
**High yield strength steel bars and
sections —**

**Part 1:
General delivery requirements**

*Barres et profilés en acier à haute limite d'élasticité —
Partie 1: Conditions générales de livraison*
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[ISO 4951-1:2001](https://standards.iteh.ai/catalog/standards/sist/571ee68f-b51b-4dff-ad83-3d263ad70aa8/iso-4951-1-2001)

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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 3.

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 part of ISO 4951 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 4951-1 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 3, *Steels for structural purposes*.

This first edition of ISO 4951-1, together with ISO 4951-2 and ISO 4951-3, cancels and replaces ISO 4951:1979, the content of which has been revised and augmented.

ISO 4951 consists of the following parts, under the general title *High yield strength steel bars and sections*:

- *Part 1: General delivery requirements* [ISO 4951-1:2001](https://standards.iteh.ai/catalog/standards/sist/571ee68f-b51b-4dff-ad83-3d263ad70aa8/iso-4951-1-2001)
- *Part 2: Delivery conditions for normalized, normalized rolled and as-rolled steels*
- *Part 3: Delivery conditions for thermomechanically-rolled steels*

Annex A of this part of ISO 4951 is for information only.

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High yield strength steel bars and sections —

Part 1: General delivery requirements

1 Scope

This part of ISO 4951 specifies the requirements for the general delivery conditions of hot-rolled bars and sections, in high yield strength steels for use in bolted, riveted or welded structures¹⁾.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 4951. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 4951 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 148:1983, *Steel — Charpy impact test (V-notch)*.

<https://standards.iteh.ai/catalog/standards/sist/571ee68f-b51b-4dff-ad83-3416c888-4-preparation>

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 4951-2:2001, *High yield strength steel bars and sections — Part 2: Delivery conditions for normalized, normalized rolled and as-rolled steels*.

ISO 4951-3:2001, *High yield strength steel bars and sections — Part 3: Delivery conditions for thermo-mechanically-rolled steels*.

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

ISO 6929:1987, *Steel products — Definition and classification*.

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

1) Compared with mild steels, these steels may require special precautions for welding. See the guide *Welding and weldability of C-Mn micro-alloy steels*, published by subcommission IX-G of the International Institute of Welding (document IIS/IIW 843-84).

3 Terms and definitions

For the purposes of this part of ISO 4951, the definitions of the terms "bars" and "sections", given in ISO 6929:1987 and the following terms and definitions apply.

- 3.1 as-rolled steel**
steel without any special rolling and/or heat treatment condition
- 3.2 normalized steel**
steel obtained by a normalizing treatment, i.e. heat treatment consisting of austenitizing followed by air cooling
- 3.3 normalized rolled steel**
steel obtained by normalizing rolling

3.4 normalizing rolling
rolling process in which the final deformation 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

NOTE In international publications for both the normalizing rolling, as well as the thermomechanical rolling, the expression "controlled rolling" may be found. However in view of the different applicability of the products a distinction of the terms is necessary.

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3.5 thermomechanical rolling
rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition with certain properties which cannot be achieved or repeated by heat treatment alone

NOTE 1 Subsequent heating above 580 °C may lower the strength values. If temperatures above 580 °C are needed reference should be made to the supplier.

NOTE 2 Thermomechanical rolling leading to the delivery condition "thermomechanically rolled" can include processes with an increasing cooling rate with or without tempering, including self-tempering but excluding direct quenching or quenching and tempering

3.6 thermomechanically rolled steel
steel obtained by thermomechanical rolling

4 General requirements

4.1 Steelmaking method

Unless otherwise agreed at the time of enquiry and order, the steelmaking method is left to the discretion of the manufacturer.

4.2 Deoxidation process

The steels shall be made to a fine-grain practice.

4.3 Delivery condition

4.3.1 Normalized steel

The delivery condition for normalized steel for bars and sections as defined in clause 3 is given in ISO 4951-2.

4.3.2 Thermomechanically rolled steel

The delivery condition for thermomechanically rolled steel for bars and sections as defined in clause 3 is given in ISO 4951-3.

4.4 Surface condition

4.4.1 Surface appearance

The products shall have a smooth surface consistent with the rolling process used; they shall not show any defects which may prejudice processing or their appropriate application.

4.4.2 Removal of discontinuities

Surface discontinuities may be removed by the manufacturer, before despatch, by means of grinding, provided that the depression does not extend below the rolled surface by more than:

— 0,8 mm for material of thickness < 10 mm;

— 1,6 mm for material of thickness 10 mm to 50 mm;

— 3 mm for material of thickness > 50 mm.

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4.4.3 Repairs by welding

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Unless otherwise specified, discontinuities that are greater in depth than limits specified in 4.4.2 may be removed and weld metal deposited subject to the following conditions.

- a) The reduction of thickness of the material resulting from the removal of discontinuities prior to welding shall not exceed 20 % of the nominal thickness at the location of the discontinuity.
- b) All welding shall be performed by competent welders using welding electrodes appropriate for the grade being repaired and shall follow welding procedures approved by the purchaser.
- c) For materials supplied in the normalized condition, it shall be specifically agreed with the purchaser whether repair welding is to be carried out prior to the heat treatment.

If agreed at the time of the order, the sites of repair welds shall be carefully recorded and pointed out to the purchaser.

5 Technical requirements

5.1 Chemical composition

5.1.1 Ladle analysis

The chemical composition determined by ladle analysis shall comply with the values given in Table 1 of ISO 4951-2:2001 or ISO 4951-3:2001.

5.1.2 Product analysis

If requested by the purchaser at the time of enquiry and order, a product analysis shall be carried out.

Table 1 gives the permissible deviations of the product analysis from the specified limits of the ladle analysis given in Table 1 of ISO 4951-2:2001 or ISO 4951-3:2001.

Table 1 — Permissible deviations for the product analysis in relation to the specified ladle analysis

Element	Specified limits %	Permissible deviation ^a
C	≤ 0,20	+ 0,02
Mn	≤ 1,7	± 0,10
Si	≤ 0,60	+ 0,05
P and S	≤ 0,035	+ 0,005
Nb	≤ 0,050	± 0,010
V	≤ 0,20	± 0,02
Ti	≤ 0,05	+ 0,01
Cr	≤ 0,30	+ 0,05
Ni	≤ 0,80	+ 0,05
Mo	≤ 0,20	+ 0,03
Cu	≤ 0,35	+ 0,04
	> 0,35 ≤ 0,70	+ 0,07
N	≤ 0,025	+ 0,002
Al _{tot}	≥ 0,020	- 0,005

^a The deviations apply either above or below the specified limits of the range, but not simultaneously. When maxima only are specified, the deviations are positive only.

5.2 Mechanical properties

The steels in the delivery conditions as defined in 4.3, shall comply with the mechanical properties specified in Table 2 of ISO 4951-2:2001 for normalized, normalized rolled and as-rolled steels or of ISO 4951-3:2001 for thermomechanically rolled steels, when these are determined on test pieces prepared in accordance with the requirements of 6.3.

NOTE In the case of angles and beams, the thickness of the product means the thickness of the flange measured on the cross-section where the test pieces are taken for the mechanical test (see Figure A.1).

6 Inspection and testing

6.1 General

The products covered by this part of ISO 4951 are subject to specific inspection and testing in accordance with the conditions specified in clause 8 of ISO 404:1992 relating to the chemical composition and mechanical properties of the product. Verification of the chemical composition of the product is only carried out by agreement at the time of enquiry and order.

6.2 Test unit

6.2.1 General

The verification of mechanical properties shall be per cast (heat).

6.2.2 Tensile tests

A test unit shall contain products of the same form, grade and delivery condition and be from the same thickness range in accordance with Table 2 in ISO 4951-2:2001 and ISO 4951-3:2001 for the specified yield strength.

For a test unit not exceeding 50 t, one tensile test shall be carried out.

For a test unit exceeding 50 t, two tensile tests shall be carried out.

6.2.3 Impact tests

A test unit shall contain products of the same form, grade and delivery condition.

For a test unit not exceeding 50 t, one impact test shall be carried out.

For a test unit exceeding 50 t, two impact tests shall be carried out.

For product thicknesses between 6 mm and 40mm, one set of tests from the thickest product shall be carried out using subsurface specimens.

For product thicknesses exceeding 40 mm, one set of tests from the thickest product shall be carried out using specimens taken from the quarter thickness position.

6.3 Position and orientation of test sample

See ISO 377 and annex A.

6.3.1 Sections

The longitudinal axes of the test pieces shall be parallel to the direction of rolling.

Test samples shall be taken so that the axis of the test piece is at 1/3 from the outer edge of the half-flange (for I sections) or in the case of small sections, as near as possible to this position (see Figure A.1).

In the case of tapered flange sections, test pieces may also be taken at the outer quarter position of the web.