TC 17

International Standard 5954

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Cold-reduced carbon steel sheet to hardness requirements

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

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5954 was developed by Technical Committee ISO/TC 17, *Steel*, and was circulated to the member bodies in February 1983.

It has been approved by the member bodies of the following countries :

Australia	Iran	Spain
Austria	Japan	Sweden
Belgium	Kenya	Switzerland
Canada	Korea, Dem. P. Rep. of	Tanzania
China	Korea, Rep. of	Turkey
Czechoslovakia	Mexico	USA
Finland	Netherlands	USSR
France	Poland	Venezuela
Germany, F.R.	Romania	
India	South Africa, Rep. of	

No member body expressed disapproval of the document.

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Cold-reduced carbon steel sheet to hardness requirements

1 Scope and field of application

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

1.2 The fabrication limits of cold-reduced carbon steel sheet to hardness requirements are dependent on the specific range of hardness specified or agreed to. It is produced in thickness of 0,36 mm and thicker (commonly produced up to 4 mm) and in widths of 600 mm and over in coils and cut lengths. The hardness is commonly reported as Rockwell B.

1.3 The following are common hardness ranges (see 4.6) :

CRH-50	Rockwell B 50 to 70
CRH-60	Rockwell B 60 to 75
CRH-70	Rockwell B 70 to 85
CRH*	Any Rockwell B range of 15 points up to and including HRB 90 maximum

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

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

2 References

ISO 80, *Rockwell hardness test (B and C scales) for steel.*

ISO 81, *Vickers hardness test for steel (Load 5 to 100 kgf).*

ISO 85, *Bend test for steel.*

ISO 87, *Simple bend testing of steel sheet and strip less than 3 mm thick.*

ISO/R 1024, *Rockwell superficial hardness test (N and T scales) for steel.*

3 Definitions and other information

3.1 cold-reduced steel sheet : A product obtained from hot-rolled descaled steel sheet by cold-reducing to the required sheet thickness followed by annealing to recrystallize the grain structure. The product is normally supplied skin passed (see 3.2).

3.2 skin pass : A final cold rolling of cold-reduced sheet. The purposes of skin passing are one or more of the following :

a) to minimize temporarily the occurrence of the condition known as stretcher strain (Lüders lines) or fluting during fabrication of finished parts;

b) to obtain required surface finish suitable for ordinary decorative painting;

c) to control the shape.

Cold-reduced sheet supplied in the skin-passed condition tends to strain-age and this may lead to increase in hardness value. Because of this, the hardness values at time of shipment will be the determining factor as to whether the hardness requirement was met.

3.3 Surface condition

The condition of the surface of cold-reduced steel sheet is not required to be the same for unexposed parts as it is for exposed parts.

Surface condition of sheet for unexposed parts may contain pores, some slight pitting, small markings, light scratches, and a light discoloration. The surface of sheet for exposed parts is reasonably free of these conditions. Unless otherwise agreed, only one side is inspected.

3.4 Surface finish

Cold-reduced steel sheet is normally produced in a matt finish, dull in appearance, which is suitable for ordinary decorative painting but is not recommended for bright electroplating.

* Designated minimum of specified range will be shown.

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.

3.5 Oiling

As a deterrent to rusting, a coating of oil is usually applied to cold-reduced steel sheet but sheet may be furnished not oiled if required. The oil is not intended as a drawing or forming lubricant and should be easily removable with degreasing chemicals.

4 Conditions of manufacture

4.1 Steelmaking

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

4.2 Chemical composition

The chemical composition (cast analysis) shall not exceed the values given in table 1.

Table 1 — Chemical composition (cast analysis), %

Designation	C[1] Max.	Mn Max.	P[1] Max.	S Max.
CRH-50	0,15	0,60	0,15	0,05
CRH-60	0,25	0,60	0,15	0,05
CRH-70	0,25	0,60	0,15	0,05
CRH-	0,25	0,60	0,15	0,05

1) The hardness requirements are normally obtained by a combination of carbon and/or phosphorus.

4.3 Chemical analysis

4.3.1 Cast analysis

A cast analysis of each cast of steel shall be made by the manufacturer to determine the percentage of carbon, manganese, phosphorus, and sulfur. On request, this analysis shall be reported to the purchaser or his representative.

4.3.2 Verification analysis

A verification 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. Non-killed steels (such as rimmed or capped) are not technlogically suited to verification analysis.

For killed steels, the sampling method and deviation limits shall be agreed upon between the interested parties at the time of ordering.

4.4 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. As carbon exceeds 0,15 % and/or phosphorus exceeds 0,05 % welding becomes more difficult.

4.5 Application

It is desirable that cold-reduced steel sheet to hardness requirements be identified for fabrication by name of part or by the intended application. Details of fabrication and special requirements (exposed or unexposed, freedom from stretcher strains or fluting) shall be specified as well as hardness range.

4.6 Hardness ranges

The Rockwell hardness ranges represent the values as shipped. Because of variations in testing standards and equipment a tolerance for check testing of two Rockwell B points on the "B" scale below minimum and above maximum of the range is allowed. It is recommended that hardness ranges be specified to the same scale as that to be used during testing.

Table 2 — Hardness ranges

Designation	Hardness ranges[1]	
	HRB	HR30T
CRH-50	50/70	50/62,5
CRH-60	60/75	56,5/67
CRH-70	70/85	62,5/75
CRH-	As agreed on by manufacturer and purchaser	

1) HRB : 1,0 mm and heavier
HR30T : thinner than 1,0 mm

5 Dimensional tolerances

Dimensional tolerances applicable to cold-reduced steel sheet shall be as given in tables 3 to 8 inclusive.

If flatness tolerances are required, they shall be negotiated.

6 Sampling

6.1 Hardness tests

One representative sample for the hardness test required in table 2 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.

6.2 Bend tests

One representative sample for the bend test shall be taken from each lot of sheet for shipment. A lot consists of all sheet of the same designation rolled to the same thickness and condition.

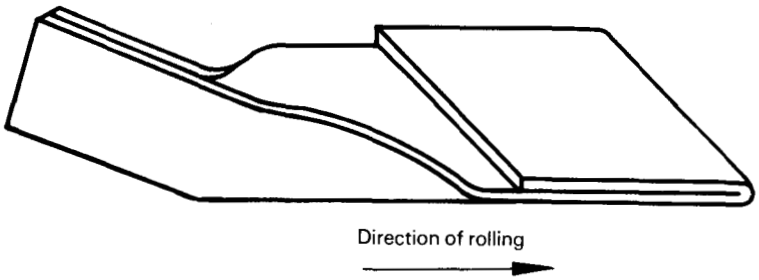
7 Tests

7.1 Hardness tests

Hardness test shall be carried out in accordance with ISO 80, or ISO/R 1024 on test pieces taken midway between the centre and the edge of the sheet as rolled.

7.2 Bend tests

Because of the different hardness ranges each designation is subject to different bend tests. Small cracks on the edges of the test pieces and cracks which require magnification to be visible shall be disregarded.



180° flat bend in either longitudinal or transverse direction

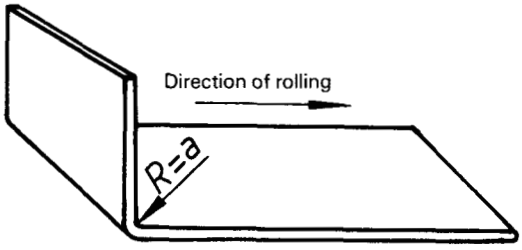
Figure 1 — Bend test piece for CRH-50

(a) 90° transverse bend around a radius of 1 a

(b) 180° longitudinal bend over one thickness

a = thickness of test piece

Figure 2 — Bend test piece for CRH-60



90° longitudinal bend around a radius of 1 a

a = thickness of test piece

Figure 3 — Bend test piece for CRH-70

8 Retests

8.1 Flaws

If any test piece shows defective areas, it shall be discarded and another test piece substituted.

8.2 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 may 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 product to a new examination for compliance with the requirements for another designation.

10 Workmanship

The surface condition should be that normally obtained in a cold-reduced product.

The steel sheet 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 opportunity to observe readily or to remove defective portions as can be carried out on the cut length product.

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 cold-reduced steel sheet is ordered in coils, a minimum or range of acceptable inside diameter (I.D.) shall be specified. In addition, the maximum outside diameter (O.D.) and the maximum accpetable 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 designation;

d) the order number;

e) the product dimensions;

f) the lot number;

g) the mass.

14 Information to be provided by the purchaser

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

a) the number of this International Standard;

b) the name and designation of the material (for example, cold-reduced steel sheet to hardness range CRH-50);

c) the dimensions of the product and quantity required;

d) the application (name of part) and whether it is an exposed or unexposed part (see 4.5);

e) whether oiled or not oiled (see 3.5);

f) the report of the cast analysis, if required (see 4.3.1);

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

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

NOTE — Typical ordering descriptions are as follows :

1) International Standard ISO 5954 cold-reduced steel sheet of hardness range CRH-70 (HRB 70/85) 1 mm × 1 200 mm × 2 000 mm, 10 000 kg to be used for brackets, oiled, maximum lift mass 4 000 kg.

2) International Standard ISO 5954 cold-reduced steel sheet of hardness range CRH-50 (HRB 50/70) 0,7 mm × 900 mm × coil, 120 000 kg to be used for tubing 500/610 mm I.D., 1 300 mm maximum O.D., maximum coil mass 12 000 kg.

Table 3 — Thickness tolerances for coils[1] and cut lengths

Values in millimetres

Width \ Thickness	Thickness tolerances[2], over and under, for specified thicknesses									
	< 0,4	> 0,4 < 0,6	> 0,6 < 0,8	> 0,8 < 1,0	> 1,0 < 1,2	> 1,2 < 1,6	> 1,6 < 2,0	> 2,0 < 2,5	> 2,5 < 3,0	> 3,0 < 4,0
> 600 to < 1 200	0,05	0,06	0,08	0,09	0,10	0,12	0,14	0,17	0,20	0,22
> 1 200 to < 1 500	0,06	0,07	0,09	0,10	0,11	0,13	0,15	0,18	0,21	0,23
> 1 500	—	0,09	0,10	0,11	0,13	0,15	0,18	0,20	0,23	0,25

1) The thickness tolerances for sheets in coil form are the same as for sheets supplied in cut lengths, but in cases where welds are present, the tolerances shall be double those given over a length of 15 m in the vicinity of the weld.

2) Thickness is measured at any point on the sheet not less than 25 mm from a side edge.

Table 4 — Width tolerances for coils and cut lengths, not resquared

Values in millimetres

Specified widths	Tolerance (all plus)
Up to and including 1 200	+ 5
Over 1 200 up to and including 1 500	+ 7
Over 1 500	+ 9

Table 5 — Length tolerances for cut lengths, not resquared

Values in millimetres

Specified lengths	Tolerance (all plus)
Up to and including 3 000	+ 20
Over 3 000 up to and including 6 000	+ 30
Over 6 000	+ 0,5 % × length

Table 6 — Camber tolerances for coils and cut lengths, not requared

Form	Camber tolerance
Coils	20 mm in any 5 000 mm length
Cut lengths	0,4 % × length

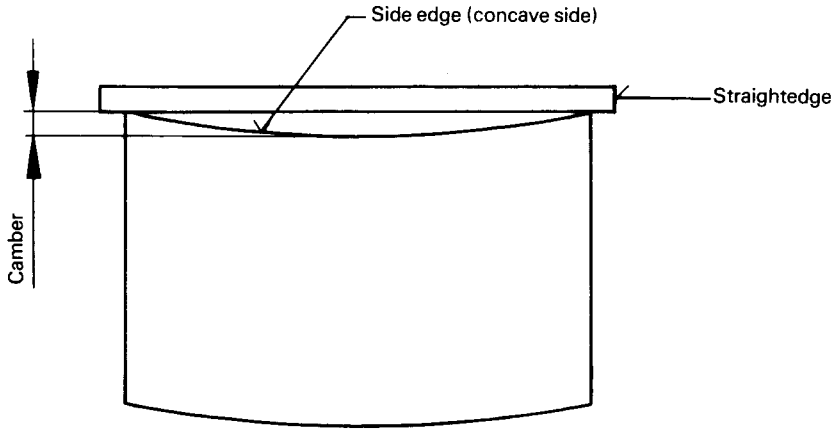


Figure 4 — Measurement of camber

Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straightedge.

Table 7 — Out-of-square tolerances for cut lengths, not requared

Dimensions	Out-of-square tolerance
All thickness and all sizes	1 % × width

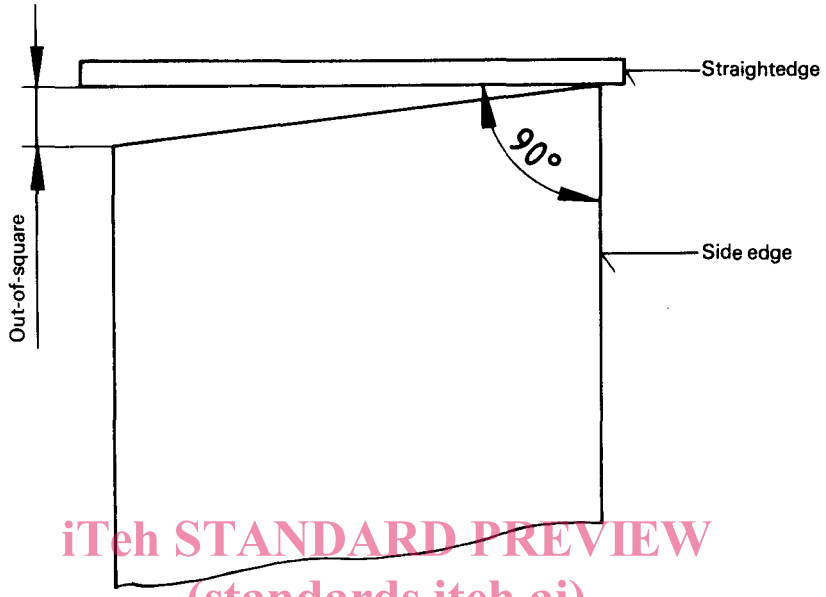


Figure 5 — Measurement of out-of-square

Out-of-square is the greatest deviation of an end edge from a straight line at right angles to a side and touching one corner, the measurement being taken as shown in figure 5. It can also be measured as one-half the difference between the diagonals of the cut length sheet.

Table 8 — Out-of-square[1] tolerances for resquared[2] material

Values in millimetres

Specified lengths	Specified widths	Out-of-square tolerance (all plus)
Up to and including 3 000	Up to and including 1 200	+ 2
	Over 1 200	+ 3
Over 3 000	All widths	+ 3

1) See figure 5.

2) When measuring material to resquared tolerances, consideration may have to be given to extreme variations in temperature.