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Cold-reduced carbon steel sheet according to hardness requirements

Tôles en acier au carbone laminées à froid à caractéristiques spéciales de dureté

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 5954:2007), which has been technically revised.

Cold-reduced carbon steel sheet according to hardness requirements

1 Scope

This International Standard applies to cold-reduced carbon steel sheet and corresponding hardness requirements. It is suitable for applications where the surface is of prime importance.

The following are common hardness ranges (see 6.6):

— CRH-50: Rockwell B 50 to 70;

— CRH-60: Rockwell B 60 to 80;

— CRH-70: Rockwell B 70 to 90;

— CRH-NN: Any Rockwell B range of 20 points up to and including HRB 90 maximum (designated minimum of specified range will be shown).

NOTE By agreement between the supplier and purchaser, Rockwell ranges less than 20 points can be specified.

This International Standard does not cover commercial quality or drawing qualities (covered in ISO 3574) and cold-reduced carbon steel strip.

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 6508 (all parts), *Metallic materials — Rockwell hardness test*

ISO 16162, *Cold-rolled steel sheet products — Dimensional and shape tolerances*

3 Terms and definitions

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

3.1
cold-reduced steel sheet
product obtained from hot-rolled descaled steel sheet by cold-reducing to the required sheet thickness followed by annealing to recrystallize the grain structure

Note 1 to entry: The product is normally supplied in the skin-passed condition.

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:

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 to entry: Some increase in hardness and some loss in ductility will result from skin passing. Cold-reduced sheet supplied in the skin-passed condition tends to strain-age and this might lead to an increase in the hardness value. Because of this, the hardness values at the time of shipment will be the determining factor as to whether the hardness requirement has been met.

3.3
lot
50 t or less of sheet of the same designation rolled to the same thickness and condition

4 Dimensions

4.1 The fabrication limits of cold-reduced carbon steel sheet according to hardness requirements are dependent on the specific range of hardness specified or agreed to. It is produced in thicknesses of 0,36 mm and above (commonly produced up to 3 mm) and in widths of 600 mm and over in coils and cut lengths. The hardness is commonly reported as Rockwell B (HRB).

4.2 Cold-reduced sheet less than 600 mm wide can be slit from wide sheet and will be considered as sheet.

5 Surface characteristics

5.1 General

The surface characteristics consist of the surface quality and the surface finish.

The surface quality and surface finish shall be as specified by the purchaser at the time of the order, in accordance with 5.2 and 5.3.

For non-skin-passed products, surface quality B (exposed) is not applicable and no requirement for a particular surface finish can be made.

5.2 Surface quality

The products are supplied with either of the surface qualities A or B.

5.2.1 Surface quality A (unexposed)

Imperfections, such as pores, slight imperfections, small marks, minor scratches, and slight colouring which do not affect the formability or the application of surface coatings, are permitted.

5.2.2 Surface quality B (exposed)

The better of the two surfaces shall be free of imperfections which might affect the uniform appearance of quality paint or an electrolytic coating (see 5.4). The other surface shall at least conform to surface quality A.

In the case of delivery of coil and slit coil, the percentage of defects might be greater than in the case of delivery in sheet or cut lengths. This should be taken into account by the purchaser, and the percentage of admissible surface defects can be agreed at the time of the enquiry and order. Unless otherwise agreed, a single surface of the product shall comply with the specified requirements. The other surface shall be such that, during subsequent treatment, it does not have a deleterious effect on the better surface.

5.3 Surface finish

When cold-reduced steel sheet is deformed during fabrication, localized areas might roughen to some degree, and such affected portions of the part might require hand-finishing to prepare the surface for the intended application.

By agreement at the time of the enquiry and order, ranges for surface roughness can be specified for specific end uses.

5.4 Suitability for surface coating

The products might be required for metallic coating by the hot dip coating or electrolytic coating process, or organic coating or other coating. When such a coating is intended, it shall be specified at the time of ordering.

5.5 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 removed using degreasing chemicals. The product might be ordered unoiled, if required, in which case, the supplier has limited responsibility if oxidation occurs.

6 Conditions of manufacture

6.1 Steelmaking

The processes used in making the steel and in manufacturing cold-reduced sheet according to hardness requirements are left to the discretion of the manufacturer. On request, the purchaser shall be informed of the steelmaking process being used.

6.2 Chemical composition

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

NOTE The hardness requirements are normally obtained by controlling carbon, phosphorus, or a combination of carbon and phosphorous.

Table 1 — Chemical composition (heat analysis)

Mass fraction in per cent

Designation	C max.	Mn max.	P max.	S max.
CRH-50	0,15	0,60	0,15	0,03
CRH-60	0,25	0,60	0,15	0,03
CRH-70	0,25	0,60	0,15	0,03
CRH-NN	0,25	0,60	0,15	0,03

Table 2 — Limits on additional chemical elements

Mass fraction in per cent

Element	Heat analysis max.	Product analysis max.
Cu[a]	0,20	0,23
Ni[a]	0,20	0,23
Cr[ab]	0,15	0,19
Mo[ab]	0,06	0,07
Nb[c]	0,008	0,018
V[c]	0,008	0,018
Ti[c]	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] Analysis greater than 0,008 % can be supplied after agreement between the producer and consumer.

6.3 Chemical analysis

6.3.1 Heat analysis

An analysis of each heat of steel shall be made by the manufacturer in order to determine compliance with the requirements given in Tables 1 and 2. On request, at the time of ordering, this analysis shall be reported to the purchaser or his representative. Each of the elements listed in Table 1 shall be included in the report of the heat analysis. If one or more of the elements in Table 2 is/are specified, the analysis shall be reported.

6.3.2 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 Table 3.

Table 3 — Product analysis tolerances

Element	Maximum of specified element %	Tolerance over maximum specified %
Carbon	≤0,15	0,03
	>0,15 to ≤0,40	0,04
Manganese	≤0,60	0,03
Phosphorus	≤0,15	0,01
Sulfur	≤0,04	0,01

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

6.4 Weldability

This product is normally suitable for welding if appropriate welding conditions are selected. The hardness can be changed in the heat-affected zone of the welds. When the mass fraction of carbon exceeds 0,15 % or the mass fraction of phosphorus exceeds 0,05 %, welding becomes more difficult.

6.5 Application

It is desirable that cold-reduced steel sheet and corresponding hardness requirements be identified for fabrication by the name of the part or by the intended application. Proper identification of the part can include visual examination, prints, or description, or a combination of these. Details of fabrication and special requirements (exposed or unexposed, freedom from stretcher strains or fluting) shall be specified, as well as the hardness range.

6.6 Hardness ranges

The Rockwell hardness ranges represent the values as-shipped.

Table 4 — Hardness ranges

Designation	Hardness ranges	
	HRB[a]	HR30T[b]
CRH-50	50/70	50/62,5
CRH-60	60/80	56,5/70
CRH-70	70/90	62,5/77
CRH-NN	As agreed on by the manufacturer and purchaser	

[a] For product thickness ≥1 mm.

[b] For product thickness <1 mm.

7 Dimensional tolerances

Dimensional tolerances applicable to cold-reduced carbon steel sheet according to hardness requirements shall be as given in ISO 16162. If flatness tolerances are required, they shall be negotiated.

8 Sampling

One representative sample for the hardness test required in Table 4 shall be taken from each lot of sheet for shipment.

9 Tests

The hardness test shall be carried out in accordance with ISO 6508 on test pieces taken midway between the centre and the edge of the sheet as rolled.

10 Cold bending properties

Although bend tests are not required, CRH-50 is expected to be capable of being bent flat on itself through 180°, both parallel and perpendicular to the rolling direction. CRH-60 is expected to be capable of being bent through 90°, with the axis of bend parallel to the rolling direction on a 1 thickness radius, or flat on itself perpendicular to the rolling direction with a 1 thickness radius. CRH-70 is expected to be capable of being bent 90° with a 1 thickness radius perpendicular to the rolling direction. By agreement between the supplier and purchaser, a bend test can be carried out with these or other values of bend radii.