INTERNATIONAL STANDARD

ISO 6932

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Cold-reduced carbon steel strip with a maximum carbon content of 0,25 %

Feuillards en acier au carbone laminés à froid avec une teneur maximale en carbone égale 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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This fourth edition cancels and replaces the third edition (ISO 6932:2008), which has been technically revised.

Cold-reduced carbon steel strip with a maximum carbon content of 0,25 %

1 Scope

This International Standard describes cold-reduced carbon steel strip with a maximum mass fraction of carbon of 0,25 %, furnished to two levels of closer tolerances than cold-reduced carbon steel sheet, with specific quality, specific hardness requirements or mechanical properties, specific edge, and specific finish.

NOTE This International Standard does not apply to the product in narrow widths known as cold-reduced carbon steel sheet slit from wider widths (see ISO 3574), nor does it include cold-reduced carbon steel strip with a mass fraction of carbon over 0,25 % (see ISO 4960).

Cold-reduced carbon steel strip is produced with a maximum mass fraction of the specified carbon not exceeding:

— 0,15 % for material specified to mechanical properties;

— 0,25 % for material specified to temper (hardness) requirements.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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.

3.1
cold-reduced carbon steel strip
product manufactured from hot-rolled, descaled coils by cold reducing to the desired thickness on a single-stand mill or on a tandem mill consisting of several single stands in series

3.2
cold reduction
process of reducing the thickness of the strip at room temperature whereby the amount of reduction is greater than that used for a *skin pass* (3.8)

3.3
aluminium killed
steel which has been deoxidized with aluminium sufficient to prevent the evolution of gas during solidification

3.4
annealing
process of heating to, and holding at, a suitable temperature and then cooling at a suitable rate for such purposes as lowering hardness, facilitating cold working, producing a desired microstructure or obtaining desired mechanical, physical, or other properties

3.5
temper
designation by number or term to indicate the hardness as a minimum, as a maximum, or as a range

Note 1 to entry: The tempers are obtained by the selection and control of chemical composition by amounts of *cold reduction* (3.2), by thermal treatment, and by a skin pass.

3.6
dead soft
condition describing annealed strip produced without definite control of stretcher strains or fluting

Note 1 to entry: It is suitable for drawing and other applications where such surface characteristics are not objectionable.

3.7
surface finish
degree of smoothness or lustre of the strip

3.8
skin pass
light cold rolling of the product resulting in an increase in hardness and some loss in ductility

Note 1 to entry: The purpose of skin passing is to minimize the appearance of coil breaks, stretcher strains and fluting, or to control the shape, or to obtain the required *surface finish* (3.7).

3.9
lot
sample portion consisting of 50 t or less of strip of the same designation rolled to the same thickness and *temper* (3.5) or mechanical properties

4 Dimensions

This product is commonly produced in thicknesses of 6 mm and under, and in widths of up to 600 mm, in coils and cut lengths.

5 Chemical composition

5.1 General

The chemical composition (heat analysis) shall not exceed the values given in Tables 1 and 2.

5.2 Heat analysis

An analysis of each heat of steel shall be made by the manufacturer to determine compliance with the requirements of Tables 1 and 2. When requested at the time of ordering, this analysis shall be reported to the purchaser or his representative.

5.3 Product analysis

A product analysis can be made by the purchaser to verify the specified analysis of the product and shall take into consideration any normal heterogeneity.

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

Table 1 — Chemical composition (heat analysis)

Mass fractions in per cent

Temper or quality designation	Carbon (C) max.	Manganese (Mn) max.	Phosphorus (P) max.	Sulfur (S) max.
Temper No. 1, 2, 3	0,25	0,60	0,035	0,04
Temper No. 4, 5	0,15	0,60	0,035	0,04
CR21	0,15	0,60	0,05	0,035
CR22	0,10	0,50	0,04	0,035
CR23	0,08	0,45	0,03	0,03
CR24	0,06	0,45	0,03	0,03

Table 2 — Limits on additional chemical elements[a]

Mass fractions in per cent

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 can 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] A heat analysis greater than 0,008 % can be supplied after agreement between producer and consumer.

Table 3 — Product analysis tolerances

Mass fractions in per cent

Element	Range of specified element	Tolerance over maximum specified
Carbon	≥0,06 to ≤0,15	0,03
	>0,15 to ≤0,25	0,04
Manganese	≤0,60	0,03
Phosphorus	≤0,05	0,01
Sulfur	≤0,04	0,01

NOTE The above maximum tolerance is the allowable excess over the specified requirements not the heat analysis.

6 Conditions of manufacture

6.1 Physical properties

6.1.1 Either temper requirements in accordance with Table 4 or mechanical properties in accordance with Table 5 can be specified as given in this International Standard, but not both, since there is no direct correlation.

6.1.2 Cold-reduced carbon steel strip specified to temper requirements is produced to the following temper designations:

— No. 1 (hard);

— No. 2 (half hard);

— No. 3 (quarter hard);

— No. 4 (skin-passed);

— No. 5 (dead soft).

6.1.3 Cold-reduced carbon steel strip specified to mechanical properties is produced to the following commercial and drawing quality designations:

— CR21 (commercial quality);

— CR22 (drawing quality);

— CR23 (deep drawing quality);

— CR24 (deep drawing quality aluminium killed).

6.2 Steelmaking

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

Table 4 — Temper and hardness requirements for cold-reduced carbon steel strip

Temper	Thickness *e* mm	Hardness			
		Rockwell B scale HRB	Rockwell 30T scale HR30T	Rockwell 15T scale HR15T	Vickers HV
No. 1	$e \leq 0{,}36$	—	—	88,2 min.	170 min.
(hard)	$0{,}36 < e \leq 1{,}0$	—	73,1 min.	—	170 min.
	$e > 1{,}0$	84 min.	—	—	162 min.
No. 2	$e \leq 0{,}36$	—	—	83,5 to 89,5	125 to 185
(half hard)	$0{,}36 < e \leq 1{,}0$	—	63,5 to 75,8	—	125 to 185
	$e > 1{,}0$	70 to 89	—	—	125 to 185
No. 3	$e \leq 0{,}36$	—	—	80 to 86,6	107 to 150
(quarter hard)	$0{,}36 < e \leq 1{,}0$	—	56,5 to 69,7	—	107 to 150
	$e > 1{,}0$	60 to 80	—	—	107 to 150
No. 4[a]	$e \leq 0{,}36$	—	—	82 max.	116 max.
(skin-passed)	$0{,}36 < e \leq 1{,}0$	—	60 max.	—	116 max.
	$e > 1{,}0$	65 max.	—	—	116 max.
No. 5[a]	$e \leq 0{,}36$	—	—	78,5 max.	100 max.
(dead soft)	$0{,}36 < e \leq 1{,}0$	—	53 max.	—	100 max.
	$e > 1{,}0$	55 max.	—	—	100 max.

[a] Can be ordered with a carbon range of 0,15 % to 0,25 %. In each instance, the maximum hardness requirement is established by agreement.

Table 5 — Mechanical property requirements for cold-reduced carbon steel strip[a]

Quality designation	Condition of delivery[b]	R_e max.[c] MPa	R_m[d] MPa	A min. %	
				L_o = 80 mm[e]	L_o = 50 mm
CR21	HK[f]	—	—	—	—
	TC	—	410 max.	28	32
	HK270	—	410 max.	28	32
	HK290	—	290 to 430	18	24
	HK390	—	390 to 540	—	—
	HK490	—	490 to 640	—	—
	HK590	—	590 to 740	—	—
	HK690	—	690 min.	—	—
CR22	TC	—	370 max.	32	35
	HK270	250	370 max.	32	35
	HK290	355	290 to 410	21	25
	HK390	—	390 to 510	5	13
	HK490	—	490 to 620	—	—
	HK590	—	590 min.	—	—
CR23	TC	—	350 max.	36	38
	HK270	225 [g]	350 max.	36	38
	HK290	325	290 to 390	23	27
	HK390	—	390 to 490	6	14
	HK490	—	490 to 600	—	—
	HK590	—	590 min.	—	—
CR24	TC	—	350 max.	36	38
	HK270	225 [g]	350 max.	36	38
	HK290	325	290 to 390	23	27
	HK390	—	390 to 490	6	14
	HK490	—	490 to 590	—	—
	HK590	—	590 to 690	—	—

[a] Longitudinal test pieces:

R_e yield strength;

R_m tensile strength;

A percentage elongation after fracture;

L_o gauge length on test piece.

[b] Conditions of delivery: HK, cold-reduced; TC, annealed; HK270, skin-passed; HK290 to HK690, cold-reduced, various amounts.

[c] For thicknesses of 0,7 mm and less, the specified maximum yield strength values are increased by 20 MPa.

[d] Minimum tensile strength values for delivery conditions HK, TC and HK270 would normally be expected to be 270 MPa.

[e] Minimum elongation values are reduced by 2 % for thicknesses of 0,5 mm to 0,7 mm inclusive and by 4 % for thicknesses of less than 0,5 mm.

[f] There are no mechanical property requirements for this condition.

[g] For thicknesses of 1,5 mm and greater, the maximum yield strength is 235 MPa.

