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Draft Indian Standard

HOT-ROLLED CARBON AND ALLOY STEEL— SPECIFICATION

ICS 77.140.01

Wrought Steel Products Sectional Committee,
MTD 04

Last date for receipt of comments:
27 June 2025

FOREWORD

(Formal clauses of the foreword will be added later.)

This standard has been prepared to cover the technical requirements of hot-rolled low, medium and high carbon and alloy steel plates, sheets and strips.

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.

The composition of the Committee responsible for formulation of this standard is given in Annex B. *(to be added at later stage)*

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 : 2022 'Rules for rounding off numerical values (second revision)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Draft Indian Standard

HOT-ROLLED CARBON AND ALLOY STEEL— SPECIFICATION

1 SCOPE

This standard covers the requirements for hot-rolled low carbon, medium carbon, high carbon and alloy steel plates, sheets and strips. The steel grades in these standards can be directly used as hot-rolled steel or can be used for rerolling. These steel grades are generally intended for further heat treatment tailored to their end-use applications.

This document does not cover hot rolled flat products for which separate standards exist, e.g.:

- a) Hot Rolled Carbon Steel Sheet, Plate and Strip — Specification (IS 1079);
- b) Hot Rolled Carbon Steel Strip for Cold Rolling Purposes — Specification (IS 11513);

2 REFERENCES

The standards listed in Annex A 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 agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMINOLOGY

For the purpose of this standard, IS 1956 (various parts) and the following definitions shall apply.

3.1 Micro-Alloying Elements — Elements such as niobium, vanadium, titanium and boron added either individually or in combination to obtain high strength steel, combined with better toughness, formability and weldability.

4 SUPPLY OF MATERIAL

4.1 General requirements relating to the supply of hot rolled carbon and alloy steel plates, sheets and strips shall conform to IS 8910.

4.2 Hot rolled carbon and alloy steel strip shall be supplied in coil form either with mill edges or sheared /trimmed (slit) edges as agreed upon between the purchaser and the supplier.

4.3 The hot rolled plates, sheets and strips shall be supplied based on the chemical composition given in **Table 1A** and **Table 1B**.

4.4 Unless otherwise agreed upon at the time of enquiry and order, the products shall be delivered in the untreated, i.e. hot-rolled condition (As Rolled, mill edge and un oiled).

4.5 If agreed upon at the time of enquiry and order, the products shall be delivered in one of the following heat-treatment conditions:

- a) Soft annealed;
- b) Normalized or Normalized rolling condition;
- c) Quenched and tempered;
- d) Spheroidized Annealed; or
- e) Other delivery conditions.

4.6 If agreed upon at the time of enquiry and order, the products shall be delivered in one of the particular surface conditions mentioned below:

- a) Pickled (descaled);
- b) Pickled and oiled;
- c) Skin passed;
- d) Skin passed and oiled; or
- e) Shot blasted.

5 DESIGNATIONS

The steel grades covered in this standard are categorized in to the following types:

- a) Low, Medium and High Carbon unalloyed Steel (**Table 1A**);
- b) Alloy Steel (**Table 1B**).

6 MANUFACTURE

6.1 The manufacturing process of the steel and of the product is left to the discretion of the manufacturer. If required, steel may further be treated in secondary refining or vacuum degassing process.

6.2 The raw material used for manufacturing the product covered in this standard shall conform to the requirements of IS 14650.

6.3 All grades shall be supplied in fully killed condition only.

7 CHEMICAL COMPOSITION

7.1 Ladle analysis of the material, when carried out either by the method specified in the relevant parts of IS 228 or any other established instrumental/chemical method shall be as given in **Table 1A** and **Table 1B**. In case of dispute the procedure given in the relevant parts of IS 228 shall be the referee method.

7.2 Product Analysis

Permissible variation in case of product analysis from the limits specified in **Table 1A** and **Table 1B** shall be as given in **Table 2**.

Table 1A Chemical Composition for Low, Medium and High Carbon Steel (Unalloyed)
(Clauses 5, 7.1 and 7.2)

Sl. No	Grade	Constituent, Percent								
		C ^{a)}	Mn ^{a)}	Si ^{b)} Max	S ^{c)} Max	P Max	Cu Max	Cr ^{d)} Max	Mo ^{d)} Max	Ni ^{d)} Max
1	10C5	0.07-0.13	0.30-0.60	0.40	0.035	0.035	0.30	0.40	0.10	0.40
2	12C5	0.10-0.15	0.30-0.60	0.40	0.035	0.035	0.30	0.40	0.10	0.40
3	15C5	0.12-0.18	0.30-0.60	0.40	0.035	0.035	0.30	0.40	0.10	0.40
4	15C8	0.12-0.18	0.60-0.90	0.40	0.035	0.035	0.30	0.40	0.10	0.40
5	15C13	0.13-0.18	1.10-1.40	0.40	0.035	0.030	0.30	0.40	0.10	0.40
6	18C5	0.15-0.20	0.30-0.60	0.40	0.035	0.030	0.30	0.40	0.10	0.40
7	18C8	0.15-0.20	0.60-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
8	20C5	0.17-0.24	0.30-0.70	0.40	0.035	0.030	0.30	0.40	0.10	0.40
9	21C8	0.18-0.23	0.60-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
10	21C13	0.17-0.24	1.10-1.50	0.40	0.035	0.030	0.30	0.40	0.10	0.40
11	22C15	0.18-0.26	1.30-1.65	0.40	0.035	0.030	0.30	0.40	0.10	0.40
12	23C5	0.20-0.25	0.30-0.60	0.40	0.035	0.030	0.30	0.40	0.10	0.40
13	25C5	0.22-0.29	0.30-0.70	0.40	0.035	0.030	0.30	0.40	0.10	0.40
14	25C8	0.22-0.29	0.60-0.90	0.40	0.035	0.030	0.30	0.40	0.10	0.40
15	25C13	0.22-0.29	1.10-1.50	0.40	0.035	0.030	0.30	0.40	0.10	0.40
16	28C8	0.25-0.31	0.60-0.90	0.40	0.035	0.030	0.30	0.40	0.10	0.40
17	28C15	0.25-0.32	1.30-1.65	0.40	0.035	0.030	0.30	0.40	0.10	0.40
18	30C8	0.27-0.34	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
19	30C13	0.26-0.34	1.10-1.50	0.40	0.035	0.030	0.30	0.40	0.10	0.40
20	33C8	0.30-0.36	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
21	34C14	0.30-0.37	1.20-1.50	0.40	0.035	0.030	0.30	0.40	0.10	0.40
22	35C8	0.32-0.39	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
23	36C15	0.33-0.40	1.30-1.65	0.40	0.035	0.030	0.30	0.40	0.10	0.40
24	40C8	0.35-0.45	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
25	41C15	0.35-0.45	1.35-1.65	0.40	0.035	0.030	0.30	0.40	0.10	0.40
26	43C8	0.40-0.47	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
27	43C15	0.39-0.46	1.30-1.65	0.40	0.035	0.030	0.30	0.40	0.10	0.40
28	45C8	0.40-0.50	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
29	47C5	0.43-0.50	0.30-0.60	0.40	0.035	0.030	0.30	0.40	0.10	0.40
30	47C15	0.43-0.51	1.35-1.65	0.40	0.035	0.030	0.30	0.40	0.10	0.40
31	48C13	0.44-0.52	1.10-1.50	0.40	0.035	0.030	0.30	0.40	0.10	0.40
32	50C8	0.45-0.55	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
33	51C14	0.47-0.55	1.20-1.50	0.40	0.035	0.030	0.30	0.40	0.10	0.40
34	55C8	0.50-0.60	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40

Sl. No	Grade	Constituent, Percent								
		C ^{a)}	Mn ^{a)}	Si ^{b)} Max	S ^{c)} Max	P Max	Cu Max	Cr ^{d)} Max	Mo ^{d)} Max	Ni ^{d)} Max
35	60C3	0.55-0.65	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
36	60C8	0.55-0.65	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
37	65C3	0.60-0.70	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
38	65C8	0.60-0.70	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
39	66C10	0.60-0.71	0.85-1.15	0.40	0.035	0.030	0.30	0.40	0.10	0.40
40	70C3	0.65-0.75	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
41	70C8	0.65-0.75	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
42	75C3	0.70-0.80	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
43	75C7	0.70-0.80	0.40-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
44	78C5	0.72-0.85	0.30-0.60	0.40	0.035	0.030	0.30	0.40	0.10	0.40
45	80C3	0.75-0.85	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
46	80C7	0.75-0.88	0.40-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
47	85C3	0.80-0.93	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
48	85C7	0.80-0.93	0.40-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
49	90C3	0.85-0.95	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
50	90C7	0.85-0.98	0.40-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
51	95C3	0.90-1.03	0.10-0.50	0.40	0.030	0.030	0.30	0.40	0.10	0.40
52	100C5	0.95-1.05	0.20-0.60	0.40	0.030	0.030	0.30	0.40	0.10	0.40
53	100C8	0.90-1.05	0.50-1.00	0.40	0.035	0.030	0.30	0.40	0.10	0.40
54	105C4	1.00-1.10	0.10-0.60	0.40	0.030	0.030	0.30	0.40	0.10	0.40
55	120C4	1.10-1.30	0.10-0.60	0.40	0.030	0.030	0.30	0.40	0.10	0.40
56	140C4	1.30-1.50	0.10-0.60	0.40	0.030	0.030	0.30	0.40	0.10	0.40

NOTES

1 Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition of such elements from scrap or other materials used in the manufacturing process, which may affect hardenability, mechanical properties, and applicability.

2 These steel grades may be supplied with the addition of Micro-alloying elements such as boron, titanium, niobium and vanadium either individually or in combination and shall not exceed 0.25 % and boron shall be 0.0008 % Max.

3 Standard killed carbon steels of fine grain quality may be produced by adding boron in the range of 0.0008 to 0.003% to improve hardenability. In such cases, the grade designation shall be suffixed with BT, e.g., 10C5BT

4 Unless otherwise agreed upon, the nitrogen content of fully killed steel shall not exceed 0.012 percent. This shall be ensured by the manufacturer by occasional check analysis.

5 Unless otherwise agreed upon, the total aluminium content in the aluminium killed steel shall not be less than 0.02 percent. Silicon content in the silicon killed steel shall not be less than 0.10 percent. When the steel is

Sl. No	Grade	Constituent, Percent								
		C ^{a)}	Mn ^{a)}	Si ^{b)} <i>Max</i>	S ^{c)} <i>Max</i>	P <i>Max</i>	Cu <i>Max</i>	Cr ^{d)} <i>Max</i>	Mo ^{d)} <i>Max</i>	Ni ^{d)} <i>Max</i>
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.										
6 Restricted chemical compositions may be agreed upon between the purchaser and the supplier.										
7 a) — Range of Carbon and/or Manganese not covered in the above table can be agreed upon between the purchaser and the supplier, provided, Carbon 0.06% minimum range and Manganese 0.30% minimum range is maintained. For these modified grades, grade designation shall be suffixed with “Mod” as indication of Modified chemistry.										
8 b) — When silicon limits are required, the following ranges are commonly used: 0.10 % max; 0.10 to 0.20 %; 0.10 to 0.35 %; 0.15 to 0.35 %; or 0.20 to 0.40 %.										
9 c) — If mutually agreed upon by the purchaser and the supplier, steel grades with sulfur content in the range of 0.020–0.040% may also be supplied. In such cases, the grade designation shall be suffixed with 'S30' (e.g., 35C8S30)..										
10 d) — Cr + Mo + Ni: 0.63% maximum. If steels are ordered without specific hardenability requirements in the quenched and tempered or normalized condition, a restriction on the carbon content up to 0.05% and/or a limitation on the total of Cr, Mo, and Ni to a maximum of 0.45% may be agreed upon at the time of ordering										

Table 1B Chemical Composition for Alloy Steel
(Clauses 5, 7.1 and 7.2)

Sl. No	Grade	Constituent, Percent											
		C	Mn Max	Si ^{a)} Max	S ^{b)} Max	P Max	Cu Max	Cr Max	Mo Max	Ni Max	V Max	B	Others
Chromium Steels													
1	15Cr3	0.12-0.18	0.30-0.60	0.40	0.030	0.030	0.40	0.50-0.80	-	0.25	-	-	-
2	17Cr3	0.12-0.20	0.60-0.90	0.40	0.030	0.030	0.40	0.70-1.25	-	0.25	-	-	-
3	20Cr4	0.17-0.23	0.60-0.90	0.40	0.030	0.030	0.40	0.70-1.20	-	0.25	-	-	-
4	28Cr4	0.24-0.31	0.60-0.90	0.40	0.030	0.030	0.40	0.90-1.20	-	0.25	-	-	-
5	32Cr4	0.28-0.36	0.60-0.90	0.40	0.030	0.030	0.30	0.80-1.20	-	0.25	-	-	-
6	37Cr4	0.33-0.41	0.60-0.90	0.40	0.030	0.030	0.30	0.90-1.20	-	0.25	-	-	-
7	38Cr2	0.35-0.42	0.50-0.80	0.40	0.030	0.030	0.30	0.40-0.60	-	0.25	-	-	-
8	41Cr4	0.38-0.45	0.60-0.90	0.40	0.030	0.030	0.30	0.80-1.20	-	0.25	-	-	-
9	45Cr4	0.43-0.48	0.60-0.90	0.40	0.030	0.030	0.30	0.90-1.20	-	0.25	-	-	-
10	46Cr2	0.42-0.50	0.50-0.80	0.40	0.030	0.030	0.30	0.40-0.60	-	0.25	-	-	-
11	50Cr4	0.45-0.55	0.60-0.90	0.40	0.030	0.030	0.30	0.80-1.20	-	0.25	-	-	-
12	56Cr3	0.52-0.60	0.65-0.95	0.40	0.030	0.030	0.30	0.65-0.95	-	0.25	-	-	-
13	75Cr1	0.70-0.80	0.50-0.90	0.50	0.030	0.030	0.40	0.20-0.50	-	0.25	-	-	-
14	85Cr1	0.80-0.90	0.80-1.10	0.40	0.030	0.030	0.30	0.20-0.50	-	0.25	-	-	-
15	95Cr1	0.90-1.00	0.10-0.50	0.40	0.030	0.030	0.40	0.20-0.50	-	0.25	-	-	-
16	102Cr6	0.95-1.10	0.10-0.50	0.40	0.030	0.030	0.40	1.30-1.65	-	0.40	-	-	-
17	105Cr3	1.00-1.10	0.80	0.40	0.030	0.030	0.30	0.50-1.00	-	0.25	-	-	-
18	120Cr1	1.10-1.30	0.80	0.40	0.030	0.030	0.30	0.20-0.50	-	0.25	-	-	-
19	125Cr2	1.20-1.30	0.10-0.50	0.40	0.030	0.030	0.40	0.40-0.60	-	0.40	-	-	-
20	16Mn5Cr4	0.14-0.19	1.00-1.30	0.40	0.030	0.030	0.40	0.80-1.10	-	0.25	-	-	-
21	20Mn5Cr5	0.17-0.22	1.10-1.40	0.40	0.030	0.030	0.40	1.00-1.30	-	0.25	-	-	-
22	20Mn5Cr2	0.17-0.23	1.20-1.50	0.40	0.030	0.030	0.30	0.35-0.70	-	0.25	-	-	-
23	43Mn6Cr2	0.40-0.46	1.35-1.65	0.40	0.030	0.030	0.30	0.35-0.70	-	0.25	-	-	-
24	30Cr4Si5	0.27-0.34	0.80-1.10	0.90-1.20	0.030	0.030	0.30	0.80-1.10	0.10	0.30	-	-	-
Chromium Molybdenum Steels													
25	15Cr4Mo2	0.13-0.18	0.60-0.90	0.40	0.030	0.030	0.30	0.90-1.20	0.15-0.30	0.25	-	-	-

Sl. No	Grade	Constituent, Percent											
		C	Mn Max	Si ^{a)} Max	S ^{b)} Max	P Max	Cu Max	Cr Max	Mo Max	Ni Max	V Max	B	Others
26	18Cr4Mo2	0.15-0.21	0.60-0.90	0.40	0.030	0.030	0.40	0.90-1.20	0.15-0.25	0.25	-	-	-
27	20Cr2Mo4	0.17-0.23	0.60-1.00	0.40	0.030	0.030	0.40	0.30-0.70	0.30-0.50	0.25	-	-	-
28	20Cr4Mo2	0.17-0.23	0.60-1.00	0.40	0.030	0.030	0.30	0.90-1.20	0.15-0.30	0.25	-	-	-
29	22Cr3Mo4	0.19-0.24	0.70-1.00	0.40	0.030	0.030	0.30	0.90-1.20	0.35-0.50	0.25	-	-	-
30	22Cr4Mo4	0.20-0.25	0.60-0.90	0.40	0.030	0.030	0.30	0.90-1.20	0.35-0.50	0.25	-	-	-
31	25Cr4Mo2	0.20-0.29	0.60-0.90	0.40	0.030	0.030	0.40	0.90-1.20	0.15-0.30	0.25	-	-	-
32	30Cr4Mo2	0.28-0.33	0.60-0.90	0.40	0.030	0.030	0.30	0.90-1.20	0.15-0.30	0.25	-	-	-
33	31Cr4Mo2	0.28-0.34	0.30-0.60	0.40	0.030	0.030	0.30	0.80-1.20	0.15-0.30	0.25	-	-	-
34	32Cr5Mo2	0.27-0.37	0.30-0.60	0.40	0.030	0.030	0.30	1.00-1.50	0.15-0.30	0.25	-	-	-
35	34Cr4Mo2	0.30-0.37	0.60-0.90	0.40	0.030	0.030	0.40	0.90-1.20	0.15-0.30	0.25	-	-	-
36	34Cr6Mo5	0.28-0.40	0.60-1.00	0.20-0.80	0.030	0.030	0.40	1.40-2.00	0.30-0.55	0.40	-	-	-
37	35Cr4Mo2	0.33-0.38	0.60-0.90	0.40	0.030	0.030	0.30	0.80-1.20	0.15-0.30	0.25	-	-	-
38	42Cr4Mo2	0.38-0.45	0.60-1.00	0.40	0.030	0.030	0.40	0.80-1.20	0.15-0.30	0.25	-	-	-
39	45Cr4Mo2	0.43-0.48	0.60-1.00	0.40	0.030	0.030	0.30	0.80-1.20	0.15-0.30	0.25	-	-	-
40	50Cr4Mo2	0.46-0.54	0.50-1.00	0.40	0.030	0.030	0.40	0.80-1.20	0.15-0.30	0.25	-	-	-
41	23Mn5Cr5Mo4	0.20-0.25	1.10-1.40	0.40	0.030	0.030	0.40	1.10-1.40	0.20-0.50	0.60	-	-	-
42	25Mn5Cr5Mo5	0.23-0.28	1.10-1.50	0.40	0.030	0.030	0.40	1.10-1.50	0.35-0.60	0.60	-	0.0008-0.003	-
43	40Mn6Cr8Mo2	0.35-0.45	1.30-1.60	0.40	0.030	0.030	0.40	1.80-2.10	0.15-0.30	0.40	-	-	-
Chromium Vanadium Steels													
44	50Cr4V2	0.45-0.55	0.50-1.10	0.40	0.030	0.030	0.40	0.80-1.20	0.10	0.40	0.10-0.30	-	-
45	58Cr4V2	0.55-0.62	0.70-1.10	0.40	0.030	0.030	0.40	0.90-1.20	0.10	0.40	0.10-0.25	-	-
46	80Cr2V2	0.75-0.85	0.30-0.60	0.40	0.030	0.030	0.40	0.40-0.60	0.10	0.40	0.10-0.25	-	-
Chromium Molybdenum Vanadium Steels													
47	15Cr5Mo9V2	0.12-0.18	0.80-1.10	0.40	0.030	0.030	0.30	1.25-1.50	0.80-1.00	0.25	0.20-0.30	-	-
48	45Cr8Mo4V1	0.42-0.48	0.85-1.10	0.40	0.030	0.030	0.30	1.70-1.90	0.25-0.40	0.25	0.01-0.10	-	-
Nickel and Nickel Chromium Steels													
49	75Ni8	0.72-0.78	0.20-0.60	0.40	0.030	0.030	0.40	0.15	0.10	1.80-2.10	-	-	-
50	15Ni9Cr1	0.12-0.18	0.35-0.65	0.40	0.030	0.030	0.30	0.20-0.50	-	2.00-2.50	-	-	-
51	15Ni13Cr3	0.12-0.20	0.35-0.70	0.40	0.030	0.030	0.40	0.60-1.00	-	3.00-3.50	-	-	-

Sl. No	Grade	Constituent, Percent											
		C	Mn Max	Si ^{a)} Max	S ^{b)} Max	P Max	Cu Max	Cr Max	Mo Max	Ni Max	V Max	B	Others
52	16Ni4Cr3	0.13-0.19	0.70-1.00	0.40	0.030	0.030	0.40	0.60-1.00	-	0.80-1.10	-	-	-
53	17Ni6Cr6	0.14-0.20	0.50-0.90	0.40	0.030	0.030	0.40	1.40-1.70	-	1.40-1.70	-	-	-
54	18Ni5Cr4	0.16-0.21	0.60-0.90	0.40	0.030	0.030	0.40	0.90-1.20	-	1.20-1.50	-	-	-
55	31Ni11Cr3	0.27-0.35	0.35-0.65	0.40	0.030	0.030	0.30	0.60-1.00	-	2.50-3.00	-	-	-
56	35Ni6Cr4	0.30-0.37	0.60-0.90	0.40	0.030	0.030	0.30	0.80-1.10	-	1.20-1.60	-	-	-
57	36Ni5Cr3	0.32-0.40	0.50-0.80	0.40	0.030	0.030	0.30	0.50-0.90	-	1.00-1.50	-	-	-
58	36Ni13Cr3	0.32-0.40	0.35-0.65	0.40	0.030	0.030	0.30	0.60-1.00	-	3.00-3.50	-	-	-
59	80Ni4Cr1	0.75-0.85	0.50	0.40	0.030	0.030	0.25	0.20-0.50	-	0.70-1.30	-	-	-
60	80Ni7Cr1	0.75-0.85	0.50	0.40	0.030	0.030	0.25	0.20-0.50	-	1.30-2.00	-	-	-
Nickel Chromium Molybdenum Steels													
61	14Ni13Cr4Mo2	0.11-0.17	0.30-0.60	0.40	0.030	0.030	0.30	0.80-1.10	0.10-0.25	3.00-3.50	-	-	-
62	15Ni7Cr2Mo2	0.12-0.18	0.40-0.70	0.40	0.030	0.030	0.30	0.40-0.65	0.15-0.30	1.60-2.00	-	-	-
63	15Ni17Cr3Mo2	0.12-0.18	0.35-0.60	0.40	0.030	0.030	0.30	0.70-1.00	0.15-0.30	4.00-4.50	-	-	-
64	17Ni2Cr2Mo2	0.15-0.20	0.60-0.90	0.40	0.030	0.030	0.40	0.40-0.60	0.15-0.30	0.40-0.70	-	-	-
65	17Ni6Cr4Mo2	0.14-0.20	0.60-0.90	0.40	0.030	0.030	0.40	0.80-1.10	0.15-0.30	1.20-1.60	-	-	-
66	17Ni12Cr6Mo5	0.13-0.20	0.80-1.20	0.40	0.030	0.030	0.30	1.40-1.80	0.40-0.60	2.80-3.20	-	-	-
67	18Ni6Cr7Mo3	0.15-0.21	0.50-0.90	0.40	0.030	0.030	0.40	1.50-1.80	0.25-0.40	1.40-1.70	-	-	-
68	20Ni2Cr2Mo2	0.17-0.23	0.60-0.95	0.40	0.030	0.030	0.40	0.35-0.70	0.15-0.30	0.40-0.70	-	-	-
69	20Ni7Cr2Mo2	0.17-0.23	0.40-0.70	0.40	0.030	0.030	0.40	0.40-0.60	0.15-0.30	1.60-2.00	-	-	-
70	25Ni13Cr5Mo2	0.20-0.30	0.35-0.60	0.40	0.030	0.030	0.30	1.00-1.50	0.15-0.30	3.00-3.50	-	-	-
71	27Ni2Cr2Mo2	0.23-0.33	0.60-0.90	0.40	0.030	0.030	0.40	0.40-0.60	0.15-0.30	0.40-0.70	-	-	-
72	30Ni12Cr12Mo6	0.25-0.35	0.35-0.60	0.40	0.030	0.030	0.30	2.50-3.50	0.50-0.70	2.50-3.50	-	-	-
73	30Ni16Cr6Mo5	0.26-0.33	0.50-0.80	0.40	0.030	0.030	0.30	1.20-1.50	0.30-0.60	3.30-4.30	-	-	-
74	30Ni8Cr8Mo4	0.26-0.34	0.50-0.80	0.40	0.030	0.030	0.30	1.80-2.20	0.30-0.50	1.80-2.20	-	-	-
75	31Ni7Cr3Mo2	0.27-0.35	0.60-0.90	0.40	0.030	0.030	0.30	0.60-1.00	0.15-0.30	1.60-2.00	-	-	-
76	34Ni6Cr6Mo2	0.30-0.38	0.50-0.80	0.40	0.030	0.030	0.30	1.30-1.70	0.15-0.30	1.30-1.70	-	-	-
77	36Ni16Cr7Mo4	0.32-0.39	0.50-0.80	0.40	0.030	0.030	0.30	1.60-2.00	0.25-0.45	3.60-4.10	-	-	-
78	39Ni3Cr3Mo2	0.35-0.43	0.50-0.80	0.40	0.030	0.030	0.30	0.60-1.00	0.15-0.30	0.70-1.00	-	-	-
79	40Ni4Cr8Mo2	0.35-0.45	1.30-1.60	0.40	0.030	0.030	0.30	1.80-2.10	0.15-0.30	0.90-1.20	-	-	-

Sl. No	Grade	Constituent, Percent											
		C	Mn Max	Si ^{a)} Max	S ^{b)} Max	P Max	Cu Max	Cr Max	Mo Max	Ni Max	V Max	B	Others
80	40Ni7Cr3Mo2	0.36-0.43	0.60-0.90	0.40	0.030	0.030	0.30	0.60-1.00	0.15-0.30	1.60-2.00	-	-	-
81	41Ni2Cr2Mo2	0.38-0.45	0.70-1.00	0.40	0.030	0.030	0.40	0.40-0.60	0.15-0.30	0.40-0.70	-	-	-
82	47Ni7Cr3Mo2	0.44-0.50	0.60-0.90	0.40	0.030	0.030	0.30	0.60-1.00	0.15-0.30	1.60-2.00	-	-	-
83	55Ni2Cr2Mo2	0.50-0.60	0.70-1.00	0.40	0.030	0.030	0.40	0.40-0.60	0.15-0.30	0.40-0.70	-	-	-
84	68Ni2Cr2Mo2	0.64-0.72	0.20-0.60	0.40	0.030	0.030	0.40	0.40-0.60	0.15-0.30	0.50-0.75	-	-	-
Boron Steels and Boron Chromium Steels													
85	20Mn5BT	0.17-0.23	1.10-1.40	0.40	0.030	0.030	0.40	0.40	-	-	-	0.0008-0.0050	-
86	22Mn5BT	0.19-0.24	1.10-1.40	0.40	0.030	0.030	0.40	0.40	-	-	-	0.0008-0.0050	-
87	26Mn5BT	0.22-0.29	1.10-1.40	0.40	0.030	0.030	0.40	0.40	-	-	-	0.0008-0.0050	-
88	30Mn5BT	0.27-0.33	1.15-1.45	0.40	0.030	0.030	0.40	0.40	-	-	-	0.0008-0.0050	-
89	34Mn5BT	0.32-0.38	1.15-1.45	0.40	0.030	0.030	0.40	0.40	-	-	-	0.0008-0.0050	-
90	38Mn5BT	0.36-0.42	1.15-1.45	0.40	0.030	0.030	0.40	0.40	-	-	-	0.0008-0.0050	-
91	16Mn5Cr4BT	0.14-0.19	1.00-1.30	0.40	0.030	0.030	0.40	0.80-1.10	-	-	-	0.0008-0.0050	-
92	27Mn5Cr2BT	0.24-0.30	1.10-1.40	0.40	0.030	0.030	0.40	0.30-0.60	-	-	-	0.0008-0.0050	-
93	33Mn5Cr2BT	0.30-0.36	1.20-1.50	0.40	0.030	0.030	0.30	0.30-0.60	-	-	-	0.0008-0.0050	-
94	39Mn6Cr2BT	0.36-0.42	1.40-1.70	0.40	0.030	0.030	0.30	0.30-0.60	-	-	-	0.0008-0.0050	-
Chromium Aluminium Molybdenum Steels													
95	45Cr6Al10Mo2	0.40-0.50	0.60	0.40	0.030	0.030	0.30	1.30-1.70	0.15-0.30	0.25	-	-	Al: 0.70-1.20
Chromium Tungsten Steels													
96	110Cr1W9	1.00-1.20	0.20-0.60	0.40	0.030	0.030	0.30	0.20-0.50	-	0.25	0.20	-	W: 2.0-2.50
Nickel Chromium Molybdenum Vanadium Steels													
97	32Ni2Cr14Mo12V4	0.28-0.35	0.70-1.20	0.40	0.030	0.030	0.30	3.6-4.2	1.0-1.40	0.50-0.80	0.25-0.40	-	-
Silicon alloy Steels													
98	38Si7	0.35-0.42	0.60-0.80	1.50-1.90	0.030	0.030	0.40	0.40	0.10	0.40	-	-	-

Sl. No	Grade	Constituent, Percent											
		C	Mn Max	Si ^{a)} Max	S ^{b)} Max	P Max	Cu Max	Cr Max	Mo Max	Ni Max	V Max	B	Others
99	50Si7	0.45-0.55	0.50-0.80	1.50-2.00	0.030	0.030	0.40	0.40	0.10	0.40	-	-	-
100	55Si7	0.50-0.60	0.60-1.00	1.50-2.00	0.030	0.030	0.40	0.40	0.10	0.40	-	-	-
101	60Si7	0.55-0.65	0.70-1.00	1.50-2.00	0.030	0.030	0.40	0.40	0.10	0.40	-	-	-

NOTES

1 Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition of such elements from scrap or other materials used in the manufacturing process, which may affect hardenability, mechanical properties, and applicability.

2 Unless otherwise agreed upon, the nitrogen content of fully killed steel shall not exceed 0.012 percent. This shall be ensured by the manufacturer by occasional check analysis.

3 Unless otherwise agreed upon, the total aluminium content in the aluminium killed steel shall not be less than 0.02 percent. Silicon content in the silicon killed steel 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

4 Restricted chemical compositions may be agreed upon between the purchaser and the supplier.

5 Wider limits, either higher or lower than the specified range for the grade, may be mutually agreed upon depending on the application and heat treatment requirements. In such cases, the grade designation shall be suffixed with 'Mod' to indicate a modified chemistry agreement

6 a) — When silicon limits are required, the following ranges are commonly used: 0.10 % max; 0.10 to 0.20 %; 0.10 to 0.35 %; 0.15 to 0.35 %; or 0.20 to 0.40 %.

7 b) — If mutually agreed upon by the purchaser and the supplier, steel grades with sulfur content in the range of 0.020–0.040% may also be supplied. In such cases, the grade designation shall be suffixed with 'S30' (e.g., 17Cr3S30)

Table 2 Permissible Variation for Product Analysis
(Clause 7.2)

S. No.	Constituent	Percentage Limit of Constituent	Permissible Variations over/under Specified Limit, Percent, <i>Max</i>
(1)	(2)	(3)	(4)
i)	C	≤ 0.30 $> 0.30 \leq 1.00$ > 1.00	0.02 0.03 0.04
ii)	Mn	≤ 1.00 > 1.00	0.04 0.06
iii)	S	≤ 0.040	0.005
iv)	P	≤ 0.035	0.005
v)	Si	≤ 0.60 > 0.60	0.03 0.10
vi)	Cr	≤ 0.50 $> 0.50 \leq 2.00$ > 2.00	0.03 0.05 0.10
vii)	Mo	≤ 0.30 > 0.30	0.03 0.04
viii)	Ni	≤ 2.00 > 2.00	0.05 0.07
ix)	V	≤ 0.30	0.02
x)	Cu	≤ 0.40	0.03
xi)	W	≤ 2.5	0.05
xii)	B	≤ 0.0050	0.0003
xiii)	Al	0.70-1.20	0.10
xiv)	Nb and Ti	As per the agreement between the purchaser and the manufacturer	

8 MECHANICAL PROPERTIES

If mutually agreed upon by the purchaser and the supplier, mechanical requirements such as tensile properties, hardness and/or any other test may be carried out in accordance with applicable IS/ISO standards. The requirements such as testing frequency, sampling plan, sampling direction, location and acceptance criteria may also be agreed upon.

Note: The steel grades in this standard are defined solely based on chemical composition, as they are intended for further re-rolling and/or heat treatment.

9 Grain Size

The grain size requirements may be agreed upon between the purchaser and the supplier at the time or ordering.

Fine grain steel shall have an austenite grain size of 5 or finer. The grain size is usually measured either by the micrographic method as per IS 4748 or by determining the aluminium content. The test method for determining the grain size may be agreed upon between the purchaser and the supplier.

If grain size is determined as per micrographic method, sampling and sample preparation shall be as per IS 4748.

If grain is determined by determining the aluminium content, the minimum aluminium content may also be agreed upon between the purchaser and the supplier. The fine grain structure is normally achieved, when the total aluminium content is 0.018 percent minimum. In this case, the aluminium content shall be reported in test certificate.

10 Non-metallic Inclusions

10.1 Microscopic Inclusions

The hot rolled carbon and alloy steel plates, sheets and strips should be reasonably free from non-metallic inclusions. If agreed upon between the purchaser and the supplier at the time of enquiry and order, the content of microscopic non- metallic inclusions may be determined as per IS 4163 and acceptance criteria may be agreed upon.

Note: For grades with specified minimum sulfur content, the agreement should not include sulphides.

10.2 Macroscopic Inclusions

If agreed upon between the purchaser and the supplier at the time of enquiry and order, the content of macroscopic non- metallic inclusions may be determined as per IS 10138 or any other international standard and acceptance criteria may be agreed upon.

11 Decarburization

If agreed upon between the purchaser and the supplier at the time of enquiry and order, the depth of decarburization may be determined as per IS 6396 and acceptance limits may be agreed upon.

12 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.

13 FREEDOM FROM DEFECTS

13.1 The hot rolled carbon and alloy steel plates, sheets and strips shall have a smooth surface finish. Minor surface imperfections, which also may occur under normal manufacturing conditions, are not to be regarded as defects.

13.2 The steel shall be reasonably free from segregation, laminations, surface flaws and other defects which are detrimental to subsequent processing and ultimate use.

13.3 The degree of surface defects in a coil may be expected to be more compared to cut lengths as it is impossible to reject the portion of a coil. Acceptance criteria and detailed requirements of surface defects, as applicable shall be agreed upon at the time of enquiry and order.

14 DIMENSIONS AND TOLERANCES

14.1 Unless otherwise agreed upon between the supplier and the purchaser, standard dimensions of hot rolled steel plate, sheet and strip shall be as specified in IS 1730.

14.2 Unless otherwise agreed upon, the thickness tolerances shall be as per IS/ISO 16160.

14.3 Crown

Crown is the difference in strip thickness from centre to edge.

$$\text{Crown} = t_c - (t_1 + t_2) / 2$$

where

t_c = thickness at centre of the strip width; and

t_1 and t_2 = thicknesses measured at 40 mm inside of the 2 edges.

The crown of the hot-rolled mill edge steel strip (thickness up to 5mm) meant for cold rolling shall be as follows:

For width up to and including 500 mm : - 0/ + 0.10 mm

For width above 500 mm : - 0/ + 0.15 mm

14.4 Permissible Width Variations

The permissible tolerance on the nominal width of hot-rolled plate, sheet and strip shall conform to the requirements specified in IS/ISO 16160.

14.5 Edge Camber

The edge camber tolerance shall be as indicated below:

Nominal Width, mm		Measured Length, mm	Camber, mm	
From	Up to and Including		Mill Edge	Slit Edge
10	40	2500	20	20
40	600	2500	20	10
600	2000	2500	25	15

14.6 Any unspecified tolerances shall be mutually agreed upon by the purchaser and supplier. Additionally, special tolerances to accommodate specific requirements may be established through mutual agreement.

15 CALCULATION OF WEIGHT

Material should be supplied on the basis of actual weight. If weighing is not possible, the mass of the material may be calculated on the basis that steel weighs 7.85 g/cm³.

16 DELIVERY

The material shall be supplied in coil form or in bundles and shall be strapped firmly to prevent any damage during transit. The mass of each coil or bundle shall be as agreed upon between the purchaser and the supplier.

17 MARKING

17.1 Each coil or bundle or package shall carry a metal tag or adhesive label/sticker bearing the cast number or identification mark or lot number traceable to the cast number and the manufacturer's name or trade-mark or shall be legibly marked at top. Marking should also include size, grade and mass of coil.

17.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder and the product(s) may be marked with the Standard Mark.

ANNEX A*(Clause 2)***LIST OF REFERRED STANDARDS**

<i>IS No.</i>	<i>Title</i>
IS 228 (In various parts)	Method for chemical analysis of steel.
IS 1730: 1989	Steel plates, sheets and strips and flats for general engineering purposes — Dimensions (second revision)
IS 1956 (various parts)	Glossary of terms related to iron and steel
IS 7598: 1990	Classification of Steels (<i>first revision</i>)
IS 8910: 2022/ ISO 404: 2013	Steel and Steel Products – General Technical Delivery Requirements (<i>second revision</i>)
IS 10138 : 2010	Macroscopic methods for determination of non-metallic inclusion content in wrought steels (Second Revision)
IS 14650: 2023	Unalloyed and alloyed steel ingot and semi-finished products for re-rolling purposes – Specification (<i>first revision</i>)
IS/ISO 16160: 2012	Continuously hot-rolled steel sheet products – Dimensional and shape tolerances (<i>first revision</i>)
IS 4163: 2021/ ISO 4967:2013	Steel – Determination of content of non-metallic inclusions – Micrographic method using standard diagrams (<i>fourth revision</i>)
IS 4748: 2021/ ISO 643: 2019	Steels – Micrographic determination of the apparent grain size (<i>third revision</i>)
IS 6396: 2023/ ISO 3887: 2017	Steels – Determination of the depth of Decarburization (<i>third revision</i>)