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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

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5954 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This third edition cancels and replaces the second edition (ISO 5954:1998), which has been technically revised.

Cold-reduced carbon steel sheet according to hardness requirements

1 Scope

1.1 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.

1.2 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).

1.3 The following are common hardness ranges (see 5.6):

— 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.

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

1.5 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 referenced documents are indispensable for the application 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 6508 (all parts), *Metallic materials — Rockwell hardness test*

ISO 16162, *Continuously 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 The product is normally supplied in the skin-passed condition.

3.2
skin pass
light cold rolling of the product

NOTE 1 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 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 may 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.

4 Surface characteristics

4.1 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 4.2 and 4.3.

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

4.2 Surface quality

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

4.2.1 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.

4.2.2 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 4.4). 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 may 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 may 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.

4.3 Surface finish

When cold-reduced steel sheet is deformed during fabrication, localized areas may roughen to some degree, and such affected portions of the part may 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 may be specified for specific end uses.

4.4 Suitability for surface coating

The products may 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.

4.5 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 may be ordered unoiled, if required, in which case, the supplier has limited responsibility if oxidation occurs.

5 Conditions of manufacture

5.1 Steelmaking

The processes used in marking 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.

5.2 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 percent

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 percent

Elements	Heat analysis max.	Product analysis max.
Cu [a]	0,20	0,23
Ni [a]	0,20	0,23
Cr [a, b]	0,15	0,19
Mo [a, b]	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 % may be supplied after agreement between thre producer and consumer.

5.3 Chemical analysis

5.3.1 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.

5.3.2 Product analysis

A product analysis may be made by the purchaser 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 steels, the sampling method and deviation limits shall be agreed upon between the interested parties at the time of ordering. 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	$\leqslant$ 0,15	0,03
	$>$ 0,15 to $\leqslant$ 0,40	0,04
Manganese	$\leqslant$ 0,60	0,03
Phosphorus	$\leqslant$ 0,15	0,01
Sulfur	$\leqslant$ 0,04	0,01
NOTE The above maximum tolerance is the allowable excess over the specified requirements and not the heat analysis.		

5.4 Weldability

This product is normally suitable for welding if appropriate welding conditions are selected. The hardness may 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.

5.5 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 may 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.

5.6 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.

6 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.

7 Sampling

One representative sample for the hardness test required in Table 4 shall be taken from each lot of sheet for shipment. A lot consists of 50 t or less of sheet of the same designation rolled to the same thickness and condition.

8 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.

9 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