treatment condition, see Tables 6 to 9;

h) standard designation for a test report 2,2 or, if required, any other type of inspection document in accordance with ISO 10474.

5.2 Options and/or supplementary or special requirements

A number of options are specified in this document and listed below. If the purchaser does not indicate a wish to implement any of these options, the products shall at least be supplied in accordance with the basic specifications of this document (see 5.1).

a) any requirement relating to the removal of surface defects, see 7.6.4;

b) any requirement for the verification of the surface quality, see 7.6.3;

c) any requirement for a product analysis, see 7.1.2.2;

d) internal soundness and any requirements for non-destructive testing, see 7.4 and 10.3;

e) verification of aptitude to cold forming, see 7.5 and 10.4;

f) maximum depth of surface discontinuities, see 7.6.2 and A.2;

g) any requirement concerning non-destructive testing of the surface, see 7.6.5 and 10.3;

h) corrosion resistance and any requirements for resistance to intergranular corrosion, see 7.7 and A.3;

i) any requirement concerning surface treatment, see 11.1;

j) any special requirements concerning special or additional marking, see 11.2;

k) any special requirements concerning packaging, see 11.3;

l) statistical evaluation, see 6.5.

5.3 Ordering example

EXAMPLE 50 t round bars with a nominal diameter of 40 mm and a nominal length of 6 000 mm with diameter tolerance according to class S and with length tolerance according to class L2 of ISO 1035-4 made of steel grade ISO 4954-2, X5CrNi18-10 in the condition +AT+PE (see Table 6), and product analysis with an inspection certificate 3.1 in accordance with ISO 10474.

50 t round bars ISO 1035-4 – 40,0S × 6 000L2

ISO 4954-2, X5CrNi18-10+AT+PE – product analysis

ISO 10474 – 3.1

6 Manufacturing process

6.1 General

The manufacturing process of the steel and of the products is, with the restrictions given by the requirements in 6.2 to 6.4, left to the discretion of the manufacturer.

6.2 Deoxidation

All steels shall be deoxidized. By agreement, aluminium may be replaced by another suitable element having a similar effect.

6.3 Heat-treatment condition and surface condition at delivery

6.3.1 Heat-treatment condition

Treatment and heat-treatment condition shall conform to one of the conditions indicated in Table 4.

Bright steel products in cold drawn or peeled/turned condition could show a residual film of grease from processing.

6.3.2 Particular surface conditions

If so agreed at the time of enquiry and order, the products shall be delivered in one of the particular surface conditions given in Table 1.

Table 1 — Surface condition at delivery

Surface condition at delivery		Symbol	Bar	Wire rod	Wire
Unless otherwise agreed	as-rolled	none or +AR	x	x	—
Particular surface conditions supplied by agreement	cold drawn	+C	x	—	x
	skin passed	+LC	x	—	x
	peeled	+PE	x	x	x

6.4 Traceability of the cast

Each product shall be traceable to the cast, see 11.2.

6.5 Statistical evaluation

Suppliers are responsible, using the means they think fit, for inspecting their product in accordance with various quality criteria specified. In view of the practical difficulties in inspecting a coil of wire rod along its entire length, it cannot be proved that no value greater than the specified limits occur in the coil as a whole. Statistical evaluation of performances applicable to all coils may be agreed between the purchaser and the manufacturer at the time of ordering.

7 Requirements

7.1 Chemical composition, mechanical properties and hardenability

7.1.1 General

Wire rod, bars and wire shall be supplied in one of the delivery conditions as indicated in Table 4 as agreed at the time of enquiry and order. These tables show the combinations of usual heat-treatment conditions at delivery, product forms and applicable requirements.

In addition to this document, the general technical delivery requirements of ISO 404 shall apply.

If grades other than those included in this document are required for cold heading and cold extruding purposes they shall comply with ISO 16143-2 or ISO 16143-3 and the mechanical values must be agreed at the time of enquiry and order, see also Annex B.

7.1.2 Chemical composition

7.1.2.1 The chemical composition determined by cast analysis shall conform to the values in Table 5.

7.1.2.2 Permissible deviations between the limiting values for cast analysis and the values for product analysis are given in Table 2. The product analysis shall be carried out when specified at the time of the enquiry and order.

Table 2 — Permissible deviations between product analysis and the limiting values of the cast analysis specified in Table 5

Elements	Limiting values of the cast (heat) analysis % mass fraction	Permissible deviation for the product analysis % mass fraction[a]
C	≤0,030 >0,030 ≤ 0,15	+0,005 ±0,01
Si	≤1,00 >1,00 ≤ 2,00	+0,05 ±0,10
Mn	≤1,00 >1,00 ≤ 2,00	+0,03 ±0,04
P	≤0,045	+0,005
S	≤0,015 >0,015 ≤ 0,030	+0,003 ±0,005
Cr	≥11,5 < 15,0 ≥15,0 ≤ 20,0 >20,0 ≤ 23,0	±0,15 ±0,20 ±0,25

[a] ± means that in one heat the deviation of the product analysis for a given element may occur over the upper value or under the lower value of the specified range of the cast analysis, but not both at the same time.