Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

IS 1079 (2009): Hot Rolled Carbon Steel Sheet and Strip
[MTD 4: Wrought Steel Products]
Indian Standard
HOT ROLLED CARBON STEEL SHEET AND STRIP - SPECIFICATION
( Sixth Revision )

ICS 77.140.50
FOREWORD

This Indian Standard (Sixth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1958 and subsequently revised in 1962, 1968, 1973, 1988 and 1994. While reviewing this standard, in the light of experience gained during these years, the Committee decided to revise it to bring in line with the present practices being followed by the Indian industry and overseas standards of hot rolled carbon steel sheets.

In this revision the following changes have been made:

a) Chemical and mechanical properties have been modified;
b) Clauses 3.2, 3.3, 8, 11 and 16.1 have been modified;
c) New grades HRO and HR5 have been added;
d) Amendments No. 1, 2, 3 and 4 have been incorporated;
e) A new clause on references has been incorporated;
f) International grades designation system has been adopted, simultaneously old designations have also been given; and

g) Requirements of dimensions and tolerances have been separated from the standard and adopted in IS/ISO 16160 : 2005 'Continuously hot-rolled steel sheet products—Dimensional and shape tolerances'.

For all the tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO Standard may also be followed as an alternate method.

While revising the standard assistance has been derived from ISO 3573 : 1999 'Hot rolled carbon steel sheet of commercial and drawing qualities'.

The composition of the Committee responsible for the formulation of this standard has been given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.
AMENDMENT NO. 1 NOVEMBER 2012
TO
IS 1079 : 2009 HOT ROLLED CARBON STEEL SHEET
AND STRIP — SPECIFICATION
(Sixth Revision)

(Page 1, clause 1) — Substitute the following for the existing clause:

1 SCOPE

This standard covers the requirements for hot rolled low carbon steel sheets and strips, including micro-alloyed steel intended for forming, drawing and general engineering purposes.
Indian Standard

HOT ROLLED CARBON STEEL SHEET AND STRIP
SPECIFICATION
( Sixth Revision )

1 SCOPE
This standard covers the requirements for hot rolled low carbon steel sheets and strips intended for forming, drawing and general engineering purposes.

2 REFERENCES
The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>228 (In- various parts)</td>
<td>Method for chemical analysis of steel</td>
</tr>
<tr>
<td>1599 : 1985</td>
<td>Method for bend test (second revision)</td>
</tr>
<tr>
<td>1608 : 2005</td>
<td>Metallic materials — Tensile testing at ambient temperature (third revision)</td>
</tr>
<tr>
<td>1730 : 1989</td>
<td>Dimensions for steel plates, sheets, strips and flats for general engineering purposes (second revision)</td>
</tr>
<tr>
<td>8910 : 1978</td>
<td>General technical delivery requirements for steel and steel products</td>
</tr>
<tr>
<td>10175 (Part 1) : 1993</td>
<td>Mechanical testing of metals—Modified Erichson cupping test sheet and strip: Part 1 Thickness up to 2 mm (first revision)</td>
</tr>
<tr>
<td>IS/ISO 16160 : 2005</td>
<td>Continuously hot-rolled steel sheet products — Dimensional and shape tolerances</td>
</tr>
</tbody>
</table>

3 SUPPLY OF MATERIAL
3.1 General requirements relating to the supply of hot rolled carbon steel sheets and strips shall conform to IS 8910.
3.2 Hot rolled carbon steel sheets and strips shall be supplied either with mill edges or flattened and sheared edges.

4 GRADES
There shall be 6 grades of hot rolled carbon steel sheet and strip designated as follows:

a) HR0 — Ordinary.
b) HR1 — Commercial quality intended for general fabrication purposes where sheets or strips are used in the flat or for bending, moderate forming and welding operations.
c) HR2 — Drawing quality intended for applications where drawing, severe forming and welding are involved.
d) HR3 — Deep drawing quality.
e) HR4 — Extra deep drawing quality.
f) HR5 — Micro alloyed.

5 MANUFACTURE
5.1 Steel shall be manufactured by any process of steel making at the discretion of the manufacturer.
5.2 Steel sheets and strips shall be supplied in the rimmed, semi-killed or killed condition as agreed to between the purchaser and the manufacturer. However, HR4 and HR5 grades shall be supplied in killed condition only.
5.3 Steels which are fully aluminium killed shall be capable of withstanding a stabilization or ageing test when cold rolled annealed and skin passed.

6 CHEMICAL COMPOSITION
6.1 Ladle Analysis
Ladle analysis of the material when carried out either by the method specified in the relevant part of IS 228 or any other established instrumental/chemical method, shall be as given in Table 1. In case of dispute, the procedure given in the relevant part of IS 228 shall be the referee method.

6.2 Product Analysis
Permissible variations in case of product analysis from the limits specified in Table 1 shall be as given in Table 2.
Table 1 Chemical Composition  
(Clause 6.1 and 6.2)

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Designation</th>
<th>Quality Name</th>
<th>Old Designation</th>
<th>Constituent</th>
<th>Percent, Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Carbon</td>
<td>Manganese</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>i)</td>
<td>HR0</td>
<td>Ordinary</td>
<td>(New)</td>
<td>0.25</td>
<td>1.70</td>
</tr>
<tr>
<td>ii)</td>
<td>HR1</td>
<td>Commercial</td>
<td>O</td>
<td>0.15</td>
<td>0.60</td>
</tr>
<tr>
<td>iii)</td>
<td>HR2</td>
<td>Drawing</td>
<td>D</td>
<td>0.10</td>
<td>0.45</td>
</tr>
<tr>
<td>iv)</td>
<td>HR3</td>
<td>Deep Drawing</td>
<td>DD</td>
<td>0.08</td>
<td>0.40</td>
</tr>
<tr>
<td>v)</td>
<td>HR4</td>
<td>Extra Deep</td>
<td>EDD</td>
<td>0.08</td>
<td>0.35</td>
</tr>
<tr>
<td>vi)</td>
<td>HR5</td>
<td>Micro-alloyed</td>
<td>(New)</td>
<td>0.16</td>
<td>1.6</td>
</tr>
</tbody>
</table>

NOTES
1. Steels of these grades can be supplied with the addition of micro-alloying elements like Boron, Titanium, Niobium and Vanadium. The micro-alloying elements shall not exceed 0.008 percent in case of Boron and 0.20 percent in case of other elements.
2. The Nitrogen content of the steel shall not be more than 0.007 percent. However, for Aluminium killed or Silicon-Aluminium killed, the Nitrogen content shall not exceed 0.012 percent. This has to be ensured by the manufacturer by occasional check analysis.
3. Grades HR4 and HR5 shall be supplied in fully Aluminium killed condition or Aluminium with stabilizing elements.
4. When the steel is Aluminium killed, the total Aluminium content shall not be less than 0.02 percent. When the steel is silicon killed, the silicon content shall not be less than 0.10 percent. When the steel is Aluminium silicon killed, the silicon content shall not be less than 0.03 percent and total Aluminium content shall not be less than 0.01 percent.
5. When copper bearing steel is required, the copper content shall be between 0.20 and 0.35 percent. In case of product analysis, the copper content shall be between 0.17 and 0.38 percent.
6. Restricted chemistry may be mutually agreed to between the purchaser and the supplier.

Table 2 Permissible Variations for Product Analysis  
(Clause 6.2)

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Constituent</th>
<th>Percentage Limit of Constituent</th>
<th>Variation Over Specified Limit, Percent, Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>i)</td>
<td>Carbon</td>
<td>Up to 0.12</td>
<td>0.02</td>
</tr>
<tr>
<td>ii)</td>
<td>Manganese</td>
<td>Up to 0.50</td>
<td>0.03</td>
</tr>
<tr>
<td>iii)</td>
<td>Sulphur</td>
<td>Above 0.50</td>
<td>0.005</td>
</tr>
<tr>
<td>iv)</td>
<td>Phosphorus</td>
<td>—</td>
<td>0.005</td>
</tr>
</tbody>
</table>

NOTE — Product analysis shall not be applicable to rimming steel.

7 TENSILE TEST

7.1 Number of Tensile Tests

One tensile test shall be taken from each cast or part thereof. However, in case of material supplied after heat treatment, one tensile test shall be conducted for each heat treatment batch or a lot of 50 t, whichever is less.

7.1.1 Where sheet and strip of more than one thickness are rolled from the same cast, one additional tensile test shall be done for each thickness of sheet and strip.

7.2 Tensile Test Pieces

Tensile test pieces shall normally be cut transverse to the direction of rolling. Longitudinal test pieces may be cut in the case of strips having width less than 150 mm.

7.3 When tested in accordance with IS 1608 as applicable, the tensile strength and percentage elongation shall be as given in Table 3.

7.3.1 If the percentage elongation of any test piece is less than that specified in Table 3, and if any part of the fracture is outside the middle half of the gauge length as scribed before the test, the test shall be discarded and a retest shall be carried out.
Table 3 Tensile Properties
(Clause 7.3 and 7.3.1)

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Quality</th>
<th>Designation</th>
<th>Old Designation</th>
<th>Name</th>
<th>Tensile Strength $R_{p 0.2}$ Max MPa</th>
<th>Percentage Elongation $A_{p 0.2}$ Min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$t \leq 3$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$L_0 = 80$ mm</td>
<td>$L_0 = 50$ mm</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
<tr>
<td>i)</td>
<td>HR0</td>
<td>(New)</td>
<td>Ordinary</td>
<td>440</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>ii)</td>
<td>HR1</td>
<td>O</td>
<td>Commercial</td>
<td>420</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>iii)</td>
<td>HR2</td>
<td>D</td>
<td>Drawing</td>
<td>400</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>iv)</td>
<td>HR3</td>
<td>DD</td>
<td>Deep Drawing</td>
<td>380</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>v)</td>
<td>HR4</td>
<td>EDD</td>
<td>Extra Deep Drawing</td>
<td>520-400</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>vi)</td>
<td>HR5</td>
<td>(New)MA</td>
<td>YST255</td>
<td>370-460</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>vii)</td>
<td></td>
<td></td>
<td>YST305</td>
<td>400-500</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>viii)</td>
<td></td>
<td></td>
<td>YST340</td>
<td>450-570</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>ix)</td>
<td></td>
<td></td>
<td>YST380</td>
<td>500-620</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>x)</td>
<td></td>
<td></td>
<td>YST450</td>
<td>550-680</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>xi)</td>
<td></td>
<td></td>
<td>YST500</td>
<td>590 min</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>xii)</td>
<td></td>
<td></td>
<td>DP780</td>
<td>780 min</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>

NOTES
1 MPa = 1 N/mm$^2$.
2 Tensile testing is not mandatory for HR1, unless agreed to between the purchaser and the manufacturer.

1) Minimum tensile strength for qualities HR1, HR2, HR3 and HR4 would normally be expected to be 270 MPa. Where minimum tensile strength is required, the value of 270 MPa may be specified. All tensile strength values are determined to the nearest 10 MPa.

2) The non-proportional test piece with a fixed original gauge length (50 mm), up to 6 mm thick sheet can be used in conjunction with a conversion table. In case of dispute, however, only die results obtained on a proportional test piece shall be valid for material 3 mm and over in thickness.

3) Where V is thickness of steel sheet, in mm.

* Properties on mutual agreement between the purchaser and the manufacturer.

8 BEND TEST

8.1 Number of Bend Tests

One bend test shall be taken from each cast or part thereof. However, in the case of material supplied after heat-treatment, one bend test shall be conducted for each heat-treated batch or a lot of 50 t, whichever is less.

8.1.1 When sheet and strip of more than one thickness are rolled from the same cast, one additional bend test shall be done for each thickness of sheet and strip.

8.2 Bend test shall be carried out in accordance with IS 1599.

8.2.1 Bend test piece shall be cut so that the axis of the bend is parallel to the direction of rolling, that is, the longer axis of the test piece shall be at 90° to the direction of rolling.

8.2.2 The test piece shall be bent cold through 180°. The internal diameter of the bend for different grades of material shall be as given in Table 4. The test pieces shall be deemed to have passed the test if the outer convex surface is free from cracks after complete bending.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Grade</th>
<th>Internal Diameter of Bend</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>HR1</td>
<td>2 t</td>
</tr>
<tr>
<td>ii)</td>
<td>HR2</td>
<td>T</td>
</tr>
<tr>
<td>iii)</td>
<td>HR3</td>
<td>Close</td>
</tr>
<tr>
<td>iv)</td>
<td>HR4</td>
<td>Close</td>
</tr>
</tbody>
</table>

NOTE — Where ‘t’ is the thickness of test piece.

8.2.2.1 It is sometimes difficult to ensure that the material is accurately following the radius. In case of dispute, the test piece may be pushed into a block of lead by a former of appropriate diameter.

9 CUPPING TEST

9.1 Cupping test as specified in IS 10175 (Part 1)
may be carried out only for sheets and strips of HR2, HR3 and HR4 grades having thickness from 0.5 mm up to 2 mm, if agreed to between the purchaser and the supplier.

9.2 The cupping test values shall be agreed upon between the purchaser and the supplier.

10 STRAIN AGEING TEST

10.1 The test is to be carried out on grades where steel is supplied with non-ageing properties/guarantee. This shall be agreed to between the purchaser and the supplier.

10.2 Selection of Sample

The sample shall be selected in such a way that the axis of bend is parallel to the direction of final rolling. In case of material too narrow to permit this, the axis of bend shall be of 90° to the direction of rolling.

10.3 Size of test piece shall be as follows:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 3 mm</td>
<td>75 mm long and 25 mm wide</td>
</tr>
<tr>
<td>3 mm and above</td>
<td>75 mm long and 40 mm wide</td>
</tr>
</tbody>
</table>

For lower width, the maximum obtainable width shall be taken.

The edges of the test pieces shall be rounded or smoothened longitudinally to an approximate semicircle.

10.4 The test piece shall be bent cold through 90° over a radius equal to one and a half times the thickness, about an axis at right angles to the length of the test piece. Then the piece shall be heated at 100°C for 1 h (or at 325° to 350°C for 15 min) and the sample cooled. The test piece shall be flattened by hammer and the piece shall not develop crack near the bend.

11 RETEST

If a test does not give the specified results, two additional tests shall be carried out at random on the same lot. Both retests shall conform to the requirements of this standard, otherwise, the lot shall be rejected.

12 FREEDOM FROM DEFECTS

12.1 The finished material in cut length shall be free from harmful defects which will affect the end use. When the material is supplied in the form of coils, the degree or amount of surface defects are expected to be more than in cut length sheets since the inspection of coils does not afford the same opportunity to reject the portion containing defects as with cut length. However, an excessive number of defects may be the cause for rejection. The standards for acceptance in such case can be agreed to between the purchaser and the supplier.

12.2 Edges may be mill edges or slit edges as agreed to between the supplier and purchaser. When mill edges are specified, the depth of the defects shall be within 5 mm from the edges of the coils on both sides.

13 DIMENSIONS AND TOLERANCES

13.1 Dimensions of steel sheet and strip shall conform to the dimensions specified in IS 1730.

13.2 Unless otherwise agreed the dimensional tolerances for hot-rolled steel sheet shall be as given in IS/ISO 16160.

13.2.1 Unless otherwise agreed the restricted thickness tolerances shall be as given in IS/ISO 16160.

14 CALCULATION OF WEIGHT

The mass of the material shall be calculated on the basis that steel weighs 7.85 g/cm².

15 DELIVERY

15.1 The material may be supplied in any one (or, in combination) of the following conditions subject to mutual agreement between the supplier and the purchaser:

a) Hot rolled,
b) Annealed,
c) Normalized, and
d) Descaled

15.2 Subject to prior agreement between the manufacturer and the purchaser, a suitable protective treatment may be given to the material.

16 MARKING

16.1 Sheets shall be supplied in bundles, and strips either in bundles or coils. Each bundle shall carry a metal tag bearing the cast number and the manufacturer's name or trade-mark. Alternatively, the top sheet or strips in each bundle shall be legibly marked with the cast number, name of the manufacturer or trade-mark.

16.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

16.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.
ANNEX A
(Foreword)

COMMITTEE COMPOSITION

Wrought Steel Products Sectional Committee, MTD 4

Organization

Tata Steel Ltd, Jamshedpur

All India Induction Furnace Association, New Delhi
Bharat Heavy Electricals Ltd, Tiruchirappalli
Central Boilers Board, New Delhi
DGSD, Bhilai Nagar/Delhi
Escorts Knowledge Management Centre, Faridabad
Essar Steels Ltd, Hazira
Institute of Steel Development and Growth, Kolkata
Jindal South West Ltd, Vasind
M. N. Dastur & Co Ltd, Kolkata/Delhi
IfIHistory of Defence (DGOFB), Kolkata
Ministry of Defence (DGQA), Ichapur
Ministry of Railways (RDSO), Lucknow
Powergrid Corporation of India Ltd, Gurugram
Rashtriya Ispat Nigam Ltd (VSP), Vishakhapatnam
SAIL, Bhilai Steel Plant, Bhilai
SAIL, Bokaro Steel Plant, Bokaro
SAIL, Central Marketing Organization, Kolkata
SAIL, Durgapur. Steel Plant, Durgapur
SAIL, ISCO Steel Plant, Borapet
SAIL, Research & Development Center for Iron & Steel, Ranchi SAIL, Rourkela Steel Plant, Rourkela
Steel Furnace Association of India, New Delhi
Steel Re-rolling Mills Association of India,
Mandi Gobindgarh TCE Consulting Engineers,
Jamshedpur Tata Motors Limited, Pune In personal capacity
(403, Udaigiri, Kaushambi, Dist Ghaziabad, U.P.) BIS

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SHRI V. RAJASEKHARAN
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REPRESENTATIVE
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SHRI SUBHARATI SINGUPTA
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SHRI T. BASU (Alternate)
SHRI S. K. KHALNANEY
SHRI P. MEENA (Alternate)
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GALGALI SHRI N. MITTRA
DR (SMT) SNEHI BHATLA, Scientist F+ and Head (MTD)
[Representing Director General (Ex-officio)]

Member Secretary
SHRI DEEPAK IJAIN
Scientist E (MTD), BIS
IS 1079 : 2009

Flat Steel Products Subcommittee, MTD 4 : 3

Organization

TCE Consulting Engineers, Jamshedpur
Apex Chambers of Commerce, Ludhiana
Bhushan Power and Steel Ltd, Hooghly
Federation of Engineering Industries of India, New Delhi
Indian Oil Corporation Limited, Noida
Tspam Industries Limited, Dolvi
SAIL, Bhatia Steel Plant, Bhatia
SAIL, Salem Steel Plant, Salem
Tata Blue Scope Steel Ltd, Pune Tata
Steel Ltd, Jamshedpur
The Tin Plate Company of India Ltd, Jamshedpur
Thyssenkrupp Electrical Steel India Pvt Ltd, Nasik

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: MTD 4 (4730).

Amendments Issued Since Publication

<table>
<thead>
<tr>
<th>Amend No.</th>
<th>Date of Issue</th>
<th>Text Affected</th>
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</thead>
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