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**ISO
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Fourth edition
2001-08-15

Hot-rolled steel sheet of structural quality

Tôles en acier de construction laminées à chaud

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

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Contents

	Page
Foreword.....	iv
1 Scope	1
2 Normative reference	1
3 Terms and definitions	1
4 Conditions of manufacture	2
5 Dimensional tolerances	5
6 Sampling.....	5
7 Mechanical property tests	5
8 Retests	10
9 Resubmission	10
10 Workmanship	10
11 Inspection and acceptance.....	10
12 Coil size	10
13 Marking	11
14 Information to be supplied by the purchaser	11
Bibliography	12

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

International Standard ISO 4995 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This fourth edition cancels and replaces the third edition (ISO 4995:1993), which has been technically revised.

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Hot-rolled steel sheet of structural quality

1 Scope

1.1 This International Standard applies to hot-rolled steel sheet of structural quality in the grades and classes listed in Tables 1 and 2, usually without the use of microalloying elements. The product is intended for structural purposes where particular mechanical properties are required. It is generally used in the delivered condition and is intended for bolted, riveted or welded structures. This product is produced on a wide strip mill, not a plate mill.

1.2 This product is commonly produced in thicknesses from 1,6 mm to 6 mm and widths of 600 mm and over, in coils and cut lengths.

1.3 Hot-rolled sheet less than 600 mm wide may be slit from wide sheet and will be considered as sheet.

NOTE Hot-rolled sheet up to but not including 3 mm in thickness is commonly known as "sheet". Hot-rolled sheet 3 mm and over in thickness is commonly known as either "sheet" or "plate".

1.4 This International Standard does not cover steels intended for boilers or pressure vessels, or steels designated as commercial quality or drawing qualities (covered in ISO 3573^[1]) or steels to be re-rolled to cold-reduced products, or steels designated as weathering steels, having increased atmospheric corrosion resistance.

2 Normative reference

[ISO 4995:2001](https://standards.iteh.ai/catalog/standards/sist/cbe5391e-4edf-453a-8b1b-90984e0b8342/iso-4995-2001)

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document 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 6892:1998, *Metallic materials — Tensile testing at ambient temperature*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1

microalloying elements

elements, such as niobium, vanadium, titanium, etc., added singly or in combination to obtain higher strength levels combined with better formability, weldability and toughness as compared with non-alloyed steel produced to equivalent strength levels

3.2

hot-rolled steel sheet

a product obtained by rolling heated steel through a continuous-type or reversing-type wide strip mill to the required sheet thickness

NOTE The product has a surface covered with oxide or scale resulting from the hot rolling operation.

3.3

hot-rolled descaled steel sheet

hot-rolled steel sheet from which oxide or scale has been removed, commonly by pickling in an acid solution

NOTE Descaling may also be performed by mechanical means such as grit blasting. Some change in properties may result from descaling.

3.4

mill edge

a normal side edge without any definite contour produced in hot-rolling

NOTE Mill edges may contain some irregularities such as cracked or torn edges or thin (feathered) edges.

3.5

sheared edge

a normal edge obtained by shearing, slitting or trimming a mill edge product

NOTE Normal processing does not necessarily provide a definite positioning of the slitting burr.

4 Conditions of manufacture

4.1 Steelmaking

Unless otherwise agreed by the interested parties, the processes used in making the steel and in manufacturing hot-rolled sheet are left to the discretion of the manufacturer. On request, the purchaser shall be informed of the steelmaking process being used.

4.2 Chemical composition

The chemical composition (heat analysis) shall conform to the requirements given in Tables 1 and 2.

4.3 Chemical analysis

4.3.1 Heat analysis

A heat analysis of each heat of steel shall be made by the manufacturer in order to determine the percentage of all elements listed in Tables 1 and 2. On request, this analysis shall be reported to the purchaser or his representative.

4.3.2 Product analysis

A product analysis may be made by the purchaser in order to verify the specified analysis of the product and shall take into consideration any normal heterogeneity. Non-killed steels (such as rimmed or capped) are not technologically suited to product analysis. For killed steel, the sampling method and deviation limits shall be agreed upon between the interested parties at the time of ordering.

4.4 Weldability

This product is normally suitable for welding if appropriate welding conditions are selected. For non-descaled steel, it may be necessary to remove the scale or oxide depending upon the welding method. As the carbon content increases above 0,15 %, spot welding becomes increasingly difficult.

4.5 Application

It is desirable that hot-rolled steel sheet be identified for fabrication by the name of the part or by the intended application. Proper identification of the part may include visual examination, prints or description, or a combination of these.

Table 1 — Chemical composition (heat analysis)

Content levels in percent by mass

Grade	Class ^{a, b}	Method of deoxidization ^{c, d}	C max.	Mn max.	Si max.	P max.	S max.
HR235	B	E or NE	0,18	1,20	Not applicable	0,035	0,035
	D	CS	0,17	1,20	Not applicable	0,035	0,035
HR275	B	E or NE	0,21	1,20	Not applicable	0,035	0,035
	D	CS	0,20	1,20	Not applicable	0,035	0,035
HR355	B	NE	0,21	1,60	0,55	0,035	0,035
	D	CS	0,20			0,035	0,035

^a Class B steels are intended for use in welded structures or structural parts, subjected to normal loading conditions.

^b Class D steels are to be used for welded structures or structural parts where, owing to loading conditions and the general design of the structure, a high resistance to brittle fracture is necessary.

^c E = Rimming; NE = Non-rimming; CS = Aluminum killed.

^d The nitrogen content is controlled; normally, it should not exceed 0,009 % for E or NE steels or 0,015 % for CS steels.

Table 2 — Limits on additional chemical elements ^a

Content levels in percent by mass

Element	Heat analysis max.	Product analysis max.
Cu ^b	0,20	0,23
Ni ^b	0,20	0,23
Cr ^{b, c}	0,15	0,19
Mo ^{b, c}	0,06	0,07
Nb ^d	0,008	0,018
V ^d	0,008	0,018
Ti ^d	0,008	0,018

^a Each of the elements listed in this table shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium or molybdenum present is less than 0,02 %, the analysis may be reported as "< 0,02 %".

^b The sum of copper, nickel, chromium, and molybdenum shall not exceed 0,50 % on heat analysis. When one or more of these elements are specified, the sum does not apply; in which case, only the individual limits on the remaining elements will apply.

^c The sum of chromium and molybdenum shall not exceed 0,16 % on heat analysis. When one or more of these elements are specified, the sum does not apply; in which case, only the individual limits on the remaining elements will apply.

^d Heat analysis greater than 0,008 % may be supplied upon agreement between producer and consumer.

4.6 Mechanical properties

At the time that the steel is made available for shipment, the mechanical properties shall be as stated in Table 3, when they are determined on test pieces obtained in accordance with the requirements of clause 7.

NOTE Either R_{eH} or R_{eL} may be specified, but not both.

4.7 Surface condition

Oxide or scale on hot-rolled steel sheet is subject to variations in thickness, adherence and colour. Removal of the oxide or scale by pickling or grit blasting may disclose surface imperfections not readily visible prior to this operation.

4.8 Oiling

As a deterrent to rusting, a coating of oil is usually applied to hot-rolled descaled steel sheet, but sheet may be furnished not oiled if required. The oil is not intended as a forming lubricant and shall be easily removable using degreasing chemicals. On request, the manufacturer shall advise the purchaser which type of oil has been used.

Table 3 — Mechanical properties

Grade ^a	R_e min. ^b N/mm ²		R_m min. (information only) N/mm ²	A min. % ^c			
				$e < 3$		$3 \leq e \leq 6$	
				R_{eH}	R_{eL}	$L_0 = 50$ mm	$L_0 = 80$ mm
HR235	235	215	330	20	18	23	22
HR275	275	255	370	17	15	20	18
HR355	355	335	450	15	13	19	16

R_e = yield stress
 R_{eH} = upper yield stress
 R_{eL} = lower yield stress
 R_m = tensile strength
A = percentage elongation after fracture
 L_0 = gauge length on test piece
 S_0 = original cross-sectional area of gauge length
 e = thickness of steel sheet, in millimetres
1 N/mm² = 1 MPa

^a Formerly designated as grades Fe37, Fe44 and Fe52.
^b Either R_{eH} or R_{eL} shall be specified and the measured value shall meet the minimum requirement. The yield stress values can be measured by 0,5 % elongation proof stress (proof stress under load) or by 0,2 % offset when a definite yield phenomenon is not present.
^c For thicknesses up to 3 mm, use either $L_0 = 50$ mm or $L_0 = 80$ mm. For thicknesses from 3 mm to 6 mm use either $L_0 = 5,65 \sqrt{S_0}$ or $L_0 = 50$ mm. In case of dispute, however, only the results obtained on a proportional test piece will be valid for material 3 mm and over in thickness.

5 Dimensional tolerances

5.1 Dimensional tolerances applicable to hot-rolled steel sheet of structural quality shall be as given in Tables 4 to 12 inclusive.

5.2 Restricted thickness tolerances are given in Table 5.

Table 4 — Normal thickness tolerances for hot-rolled sheet steel (including descaled sheet), coils and cut lengths

Values in millimetres

Specified widths	Thickness tolerances ^a for specified thicknesses ^b					
	1,6 ≤ 2,0	> 2,0 ≤ 2,5	> 2,5 ≤ 3,0	> 3,0 ≤ 4,0	> 4,0 ≤ 5,0	> 5,0 ≤ 6,0
600 ≤ 1 200	± 0,17	± 0,18	± 0,20	± 0,22	± 0,24	± 0,26
> 1 200 ≤ 1 500	± 0,19	± 0,21	± 0,22	± 0,24	± 0,26	± 0,28
> 1 500 ≤ 1 800	± 0,21	± 0,23	± 0,24	± 0,26	± 0,28	± 0,29
> 1 800	—	± 0,25	± 0,26	± 0,27	± 0,29	± 0,31

The values specified do not apply to the uncropped ends for a length "l" of a mill edge coil. The total length "l" would be calculated using the following formula:

$$\text{Total length "l" in meters} = \frac{90}{\text{Thickness in mm}}$$

provided that the result was not greater than 20 m.

^a For grade HR355 increase the thickness tolerances by 10 % applying normal rounding off procedures.

^b Thickness is measured at any point on the sheet not less than 25 mm from a sheared edge and 40 mm from a mill edge. Points closer than these are subject to negotiation.

6 Sampling

One representative sample for the tensile test required in Table 3 shall be taken from each lot of sheet for shipment. A lot consists of 50 tonnes or less of sheet of the same grade and class rolled to the same thickness and condition.

7 Mechanical property tests

The tensile test shall be carried out in accordance with ISO 6892. Transverse test pieces shall be taken midway between the centre and edge of the sheet as rolled.