

INTERNATIONAL STANDARD

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High yield strength flat steel products —

Part 1: General requirements

Produits plats en acier à haute limite d'élasticité

Part 1: Prescriptions générales



Reference number
ISO 4950-1:1995(E)

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.

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.

International Standard ISO 4950-1 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 3, *Steels for structural purposes*.

This second edition cancels and replaces the first edition (ISO 4950-1:1981), which has been technically revised.

ISO 4950 consists of the following parts, under the general title *High yield strength flat steel products*:

- Part 1: *General requirements*
- Part 2: *Products supplied in the normalized or controlled rolled condition*
- Part 3: *Products supplied in the heat-treated (quenched + tempered) condition*

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High yield strength flat steel products —

Part 1: General requirements

1 Scope

This part of ISO 4950 specifies the methods of manufacture, the acceptance conditions and the marking of high yield strength flat steel products.

It applies to hot-rolled plates, wide strip in coils of width greater than or equal to 600 mm, and wide flats in high yield strength steels (R_e min. ≥ 355 N/mm²) in the thicknesses and conditions specified in ISO 4950-2 and ISO 4950-3 for use in bolted, rivetted or welded structures¹⁾.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 4950. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 4950 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 377-1:1989, *Selection and preparation of samples and test pieces of wrought steel — Part 1: Samples and test pieces for mechanical tests*.

ISO 377-2:1989, *Selection and preparation of samples and test pieces of wrought steel — Part 2: Samples for the determination of the chemical composition*.

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 4950-2:1995, *High yield strength flat steel products — Part 2: Products supplied in the normalized or controlled rolled condition*.

ISO 4950-3:1995, *High yield strength flat steel products — Part 3: Products supplied in the heat-treated (quenched + tempered) condition*.

ISO 6892:1984, *Metallic materials — Tensile testing*.

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

ISO 7452:1984, *Hot-rolled structural steel plates — Tolerances on dimensions and shape*.

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

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

3 Definitions

For the purposes of this part of ISO 4950, the definitions of the terms "plates", "wide strip" and "wide flat" given in ISO 6929 apply.

4 Manufacture

4.1 Steelmaking method

Unless otherwise agreed at the time of ordering, the steelmaking method is left to the discretion of the manufacturer; however, it shall be stated to the purchaser on request at the time of delivery.

1) For precautions to be taken when welding, the guide for the welding and weldability of C-Mn and C-Mn micro-alloy steels published by Sub-commission IX-G of the International Institute of Welding (Document ISS/IIW 843-87) may be helpful.

4.2 Weldability

Unlike low-carbon steels, these steels may necessitate special precautions when welding. [See in particular the guide for the welding and weldability of C-Mn and C-Mn micro-alloy steels published by Sub-commission IX-G of the International Institute of Welding (Document IIS/IIW 843-87).]

4.3 Surface appearance — Defects

4.3.1 Surface appearance

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

4.3.2 Removal of defects

The requirements of ISO 7788 shall be complied with. However, in the case of the products specified in ISO 4950-3, the prior agreement of the user is required.

4.4 Tolerances on dimensions

The requirements of ISO 7452 shall be complied with.

5 Inspection and testing

5.1 General

The products covered by this part of ISO 4950 may be the subject of an 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 if this is agreed and stated in the order.

If inspection and testing is specified in the order, it shall be carried out in accordance with 5.2 to 6.5.

5.2 Test unit

5.2.1 Products shall be tested separately for each cast and heat-treatment condition. The test unit shall be 50 t or part thereof. However, by agreement at the time of ordering, the test unit may be the parent sheet or coil.

5.2.2 For each test unit and thickness range according to tables 3 of ISO 4950-2:1995 and ISO 4950-3:1995, a series of tests shall be carried out comprising

- one tensile test (or more, in accordance with 5.2.4.1 in the case of products of thickness up to and including 16 mm);
- one set of three impact tests at the temperatures specified in tables 3 of ISO 4950-2:1995 and ISO 4950-3:1995. Verification at other temperatures may be agreed upon at the time of ordering (see annex A of ISO 4950-2:1995);

and, if specified on the order,

- one product analysis.

5.2.3 The purchaser or his representative may be present at the time of selection of the sample products from which samples shall be taken for verification of the properties (see ISO 404).

5.2.4 Unless otherwise stated by the purchaser, the procedure shall be as follows:

5.2.4.1 Tensile test

A sample shall be taken for each specified thickness range with the additional requirement that, for the thickness range $e \leq 16$ mm, the maximum thickness of the products of the batch shall be not greater than twice the minimum thickness.

5.2.4.2 Impact test

A sample shall be taken from each thickness range.

5.3 Position and orientation of test samples (see ISO 377-1)

Test samples shall be taken midway between the axis in the direction of rolling and the edge of the rolled product.

5.3.1 Tensile test pieces

The axis of the tensile test pieces shall be perpendicular to the direction of rolling, except for wide flats with a width of 600 mm or less, for which it shall be parallel to the direction of rolling.

5.3.2 Impact test pieces

In accordance with the requirements of the order, the axis of the impact test pieces shall be either parallel or

perpendicular to the direction of rolling. In the absence of a specification, the axis of the test piece shall be parallel to the direction of rolling.

6 Test methods

6.1 Tensile test (see ISO 6892)

Normally, the test piece used shall have a proportional prismatic or cylindrical shape and have an original gauge length L_0 given by the formula

$$L_0 = 5,65\sqrt{S_0}$$

where S_0 is the cross-sectional area of the gauge length of the test piece.

The prismatic test piece of rectangular cross-section shall have a maximum width on the gauge length portion of 40 mm, and its thickness shall be that of the product; however, if the product thickness exceeds 30 mm, it may be reduced to 30 mm by planing or milling on one face only.

A cylindrical test piece may be used for products more than 40 mm thick; it shall be 10 mm to 30 mm in diameter and its original gauge length shall be determined by the above formula; the axis of the test piece shall be positioned at 1/4 of the thickness of the product.

A non-proportional test piece with a fixed initial gauge length (for example 200 mm) may be used. In this case, reference shall be made to a conversion table (see ISO 2566-1). However, in case of dispute, only the results obtained on a proportional test piece shall be taken into consideration.

The yield strength specified in tables 3 of ISO 4950-2:1995 and ISO 4950-3:1995 is the upper yield stress R_{eH} . If the yield phenomenon is not visible, either the 0,2 % proof stress ($R_{p0,2}$) or the 0,5 % proof stress (total elongation) ($R_{t0,5}$) may be used. The specification of the material is complied with in this respect if one or other of these values satisfies the specified yield strength value.

6.2 Impact test

6.2.1 The impact test shall normally be carried out on products having a thickness greater than or equal to 12 mm. The test piece shall be machined so that the face nearest to the rolled surface is not more than 1 mm from it.

For products of thickness greater than 40 mm, the test piece shall be taken in such a way that its axis is positioned at 1/4 of the thickness from the surface.

The notch shall be perpendicular to the rolled surface.

If agreed at the time of ordering, impact tests may be carried out on products having a thickness less than 12 mm; the dimensions of the test pieces shall be in accordance with the requirements of ISO 148, i.e. 10 mm × 7,5 mm and 10 mm × 5 mm, or shall correspond to $10 \times e$, e being the product thickness.

6.2.2 The test shall be carried out using a V-notch test piece supported at both ends (see ISO 148), the value to be taken into account being the average of the results obtained from three test pieces cut adjacent to each other from the same product, unless there are reasons for a retest (see 6.5).

6.3 Chemical analysis

6.3.1 If a product analysis is specified on the order, the number of samples to be taken shall be agreed between the parties concerned.

The samples may be taken from the test pieces used to check the mechanical properties or from the full thickness of the product at the same location as the test pieces. In case of dispute, only the analysis of drillings from the full thickness of the product shall apply.

For the selection and preparation of samples for chemical analysis, the requirements of ISO 377-2 shall be applied.

6.3.2 In case of dispute, the methods used for the chemical analysis shall be in accordance with the requirements specified in the corresponding International Standards. If no International Standard exists, the method to be used shall be agreed between the parties concerned.

6.4 Faulty tests

When a test does not give the required result because of an error in its execution, the test shall be cancelled. Error in carrying out the test means: incorrect machining; incorrect mounting in the test machine; a malfunction of the test machine, or any other anomaly independent of the metal itself.

6.4.1 Defective test piece

If a defective test piece gives satisfactory results, the batch shall be accepted, but the corresponding item (from which the test sample was taken) may be subjected to an individual examination for soundness.

6.5 Retests

If, during inspection, a test does not give the required result, additional tests, unless otherwise agreed, may be carried out as follows.

6.5.1 Tensile test

The procedures defined in 8.3.4.3.2 "non-sequential tests" of ISO 404:1992 shall apply.

6.5.2 Impact test

The assessment of the impact test shall be made according to a sequential method described in 8.4.3.2 of ISO 404:1992 and, if retests are necessary, they shall be carried out according to 8.3.4.3.3 of ISO 404.

7 Inspection documents

The type of inspection document required shall be selected from those defined in ISO 10474 and specified in the order.

In all cases, this inspection document shall indicate the manufacturer's results for the cast analysis of all chemical elements specified for the steel grade concerned.

8 Sorting and reprocessing

8.1 The requirements of clause 9 of ISO 404:1992 shall apply.

8.2 The manufacturer has the right to present items rejected during a first examination for re-examination for another quality or grade.

9 Non-destructive tests

In the purchaser requires non-destructive tests to check the soundness of the products by means of radiographic, ultrasonic, magnetic or dye penetrant methods, these tests shall be agreed upon at the time of enquiry and order. This agreement shall include details of the test method and interpretation of results.

10 Marking

Unless otherwise agreed at the time of enquiry and order, products shall be marked with the following:

- a) the identification symbols for the grade and quality of the steel;
- b) the brand of the manufacturer;
- c) where necessary: a symbol, letters or numbers which identify the inspection documents, test pieces and products.

In the case of products of small unit mass and which are consigned in bundles, the information specified above may be marked on a tag securely attached to each bundles (or may be marked on the topmost item in the bundle).

11 Order

The order shall state

- if the steelmaking process shall be indicated (4.1);
- if inspection is to be by batch or by parent sheet or coil (5.2.1);
- if a product analysis is required (5.2.2) and the number of samples (6.3.1);
- if the impact test pieces are to be taken in the transverse direction (5.3.2);
- if impact tests are required for products of thickness less than 12 mm (6.2.1);
- if retests are not permitted (6.4);
- the type of inspection document required (clause 7);
- if non-destructive tests are required (clause 9);
- if other types of marking are required (clause 10).

Items that are not specified in this list should not be considered by the manufacturer.