BUREAU OF INDIAN STANDARDS

Draft Indian Standard

COLD REDUCED CARBON AND ALLOY STEEL — SPECIFICATION

(*Second Revision of IS 2507)*

ICS 77.140.50

Wrought Steel Products Sectional Committee, MTD 04	Last date for receipt of comments: **02 July 2025**

FOREWORD

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

This standard was first published in 1965 and subsequently revised in 1975. While reviewing the standard in the light of experience gained during these years, the Committee decided to revise it to bring it in line with the present practices being followed by the Indian industry.

In this revision the following major changes have been made:

1. This standard has been merged with IS 7226 : 1974 ‘Specification for cold - Rolled medium, high carbon and low alloy steel strip for general engineering purposes’ and a comparison of withdrawn grades of IS 2507:1975 and IS 7226: 1974 and new grades has been added in Annexure B for reference.
2. The scope of this standard has been broadened to cover cold rolled low, medium, high carbon and alloy steel plates for wide range of applications.
3. Title of the standard has been modified accordingly.
4. Chemical composition table has been removed and reference of corresponding hot rolled standard has been provided.
5. Additional surface conditions, surface finishes were added.

While revising the standard, assistance has been derived from ISO 4960 : 2019.

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 C. *(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

COLD REDUCED CARBON AND ALLOY STEEL — SPECIFICATION

(*Second Revision of* IS 2507)

1 SCOPE

This standard covers the requirements for cold-reduced low, medium and high carbon, and alloy steel sheets and strips in coils and cut lengths.

Cold-reduced low, medium, high carbon, and alloy steel sheets and strips are available in different types, grades and finishes for general applications and special applications, particularly springs.

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

a) Cold Reduced Carbon Steel Sheet and Strip (Part 1): Cold Forming and Drawing Purpose (IS 513 Part 1);
b) Cold Reduced Carbon Steel Sheet and Strip (Part 2): High Tensile and Multi-Phase Steel (IS 513 Part 2).

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 Matte Finish / Dull Finish — Rougher finish obtained by temper passing cold reduced sheet/strip. The typical surface roughness of the sheet/strip is Ra 0.6 µm to 2.0 µm, which is beneficial to obtain better paint adhesion, and aids drawing by reducing surface friction due to better oil adhesion.

3.2 Regular Bright Finish — Moderately bright reflective lustre finish obtained by temper passing cold reduced sheet/strip. The typical surface roughness of the strip is 0.5 µm (≤ 0.6 µm), which is suitable for many applications but not necessarily for bright plating applications.

3.3 Plating Bright Finish — Smooth bright finish of the sheet/strip with a typical surface roughness of 0.25 µm max.

3.4 Best Bright Finish — Mirror bright finish obtained by temper passing cold reduced sheet/strip with a typical surface roughness of 0.10 µm. It is the highest quality finish commonly produced and is particularly suited for bright plating. The production of this finish requires extreme care in processing.

3.5 Production Lot/ Lot — products from the same cast, with the same thickness and the same heat-treatment cycle.

3.6 Spheroidizing — The heating and cooling of the sheet/strip in controlled conditions (annealing) to produce a spheroidal or globular form of carbide micro constituent (commonly free of pearlite).

4 CLASSIFICATION AND DESIGNATIONS

Cold-reduced low, medium and high carbon steel sheets/strips are classified into non-alloy and alloy categories and are further designated into grades based on the carbon composition and alloy compositions. Refer Document "MTD 04 (27497) - Hot Rolled Carbon and Alloy Steel — Draft Specification" clause 5 for steel grades designations.

Comparison between withdrawn grade designations of IS 2507 and IS 7226 with new grade designations have been provided in **Annex B** for information.

5 SUPPLY OF MATERIAL

5.1 General requirements relating to the supply of cold-reduced low, medium and high carbon non alloy and alloy steel strips and Sheets (cut lengths) shall confirm to IS 8910.

5.2 Strips may be supplied with mill, trimmed or different kinds of edges as mentioned in **Table 6.**

5.3 Strips may be supplied with different kinds of surface Appearance and Finishes as mentioned in **Table 7** and **Table 8** respectively.

6 MANUFACTURING PROCESS

6.1 The chemical composition of the raw material used for manufacturing the sheets/strips covered in this standard shall conform to the requirements of MTD 04 (27497)

6.2 Delivery conditions of the cold-reduced steel sheet/strip shall be in one of the following conditions:

6.2.1 *As-rolled / Cold Rolled (R)* — Hot rolled pickled coil cold reduced to final thickness.

6.2.2 *Annealed (A)* — Cold reduced, soft annealed followed by a temper rolling.

6.2.3 *Annealed and Re-rolled (AR)* — Cold reduced, annealed and further cold reduced to Final thickness.

6.2.4 *Spheroidized Annealed (S)* — Cold Reduced and Spheroidized annealed to a required microstructure.

6.2.5 *Quenched and Tempered (QT)* — Heat treatment process applied to a cold reduced strip to achieve Martensitic and /or Bainitic structure and mechanical properties

6.2.6 In addition to the above, sheets/strips may also be supplied in any other delivery conditions as agreed upon between the purchaser and the manufacturer.

6.2.7 For the delivery condition – "Spheroidized Annealed (S)"– limits on spheroidization (clause 13) and mechanical properties may also be agreed upon at the time of enquiry and order.

6.2.8 The condition cold rolled (R) can also be applied to annealed material.

6.2.9 The condition quenched and tempered (QT) is aiming for a martensitic and/or bainitic structure. Specific structures if required, may be agreed upon.

7 DIMENSIONS AND TOLERANCES

7.1 Cold-reduced low, medium, high carbon, and alloy steel sheets/strips are typically produced in thicknesses of 6 mm or less and widths up to 600 mm, available in both coil and cut lengths. Products exceeding 600 mm in width or 6 mm in thickness may also be supplied by mutual agreement between the purchaser and the manufacturer. For these products, acceptance criteria will be determined based on the agreement between the purchaser and the manufacturer.

7.2 The nominal dimensions shall be agreed upon during the enquiry and order. Dimensional tolerances shall be in accordance with **Tables 9 to Table 14,** except for width tolerances of quenched and tempered sheets/strips (QT).

7.3 Width tolerances for the sheets /strips in the quenched and tempered condition (QT) shall be agreed upon between purchaser and manufacturer.

7.4 Shape tolerances may be agreed upon between the purchaser and the manufacturer.

7.5 Tolerances on width for the sheets/strips supplied in any edge conditions other than conditions mentioned in **Table 6** shall be agreed upon between purchaser and the manufacturer.

8 CHEMICAL COMPOSITION

8.1 Ladle Analysis

The ladle analysis of the steel sheet/strip shall be as per the requirements given in “Table 1A and Table 1B of MTD 04 (27497) - Hot Rolled Carbon and Alloy Steel — Draft Specification” for Non-alloy and alloy type steel grades respectively, when carried out either by the method specified in the relevant parts of IS 228 or IS 8811 or any other national/international standard for instrumental/chemical method. In case of dispute, the procedure given in the relevant parts of IS 228 shall be the referee method.

8.2 Product Analysis

Permissible variation in the case of product analysis, from the limits specified in “Table 1A and Table 1B of MTD 04 (27497) - Hot Rolled Carbon and Alloy Steel — Draft Specification” shall be as given in Table 2 of “MTD 04 (27497) - Hot Rolled Carbon and Alloy Steel — Draft Specification”.

9 MECHANICAL PROPERTIES

9.1 Cold-reduced low, medium, high carbon, and alloy steel strips shall be ordered either on the basis of hardness or tensile strength or in combination as agreed upon between the purchaser and the manufacturer.

9.2 A sample of sufficient size for all required tests must be extracted, which can be taken from any position on the strip or cut lengths. In the event of a dispute, samples should be collected from a location at least 3 meters away from either end of the coil.

9.3 Tests shall be conducted on every lot of 50 tons or less of material of the same cast, rolled to the same dimensions, and treated under the same delivery conditions and surface finish.

9.4 Hardness

Hardness shall be tested in accordance with IS 1501 (Part 1) and the results shall confirm to the values given in **Table 1** for non-alloy steel sheets/strips and **Table 2** for alloy steel sheets/strips respectively for the applicable delivery condition.

NOTE — While the Vickers Hardness test as per IS 1501 (Part 1) is the preferable test method, Rockwell Hardness as per IS 1586 (Part 1) may also be used and the corresponding values are provided in table1 and table 2 for reference.

9.5 Tensile Test

The tensile test shall be carried out in accordance with IS 1608 (Part 1) and the results shall conform to the values in **Table 3** for non-alloy steel sheets/strips and **Table 4** for alloy steel sheets/strips respectively for the applicable delivery condition.

9.6 Tensile test specimens shall be taken parallel to the rolling direction and in a position midway between the centre and the longitudinal edge of the sheet/strip. The tensile specimen shall not be further worked on the either surface.

9.7 Any other test may also be agreed upon between the purchaser and the manufacturer and the test requirements test frequency, sample direction, sample location, test methods as per applicable IS/ ISO standards and test values or acceptance criteria may also be mutually agreed upon between the purchaser and manufacturer.

NOTES

1 Heat treatment recommendations for quenched and tempered steel sheets/strips and the minimum hardness values in the quenched condition without tempering are shown in **Table 15.**

2 The steel may be quenched in water, oil or isothermally treated (e. g. metal bath), *see* **Table 15.**

10 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.

Unless otherwise agreed upon, when the grain size is determined based on the aluminium content, the total aluminium content shall be 0.018 percent minimum for the fine grain structure. Any other

minimum aluminium content may also be agreed upon between the purchaser and the supplier. In any case, the aluminium content shall be reported in the test certificate.

11 NON-METALLIC INCLUSIONS

The cold reduced carbon and alloy steel sheets/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, microscopic non- metallic inclusions may be determined as per IS 4163 and the acceptance criteria may be agreed upon.

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

12 DECARBURISATION

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

However, all steel sheets/strips for quenching and tempering of any condition with carbon content of minimum 0.50 percent shall not exceed the decarburization levels specified in **Table 5**, when measured at a distance of at least 10mm from the strip edge.

13 SPHEROIDIZATION OF CARBIDES

If agreed upon between the purchaser and the supplier at the time of enquiry and order, the degree of spheroidization in the spheroidized annealed (S) strips may be determined as per ISO 23825 and acceptance limits may be agreed upon. The cross-section of each test piece shall be prepared, polished, and then etched using a suitable solution. The degree of spheroidization of cementite shall be verified through microscopic examination of the section, typically at a magnification of × 500.

14 RE-TEST

If a sample is found non-conforming in any requirement, two additional samples from the same lot shall be re-tested for that specific requirement. If both re-test samples are found conforming, the lot may be accepted.

During a tensile test, if the fracture occurs outside the middle half of the gauge length marked before the test, and if the measured values are out of the specification limit, the sample shall be discarded, and a new sample shall be tested.

15 SURFACE CHARACTERISTICS

15.1 Surface appearance

Unless otherwise agreed upon, the as-rolled/ cold rolled (R), annealed (A), annealed and re-rolled (AR) and spheroidized annealed (S) steel sheets/strips shall be supplied in MA surface appearance**.**

If agreed upon at the time of enquiry and order, surface appearance of the as-rolled/ cold rolled (R), annealed (A), annealed and re-rolled (AR) and spheroidized annealed (S) steel strips shall be as per **Table 7.**

The appearance described in Table 7 for R, A, AR, and S is applicable to the outer surface of the coils and the upper surface of cut lengths. The appearance of the other side should at least match the MA surface appearance. These appearance requirements do not apply to the first two inner and outer laps of the coil or to cut lengths taken from them.

15.2 Surface finish

Unless otherwise agreed upon, as-rolled/ cold rolled (R), annealed (A), annealed and re-rolled (AR) and spheroidized annealed (S) steel sheets/strips shall be supplied in surface finish RL (Ra≤ 0.6 µm) and quenched and tempered (QT) steel sheets/strips shall be supplied in oxide finish.

If agreed upon at the time of enquiry and order, surface finish of R, A, AR, S and QT steel sheets/strips shall be as per **Table 8.**

Single scratches may occur in QT steel strips due to processing. The depth of these scratches, measured in roughness Ra, shall be less than 15 µm

15.3 Surface Defects

The steel sheets in cut lengths shall be free from laminations, surface flaws and other imperfections that are detrimental to the final product's practical application or subsequent processing. However, as it is difficult to inspect and remove the defects in the coil, the acceptance criteria may be agreed upon by the purchaser and the supplier.

15.4 Surface Protection

Unless otherwise agreed upon, the cold reduced steel sheets/strips shall be protected by a uniform coating of non-drying neutral oil, free from foreign particles, to provide resistance to scratching and corrosion for up to 3 months under normal packing, storage, and transportation conditions.

16 PACKING

The steel sheets/strips shall be packed appropriately to prevent any damage during transit, handling, and storage, in accordance with the agreement between the purchaser and the manufacturer.

17 MARKING

17.1 Every coil or bundle or package shall carry a metal tag or adhesive label/sticker legibly and indelibly marked with the following details:

a) IS No. of this standard;
b) Manufacturer's name or trademark;
c) Material identification/coil number/packet number/batch number, etc.;
d) Product dimensions;
e) Weight or mass of the product — coil or packet/bundle; and
f) Designation and Grade.

Any additional marking may also be agreed upon at the time of the enquiry or order.

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.

Table 1 Hardness Requirements for Non-Alloy Type steels
(Clause 9.4*)*

Grade [d]	Delivery condition [a]						
	Annealed (A)		Annealed and Re rolled (AR)		Quenched and Tempered (QT) [b]		Cold Rolled/ As-Rolled (R)
	HRB [c] (For Reference)	HV [c]	HRC [c] (For Reference)	HV [c]	HRC [c] (For Reference)	HV [c]	HV [c]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
10C5	73 Max	135 Max	--	--	--	--	250 Max
15C5	76 Max	140 Max	--	--	--	--	260 Max
20C5	78 Max	155 Max	--	--	--	--	265 Max
25C5	80 Max	160 Max	--	--	--	--	270 Max
30C8	--	160 Max	--	--	--	--	260 Max
35C8	86 Max	175 Max	--	--	--	--	280 Max
40C8	87 Max	180 Max	28 Max	290 Max	--	240-400	285 Max
41C15	--	200 Max	--	--	--	--	310 Max
43C15	--	205 Max	--	--	--	--	310 Max
45C8	88 Max	185 Max	--	--	--	270-460	295 Max
50C8	89 Max	185 Max	--	--	33-50	315-505	300 Max
55C8	90 Max	195 Max	35 Max	350 Max	34-51	300-520	305 Max
60C8	91 Max	200 Max	--	--	35-52	335-530	310 Max
65C8	--	205 Max	--	--	--	340-580	310 Max
70C8	92 Max	215 Max	35 Max	350 Max	38-54	350-580	320 Max
75C7	93 Max	220 Max	--	--	38-54	350-580	325 Max
80C7	94 Max	220 Max	36 Max	360 Max	38-54	350-590	330 Max
85C7	94 Max	225 Max	36 Max	360 Max	38-55	350-600	330 Max
90C7	94 Max	230 Max	--	--	38-55	370-600	330 Max
95C3	--	210 Max	--	--	--	330-610	310 Max
100C5	95 Max	220 Max	--	--	38-55	360-600	325 Max
100C8	95 Max	230 Max	36 Max	360 Max	--	370-600	325 Max
105C4	--	220 Max	--	--	--	--	325 Max
120C4	97 Max	230 Max	--	--	38-55	360-600	325 Max

(--) No specific requirement. Values may be agreed upon between the purchaser and manufacturer.

[a] The purchaser may order based on hardness or tensile requirements. However, if no specific requirements are provided, only the tensile requirements will be applicable. Restricted or Stricter mechanical properties may be agreed upon between the manufacturer and the purchaser.

[b] Values apply to the quenched and tempered condition with thicknesses 0.30 mm $\leq t \leq$ 3.0 mm and martensitic and/or bainitic structure. For thicker strip or other structure, the values for the mechanical properties shall be agreed upon at the time of enquiry and order.

[c] HRB- Rockwell hardness (scale B); HRC- Rockwell hardness (scale C); HV- Vickers hardness. Since slight surface decarburization is unavoidable, the minimum hardness values specified may be considered approximate.

[d] For the grades which are not covered in the above table the hardness values shall be as per the agreement between the purchaser and the manufacturer.

Table 2 Hardness Requirements for Alloy Steel

(Clause 9.4*)*

Grade [d]	**Delivery condition** [a]						
	Annealed (A)		**Annealed and Re rolled (AR)**		**Quenched and Tempered (QT)** [b]		**Cold Rolled/ As Rolled (R)**
	HRB [c] (For Reference)	HV [c]	HRC [c] (For Reference)	HV [c]	HRC [c] (For Reference)	HV [c]	HV [c]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
17Cr3	84 Max	170 Max	--	--	--	--	--
20Cr4	--	180 Max	--	--	--	--	285 Max
37Cr4	--	190 Max	--	--	--	--	300 Max
41Cr4	--	200 Max	--	--	--	--	310 Max
50Cr4	--	240 Max	--	--	--	500-650	--
56Cr3	--	200 Max	--	--	--	--	310 Max
75Cr1	94 Max	220 Max	--	--	38-54	370-580	--
85Cr1	--	200 Max	--		--	--	310 Max
95Cr1	95 Max	220 Max	--	--	38-55	370-600	--
102Cr6	97 Max	235 Max	--	--	42-55	400-600	--
105Cr3	--	230 Max	--		--	--	325 Max
120Cr1	98 Max	240 Max	35 Max	350 Max	--	370-600	340 Max
125Cr2	97 Max	235 Max	--	--	42-55	390-610	--
16Mn5Cr4	84 Max	170 Max	--	--	--	--	--
15Cr4Mo2	--	170 Max	--		--	--	270 Max
25Cr4Mo2	87 Max	175 Max	--	--	31-44	305-435	--
30Cr4Mo2	--	180 Max	--		--	--	285 Max
34Cr4Mo2	88 Max	185 Max	--	--	32-46	315-465	--
35Cr4Mo2	--	190 Max	--		--	--	300 Max
42Cr4Mo2	90 Max	200 Max	--	--	35-49	340-490	--
50Cr4Mo2	94 Max	220 Max	--	--	38-53	370-550	--
50Cr4V2	94 Max	220 Max	--	--	38-53	350-670	330 Max
58Cr4V2	95 Max	225 Max	--	--	38-54	370-580	--
80Cr2V2	95 Max	225 Max	--	--	38-53	360-590	--
75Ni8	94 Max	220 Max	--	--	38-53	360-550	--
15Ni9Cr1	--	170 Max	--		--	--	270 Max
31Ni11Cr3	--	180 Max	--		--	--	285 Max
36Ni13Cr3	--	190 Max	--		--	--	300 Max
80Ni4Cr1	--	200 Max	--		--	--	310 Max
80Ni7Cr1	--	200 Max	--		--	--	310 Max
15Ni7Cr2Mo2	--	180 Max	--		--	--	285 Max
20Ni2Cr2Mo2	--	180 Max	--		--	--	285 Max
68Ni2Cr2Mo2	95 Max	225 Max	--	--	38-53	370-580	--
20Mn5BT	86 Max	170 Max	--	--	--	--	--
27Mn5Cr2BT	89 Max	175 Max	--	--	31-46	310-450	--
110Cr1W9	98 Max	250 Max	35 Max	350 Max	--	370-600	340 Max
55Si7	96 Max	240 Max	--	--	38-51	370-570	--
60Si7	--	210 Max	--		--	--	310 Max
(--)No specific requirement. Values may be agreed upon between the purchaser and manufacturer.							

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[a] The purchaser may order based on the hardness or tensile requirements. However, if no specific requirements are provided, only the tensile requirements will be applicable. Restricted or Stricter mechanical properties may be agreed upon between the manufacturer and the purchaser.

[b] Values apply to the quenched and tempered condition with thicknesses 0.30 mm ≤ t ≤ 3.0 mm and martensitic and/or bainitic structure. For thicker strip or other structure, the values for the mechanical properties shall be agreed upon at the time of enquiry and order.

[c] HRB- Rockwell hardness (scale B); HRC- Rockwell hardness (scale C); HV- Vickers hardness. Since slight surface decarburization is unavoidable, the minimum hardness values specified may be considered approximate.

[d] For the grades which are not covered in the above table the hardness values shall be as per the agreement between the purchaser and the manufacturer.

Table 3 Tensile Properties Requirements for Non-Alloy Type Steel

(Clause 9.5*)*

Grade [c]	**Delivery condition** [a]								
	Quenched and Tempered (QT) [b]			**Annealed (A)**			**Cold Rolled/ As-Rolled (R)**		
	YS MPa	**TS** MPa	**El,** Percent GL-80	**YS** MPa	**TS** MPa	**El,** Percent GL-80	**YS** MPa	**TS** MPa	**El,** Percent GL-80
10C5	--	--	--	345 Max	430 Max	26 Min	--	830 Max	--
15C5	--	--	--	360 Max	450 Max	25 Min	--	870 Max	--
20C5	--	--	--	400 Max	500 Max	22 Min	--	900 Max	--
25C5	--	--	--	410 Max	510 Max	21 Min	--	910 Max	--
35C8	--	--	--	450 Max	560 Max	18 Min	--	930 Max	--
40C8	--	800-1300	--	460 Max	570 Max	17 Min	--	970 Max	--
45C8	830 Min	880-1500	2 Min	270-475	590 Max	17 Min	--	1020 Max	--
50C8	--	1030-1650	--	475 Max	590 Max	17 Min	--	1050 Max	--
55C8	1000 Min	1080-1700	2 Min	270-485	610 Max	17 Min	--	1070 Max	--
60C8	--	1130-1750	--	500 Max	620 Max	17 Min	--	1100 Max	--
65C8	1030 Min	1180-1800	2 Min	270 Min	620 Max	17 Min	--	--	--
70C8	1030 Min	1180-1900	2 Min	270-520	650 Max	16 Min	--	1150 Max	--
75C7	1050 Min	1180-1900	2 Min	280-520	650 Max	15 Min	--	1180 Max	--
80C7	1060 Min	1180-1950	2 Min	280-545	680 Max	14 Min	--	1200 Max	--
85C7	1080 Min	1200-2000	2 Min	280-555	690 Max	14 Min	--	1210 Max	--
90C7	--	1200-2000	--	565 Max	700 Max	13 Min	--	1220 Max	--
100C5	--	1200-2000	--	550 Max	690 Max	13 Min	--	1200 Max	
100C8	1150 Min	1250-2000	2 Min	310 Min	700 Max	13 Min	--	--	--
120C4	1200 Min	1180-2000	--	600 Max	740 Max	11 Min	--	1200 Max	--

(--)No specific requirement. Values may be agreed upon between the purchaser and manufacturer

1. Other gauge lengths such as 50mm, 5.65 Sqrt A, etc along with corresponding elongation values may also be agreed upon. For Gauge Length of 80mm - Type 2 specimen and for gauge length of 50mm - Type1 and Type 3 Specimens are applicable (*see* Annex B of IS 1608 (Part 1))

[a] The purchaser may order based on hardness or tensile requirements. However, if no specific requirements are provided, only the tensile requirements will be applicable. Restricted or Stricter mechanical properties may be agreed upon between the manufacturer and the purchaser

[b] Values apply to the quenched and tempered condition with thicknesses 0.30 mm ≤ *t* ≤ 3.0 mm and martensitic and/or bainitic structure. For thicker strip or other structure, the values for the mechanical properties shall be agreed upon at the time of enquiry and order.

[c] For the grades which are not covered in the above table the tensile properties shall be as per the agreement between the purchaser and the manufacturer.

Table 4 Tensile Properties Requirements for Alloy Type Steel

(Clause 9.5*)*

Grade [d]	**Delivery condition** [a]								
	Quenched and Tempered (QT) [b]			**Annealed (A)**			**Cold Rolled/ As Rolled (R)** [c]		
	YS MPa	**TS** MPa	**El,** Percent GL-80	**YS** MPa	**TS** MPa	**El,** Percent GL-80	**YS** MPa	**TS** MPa	**El,** Percent GL-80
17Cr3	--	--	--	420 Max	550 Max	21 Min	--	--	--
50Cr4	1050 Min	1200-2260	1 Min	340 Min	780 Max	11 Min	--	--	--
75Cr1	--	1200-1900	--	550 Max	690 Max	13 Min	--	--	--
95Cr1	--	1200-2000	--	560 Max	700 Max	12 Min	--	--	--
102Cr6	--	1280-2000	--	590 Max	750 Max	11 Min	--	--	--
125Cr2	--	1250-2000	--	590 Max	750 Max	11 Min	--	--	--
16Mn5Cr4	--	--	--	420 Max	550 Max	21 Min	--	--	--
25Cr4Mo2	--	990-1400	--	440 Max	580 Max	19 Min	--	--	--
34Cr4Mo2	--	1020-1500	--	460 Max	600 Max	16 Min	--	--	--
42Cr4Mo2	--	1100-1600	--	480 Max	620 Max	15 Min	--	--	--
50Cr4Mo2	--	1200-1800	--	540 Max	700 Max	13 Min	--	--	--
50Cr4V2	--	1150-2300	--	340-560	780 Max	12 Min	--	--	--
58Cr4V2	--	1200-1900	--	580 Max	720 Max	12 Min	--	--	--
80Cr2V2	--	1180-1950	--	580 max	720 Max	12 Min	--	--	--
75Ni8	--	1180-1800	--	550 Max	690 Max	13 Min	--	--	--
68Ni2Cr2Mo2	--	1200-1900	--	590 Max	730 Max	11 Min	--	--	--
20Mn5BT	--	--	--	430 Max	540 Max	20 Min	--	--	--
27Mn5Cr2BT	--	1000-1450	--	460 Max	580 Max	18Min	--	--	--
55Si7	1150 min	1200-1960	2 Min	340-600	780 Max	11 Min	--	--	--

(--)No specific requirement. Values may be agreed upon between the purchaser and manufacturer

1. Other gauge lengths such as 50mm, 5.65 Sqrt A, etc along with corresponding elongation values may also be agreed upon. For Gauge Length of 80mm - Type 2 specimen and for gauge length of 50mm - Type1 and Type 3 Specimens are applicable (see Annex B of IS 1608 (Part 1)).

[a] The purchaser may order based on hardness or tensile requirements. However, if no specific requirements are provided, only the tensile requirements will be applicable. Restricted or Stricter mechanical properties requirement may be agreed to between the manufacturer and the purchaser

[b] Values apply to the quenched and tempered condition with thicknesses 0.30 mm ≤ *t* ≤ 3.0 mm and martensitic and/or bainitic structure. For thicker strip or other structure, the values for the mechanical properties shall be agreed upon at the time of enquiry and order.

[c] For the grades which are not covered in the above table the tensile properties shall be as per the agreement between the purchaser and the manufacturer.

Table 5 Decarburisation

(Clause 12*)*

Type	Thickness (mm)	Decarburisation limit
Non-Alloy Type	Thickness ≥ 0.20 mm	Maximum of 2 % of the material thickness per side
	Thickness < 0.20 mm	Maximum of 4 µm per side
Alloy Type	Thickness ≥ 0.20 mm	Maximum of 3 % of the material thickness per side
	Thickness < 0.20 mm	Maximum of 6 µm per side

Table 6 Edge Conditions

(Clause 5.2 *and* 7*)*

Edge Symbol	Characteristic
SE	A prepared edge of specified contour (round or square, etc) that is produced when a very accurate width is required or when edge condition suitable for electroplating is required or both.
ME	A natural mill edge carried through the cold rolling from the hot rolled strip without additional processing of the edge.
TE	An approximately square edge produced from slit edge material on which the burr is eliminated.
TE1	An approximately square edge produced by slitting on which the burr is not eliminated. This is produced when the edge condition is not a critical requirement for the finished part. Normal coiling or piling does not provide a definite positioning of the slitting burr.
RE	An approximately rounded edge. This edge is produced when the width tolerance and edge condition are not as exacting as for “SE” edges.
SE1	An approximately squared edge. This edge is produced when the width tolerance and edge condition are not as exacting as for “SE” edges.
In addition to the above-mentioned edge conditions, additional edge conditions may also be agreed upon between the purchaser and the manufacturer.	

Table 7 Surface Appearance

(Clause 5.3*,* 15.1 *and* 15.3*)*

Symbol	Characteristic	Delivery conditions	Available surface finishes [b)]
MA	Bright, Metallic clean surfaces, pitting groves and scratches are permitted	All thickness Delivery Condition - R, A, AR & S	RR -Rough RM -Matt/Dull RL -Bright RP- Plating Bright RM- Mirror Bright
MB	Bright, Metallic clean surfaces, pitting grooves and scratches are permitted as long as the uniform smooth appearance is not substantially impaired when viewed with the naked eye	Thickness ≤ 2.00 mm [a)] Delivery Condition - R, A, AR & S (Except when skin pass or cold rolling is not applied as final stage of processing)	RM -Matt/Dull RL -Bright RP- Plating Bright RM- Mirror Bright

[a)] The supply of products of greater thickness with this surface appearance shall be agreed upon at the time of enquiry and order.
[b)] Table 8 for surface finish requirements.

Table 8 Surface Finish
(Clause 5.3, 15.2, 15.4 *and* 15.5*)*

Surface Finish	Note	Symbol	Mean Surface Roughness (Ra, µm)
For delivery conditions - R, A , AR & S			
Rough	--	RR	Ra ≥ 1.5 µm
Matt/Dull	--	RD	0.6 µm < Ra ≤ 2.0 µm
Bright	--	RL	Ra ≤ 0.6 µm
Plating Bright	--	RP	Ra ≤ 0.25 µm
Mirror Bright	--	RM	Ra ≤ 0.10 µm
For delivery conditions – QT			
Oxide Finish	Unpolished (e.g Grey/Blue)	-	Ra ≤ 0.6 µm
Bright Tempered	Unpolished	--	
Polished	Obtained by fine grinding, abrasive brushing, or other processes		Max Ra value may be agreed upon at the time of enquiry and order
Polished and coloured	Blue, yellow, or other colours obtained by oxidization by heat treatment or other processes		

Table 9 Tolerance on Thickness
(Clause 7*)*

Thickness (t in mm)	**Tolerance for specified width** (w in mm and Tolerance in mm)					
	≤ 125		**125 < w ≤ 250**		**250 < w ≤ 600**	
	Normal	**Special**	**Normal**	**Special**	**Normal**	**Special**
t ≤ 0.15	±0.01	±0.01	±0.02	±0.015	±0.02	±0.015
0.15 < t ≤ 0.25	±0.02	±0.015	±0.025	±0.015	±0.03	±0.02
0.25 < t ≤ 0.40	±0.02	±0.015	±0.03	±0.02	±0.03	±0.02
0.40 < t ≤ 0.60	±0.03	±0.02	±0.04	±0.03	±0.04	±0.03
0.60 < t ≤ 0.80	±0.04	±0.03	±0.05	±0.035	±0.05	±0.035
0.80 < t ≤ 1.00	±0.04	±0.03	±0.05	±0.035	±0.06	±0.045
1.00 < t ≤ 1.50	±0.05	±0.035	±0.06	±0.045	±0.07	±0.055
1.50 < t ≤ 2.50	±0.06	±0.04	±0.07	±0.055	±0.08	±0.06
2.50 < t ≤ 4.00	±0.08	±0.06	±0.09	±0.06	±0.10	±0.08
4.00 < t ≤ 6.00	±0.09	±0.06	±0.10	±0.08	±0.12	±0.09

NOTES
1 Thickness measured at any point on the sheet/strip shall not be less than 20 mm from a side edge for the mill edge strip and not less than 10 mm from a side edge for other slit edge types.
2 For mill edge sheets/strips of widths 40mm or less and sheared edge sheets/strips of width 20 mm or less, measurements are made on the centre line of the sheet/strip.
3 Measurements are not made on top of the shear burr.
4 For widths and thicknesses not mentioned in the above table, tolerances shall be as per the agreement between the purchaser and the manufacturer.

Table 10 Width tolerances for Mill edge (Edge Symbol - ME)
(Clause 7)

Specified Width (w in mm)	**Width Tolerance (in mm)**
w < 100	± 1.5
100 ≤ w < 200	± 2.0
200 ≤ w < 400	± 2.5
400 ≤ w < 500	± 4.0
500 ≤ w < 600	± 6.0

NOTES
1 These values do not apply to the uncropped ends of mill edge coil within 7 m inclusive of both ends or as per the mutual agreement between the purchaser and the manufacturer.
2 By agreement between the purchaser and the manufacturer, material can be ordered with wider (more than the above-mentioned range) or stricter tolerances.
3 For widths and thicknesses not mentioned in the above table, tolerances shall be as per the agreement between the purchaser and the manufacturer.

Table 11 Width Tolerances for Slit Edge Not Deburred (Edge type – TE1)
(Clause 7)

Specified Width (w in mm)	**Width Tolerance for Specified Thickness** (t in mm)			
	t ≤ 1.5	**1.5 < t ≤ 2.5**	**2.5 < t ≤4.5**	**4.5 < t ≤ 6.0**
w ≤ 100	±0.15	±0.20	±0.25	±0.40
100 < w ≤200	±0.15	±0.25	±0.40	±0.50
200 < w ≤ 300	±0.25	±0.25	±0.40	±0.50
300 < w ≤ 450	±0.40	±0.40	±0.50	±0.80
450 < w ≤ 600	±0.50	±0.50	±0.50	±0.80

NOTES
1 By agreement between the purchaser and the manufacturer, the material can be ordered with wider (more than the above-mentioned range) or stricter tolerances.
2 For widths and thicknesses not mentioned in the above table, tolerances shall be as per the agreement between the purchaser and the manufacturer.

Table 12 Width Tolerances for Slit Edge (Edge type – SE, TE, RE and SE1)
(Clause 7)

Edge Symbol	**Specified Width** (w in mm)	**Specified Thickness** (t in mm)	**Width Tolerance** (in mm)
SE	$12.5 < w \leq 200$	$t \leq 3.0$	±0.15
RE	$w \leq 25$	$0.6 \leq t \leq 5.0$	±0.38
	$25 < w \leq 50$	$0.6 \leq t \leq 6.0$	±0.65
	$50 < w \leq 150$	$1.0 \leq t \leq 6.0$	±1.20
TE	$w \leq 100$	$t \leq 3.0$	±0.15
	$100 < w \leq 500$	$0.4 \leq t \leq 3.0$	±0.25
	$500 < w \leq 600$	$0.6 \leq t \leq 2.0$	±0.38
SE1	$w \leq 25$	$0.6 \leq t \leq 5.0$	±0.38
	$25 < w \leq 50$	$0.6 \leq t \leq 6.0$	±0.65
	$50 < w \leq 150$	$1.0 \leq t \leq 6.0$	±1.20

NOTES
1 By agreement between the purchaser and the manufacturer, the material can be ordered with wider (more than the above-mentioned range) or stricter tolerances.
2 For widths and thicknesses not mentioned in the above table, tolerances shall be as per the agreement between the purchaser and the manufacturer.

Table 13 Length Tolerances for Cut Lengths
(Clause 7)

Specified Length (l in mm)	**Tolerances (in mm) for specified widths up to 600 mm**
$l \leq 1500$	+15
$1500 < l \leq 3000$	+20
$3000 < l \leq 6000$	+25
$6000 < l$	+ 0.5 % of specified length

NOTES
1 For widths not mentioned in the above table, tolerances shall be as per the agreement between the purchaser and the manufacturer.
2 Stricter tolerances and under tolerances (negative side) can be agreed between the purchaser and the manufacturer.

Table 14 Camber Tolerances for Coils and Cut Lengths
(Clause 7)

Specified Width (w in mm)	**Camber Tolerances t_1** (in mm)
$10 < w \leq 40$	25 max in any 2000 length
$40 < w \leq 600$	T < 2mm: 10 max in any 2000 length T ≥ 2mm: 15 max in any 2000 length

NOTES

1 Camber is the greatest deviation of a side edge from a straight line (*see* Figure 1), the measurement being taken on the concave side with a straight edge.

2 In those cases, where it is not practical to measure the tolerance as given in this table, the camber tolerance, t_2, may be calculated from the formula:

$$t_2 = (l_2 \times t_1) / l_1$$

where

l_1 is the standard length in this table (2000 mm)

l_2 is the non-standard length;

t_1 is the camber tolerance in this table

3 For widths not mentioned in the above table, tolerances shall be as per the agreement between the purchaser and the manufacturer.

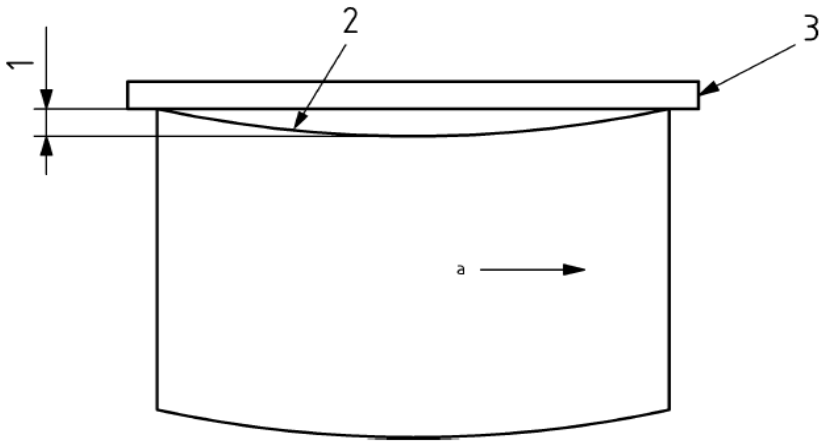

Figure 1 — Measurement of edge camber

Key

1 Edge Camber

2 Side edge (concave side)

3 Straight edge

a Rolling direction

Table 15 Guidelines for the Heat Treatment and the Minimum Hardness Values in the Quenched Condition

(Informative)

Grade	Austenitizing Temperature [c]	Quenching Medium	Minimum hardness a in the quenched condition without tempering [a]	
	(° C)		HRC [b]	HV [b]
Non-alloy steels for quenching and tempering				
35C8	840-880	Water or Oil	47	470
40C8	830-870	Water or Oil	51	530
45C8	820-870	Water or Oil	52	540
50C8	810-850	Oil or Water	53	560
55C8	805-850	Oil or Water	55	600
60C8	800-850	Oil or Water	570	640
65C8	810-850	Oil or Water		
70C8	800-850	Oil	59	670
75C7	780-840	Oil	60	700
80C7	780-840	Oil	60	700
85C7	770-830	Oil	61	720
90C7	790-820	Oil	61	720
100C5	790-820	Oil	61	720
100C8	770-820	Oil		
120C4	780-820	Oil	62	750
Alloy steels for quenching and tempering				
50Cr4	820-860	Oil or Water		
75Cr1	810-840	Oil	60	700
95Cr1	800-840	Oil	60	720
102Cr6	830-860	Oil	60	700
125Cr2	820-850	Oil	62	750
25Cr4Mo2	840-880	Water or Oil	44	430
34Cr4Mo2	830-870	Oil or Water	48	480
42Cr4Mo2	820-860	Oil or Water	51	530
50Cr4Mo2	820-860	Oil	57	640
50Cr4V2	820-860	Oil	57	640
58Cr4V2	810-850	Oil	58	650
80Cr2V2	840-870	Oil	60	700
75Ni8	820-850	Oil	60	700
68Ni2Cr2Mo2	810-840	Oil	60	700
20Mn5BT	880-920	Water	42	410
27Mn5Cr2BT	880-920	Water or Oil	45	440
55Si7	830-870	Oil	55	600

[a] The thickness ranges up to which these minimum values apply is 0.30 mm to 3.0 mm.
[b] HRC- Rockwell hardness (scale C); HV- Vickers hardness.
[c] For the grades which are not covered in the above table the Austenitizing Temperature and Quenching Medium shall be as per the agreement between the purchaser and the manufacturer.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 228 (Various parts)	Method for chemical analysis of steel
IS 1501 (Part 1): 2020/ ISO 6507-1: 2018	Metallic materials – Vickers hardness test Part 1 test method (*fifth revision*)
IS 1586 (Part 1): 2018/ ISO 6508-1: 2016	Metallic materials – Rockwell hardness test: Part 1 test method (*fifth revision*)
IS 1608 (Part 1): 2022/ ISO 6892-1: 2019	Metallic materials – Tensile testing: Part 1 Method of test at room temperature (*fifth revision*)
IS 1956 (various parts)	Glossary of terms related to iron and steel (*second revision*)
IS 8811: 1998	Method for emission spectrometric analysis of plain carbon and low alloy steels point to plane technique (*first revision*)
IS 8910: 2022 / ISO 404: 2013	Steel and Steel Products - General Technical Delivery Requirements (*second revision*)
IS 15262: 2002/ ISO 4287: 1997	Geometrical product specifications (GPS) – surface texture: Profile method – terms, definitions, and surface texture parameters
IS 4163: 2021/ ISO 4967:2013	Steel – Determination of content of non-metallic inclusions – Micrographic method using standard diagrams (fourth revision)
IS 4748: 2021/ ISO 643: 2019	Steels – Micrographic determination of the apparent grain size (*third revision*)
IS 6396: 2023/ ISO 3887: 2017	Steels – Determination of the depth of Decarburization (*third revision*)
ISO 23825:2020	Method for evaluating the nodularity of spheroidal carbides — Steels for cold heading and cold extruding

ANNEX B

(Informative)

(Foreword and Clause 4)

Comparison of Grades Between Withdrawn Grade Designations of Standards IS 2507 and IS 7226 and Current Grade Designations

Equivalent New Grade Designation	**IS 2507 Withdrawn Grade Designation**	**IS 7226 Withdrawn Grade Designation**
40C8	-	C40
45C8	45C 8	-
55C8	55C 6	C55
65C8	65C 6	-
70C8	70C 6	C70
75C7	75C 6	-
80C7	80C 6	C80
85C7	85C 6	C85
100C8	98C 6	C98
120Cr1	-	120Cr35
110Cr1W9	-	110Cr35W2
55Si7	55Si7	-
50Cr4	50Cr4	-
50Cr4V2	50Cr4V2	-