JIS

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS G 3141 : 2005

(JISF)

Cold-reduced carbon steel sheets and strips

ICS 77.140.50
Reference number : JIS G 3141 : 2005 (E)

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by the Japan Iron and Steel Federation (JISF) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14..

Consequently **JIS G 3141** : 1996 is replaced with this Standard.

This revision has been made based on **ISO 3574** : 1999 *Cold-reduced carbon steel sheet of commercial and drawing qualities* for the purpose of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Editor's notice: New **JIS** Mark Scheme went into effect on October 1st, 2005 according to the revision of the Industrial Standardization Law, so old **JIS** mark indication is omitted from this English version. Up-to-date information including list of **JIS** subject to New **JIS** Marking System is issued on the website of JISC (http://www.jisc.go.jp).

Date of Establishment: 1969-02-01
Date of Revision: 2005-02-20
Date of Public Notice in Official Gazette: 2005-02-21
Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Iron and Steel

JIS G 3141 : 2005, First English edition published in 2006-03

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

Contents

Page

Cold-reduced carbon steel sheets and strips

Introduction This Japanese Industrial Standard has been prepared based on the third edition of **ISO 3574** *Cold-reduced carbon steel sheet of commercial and drawing qualities* published in 1999 with some modifications of the technical contents.

The portions given sidelines or dotted underlines are the matters modified from the original International Standard. A list of modifications with the explanations is given in Annex 2 (informative).

1 Scope This Standard specifies the cold-reduced carbon steel sheets, coils and strips (hereafter referred to as "steel sheet and coil"), including the cold rolled strip steel (steel coils less than 500 mm in width during cold rolling) and also the cut lengths therefrom.

Remarks : The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 3574 : 1999 *Cold-reduced carbon steel sheet of commercial and drawing qualities* (MOD)

2 Normative references The standards listed in attached table 1 contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) given in the table shall be applied.

3 Grade and symbols The steel sheet and coil shall be classified into five categories and their symbols shall be as given in table 1. They shall be subclassified according to the temper grade and surface finish as given in tables 2 and 3, respectively.

Table 1 Symbol of grade

Symbol of grade	Remarks
SPCC	Commercial quality
SPCD	Drawing quality
SPCE	Deep drawing quality
SPCF	Deep drawing quality, non-ageing
SPCG	Extra deep drawing quality, non-ageing

Remarks 1 When the SPCC steel sheet and coil of standard temper grade and these as-annealed are guaranteed for their tensile strength and elongation upon request by the purchaser, T shall be suffixed to the symbol so that it reads SPCCT.

2 Usually SPCG is manufactured by IF steel. IF steel is a kind of steel manufactured by a process of lessening carbon and nitrogen is solid solution as few as possible.

Table 2 Temper grade

Temper grade	Symbol of temper grade
As-annealed	A
Standard temper grade	S
1/8 hard	8
1/4 hard	4
1/2 hard	2
Full hard	1

Table 3 Surface finish

Surface finish	Symbol of surface finish	Remarks
Dull finish	D	A matt finish produced with a roll roughened its surface mechanically or chemically
Bright finish	B	A smooth finish produced with a roll finished its surface smoothly

Remarks : This table is not applicable to the steel sheet and coil that are as-annealed.

4 Chemical composition The steel sheet and coil shall be tested in accordance with **13.1**, and their cast analysis value shall be as given in table 4. The specification in table 4 shall be applied to steel sheet and coil of as-anneal or standard temper only.

Table 4 Chemical composition

Unit : %

Symbol of grade	C	Mn	P	S
SPCC	0.15 max.	0.60 max.	0.100 max.	0.050 max.
SPCD	0.12 max.	0.50 max.	0.040 max.	0.040 max.
SPCE	0.10 max.	0.45 max.	0.030 max.	0.030 max.
SPCF	0.08 max.	0.45 max.	0.030 max.	0.030 max.
SPCG (1)	0.02 max.	0.25 max.	0.020 max.	0.020 max.

Note (1) The upper limit value may be differ upon agreement between the purchaser and the supplier.

Remarks : Alloying elements other than those in table 4 can be added as necessary.

5 Mechanical properties

5.1 Yield point or proof stress, tensile strength and elongation The steel sheet and coil of standard temper grade and those as-annealed shall be tested in accordance with **13.2**, and their yield point or proof stress, tensile strength and elongation shall be as given in table 5.

Table 5 Yield point or proof stress, tensile strength and elongation

Symbol of grade	Yield point or proof stress N/mm²	Tensile strength N/mm²	Elongation %							Tensile test piece
	Division according to nominal thickness mm		Division according to nominal thickness mm							
	0.25 or over	0.25 or over	0.25 or over to and excl. 0.30	0.30 or over to and excl. 0.40	0.40 or over to and excl. 0.60	0.60 or over to and excl. 1.0	1.0 or over to and excl. 1.6	1.6 or over to and excl. 2.5	2.5 or over	
SPCC	—	—	—	—	—	—	—	—	—	No. 5 test piece, rolling direction (3)
SPCCT (2)	—	270 min.	28 min.	31 min.	34 min.	36 min.	37 min.	38 min.	39 min.	
SPCD	(240 max.)	270 min.	30 min.	33 min.	36 min.	38 min.	39 min.	40 min.	41 min.	
SPCE	(220 max.)	270 min.	32 min.	35 min.	38 min.	40 min.	41 min.	42 min.	43 min.	
SPCF	(210 max.)	270 min.	—	—	40 min.	42 min.	43 min.	44 min.	45 min.	
SPCG	(190 max.)	270 min.	—	—	42 min.	44 min.	45 min.	46 min.	—	

Notes (2) For SPCC that guarantees tensile strength and elongation.

(3) In the case that No. 5 test piece can not be cut out, tensile strength and elongation shall be agreed upon between the purchaser and the supplier.

Remarks 1 For those less than 0.60 mm in thickness, as a rule, the tensile test shall be omitted.

2 The elongation specification in table 5 is not applied to steel sheet and coil of standard temper grade that have been bright finished.

3 SPCF and SPCG shall be guaranteed for non-ageing property for six months after shipment from the manufacturer's factory.

4 The upper limit of yield point or proof stress in parenthesis is informative and can be applied when agreed upon between the purchaser and the supplier.

5 1 N/mm^2 = 1 MPa

5.2 Average ratio of plastic strain The steel sheet and coil of SPCG shall be tested in accordance with **13.2**. The average ratio of plastic strain $\bar{r}$ shall be as given in table 6.

Table 6 The average ratio of plastic strain $\bar{r}$

Symbol of grade	Division according to nominal thickness mm			
	Under 0.50	0.50 or over up to and incl. 1.0	Over 1.0 up to and incl. 1.6	Over 1.6
SPCG	—	1.4 min.	1.3 min.	—

5.3 Hardness The steel sheet and coil of grades 1/8 hard, 1/4 hard, 1/2 hard and full hard (hereafter referred to as "hard material") shall be tested in accordance with **13.2** and their hardness shall be as given in table 7 or table 8. For those material so thin in thickness that HRB hardness can not be measured, hardness may be measured by HR30T, HR15T or HV, and may be converted to HRB by conversion table as given in tables 9 to 11. Examples of HRB and minimum applied thickness are given in reference table 2.

Hardness value which is not in the hardness conversion table shall be calculated by interpolation.

Remarks : **JIS Z 2245** specifies that "The thickness of the specimen shall be such that the deformation of the test is not observed on the opposite side of the specimen." and reference table 1 shows the equation to calculate the minimum thickness of the specimen where spherical indenters are to be used.

Reference table 1 Equation to calculate the minimum thickness of the specimen

Indenter	Rockwell hardness	Rockwell superficial hardness
Spherical indenter	15 h or 0.03 (130 − H)	15 h or 0.015 (100 − H)

Where, h : Indentation's permanent deformation (mm)

H : Hardness value

Table 7 Rockwell hardness of hard material (HRB)

Temper grade	Temper symbol	HRB
1/8 hard	8	50 to 71
1/4 hard	4	65 to 80
1/2 hard	2	74 to 89
Full hard	1	85 or over

Table 8 Vickers hardness of hard material

Temper grade	Temper symbol	HV
1/8 hard	8	95 to 130
1/4 hard	4	115 to 150
1/2 hard	2	135 to 185
Full hard	1	170 or over

Reference table 2 HRB and minimum applied thickness

HRB hardness	50	65	74	85
Minimum applied thickness	2.40	1.95	1.68	1.35

Table 9 Conversion table from HR30T to HRB

HR30T	Converted HRB	HR30T	Converted HRB	HR30T	Converted HRB	HR30T	Converted HRB
35.0	28.1	47.0	46.0	59.0	63.9	71.0	81.9
36.0	29.6	48.0	47.5	60.0	65.4	72.0	83.4
37.0	31.1	49.0	49.0	61.0	66.9	73.0	84.9
38.0	32.5	50.0	50.5	62.0	68.4	74.0	86.4
39.0	34.0	51.0	52.0	63.0	69.9	75.0	87.9
40.0	35.5	52.0	53.5	64.0	71.4	76.0	89.4
41.0	37.0	53.0	55.0	65.0	72.9	77.0	90.8
42.0	38.5	54.0	56.5	66.0	74.4	78.0	92.3
43.0	40.0	55.0	58.0	67.0	75.9	79.0	93.8
44.0	41.5	56.0	59.5	68.0	77.4	80.0	95.3
45.0	43.0	57.0	60.9	69.0	78.9	81.0	96.8
46.0	44.5	58.0	62.4	70.0	80.4	82.0	98.3

Remarks : Conversion table shown as table 9 is in accordance with table 2 of **ASTM E140**. Hardness not in table of **ASTM**, is calculated by interpolation.

Table 10 Conversion table from HR15T to HRB

HR15T	Converted HRB	HR15T	Converted HRB	HR15T	Converted HRB	HR15T	Converted HRB
70.0	28.8	76.0	47.3	82.0	65.8	88.0	84.3
70.5	30.3	76.5	48.8	82.5	67.3	88.5	85.8
71.0	31.9	77.0	50.4	83.0	68.8	89.0	87.3
71.5	33.4	77.5	51.9	83.5	70.4	89.5	88.9
72.0	35.0	78.0	53.4	84.0	71.9	90.0	90.4
72.5	36.5	78.5	55.0	84.5	73.5	90.5	92.0
73.0	38.0	79.0	56.5	85.0	75.0	91.0	93.5
73.5	39.6	79.5	58.1	85.5	76.6	91.5	95.0
74.0	41.1	80.0	59.6	86.0	78.1	92.0	96.6
74.5	42.7	80.5	61.1	86.5	79.6	92.5	98.1
75.0	44.2	81.0	62.7	87.0	81.2	93.0	99.7
75.5	45.7	81.5	64.2	87.5	82.7		

Remarks : Conversion table shown as table 10 is in accordance with table 2 of **ASTM E140**. Hardness not in table of **ASTM**, is calculated by interpolation.

Table 11 Conversion table from HV to HRB

HV	Converted HRB	HV	Converted HRB	HV	Converted HRB	HV	Converted HRB
85	41.0	115	65.0	145	76.6	175	86.1
90	48.0	120	66.7	150	78.7	180	87.1
95	52.0	125	69.5	155	79.9	185	88.8
100	56.2	130	71.2	160	81.7	190	89.5
105	59.4	135	73.2	165	83.1	195	90.7
110	62.3	140	75.0	170	85.0	200	91.5

Remarks : Conversion table shown as table 11 is in accordance with table 1 of **SAE J417**. Hardness not in table of **SAE**, is calculated by interpolation.

5.4 Bendability The steel sheet and coil of hard materials and those of SPCC shall be tested in accordance with **13.2** and the bendability shall be as given in table 12. In this case, the test piece shall withstand being bent without cracking on the outside surface of the bent portion. However, the bend test may be omitted unless requested by the purchaser.

Table 12 Bendability

Temper grade	Symbol of temper grade	Bend test		
		Bend angle	Inside radius	Bend test piece
As-annealed	A	180°	Flat on itself	No. 3 test piece, in the rolling direction
Standard temper grade	S	180°	Flat on itself	
1/8 hard	8	180°	Flat on itself	
1/4 hard	4	180°	Thickness × 0.5	
1/2 hard	2	180°	Thickness × 1.0	
Full hard	1	—	—	

6 Expression of size The size of the steel sheet and coil shall be expressed as follows :

a) The size of the steel sheet shall be expressed by thickness, width and length in millimetre.

b) The size of the steel coil shall be expressed by thickness and width in millimetre.

7 Standard dimensions The standard thickness of the steel sheet and coil 500 mm or over in width during cold rolling shall be as given in table 13.

Table 13 Standard dimensions

Unit : mm

Standard thickness	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4
	1.6	1.8	2.0	2.3	2.5	(2.6)	2.8	(2.9)	3.2

Remarks : The standard thickness not in parentheses should preferably be used.

8 Dimensional tolerances

8.1 Position of measurement on dimensions The position of measurement on dimensions shall be as follows :

a) For the steel sheet and regular portion of the steel coil, measurement on thickness shall be made at any point not less than 15 mm apart from both side edges. In the case where the width is less than 30 mm, however, the measurement shall be made at a mid-width position.

b) Measurement on width shall be made at regular portion for the steel coil and at any place for the steel sheet.

c) Measurement on length shall be made at any place for the steel sheet.

8.2 Thickness tolerances The thickness tolerances shall be as follows :

a) The thickness tolerances shall be applied to the nominal thickness.

b) The thickness tolerances shall be classified into Classes A and B as given in table 14 and table 15, respectively. The thickness tolerances of Class A shall generally be applied. However, tolerances of Class B may be applied as agreed between the purchaser and the supplier.

Table 14 Thickness tolerances, Class A

Unit : mm

Division according to nominal thickness	Division according to nominal width				
	Under 630	630 or over to and excl. 1 000	1 000 or over to and excl. 1 250	1 250 or over to and excl. 1 600	1 600 or over
Under 0.25	± 0.03	± 0.03	± 0.03	—	—
0.25 or over to and excl. 0.40	± 0.04	± 0.04	± 0.04	—	—
0.40 or over to and excl. 0.60	± 0.05	± 0.05	± 0.05	± 0.06	—
0.60 or over to and excl. 0.80	± 0.06	± 0.06	± 0.06	± 0.06	± 0.07
0.80 or over to and excl. 1.00	± 0.06	± 0.06	± 0.07	± 0.08	± 0.09
1.00 or over to and excl. 1.25	± 0.07	± 0.07	± 0.08	± 0.09	± 0.11
1.25 or over to and excl. 1.60	± 0.08	± 0.09	± 0.10	± 0.11	± 0.13
1.60 or over to and excl. 2.00	± 0.10	± 0.11	± 0.12	± 0.13	± 0.15
2.00 or over to and excl. 2.50	± 0.12	± 0.13	± 0.14	± 0.15	± 0.17
2.50 or over to and excl. 3.15	± 0.14	± 0.15	± 0.16	± 0.17	± 0.20
3.15 or over	± 0.16	± 0.17	± 0.19	± 0.20	—

Table 15 Thickness tolerances, Class B

Unit : mm

Division according to nominal thickness	Division according to nominal width			
	Under 160	160 or over to and excl. 250	250 or over to and excl. 400	400 or over to and excl. 630
Under 0.10	± 0.010	± 0.020	—	—
0.10 or over to and excl. 0.16	± 0.015	± 0.020	—	—
0.16 or over to and excl. 0.25	± 0.020	± 0.025	± 0.030	± 0.030
0.25 or over to and excl. 0.40	± 0.025	± 0.030	± 0.035	± 0.035
0.40 or over to and excl. 0.60	± 0.035	± 0.040	± 0.040	± 0.040
0.60 or over to and excl. 0.80	± 0.040	± 0.045	± 0.045	± 0.045
0.80 or over to and excl. 1.00	± 0.04	± 0.05	± 0.05	± 0.05
1.00 or over to and excl. 1.25	± 0.05	± 0.05	± 0.05	± 0.06
1.25 or over to and excl. 1.60	± 0.05	± 0.06	± 0.06	± 0.06
1.60 or over to and excl. 2.00	± 0.06	± 0.07	± 0.08	± 0.08
2.00 or over to and excl. 2.50	± 0.07	± 0.08	± 0.08	± 0.09
2.50 or over to and excl. 3.15	± 0.08	± 0.09	± 0.09	± 0.10
3.15 or over	± 0.09	± 0.10	± 0.10	± 0.11

8.3 Width tolerances The width tolerances shall be as follows :

a) The width tolerances shall be applied to the nominal width.

b) The width tolerances shall be classified into Classes A, B and C as given in table 16, table 17 and table 18, respectively. Table 16 is applied to those by ordinary cutting method, table 17 is applied to those re-cut or precision cut and table 18 is applied to those slit.

Table 16 Width tolerances, Class A

Unit : mm

Division according to nominal width	
Under 1 250	1 250 or over
+ 7 0	+ 10 0

Remarks : The plus side tolerances shall not be applied to the stretcher-levelled steel sheet.

Table 17 Width tolerances, Class B

Unit : mm

Division according to nominal width	
Under 1 250	1 250 or over
+ 3 0	+ 4 0

Table 18 Width tolerances, Class C

Unit : mm

Division according to nominal thickness	Division according to nominal width			
	Under 160	160 or over to and excl. 250	250 or over to and excl. 400	400 or over to and excl. 630
Under 0.60	± 0.15	± 0.20	± 0.25	± 0.30
0.60 or over to and excl. 1.00	± 0.20	± 0.25	± 0.25	± 0.30
1.00 or over to and excl. 1.60	± 0.20	± 0.30	± 0.30	± 0.40
1.60 or over to and excl. 2.50	± 0.25	± 0.35	± 0.40	± 0.50
2.50 or over to and excl. 4.00	± 0.30	± 0.40	± 0.45	± 0.50
4.00 or over to and excl. 5.00	± 0.40	± 0.50	± 0.55	± 0.65

8.4 Length tolerances The length tolerances shall be as follows :

a) The length tolerances shall be applied to the nominal length of the steel sheet.

b) The tolerances on length shall be classified into Classes A and B as given in table 19 and table 20, respectively. Table 19 is applied to those by ordinary cutting method and table 20 is applied to those re-cut or precision cut.

Table 19 Length tolerances, Class A

Unit : mm

Division according to nominal length	Tolerances
Under 2 000	+ 10 0
2 000 or over to and excl. 4 000	+ 15 0
4 000 or over to and excl. 6 000	+ 20 0

Remarks : The plus side tolerances shall not be applied to the stretcher-levelled steel sheet.

Table 20 Length tolerances, Class B

Unit : mm

Division according to nominal length	Tolerances
Under 1 000	+ 3 0
1 000 or over to and excl. 2 000	+ 4 0
2 000 or over to and excl. 3 000	+ 6 0
3 000 or over to and excl. 4 000	+ 8 0

9 Shape

9.1 Flatness The flatness tolerances shall be classified into Class A and Class B as given in table 21 and table 22, respectively. Table 22 generally applies to stretcher-levelled steel sheets. The flatness specified shall apply only to the steel sheet of standard temper grade which is 500 mm or over in width during cold rolling.

Remarks 1 Flatness shall be measured by laying a steel sheet under its own mass on a flat surface plate, and the value of flatness shall be determined as the difference between the maximum deviation of convex from the flat surface and the nominal thickness of the steel sheet when its convex side is upper-most. The flat surface plate shall be of a sufficient length to measure the flatness of steel sheets.

2 According to its shape and initiation zone, strain is categorized as follows.

Bow : A sheet in which condition with curvature. There are curvature in rolling direction and curvature in at a right angle to rolling direction.

Wave : A sheet in which condition with rippling in rolling direction.

Edge wave : A sheet in which condition with wavy on the edge (edge of the width direction) and flat in the middle.

Centre buckle : A sheet in which condition with wavy in the middle and flat on the edge.

Table 21 Maximum deviation from flatness, Class A

Unit : mm

Division according to nominal width	Classification of shape-irregularity		
	Bow, wave	Edge wave	Centre buckle
Under 1 000	12	8	6
1 000 or over to and excl. 1 250	15	9	8
1 250 or over to and excl. 1 600	15	11	8
1 600 or over	20	13	9

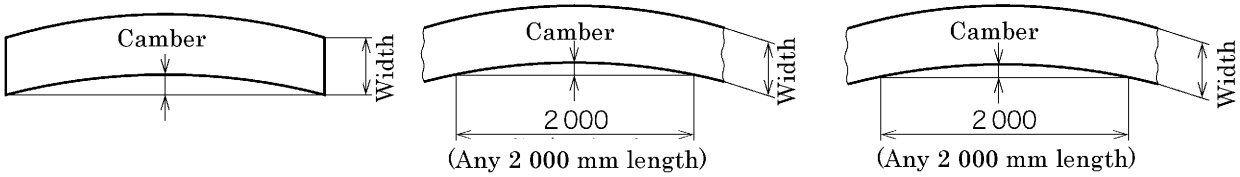
Table 22 Maximum deviation from flatness, Class B

Unit : mm

Division according to nominal width	Classification of shape-irregularity		
	Bow, wave	Edge wave	Centre buckle
Under 1 000	2	2	2
1 000 or over to and excl. 1 250	3	2	2
1 250 or over to and excl. 1 600	4	3	2
1 600 or over	5	4	2

9.2 Camber The camber for the steel sheet and coil shall be as given in figure 1. The maximum values of camber, classified into A and B, shall be as shown in table 23 and table 24, respectively. Table 24 shall be applied as agreed between the purchaser and the supplier.

The camber values specified shall not apply to the irregular parts of steel coils. The measurement of the camber shall be conducted only when requested by the purchaser.



Steel sheets less than 2 000 mm in length

Steel sheets 2 000 mm or greater in length

Steel coils

Figure 1 Application of camber for steel sheets and coils

Table 23 Maximum value of camber, A

Unit : mm

Division according to nominal width	Product form		
	Steel sheets		Steel coils
	Under 2 000 in length	2 000 or over in length	
30 or over up to and excl. 40	8	8 in any 2 000 length	
40 or over up to and excl. 630	4	4 in any 2 000 length	
630 or over	2	2 in any 2 000 length	

Table 24 Maximum value of camber, B

Unit : mm

Division according to nominal width	Product form		
	Steel sheets		Steel coils
	Under 2 000 in length	2 000 or over in length	
30 or over up to and excl. 40	25	25 in any 2 000 length	
40 or over up to and excl. 630	10	10 in any 2 000 length	
630 or over	2	2 in any 2 000 length	

9.3 Squareness Drop a perpendicular line from a corner and find a deviation (A) from the opposite corner and the line as shown in figure 2, which ratio (A/B) with width (B) is specified as out of square, that shall not be more than 1.0 %.

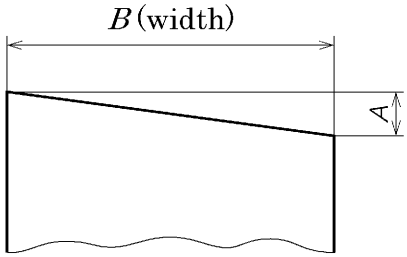


Figure 2 Squareness of steel sheet

10 Mass

10.1 Mass of steel sheet The mass of the steel sheet shall be as follows :

a) The mass of the steel sheet shall be expressed in kilogrammes. The theoretical mass shall generally be applied for the steel sheet 500 mm or more in width during cold rolling, and the actual mass shall be applied for the steel sheet under 500 mm in width during cold rolling.

b) The method for calculation of mass of the steel sheet shall be in accordance with table 25 using the nominal dimensions.

c) The standard mass of a single bundle of the steel sheets 500 mm or more in width shall be 2 000 kg, 3 000 kg and 4 000 kg.

Table 25 Calculation procedure of theoretical mass

Sequence of calculation	Calculation method	Rounding off rule of calculated result
Basic mass kg/mm·m²	7.85 (mass per millimetre thickness per square metre area)	—
Unit mass kg/m²	Basic mass (kg/mm·m²) × thickness (mm)	Rounded off to 4 significant figures.
Area of steel sheet m²	Width (m) × length (m)	Rounded off to 4 significant figures.
Mass of single sheet kg	Unit mass (kg/m²) × area (m²)	Rounded off to 3 significant figures.
Mass of single bundle kg	Mass of single sheet (kg) × number of sheets per bundle of same size	Rounded off to integer in kg.
Total mass kg	Sum of mass of each bundle	Integer in kg

Remarks 1 The total mass may be calculated by multiplying the mass of a single sheet (kg) by the total number of sheets.

2 Rounding off of the numerical values shall be in accordance with rule A of **JIS Z 8401**.

10.2 Mass of steel coil The mass of the steel coil shall be as follows :

a) The mass of the steel coil shall be the actual one expressed in kilogrammes.

b) For the mass of the steel coil, the maximum mass of each coil shall generally be designated, and the specified maximum mass shall usually be not less than the following values.

1) For the steel coils of 500 mm or more in width : 3 kg/mm of width

2) For the steel coils less than 500 mm in width : 1 kg/mm of width

11 Oiling The steel sheet and coil shall be oiled, unless otherwise specified.

12 Appearance The appearance shall be as follows :

a) The steel sheet and coil shall be free from such defects as holes, lamination and other imperfections that are detrimental to practical use. Provisions on defects other than holes and lamination, however, shall generally be applied to one side of the surface (4) of the steel sheet and coil.

For the steel coil, however, some irregular portions and welds may be included therein, since generally the steel coil is afforded no opportunity to inspect and to remove such defective parts.

Note (4) The term "one side of the surface" means, as a rule, the top of each package for the steel sheet and the outside surface for the steel coil.

b) For the steel sheet and coil of as-annealed grade, the coil break, edge wave, etc.

caused by omission of skin pass shall not be regarded as detrimental defects.

c) For the unoiled steel sheet and coil, the rust, scratch, etc. caused by omission of oiling shall not be regarded as detrimental defects.

13 Test

13.1 Chemical analysis

13.1.1 General requirements and sampling method for chemical analysis The chemical composition of the steel sheet and coil shall be determined by cast analysis, and the general requirements for chemical analysis and the sampling method of specimen for analysis shall be as specified in clause 8 of JIS G 0404.

13.1.2 Test method The method for chemical analysis shall be in accordance with JIS G 0320.

13.2 Mechanical test

13.2.1 General requirements for mechanical test The general requirements for mechanical testing shall be in accordance with the specifications in clause 9 of JIS G 0404. With this respect, the sampling method of specimen shall conform to Class A of 7.6 in JIS G 0404, and the number of test pieces and the sampling position shall be as follows :

a) **Number of test pieces** One test piece shall be taken from each steel coil defined in cold rolling process (hereafter referred to as "coil").

In the case where the mass of the single coil is less than 3 t, one test piece shall be taken from each lot of the same heat, rolled to the same thickness under the same rolling conditions and the same heat treatment conditions.

b) **Sampling position of test piece** The centre of each test piece shall be at a quarter-width. When it is infeasible, however, the sampling should be made as close to the aforementioned position as possible. The tensile and bend test pieces shall be taken parallel to the rolling direction.

13.2.2 Test piece and test method

a) **Tensile test** The tensile test shall be carried out as follows :

1) As to a test piece, No. 5 test piece specified in JIS Z 2201 shall be used. When this is infeasible, the test piece shall be as agreed between the purchaser and the supplier.

2) The test method shall be as specified in JIS Z 2241.

b) **Plastic strain ratio determination** The method of sampling and determination shall be as specified in JIS Z 2254.

c) **Hardness test** The test shall be as specified in JIS Z 2244 or JIS Z 2245.

d) **Bend test** The bend test shall be carried out as follows :

1) As to a test piece, No. 3 test piece specified in **JIS Z 2204** shall be used.

2) The test method shall be as specified in **JIS Z 2248**.

14 Inspection

14.1 Inspection The inspection shall be carried out as follows :

a) General requirements for inspection shall be as specified in **JIS G 0404**.

b) The chemical composition shall conform to the requirements specified in clause 4.

c) The mechanical properties shall conform to the requirements specified in clause 5.

d) The dimensional tolerances shall conform to the requirements specified in clause 8.

e) The shape shall conform to the requirements specified in clause 9.

f) The mass shall conform to the requirements specified in clause 10.

g) The appearance shall conform to the requirements specified in clause 12.

14.2 Retests The steel sheets and coils which have failed in the mechanical test may be subjected to a retest as specified in 9.8 of **JIS G 0404** for final acceptance.

15 Packaging and marking The steel sheet and coil which have passed the inspection shall, as a rule, be packed and clearly marked with the following details by suitable means specified in clause 14 of **JIS G 0404**. According to the agreement between the purchaser and the supplier, however, a part of the details given below may be omitted.

a) Classification symbol

b) Symbol of temper grade

c) Symbol of surface finish

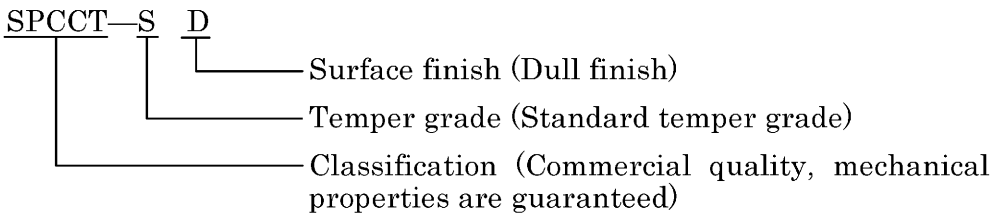
d) Manufacture number or inspection number

e) Dimensions

f) Number of sheets or mass (this may be omitted for the strip steel and cut lengths therefrom which are cold-rolled under 500 mm in width)

g) Manufacturer's name or its identifying brand

Remarks : An example of marking on symbols of quality, temper grade and surface finish



16 Report The report shall be in accordance with clause **13** of **JIS G 0404**. When requested by the purchaser in advance, the manufacturer shall submit an inspection document including the test results, the method of manufacture, ordered size and quantity, and record of manufacture in accordance with **JIS G 0415**. The type of inspection document shall be, unless otherwise specified, 2.3 or 3.1B in table 1 of **JIS G 0415**.

Attached Table 1 Normative references

JIS G 0320 *Standard test methods for heat analysis of steel products*

JIS G 0404 *Steel and steel products—General technical delivery requirements*

JIS G 0415 *Steel and steel products—Inspection documents*

JIS Z 2201 *Test pieces for tensile test for metallic materials*

JIS Z 2204 *Bend test pieces for metallic materials*

JIS Z 2241 *Method of tensile test for metallic materials*

JIS Z 2244 *Vickers hardness test—Test method*

JIS Z 2245 *Rockwell hardness test—Test method*

JIS Z 2248 *Method of bend test for metallic materials*

JIS Z 2254 *Method of determining the plastic strain ratio for metallic sheet and strip*

JIS Z 8401 *Guide to the rounding of numbers*

Annex 1 (informative) Additional information

This Annex describes the reference values for the agreement between the supplier and the purchaser concerning the hardness of the standard temper grade and as-annealed grade, tensile strength and elongation of hard materials, as well as the matters to be attended at the time of contract, and is not to constitute the provisions of this Standard.

1 Hardness of the standard temper grade and as-annealed grade Hardness of the standard temper grade and as-annealed grade shall be in accordance with either Annex 1 table 1 or Annex 1 table 2. However, the hardness values of HR30T , HR15T and HV may be converted to HRB hardness values according to the conversion tables 9 to 11 of the text. Test method shall be in accordance with **13.2** of the text.

Remarks 1 **JIS Z 2245** specifies that "The thickness of the specimen shall be such that the deformation of the test is not observed on the opposite side of the specimen." Since the influence of the test can be detected on the back side of the test piece for the standard temper grade and as-annealed grade easier than for the hard materials, sufficient attention is required in selecting the scales for Rockwell hardness.

2 HRB should not be used because the deformation of the test can easily be observed on the back side of the specimen.

Annex 1 table 1 Rockwell hardness of the standard temper grade and as-annealed grade

Temper grade	Symbol of temper grade	Hardness		
		HRB	HR30T	HR15T
As-annealed	A	57 max.	54 max.	79 max.
Standard temper grade	S	65 max.	60 max.	82 max.

Annex 1 table 2 Vickers hardness of the standard temper grade and as-annealed grade

Temper grade	Symbol of temper grade	HV
As-annealed	A	105 max.
Standard temper grade	S	115 max.

2 Tensile strength and elongation of hard materials Tensile strength and elongation of hard materials shall be in accordance with Annex 1 table 3. Test method shall be in accordance with **13.2** of the text.

Annex 1 table 3 Tensile strength and elongation of hard materials

Temper grade	Symbol of temper grade	Tensile strength	Elongation	Tensile test piece
1/8 hard	8	290 to 410	25 min.	No.5 test piece, rolling direction
1/4 hard	4	370 to 490	10 min.	
1/2 hard	2	440 to 590	—	
Full hard	1	550 min.	—	

Remarks : Annex 1 table 3 applies to steel sheets and strips 0.25 mm or greater in thickness and 30 mm or greater in width.

3 Matters to be attended at the time of contract It is recommended that the purchaser specifies the following items at the times of contract.

a) **General matters to be specified at the time of ordering**

1) Product form : coil or cut lengths (1)
2) Classification symbol
3) Symbol of temper grade
4) Symbol of surface finish
5) Dimensions
6) Quantity
7) Mass of bundled steel sheets (if required)
8) Allowable range on total quantity of shipment in comparison with ordered quantity
9) Date and method of delivery and destination
10) Maximum mass of single coil
11) Inside diameter of coil (if required)
12) Designation of unoiling (if required)
13) Use

Note (1) For the steel in coil form and cut lengths therefrom which have been cold rolled under 500 mm in width, they shall be designated as the "cold rolled strip steel" at the time of ordering.

b) **Temper rolling and surface finish** The steel sheet and coil are supplied in the following conditions, unless otherwise specified.

1) The coil cold rolled 500 mm or more in width and cut lengths :

Standard temper grade and dull finish

2) The strip cold rolled under 500 mm in width and cut lengths :

Standard temper grade and bright finish

c) **Dimensional tolerance and flatness** Unless otherwise specified, the dimensional tolerances and flatness mentioned below are applied. In other cases, specific Class(es) shall be designated.

1) The coil cold rolled 500 mm or more in width and cut lengths :

Thickness tolerance, Class A, width tolerance, Class A, length tolerance, Class A, and flatness, Class A

2) The strip cold rolled under 500 mm in width and cut lengths :

Thickness tolerance, Class B, width tolerance, Class B, and length tolerance, Class B

d) **Others** Where denotation of the date of skin pass for the standard temper grade is necessary, this matter shall be specifically designated.

Annex 2 (informative)

Comparison table between JIS and corresponding International Standard

JIS G 3141 : 2005 *Cold-reduced carbon steel sheets and strips*					ISO 3574 : 1999 *Cold-reduced carbon steel sheet of commercial and drawing qualities*		
(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
1 Scope	Cold-reduced carbon steel sheets and strips for commercial and drawing use		1	Cold-reduced carbon steel sheets and strips for commercial and drawing use	IDT		
2 Normative references	**JIS Z 2241** **JIS** shown in attached table (excluding **JIS Z 2241**)		2	**ISO 6892** —	IDT MOD/addition	In **JIS**, **JIS** necessary for analytical tests and **JIS** for hardness tests and for bend tests are added.	In **JIS**, **JIS** for analytical tests is necessary and since hardness tests and bend tests are specified, **JIS** concerning them are required as the normative references.
3 Grade and symbols	Five types of classifications, temper grades and surface finishes are specified.		1	Five types of qualities are specified.	MOD/addition	In **JIS**, temper grade and surface finish are added.	In **JIS**, temper grade and surface finish are added because wider range of cold-reduced carbon steel sheets are specified in **JIS** than in **ISO**.
4 Chemical composition	Chemical compositions of four elements C, Mn, P, S are specified for each five classifications.		5.2	Chemical compositions of five elements C, Mn, P, S, Ti are specified for each five classifications.	MOD/alteration	Composition of P in SPCC is higher than in **ISO**. Ti is not specified for SPCG, while specified in **ISO**.	SPCC requires higher composition of P than in **ISO** because it is often applied to hard materials not specified in **ISO**. It is specified in **JIS** that alloying elements such as Ti or other elements can be added as necessary for SPCG.

(Ⅰ) Requirements in **JIS**		(Ⅱ) International Standard number	(Ⅲ) Requirements in International Standard		(Ⅳ) Classification and details of technical deviation between **JIS** and the International Standard by clause		(Ⅴ) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
5 Mechanical properties	Yield point or proof stress, tensile strength, elongation, average ratio of plastic strain, hardness and bendability are specified.		5.6	Yield point or proof stress, tensile strength, elongation, average ratio of plastic strain, and tensile strain hardening exponent are specified.	MOD/addition	In **ISO**, hardness and bendability were deleted at the revision.	Although bendability was deleted in **ISO**, **JIS** specified that it shall be applied when requested. Provisions of hardness is necessary for hard materials of **JIS**.
					MOD/alteration	**JIS** and **ISO** differ in tensile strength and elongation. **ISO** specifies tensile strength by the upper limit, contrary to the lower limit in **JIS**.	**JIS** and **ISO** differ in the shape of the test piece and the tensile direction. Further, the lower limit of the tensile strength in JIS is the same as the reference value in **ISO**.
					MOD/deletion	In **JIS**, tensile strain hardening exponent was deleted.	Tensile strain hardening exponent is used rarely for cold-reduced carbon steel sheet.
6 Expression of size	Expression of size is specified.		15	Dimensions to be supplied by the purchaser are specified.	IDT		
7 Standard dimensions	Standard thickness is specified.		—		MOD/addition	In **JIS**, the thickness used normally is specified as the standard thickness.	**JIS** products are for general use and the standard thickness is necessary.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
8 Dimensional tolerances	Tolerances for thickness, width and length are specified.		6	Tolerances for thickness, width, length, flatness, squareness and camber are specified.	MOD/alteration	Tolerances in **JIS** are stricter than in **ISO**.	Proposal of tolerances of **JIS** will be submitted to **ISO**.
9 Shape	Flatness and camber are specified.		6	Tolerances for thickness, width, length, flatness, squareness and camber are specified.	MOD/alteration	Tolerances in **JIS** are stricter than in **ISO**.	Proposal of tolerances of **JIS** will be submitted to **ISO**.
10 Mass	Mass is specified.		—		MOD/addition	In **JIS**, theoretical mass and actual mass are specified.	Two types of mass are required by commercial custom and they are specified in **JIS**.
11 Oiling	Oiling is specified.		4.6	Oiling is specified.	IDT		
12 Appearance	Appearance is specified.		4.4 11	Appearance is specified.	IDT		
13 Test	Analytical test, tensile test, hardness test, bend test and plastic strain ratio determination are specified.		5.3 7 8	Analytical test and tensile test are specified.	MOD/addition	In **JIS**, hardness test, bend test and plastic strain ratio determination are added.	In **ISO**, bendability and hardness were deleted at the revision, and there is no provision for plastic strain ratio determination. In **JIS**, provisions for hardness test, bend test and plastic strain ratio determination are added.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
14.1 Inspection	Inspection is specified.		—	No clause in **ISO**.	MOD/addition	**JIS** specifies inspection in one integrated clause, while **ISO** specifies it in each clause.	This is the unique configuration of **JIS** and is kept as it is.
14.2 Retests	Reinspection and the judgment are specified.		9 10	Reinspection is specified. Judgment of the reinspection is specified.	IDT IDT		
15 Packaging and marking	Packaging and seven items to be marked are specified.		14	Seven items to be marked are specified.	MOD/addition	In **JIS**, packaging is added.	Since packaging is required by commercial custom, it is specified in **JIS**.
16 Report	Report is submitted when requested by the purchaser.		15	Report is submitted on the items requested by the purchaser.	IDT		
Annex 1	Hardness of the standard temper grade and as-annealed grade, tensile strength of hard materials, as well as the matters to be attended at the time of contract are described for reference.		13 15	It is required to specify the inside diameter, the maximum outside diameter of the coil and the maximum mass. Matters to be supplied by the purchaser are specified.	MOD/addition	In **JIS**, hardness of the standard temper grade and as-annealed grade and tensile strength of hard materials are added.	Since the hardness of the standard temper grade and as-annealed grade and the tensile strength of hard materials can be used by commercial custom, they are added in **JIS**.

(Ⅰ) Requirements in **JIS**		(Ⅱ) International Standard number	(Ⅲ) Requirements in International Standard		(Ⅳ) Classification and details of technical deviation between **JIS** and the International Standard by clause		(Ⅴ) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
			3	Terms and definitions are specified.	MOD/deletion	In **JIS**, terms and definitions are deleted.	Since terms are defined in **JIS G 0203**, it is kept as it is.
			12	Acceptance inspection prior to shipment is specified.	MOD/deletion	In **JIS**, acceptance inspection is deleted.	Since **JIS** products are for general use and acceptance inspection prior to shipment is not carried out normally, it is deleted.

Designated degree of correspondence between **JIS** and International Standard: MOD

Remarks 1 Symbols in sub-columns of classification by clause in the above table indicate as follows:
- IDT : Identical in technical contents.
- MOD/deletion : Deletes the specification items(s) or content(s) in International Standard.
- MOD/ addition : Adds the specification item(s) or content(s) which are not included in International Standard.
- MOD/ alteration : Alters the specification content(s) which are included in International Standard.

2 Symbol in column of designated degree of correspondence between **JIS** and International Standard in the above table indicates as follows:
- MOD : Modifies International Standard.

Errata for JIS (English edition) are printed in *Standardization Journal*, published monthly by the Japanese Standards Association, and also provided to subscribers of JIS (English edition) in *Monthly Information*.

Errata will be provided upon request, please contact:

Standardization Promotion Department, Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN
TEL. 03-3583-8002 FAX. 03-3583-0462