

International Standard



4951

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High yield strength steel bars and sections

Barres, profilés et poutrelles en acier à haute limite d'élasticité

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4951 was developed by Technical Committee ISO/TC 17, *Steel*, and was circulated to the member bodies in November 1976.

It has been approved by the member bodies of the following countries :

Austria	Germany, F. R.	Romania
Brazil	Hungary	South Africa, Rep. of
Bulgaria	India	Spain
Canada	Iran	Sweden
Chile	Italy	Switzerland
Czechoslovakia	Korea, Rep. of	Turkey
Denmark	Mexico	United Kingdom
Egypt, Arab Rep. of	New Zealand	USSR
Finland	Norway	Yugoslavia
France	Poland	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Belgium
Japan
USA

High yield strength steel bars and sections

1 Scope

This International Standard specifies the chemical composition, the mechanical properties and the acceptance testing of hot-rolled bars, sections and hollow sections of thickness up to and including 70 mm, in high yield strength steels (R_e min. $> 355 \text{ N/mm}^2$) used in bolted, riveted or welded structures.¹⁾

2 Field of application

This International Standard applies to bars and sections of thickness, diameter or length of side up to and including 70 mm, to hollow sections of thickness up to and including 40 mm and to beams with flange thickness up to and including 40 mm, made of steel and having a specified minimum yield strength of 355 to 420 N/mm² for thicknesses up to and including 16 mm.

3 References

ISO 82, *Steel — Tensile testing*.

ISO/R 148, *Beam impact test (V-notch) for steel*.²⁾

ISO/R 377, *Selection and preparation of samples and test pieces for wrought steel*.²⁾

ISO/R 404, *General technical delivery requirements for steel*.²⁾

ISO 2566/1, *Steel — Conversion of elongation values — Part 1 : Carbon and low alloy steels*.

4 Manufacture

4.1 Steelmaking method

4.1.1 Unless otherwise agreed at the time of enquiry and order, the steelmaking method is left to the choice of the manufacturer within the limitation of 4.1.2.

1) Compared with mild steels, these steels may require special precautions for welding. (See in particular the guide for welding and weldability of C-Mn and C-Mn micro-alloy steels published by Sub-commission IX-G of the International Welding Institute — document IIS/IIW 382-71.)

2) In course of revision.

4.1.2 The steel shall be produced in an open hearth furnace, in an electric furnace, or by an oxygen process. Other methods may be used by agreement between the parties concerned. The steelmaking method shall be stated to the purchaser on request, at the time of delivery.

4.2 Deoxidation process

The steels shall be from casts with addition elements capable of producing a fine grain. In addition, steels of qualities CC and DD may be supplied as non-rimming steel.

4.3 Delivery condition

The products covered by this International Standard shall be delivered in the as-rolled condition or in the normalized condition — or, unless otherwise agreed and stated in the order, in an equivalent condition obtained by controlled rolling¹⁾ — or in the normalized and tempered condition.

4.4 Surface appearance — Defects

4.1.1 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 defects

4.4.2.1 Surface defects may be removed by the manufacturer, before despatch, by grinding, provided that the depression does not extend below the rolled surface by more than

- 0,8 mm for material of thickness less than 10 mm;
- 1,6 mm for material of thickness 10 to 50 mm, inclusive;
- 3 mm for material of thickness over 50 mm.

4.4.2.2 Unless otherwise specified on ordering, deeper surface defects which reduce the thickness by more than the minimum limits specified above may be removed by grinding, chipping or arc-air gouging, followed by deposition of weld metal, subject to the following conditions :

- a) The total area of the chipped or ground surface of any piece prior to welding shall not exceed 2 % of the total surface area of that piece.
- b) The reduction of thickness of the material resulting from the removal of defects prior to welding shall not exceed 20 % of the nominal thickness at the location of the defect.
- c) The toes of angles, beams, channels and zeds, and the stems and toes of tees, may be conditioned by grinding, chipping or arc-air gouging and welding. Prior to welding, the depth of the depression, measured from the toe inward, shall be limited to the thickness of the material at the base of the depression with a maximum depth limit of 13 mm.

d) All welding shall be performed by competent welders using low-hydrogen welding electrodes appropriate for the grade being repaired. The electrodes shall be protected from moisture during storage and use. The manufacturer shall establish and follow documented welding procedures which are appropriate to the material being welded.

e) The weld and adjacent heat-affected zone shall be sound and free of cracks, the deposited metal being thoroughly fused to all surfaces and edges without undercutting or overlap. Any visible cracks, porosity, lack of fusion or undercut in any layer shall be removed prior to deposition of the succeeding layer. Weld metal shall project by at least 2 mm above the rolled surface after welding, and the projecting metal shall be removed by chipping or grinding, or both, to make it flush with the rolled surface and to produce a workmanlike finish.

f) The manufacturer shall draw up an inspection programme for the work to verify that

- 1) defects have been completely removed;
- 2) the limitations specified above have not been exceeded;
- 3) established welding procedures have been followed;
- 4) any weld metal is of acceptable quality as defined above.

g) If materials are intended to be supplied in the as-treated condition (including normalizing), it shall be specifically agreed with the purchaser whether welding is to be carried out prior to heat treatment.

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

5 General requirements

5.1 Chemical composition

5.1.1 Ladle analysis

Table 1 gives the composition limits for the ladle analysis.

5.1.2 Product analysis

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

Table 2 gives the permitted deviations for the product analysis relative to the values for ladle analysis given in table 1.

5.2 Mechanical properties

Table 3 specifies the mechanical properties in the delivery conditions given in 4.3, determined on test pieces prepared in accordance with the requirements of 6.2.

¹⁾ Products produced by controlled rolling may be subject to deterioration of their properties if subsequently hot formed.