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Fourth edition
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Steel strip, cold-reduced with a mass fraction of carbon over 0,25 %

Feuillards en acier au carbone laminés à froid à teneur en carbone supérieure à 0,25 %

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document 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 4960:2007), which has been technically revised. The main changes compared to the previous edition are as follows:

— added definitions for surface finishes and "lot";

— revised scope;

— added Clause 4 for “Dimensions”;

— “Specified qualities appropriate to the particular grade” changed to “Ordering conditions”, renumbered as 5.3;

— 5.5.1 changed from HRB to HRBW;

— previous 5.5 changed to 5.8 using revised surface finish terminology, addition of surface roughness requirements;

— revised Table 5.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Steel strip, cold-reduced with a mass fraction of carbon over 0,25 %

1 Scope

This document specifies the minimum requirements for steel strip of carbon over 0,25 %, in coils and cut lengths.

The product is applicable to highly stressed parts of many different types and is characterized by close dimensional tolerances and controlled surface finishes.

The steel strip is produced in a number of types and surface finishes to be compatible with differing applications requirements.

This document does not apply to alloy steels or stainless steels.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
cold-reduced carbon steel strip
product produced from a hot-rolled pickled coil which has been given substantial cold reduction

Note 1 to entry: The product is characterized by an improved surface, greater uniformity in thickness and improved mechanical properties compared to hot-rolled strip. A cold-reduced strip is also characterized by tighter thickness tolerances than a cold-reduced sheet, as well as by specified edges.

3.2
skin pass
light cold rolling of the product

Note 1 to entry: The purpose of the skin passing is one or more of the following: to minimize the appearance of coil breaks, stretcher strains and fluting; to control the shape; and to obtain the required surface finish.

Note 2 to entry: Some increase in hardness and some loss in ductility will result from skin passing.

3.3
mill edge
normal side edge without any definite contour produced in hot rolling

Note 1 to entry: Mill edges may contain some irregularities, such as cracked or torn edges or thin (feathered) edges.

3.4
sheared edge
material with a burr developed where the material was cut

3.5
matte finish
dull finish
rougher finish obtained by temper passing cold-reduced strip using rolls roughened by mechanical or chemical means

Note 1 to entry: Surface roughness of the strip is typically *Ra* 0,5 µm to 2,0 µm, which is beneficial in obtaining better paint adhesion, and in aiding drawing by reducing surface friction due to better oil adhesion.

3.6
regular bright finish
moderately bright reflective lustre finish obtained by temper passing cold-reduced strip using rolls with a ground finish

Note 1 to entry: Surface roughness of the strip is typically *Ra* 0,5 µm, which is suitable for many applications but not necessarily for bright plating applications.

3.7
plating bright finish
smooth bright finish where a high lustre is not necessary obtained by temper passing cold-reduced strip using rolls with a fine ground finish

Note 1 to entry: Surface roughness of the strip is typically *Ra* 0,25 µm max.

3.8
best bright finish
mirror bright finish obtained by temper passing cold-reduced strip using rolls with a polished finish

Note 1 to entry: Surface roughness is of the strip is typically *Ra* 0,10 µm max., which is suitable for bright plating.

3.9
lot
up to a specified quantity of material of the same designation rolled to the same thickness and surface condition

4 Dimensions

Cold-reduced steel strip is commonly produced in thicknesses of 6 mm and under, and in widths up to 600 mm, in coils and cut lengths. Strip products may be available in widths greater than 600 mm by agreement between producer and purchaser; however, such products are typically classified as cold-rolled sheet.

5 Conditions of manufacture

5.1 Steelmaking

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

5.2 Chemical composition

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

5.3 Chemical analysis

5.3.1 Heat analysis

An analysis of each heat shall be made by the manufacturer in order to determine conformity with the requirements given in Tables 1 and 2. On request, a report of the heat analysis shall be made available to the purchaser or the purchaser's representative. Each of the elements listed in Tables 1 and 2 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 %".

5.3.2 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. The product analysis shall be in accordance with Tables 2 and 3.

Table 1 — Chemical composition (heat analysis)

Mass fractions in percent

Grade	C	Mn[a]	P[b] max.	S[b] max.	Si[c] max.
CS30	0,28 to 0,34	0,60 to 0,90	0,035	0,03	0,35
CS35	0,32 to 0,38	0,60 to 0,90	0,035	0,03	0,35
CS40	0,37 to 0,44	0,60 to 0,90	0,035	0,03	0,35
CS45	0,43 to 0,50	0,60 to 0,90	0,035	0,03	0,35
CS50	0,48 to 055	0,60 to 0,90	0,035	0,03	0,35
CS55	0,50 to 0,60	0,60 to 0,90	0,035	0,03	0,35
CS60	0,55 to 0,65	0,60 to 0,90	0,035	0,03	0,35
CS65	0,60 to 0,70	0,60 to 0,90	0,035	0,03	0,35
CS70	0,65 to 0,75	0,60 to 0,90	0,035	0,03	0,35
CS75	0,70 to 0,80	0,40 to 0,70	0,035	0,03	0,35
CS85	0,80 to 0,93	0,70 to 1,00	0,035	0,03	0,35
CS95	0,90 to 1,03	0,30 to 0,50	0,035	0,03	0,35

[a] Other manganese values can be specified upon agreement at the time of ordering, provided a range of 0,30 % is maintained.

[b] When specified, phosphorus and sulfur may be ordered to 0,020 % maximum by heat analysis.

[c] Silicon can be specified as a restricted range upon agreement at the time of ordering.

Table 2 — Limits on additional chemical elements

Mass fractions in percent

Element	Grade	Heat analysis max.	Product analysis max.
Cu[a]	(CS30–CS75)	0,30	0,33
	(CS85–CS95)	0,25	0,28
Ni[a]	(CS30–CS75)	0,20	0,23
	(CS85–CS95)	0,25	0,28
Cr[abc]	(CS30–CS75)	0,20	0,24
	(CS85–CS95)	0,30	0,34
Mo[ab]	(CS30–CS95)	0,06	0,07
Nb[d]	(CS30–CS95)	0,008	0,018
V[d]	(CS30–CS95)	0,008	0,018
Ti[d]	(CS30–CS95)	0,008	0,018

[a] 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.

[b] 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.

[c] A higher value of Cr may be supplied after agreement between the producer and consumer.

[d] An analysis greater than 0,008 % may be supplied after agreement between the manufacturer and the purchaser.

Table 3 — Product analysis tolerances for Table 1

Mass fractions in percent

Element	Range/Maximum of specified element	Tolerance over maximum specified
C	0,15 < C ≤ 0,40	0,04
	0,40 < C ≤ 0,80	0,05
	>0,80	0,06
Mn	≤0,60	0,03
	0,60 < Mn ≤ 1,15	0,04
Si	0,30 < Si ≤ 0,60	0,05
P	≤0,04	0,01
S	≤0,04	0,01

NOTE The above maximum tolerance is the allowable excess over the requirement of the heat analysis shown in Table 1.

5.4 Ordering conditions

5.4.1 Cold-reduced steel strip is supplied one of the following ordering conditions:

a) full-hard quality: material rolled to the final thickness with a minimum hardness;

b) spheroidized annealed quality: annealed to a hardness or tensile strength, or both;

c) quenched and tempered quality: quenched and tempered steel strip for steel designations of CS55 and over, tempered to properties;

d) intermediate quality: temper rolled to a hardness range by a controlled amount of cold-reduced after annealing.

5.4.2 The material shall be ordered in accordance with either hardness or tensile strength requirements, but not with both, unless agreed to by both parties.

5.5 Mechanical properties

5.5.1 Hardness

When required [see 5.4.2 and Clause 15 h)], the hardness shall conform to Tables 4, 5, 7 or 8. In case of the intermediate quality, hardness shall conform to Table 8, or shall be as agreed upon between the manufacturer and the purchaser.

HV is the Vickers hardness.

HR is the Rockwell hardness. HRBW is the Rockwell hardness (type B) using tungsten carbide indenter ball.

5.5.2 Tensile properties

When required [see 5.4.2 and Clause 15 h)] the tensile properties shall be as stated in Tables 5 and 6, at the time the steel is made available for shipment if the mechanical property designation is specified.

5.6 Application

It is desirable to identify the specified product 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.

5.7 Weldability

This product is suitable for welding if appropriate welding conditions are selected.

5.8 Surface finish condition

5.8.1 Cold-reduced steel strip is produced in a regular bright finish by rolling on rolls having a moderately smooth finish (it is not generally applicable to bright plating); or in a dull finish by rolling on rolls roughened by mechanical or chemical means. The dull finish is suitable for lacquer or paint adhesion.

5.8.2 Quenched and tempered strip (see 5.4.1) may be supplied with the following surface finishes:

a) matte (dull);

b) regular bright;

c) plating bright;

d) best bright.

5.9 Oiling

As a deterrent to rusting, a coating of oil is usually applied to cold-reduced steel strip. The oil is not intended as a drawing or forming lubricant and should be easily removable with degreasing chemicals. On request, the manufacturer shall advise the purchaser which type of oil has been used. Cold-reduced steel strip may be ordered not oiled, if required, in which case the supplier has limited responsibility if oxidation occurs.