INTERNATIONAL STANDARD

ISO 6317

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Hot-rolled carbon steel strip of commercial and drawing qualities

Feuillards en acier au carbone laminés à chaud de qualités commerciale et pour emboutissage

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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 6317 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This second edition cancels and replaces the first edition (ISO 6317:1982), which has been technically revised.

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Hot-rolled carbon steel strip of commercial and drawing qualities

1 Scope

1.1 This International Standard applies to hot-rolled carbon steel strip of commercial and drawing qualities.

NOTE Steel strip that is to be subjected to subsequent rerolling is not covered by this International Standard.

Hot-rolled steel strip is suitable for many applications where the presence of oxide or scale, or normal surface imperfections disclosed after removal of oxide or scale, are not objectionable. It is not suitable for applications where surface is of prime importance. It is rolled on a narrow strip mill.

1.2 Commercial-quality strip (HR1) is intended for general fabrication purposes where strip is used in the flat, or for bending, moderate forming and welding operations. It is commonly produced in the range of thicknesses 0,65 mm to 12 mm inclusive, and widths up to 600 mm exclusive, in coils and cut lengths.

1.3 Drawing-quality strip (HR2, HR3, HR4) is intended for drawing or severe forming, including welding. It is commonly produced in the range of thicknesses 0,65 mm to 12 mm inclusive, and widths up to 600 mm exclusive, in coils and cut lengths. Drawing-quality strip is furnished to all the requirements of this International Standard or, by agreement when ordered, to fabricate an identified part, in which case the mechanical properties in Table 2 do not apply. Specific drawing qualities are identified as follows:

HR2 Drawing quality

HR3 Deep-drawing quality

HR4 Deep-drawing quality, aluminium-killed

2 Normative reference

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, this publication 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, *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
aluminium-killed steel
steel which has been deoxidized with aluminium sufficient to prevent the evolution of gas during solidification

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3.2
hot-rolled steel strip
a product obtained usually by rolling heated steel (billet or slab) through a continuous-type mill to the required strip thickness and tolerances

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

3.3
hot-rolled descaled steel strip
hot-rolled steel strip from the surface of 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 increase in hardness and some loss of ductility may result from descaling.

3.4
skin pass
a light cold rolling of the product

NOTE 1 The purpose of skin passing is one or more of the following:

a) to minimize the appearance of coil breaks, stretcher strains and fluting;

b) to control the shape;

c) to obtain the required surface finish.

NOTE 2 Some increase in hardness and some loss in ductility will result from skin passing.

3.5
mill edge
a normal side edge produced without any definite contour in hot rolling

NOTE 1 Mill edges may contain some irregularities such as cracked or torn edges or thin (feathered) edges.

NOTE 2 A square mill edge can be produced by hot-edge rolling (with the corners not as square as a square-edge bar).

3.6
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

The processes used in making the steel and in manufacturing hot-rolled strip are left to the discretion of the manufacturer. On request, the purchaser shall be informed of the steelmaking process being used.

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4.2 Chemical composition

The chemical composition (heat analysis) shall be as agreed upon between the interested parties at the time of ordering. The ranges or limits shall be in accordance with the requirements of Table 1 for the designation specified.

Table 1 — Chemical composition (heat analysis)

Quality		C	Mn	P	S
Designation	Name	% max.	% max.	% max.	% max.
HR1	Commercial	0,12	0,60	0,045	0,045
HR2	Drawing	0,10	0,45	0,035	0,035
HR3	Deep drawing	0,08	0,40	0,030	0,030
HR4	Deep drawing, aluminium-killed	0,08	0,35	0,025	0,025

4.3 Chemical analysis

4.3.1 Heat analysis

A heat analysis of each heat of steel shall be made by the manufacturer to determine compliance with the requirements of Table 1. When requested at the time of ordering, 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 to verify the specified analysis of the semi-finished or finished steel and shall take into consideration any normal heterogeneity. For killed steels, the sampling method and deviation limits shall be agreed upon between the manufacturer and purchaser at the time of ordering.

4.4 Weldability

This product is normally suitable for welding if appropriate welding conditions are selected. For undescaled steel, it may be necessary to remove the scale or oxide, depending upon the welding method.

4.5 Application

It is desirable that hot-rolled steel strip be identified for fabrication by name of the part or by the intended application. Hot-rolled steel strip (HR1, HR2, HR3, HR4) may be produced to make an identified part within a properly established breakage allowance which shall be previously agreed upon between the interested parties. In this case, part name, details of fabrication and special requirements such as freedom from stretcher strains or from fluting shall be specified and the mechanical properties in Table 2 do not apply.

4.6 Mechanical properties

Except when ordered to make an identified part, as explained in 4.5, at the time that the steel is made available for shipment, the mechanical properties shall be as given in Table 2, when they are determined on test pieces obtained in accordance with the requirements of clause 6.

Prolonged storage of the strip can cause a change in the mechanical properties (increase in hardness and a decrease in elongation), leading to a decrease in drawability. To minimize this effect, the quality HR4 should be specified.

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4.7 Surface condition

Oxide or scale on hot-rolled steel strip is subject to variations in thickness, adherence and colour. Removal of the oxide or scale by pickling or blast cleaning may disclose surface imperfections not readily visible prior to this operation. Also, after drawing, imperfections may be visible which were not apparent in the flat strip.

4.8 Oiling

As a deterrent to rusting, a coating of oil is usually applied to the product. The oil is not intended as a drawing or forming lubricant and shall be easily removable with degreasing chemicals. The product may be ordered not oiled, if required, in which case the supplier has limited responsibility if oxidation occurs.

Table 2 — Mechanical properties

Quality		R_m, max. [a] N/mm^2	A min. [b,c]			
			$e < 3$		$3 \leqslant e \leqslant 6$	
Designation	Name		L_o = 80 mm	L_o = 50 mm	$L_o = 5{,}65\sqrt{S_o}$	L_o = 50 mm
HR1	Commercial	440	23	24	28	29
HR2	Drawing	420	25	26	30	31
HR3	Deep drawing	400	28	29	33	34
HR4	Deep drawing, aluminium-killed	380	31	32	36	37

R_m = tensile strength

A = percentage elongation after fracture

L_o = gauge length on test piece

S_o = original cross-sectional area of gauge length

e = thickness of steel strip, in millimetres

1 N/mm^2 = 1 MPa

[a] Minimum tensile strength for qualities HR1, HR2, HR3 and HR4 would normally be expected to be 270 N/mm^2. Where minimum tensile strength is required, the value of 270 N/mm^2 may be specified. All tensile-strength values are determined to the nearest 10 N/mm^2.

[b] For thicknesses up to 3 mm, use either L_o = 50 mm or L_o = 80 mm. For thicknesses from 3 mm to 6 mm inclusive, use either $L_o = 5{,}65\sqrt{S_o}$ or L_o = 50 mm. In cases of dispute, however, only the results obtained on a proportional test piece will be valid for material 3 mm and over in thickness.

[c] Refer to 4.5 (application).

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5 Dimensional tolerances

Dimensional tolerances applicable to hot-rolled strip of commercial and drawing qualities shall be as given in Tables 3 to 8 inclusive.

Restrictive thickness tolerances are given in Table 4.

It has not been found practicable to formulate flatness tolerances for hot-rolled steel strip.

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6 Sampling

One representative sample for the tensile test required in Table 2 shall be taken from each lot of strip for shipment. A lot consists of 50 t or less of strip of the same designation, rolled to the same thickness and condition.

7 Mechanical-property tests

The tensile test shall be carried out in accordance with ISO 6892. Longitudinal test pieces shall be used.

8 Retests

8.1 Machining and flaws

If any test piece shows defective machining or develops flaws, it shall be discarded and another test piece substituted.

8.2 Elongation

If the percentage elongation of any test piece is less than that specified in Table 2 or if any part of the fracture is outside the middle half of the gauge length as scribed before the test, the test shall be discarded and a retest shall be carried out.

8.3 Additional tests

If a test does not give the specified results, two more tests shall be carried out at random on the same lot. Both retests shall conform to the requirements of this International Standard; otherwise, the lot may be rejected.

9 Resubmission

9.1 The manufacturer may resubmit for acceptance the products that have been rejected during earlier inspection because of unsatisfactory properties, after he has subjected them to a suitable treatment (selection, heat treatment) which, on request, will be indicated to the purchaser.

In this case, the tests shall be carried out as if they applied to a new batch.

9.2 The manufacturer has the right to present the rejected products to a new examination for compliance with the requirements for another quality.

10 Workmanship

The surface condition shall be that normally obtained in a hot-rolled or hot-rolled descaled product.

The steel strip in cut lengths shall be free from amounts of laminations, surface flaws and other imperfections that are detrimental to subsequent appropriate processing.

Processing for shipment in coils does not afford the manufacturer the opportunity to observe readily or to remove imperfect portions as can be carried out on the cut length product.

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11 Inspection and acceptance

11.1 While not usually required for products covered by this International Standard, when the purchaser specifies that inspection and tests for acceptance be observed prior to shipment from the manufacturer's works, the manufacturer shall afford the purchaser's inspector all reasonable facilities to determine that the steel is being furnished in accordance with this International Standard.

11.2 Steel that is reported to be defective after arrival at the user's works shall be set aside, properly and correctly identified and adequately protected. The supplier shall be notified in order that he may properly investigate.

12 Coil size

When hot-rolled steel strip is ordered in coils, a minimum inside diameter (ID) or range of acceptable inside diameters shall be specified. In addition, the maximum outside diameter (OD) and the maximum acceptable coil mass shall be specified.

13 Marking

Unless otherwise stated, the following minimum requirements for identifying the steel shall be legibly stencilled on the top of each lift or shown on a tag attached to each coil or shipping unit:

a) the manufacturer's name or identifying brand;

b) the number of this International Standard;

c) the quality designation;

d) the order number;

e) the product dimensions;

f) the lot number;

g) the mass.

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14 Information to be supplied by the purchaser

To specify requirements adequately in accordance with this International Standard, inquiries and orders shall include the following information:

a) reference to this International Standard, i.e. ISO 6317;

b) the name and quality of the material (for example, hot-rolled steel strip, deep-drawing quality HR3) (see 1.2 and 1.3);

c) the dimensions of the product and the quantity required;

d) the application (name of part) if possible (see 4.5);

e) for drawing qualities HR2, HR3 and HR4, whether ordered to mechanical properties or to fabricate an identified part (see 4.6 and 4.5);

f) whether pickling or descaling by grit or shot blasting is required (material so specified will be oiled unless ordered not oiled) (see 3.3 and 4.8);

g) the type of edge (see 3.5 and 3.6);

h) whether skin passing is required (see 3.4);

i) the report of the heat analysis, if required (see 4.3.1);

j) limitations on mass and dimensions of individual coils or bundles, if applicable (see clause 12);

k) inspection and tests for acceptance prior to shipment from the manufacturer's works, if required (see 11.1).

NOTE Typical ordering descriptions are as follows:

1) ISO 6317, hot-rolled steel strip, commercial quality HR1, 3 mm × 200 mm × 1 600 mm, 10 000 kg, to be used for warehouse resale, edge trimmed, furnish report of heat analysis, maximum lift mass 1 000 kg.

2) ISO 6317, hot-rolled steel strip, deep-drawing quality HR3, 2,5 mm × 300 mm × coil, 50 000 kg, ordered to mechanical properties, pickled and oiled, mill edge, coils 600 mm minimum ID, 1 500 mm maximum OD, maximum coil mass 3 000 kg.

Table 3 — Normal thickness tolerances for hot-rolled steel strip (including descaled strip), coils and cut lengths

Values in millimetres

Specified width	**Thickness tolerances** for specified thicknesses							
	$e \leqslant 1{,}5$	$1{,}5 < e \leqslant 2$	$2 < e \leqslant 4$	$4 < e \leqslant 5$	$5 < e \leqslant 6$	$6 < e \leqslant 8$	$8 < e \leqslant 10$	$10 < e \leqslant 12$
$\geqslant 10$ < 100	± 0,12	± 0,14	± 0,15	± 0,16	± 0,17	± 0,18	± 0,19	—
$\geqslant 100$ < 600	± 0,14	± 0,16	± 0,17	± 0,18	± 0,19	± 0,20	± 0,22	± 0,27

NOTE 1 The values specified do not apply to the uncropped ends of a mill-edge coil within 7 m inclusive of either end.

NOTE 2 The thickness is measured at any point on the strip not less than 20 mm from a side edge for mill-edge strip and not less than 10 mm from a side edge for edge-trimmed strip. Measurement shall not be made on top of the shear burr.

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Table 4 — Restrictive thickness tolerances for hot-rolled steel strip (including descaled strip) and cut lengths

Values in millimetres

Specified width	Thickness tolerances for specified thicknesses							
	$e \leqslant 1{,}5$	$1{,}5 < e \leqslant 2$	$2 < e \leqslant 4$	$4 < e \leqslant 5$	$5 < e \leqslant 6$	$6 < e \leqslant 8$	$8 < e \leqslant 10$	$10 < e \leqslant 12$
$\geqslant 10$ < 100	± 0,09	± 0,10	± 0,11	± 0,12	± 0,13	± 0,14	± 0,14	—
$\geqslant 100$ < 600	± 0,10	± 0,12	± 0,13	± 0,14	± 0,14	± 0,15	± 0,17	± 0,20

NOTE 1 The values specified do not apply to the uncropped ends of a mill-edge coil within 7 m inclusive of either end.

NOTE 2 The thickness is measured at any point on the strip not less than 20 mm from a side edge for mill-edge strip and not less than 10 mm from a side edge for edge-trimmed strip. Measurement shall not be made on top of the shear burr.

Table 5 — Width tolerances for hot-rolled steel strip (including descaled strip), mill edge coils and cut lengths

Values in millimetres

Specified width	Tolerance
$\leqslant 50$	± 0,8
$> 50 \leqslant 100$	± 1,2
$> 100 \leqslant 200$	± 1,6
$> 200 \leqslant 400$	± 2
$> 400 \leqslant 600$	± 2,5

NOTE 1 The values specified do not apply to the uncropped ends of a mill-edge coil within 7 m inclusive of either end.

NOTE 2 By agreement between the manufacturer and purchaser, material can be ordered to all plus tolerances, in which case the value in the table is doubled.

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