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**Cold-reduced carbon steel sheet and  
strip**

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## 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** : 2005 is replaced with this Standard.

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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.

# Cold-reduced carbon steel sheet and strip

## Introduction

This Japanese Industrial Standard has been prepared based on **ISO/DIS 3574** published in 2007 with some modifications of the technical contents.

The portions given sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JB.

## 1 Scope

This Standard specifies the cold-reduced carbon steel sheet and strip (hereafter referred to as "steel sheet and strip"). The cold-rolled steel strip in coil (that of under 600 mm in width) and the steel sheet cut from the cold-rolled steel strip in coil are included in the steel sheet and strip.

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

**ISO/DIS 3574** : 2007 *Cold-reduced carbon steel sheet of commercial and drawing qualities (MOD)*

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**.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

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 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 2254 *Metallic materials — Sheet and strip — Determination of plastic strain ratio*

JIS Z 8401 *Guide to the rounding of numbers*

### 3 Grade and symbol

The steel sheet and strip shall be classified into five grades and symbols thereof as given in table 1. They shall be divided according to the temper grade and the surface finish as given in table 2 and table 3, respectively.

Upon the agreement between the purchaser and the manufacturer, the intermediate temper grade not specified in table 2 or table 3 or the subdivided surface finish may be applicable.

**Table 1 Symbol of grade**

Symbol of grade	Application
SPCC <sup>a)</sup>	Commercial quality
SPCD	Drawing quality
SPCE	Deep drawing quality
SPCF	Non-ageing deep drawing quality
SPCG <sup>b)</sup>	Non-ageing extra deep drawing quality
Notes <sup>a)</sup> When the SPCC steel sheet and strip of the standard temper grade and as-annealed are guaranteed for their tensile strength upon request by the purchaser, T shall be suffixed to the symbol so that it reads SPCC T. <sup>b)</sup> Usually SPCG is manufactured from the IF steel. <u>The IF steel is the steel manufactured by the method in which the solid solution of carbon and nitrogen becomes as small as possible.</u>	

**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
1/8 hard, 1/4 hard, 1/2 hard and full hard are only applicable to SPCC.	

**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
This table is not applicable to the steel sheet and strip as-annealed.		

#### 4 Chemical composition

The steel sheet and strip shall be tested in accordance with **13.1**, and the heat analysis value thereof shall be as given in table 4. The specification in table 4 is not applicable to the steel sheet and strip of 1/8 hard, 1/4 hard, 1/2 hard and full hard.

**Table 4 Chemical composition**

Unit: %

Symbol of grade	C	Mn	P	S
SPCC	0.15 max.	0.60 max.	<u>0.100 max.</u>	0.050 max.
SPCD	<u>0.12 max.</u>	0.50 max.	0.040 max.	<u>0.040 max.</u>
SPCE	<u>0.10 max.</u>	0.45 max.	0.030 max.	0.030 max.
SPCF	<u>0.08 max.</u>	0.45 max.	0.030 max.	0.030 max.
SPCG <sup>a)</sup>	0.02 max.	0.25 max.	0.020 max.	0.020 max.
<u>Alloying elements other than those in this table may be added as necessary.</u>				
Note <sup>a)</sup> The upper limit value of Mn, P or S may alter upon the agreement between the purchaser and the manufacturer.				

#### 5 Mechanical properties

##### 5.1 Yield point or proof stress, tensile strength and elongation

The steel sheet and strip of standard temper grade and 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. The specification in table 5 is applicable only to the steel sheet and strip of 30 mm or over in width.

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

Symbol of grade	Yield point or proof stress <sup>a)</sup> N/mm <sup>2</sup>	Tensile strength N/mm <sup>2</sup>	Elongation %							Tensile test piece
			Thickness mm		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	
SPCC	—	—	—	—	—	—	—	—	—	No. 5 test piece, rolling direction
SPCCT <sup>b)</sup>	—	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 <sup>c)</sup>	(210 max.)	270 min.	—	—	40 min.	42 min.	43 min.	44 min.	45 min.	
SPCG <sup>c)</sup>	(190 max.)	270 min.	—	—	42 min.	44 min.	45 min.	46 min.	—	

For those under 0.60 mm in thickness the tensile test shall generally be omitted. The elongation of the steel sheet and strip of standard temper grade that have been bright finished shall be the value so as that 2 is subtracted from the value of this table.

NOTE : 1 N/mm<sup>2</sup> = 1 MPa

Notes <sup>a)</sup> The upper limit value of yield point or proof stress in parentheses is informative and may be applied upon the agreement between the purchaser and the manufacturer.

<sup>b)</sup> The tensile test value is guaranteed for those among SPCC.

<sup>c)</sup> The non-ageing property of SPCF and SPCG shall be guaranteed for six months after the shipment from the manufacturer's factory. When the shipment is delayed due to the request from the purchaser, the term shall be six months from the original shipment date. The non-ageing property is the characteristic that does not grow the stretcher-strain at the time of working.

## 5.2 Average plastic strain ratio

The steel sheet and strip of SPCG shall be tested in accordance with 13.2, and the average plastic strain ratio shall be as given in table 6.

**Table 6 Average plastic strain ratio  $\bar{r}$** 

Symbol of grade	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	—	1.5 min.	1.4 min.	—

### 5.3 Hardness

The steel sheet and strip of 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. However, the hardness shall be in accordance with table 7 unless otherwise specified. For the material so thin in thickness that Rockwell hardness scale B (hereafter referred to as "HRB") cannot be measured, the hardness may be measured by Rockwell superficial hardness scale 30T (hereafter referred to as "HR30T"), Rockwell superficial hardness scale 15T (hereafter referred to as "HR15T") or Vickers hardness (hereafter referred to as "HV"), and converted to HRB by the conversion table as given in table 9 to table 11. An example of HRB and the minimum applicable thickness is given in table 12.

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

NOTE : **JIS Z 2245** specifies so that "After the test, no deformation shall be visible on the surface of the sample opposite the indentation." and the equation to calculate the minimum thickness of the sample where spherical indenter is used is shown in table 13 for informative.

**Table 7 Rockwell hardness of hard material (HRB)**

Temper grade	Symbol of temper grade	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 (HV)**

Temper grade	Symbol of temper grade	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

**Table 9 Conversion table from HR30T to 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

NOTE: This conversion table shall be in accordance with table 2 [1] of **ASTM E140**. Hardness not in the table of **ASTM** is calculated by interpolation.

**Table 10 Conversion table from HR15T to 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		

NOTE: This conversion table shall be in accordance with table 2 of **ASTM E140**. Hardness not in the table of **ASTM** is calculated by interpolation.

**Table 11 Conversion table from HV to 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

NOTE: This conversion table shall be in accordance with table 1 [2] of **SAE J147**. Hardness not in the table of **SAE** is calculated by interpolation.

**Table 12 HRB and minimum applicable thickness**

HRB hardness value	50	65	74	85
Minimum applicable thickness mm	2.40	1.95	1.68	1.35

**Table 13 Equation to calculate minimum thickness of sample**

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

NOTE:  $h$ : Depth of permanent indentation  $H$ : Hardness value

#### 5.4 Bendability

The steel sheet and strip of hard material, and SPCC shall be tested under the test condition as given in table 14 and tested in accordance with **13.2**, and the outside surface of the test piece shall not show the cracking.

NOTE: For the bend test, see **13.2.5**.

**Table 14 Bendability**

Temper grade	Symbol of temper grade	Bending angle	Inside clearance a)
As-annealed	A	180°	Flat on itself
Standard temper grade	S	180°	Flat on itself
1/8 hard	8	180°	Flat on itself
1/4 hard	4	180°	1
1/2 hard	2	180°	2
Full hard	1	—	—

Note <sup>a)</sup> Maximum number of sheets of nominal thickness.

## 6 Expression of dimensions

The dimensions of the steel sheet and strip shall be expressed as follows.

- a) The dimensions of the steel sheet shall be expressed by thickness, width and length in millimetre.
- b) The dimensions of the steel strip shall be expressed by thickness and width in millimetre.

## 7 Standard thickness

The standard thickness of the cold-reduced carbon steel sheet and strip of 600 mm or over in width shall be as given in table 15.

**Table 15 Standard thickness**

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
The standard thickness not in parentheses should preferably be used.									

## 8 Dimensional tolerances

### 8.1 Measuring position of dimensions

The measuring position of dimensions shall be as follows.

- a) Thickness shall be measured at a normal portion for steel strip and at any point not less than 15 mm inward from each edge (end part in the width direction) for steel sheet. For those whose width is less than 30 mm, the measurement shall be made at a mid-width position.
- b) Width shall be measured at a normal portion for steel strip and at any position for steel sheet.
- c) Length shall be measured at any position for steel sheet.

### 8.2 Tolerances on thickness

The tolerances on thickness shall be as follows.

- a) The tolerances on thickness shall be applied to the nominal thickness.
- b) The tolerances on thickness shall be divided into A and B as given in table 16 and table 17, respectively. The tolerances on thickness A shall generally be applied. However, B may be applied upon the agreement between the purchaser and the manufacturer.

**Table 16 Tolerances on thickness A**

Unit: mm

Thickness	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 17 Tolerances on thickness B**

Unit: mm

Thickness	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 Tolerances on width

The tolerances on width shall be as follows.

- a) The tolerances on width shall be applied to the nominal width.
- b) The tolerances on width shall be divided into A, B and C as given in table 18 table 19 and table 20, respectively. Table 18 is applied to those by ordinary cutting method, table 19 is applied to those by re-cut or precision cut and table 20 is applied to those by slit.

**Table 18 Tolerances on width A**

Unit: mm

Width	
Under 1 250	1 250 or over
+7 0	+10 0
The plus side tolerances shall not be specified to the stretcher-levelled steel sheet.	

**Table 19 Tolerances on width B**

Unit: mm

Width	
Under 1 250	1 250 or over
+3 0	+4 0

**Table 20 Tolerances on width C**

Unit: mm

Thickness	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 Tolerances on length

The tolerances on length shall be as follows.

- a) The tolerances on length shall be applied to the nominal length of the steel sheet.
- b) The tolerances on length shall be divided into A and B as given in table 21 and table 22, respectively. Table 21 is applied to those by ordinary cutting method and table 22 is applied to those by re-cut or precision cut.

**Table 21 Tolerances on length A**

Unit: mm

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
The plus side tolerances shall not be specified to the stretcher-levelled steel sheet.	

**Table 22 Tolerances on length B**

Unit: mm

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 of the steel sheet and strip shall be as follows.

- a) **Flatness of steel sheet** The flatness of steel sheet shall be divided into A and B as given in table 23 and table 24, respectively. Table 24 generally applies to the stretcher-levelled steel sheet. The flatness shall apply only to the steel sheet cut from the cold-reduced carbon steel strip of the standard temper grade of 600 mm or over in width. The flatness shall be measured by laying a steel sheet on a flat surface plate, and the value shall be determined by subtracting the thickness of the steel sheet from the maximum strain<sup>1)</sup> from the upper side of the flat surface of the steel sheet.

Note <sup>1)</sup> According to its shape and location of occurrence, the strain is categorized as follows.

- Bow: curving of the whole steel sheet, either in the rolling direction or in the direction transverse to the rolling direction
- Wave: rippling in rolling direction of the steel sheet
- Edge wave: wave appearing on the edge of steel sheet (end part in the width direction)
- Centre buckle: wave appearing on the centre part of the steel sheet

**Table 23 Maximum value of flatness A**

Unit: mm

Width	Type of strain		
	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 24 Maximum value of flatness B**

Unit: mm

Width	Type of strain		
	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

- b) **Flatness of steel strip** The flatness of steel strip shall be as given in table 23, provided that it is not applicable to the bow. Also, it shall not apply to the irregular parts of the steel strip. The flatness of steel strip shall be inspected on the inspection station installed on the production line. When the measurement value is necessary, the measurement including the measurement method shall be reported upon the agreement between the purchaser and the manufacturer.

The measurement of flatness of steel strip may be omitted <sup>2)</sup>.

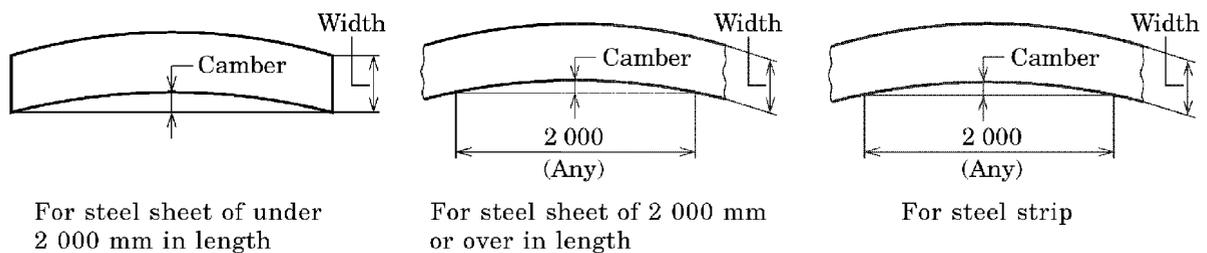
Note <sup>2)</sup> The omission of the measurement of flatness based on the judgment of the manufacturer is permissible on the precondition that the flatness shall satisfy the specified value.

## 9.2 Camber

The application of camber for the steel sheet and strip shall be as given in figure 1. The camber of steel sheet and strip shall be divided into A and B as given in table 25 and table 26, respectively. Table 26 shall be applied upon the agreement between the purchaser and the manufacturer, and when applied, the purport shall be indicated. The camber shall not apply to the irregular parts of steel strip.

The measurement of camber may be omitted <sup>3)</sup>. When specified by the purchaser, the measurement shall be performed.

Note <sup>3)</sup> The omission of the measurement of camber based on the judgment of the manufacturer is permissible on the precondition that the camber shall satisfy the specified value.



**Figure 1 Application of camber of steel sheet and steel strip**

**Table 25 Maximum value of camber A**

Unit: mm

Width	Division of steel sheet and steel strip		
	Steel sheet		Steel strip
	Under 2 000 in length	2 000 or over in length	
30 or over to and excl. 40	8	8 in any 2 000 in length	
40 or over to and excl. 630	4	4 in any 2 000 in length	
630 or over	2	2 in any 2 000 in length	

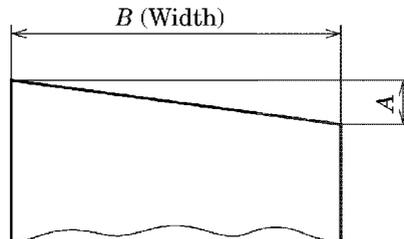
**Table 26 Maximum value of camber B**

Unit: mm

Width	Division of steel sheet and steel strip		
	Steel sheet		Steel strip
	Under 2 000 in length	2 000 or over in length	
30 or over to and excl. 40	25	25 in any 2 000 in length	
40 or over to and excl. 630	10	10 in any 2 000 in length	

### 9.3 Squareness

The squareness for the steel sheet shall be expressed by the ratio (A/B) as shown in figure 2, wherein A is the distance between a perpendicular line from an edge drawn at a corner point and the corner point of the opposite edge and B is the length of the perpendicular. In this case, the ratio shall not exceed 1.0 %.



**Figure 2 Squareness of steel sheet**

## 10 Mass

### 10.1 Mass of steel sheet

The mass of steel sheet shall be as follows.

- The mass of steel sheet shall be given in kilograms. Generally, for the steel sheet cut from the cold-reduced carbon steel strip of 600 mm or over in width, the theoretical mass shall be applied; and for the cold-reduced steel sheet of under 600 mm in width, the actual mass shall be applied.
- The calculating method of mass of steel sheet shall be as given in table 27.
- The standard mass of single bundle of steel sheet of 600 mm or over in width shall be 2 000 kg, 3 000 kg or 4 000 kg.

**Table 27 Calculation method of mass**

Calculation order	Calculation method	Number of digits in resultant <sup>b)</sup>
Basic mass kg/mm·m <sup>2</sup>	7.85 (mass of 1 mm in thickness per 1 m <sup>2</sup> in area)	—
Unit mass kg/m <sup>2</sup>	Basic mass (kg/mm·m <sup>2</sup> ) × thickness (mm)	Rounded off to 4 significant figures
Area of steel sheet m <sup>2</sup>	Width (mm) × length (mm) × 10 <sup>-6</sup>	Rounded off to 4 significant figures
Mass of single sheet kg	Unit mass (kg/m <sup>2</sup> ) × area (m <sup>2</sup> )	Rounded off to 3 significant figures
Mass of single bundle kg	Mass of single sheet (kg) × number of sheets in single bundle of same dimensions	Rounded off to integral number in kg
Total mass <sup>a)</sup> kg	Sum of the mass of each bundle	Integral number in kg
Notes <sup>a)</sup> The total mass may be calculated as mass of a single sheet (kg) × total number of sheets.		
<sup>b)</sup> The rounding off of numerical values shall be in accordance with the rule A of <b>JIS Z 8401</b> .		

## 10.2 Mass of steel strip

The mass of steel strip shall be as follows.

- a) The mass of steel strip shall be given as the actual measured mass in kilograms.
- b) For the mass of steel strip, the maximum mass shall generally be specified upon the agreement between the purchaser and the manufacturer, and the specified maximum mass shall generally be the following value or over.
  - 1) For the steel strip of 600 mm or over in width, 3 kg per 1 mm in width
  - 2) For the steel strip of under 600 mm in width, 1 kg per 1 mm in width

## 11 Oiling

The steel sheet and strip shall be oiled unless otherwise specified.

## 12 Appearance

The appearance shall be as follows.

- a) The steel sheet and strip shall be free from defects to the extent of detrimental to practical use. The defects on the surface shall generally apply to one-side surface <sup>4)</sup> of the steel sheet and strip.

The steel strip may contain some irregular portions and welds, since the inspection thereof generally does not afford the manufacturer the opportunity to remove the defective portions.

NOTE : Defects are such as holes, laminations and surface flaws.

Note <sup>4)</sup> The one-sided surface generally refers to the surface of the upper side in packaging for the steel sheet and an outside surface for the steel strip.

- b) For the steel sheet and strip of as-annealed, the coil break, edge wave, etc. caused by the omission of temper rolling shall not be regarded as detrimental defects.
- c) For the steel sheet and strip for which "unoil" is specified, rust, scratches and other defects likely to occur due to uncoiling shall not be regarded as the detrimental defects.

## 13 Tests

### 13.1 Chemical analysis

#### 13.1.1 General requirements and sampling method for chemical analysis

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

#### 13.1.2 Analytical method

The analytical method shall be as specified in JIS G 0320.

## 13.2 Mechanical test

### 13.2.1 General matters of mechanical test

General matters of the mechanical test shall be as specified in clause 7 and clause 9 of **JIS G 0404**. In this case, the sampling method shall be Class A of 7.6 of **JIS G 0404** and the number and the sampling position of the test pieces shall be as follows.

- a) **Number of test pieces** Take one piece from each coil while in cold rolling (hereafter referred to as "coil").

When the mass of coil is under 3 000 kg, one test piece shall be taken from those of the same heat, same thickness, same rolling condition and same heat treatment, respectively.

- b) **Sampling position of test piece** The centre of a test piece shall be in the position 1/4 inward in the width direction or the position close to it. The tensile and bend test pieces shall be taken parallel to the rolling direction.

### 13.2.2 Tensile test

The tensile test shall be as follows.

- a) The test piece to be used shall be No. 5 test piece specified in JIS Z 2201. When sampling of No. 5 test piece is infeasible, the test piece shall be upon the agreement between the purchaser and the manufacturer.
- b) The test method shall be as specified in JIS Z 2241.

### 13.2.3 Plastic strain ratio test

The test piece and the test method shall be as specified in **JIS Z 2254**.

### 13.2.4 Hardness test

The sample and the test method shall be as specified in **JIS Z 2244** or **JIS Z 2245**.

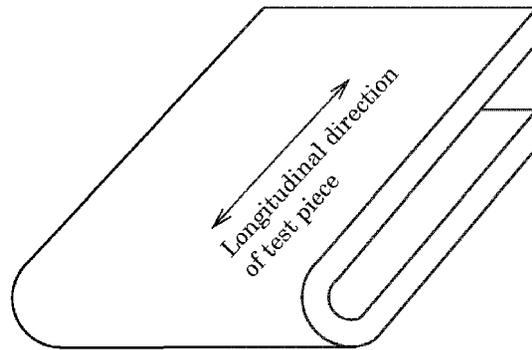
### 13.2.5 Bend test

The bend test shall be as follows.

The test for bendability may be omitted<sup>5)</sup>. However, when particularly specified by the purchaser, the test shall be performed.

Note <sup>5)</sup> The test for bendability may be omitted by the judgment of the manufacturer on the precondition that the bendability shall satisfy the specified value.

- a) **Test piece** The test piece shall have a width of 15 mm to 50 mm and a suitable length of about twice the width. Unless otherwise specified, one test piece shall be taken from the sample parallel to the rolling direction.
- b) **Bending of test piece** The test piece shall be bent manually with a hand vise at 180° in the longitudinal direction of the test piece as shown in figure 3. When a hand vise is not available, other suitable means of testing may be adopted.



**Figure 3** Direction of bend test

## **14 Inspection and re-inspection**

### **14.1 Inspection**

The inspection shall be as follows.

- a) General requirements of inspection shall be as specified in **JIS G 0404**.
- b) The chemical composition shall comply with clause 4.
- c) The mechanical properties shall comply with clause 5.
- d) The dimensional tolerances shall comply with clause 8.
- e) The shape shall comply with clause 9.
- f) The mass shall comply with clause 10.
- g) The appearance shall comply with clause 12.

### **14.2 Re-inspection**

The steel sheet and strip 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.

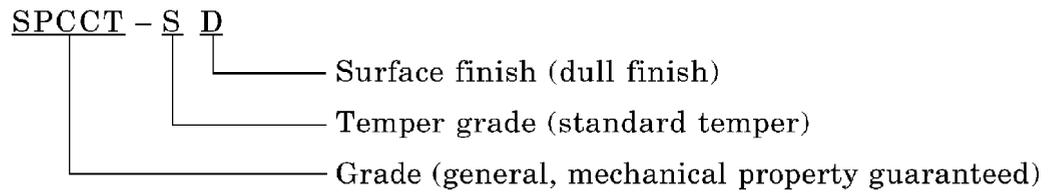
## **15 Packaging and marking**

The steel sheet and strip which have passed the inspection shall generally be packaged and marked with the following items by suitable means. According to the agreement between the purchaser and the manufacturer, however, a part of them except **h**) may be omitted.

- a) Symbol of grade
- b) Symbol of temper grade
- c) Symbol of surface finish
- d) Serial number or inspection number
- e) Dimensions (see clause 6)
- f) Number of sheets or mass (omissible for the cold-reduced carbon steel sheet and strip of under 600 mm in width)
- g) Manufacturer's name or its identifying brand

h) Symbol which denotes camber : B (when applied)

Example: Expression of symbol of grade, symbol of temper grade and symbol of surface finish



## 16 Report

When there is a request from the purchaser beforehand, the manufacturer shall submit the inspection document to the purchaser. In this case, the report shall comply with the requirements in clause 13 of **JIS G 0404**. However, unless otherwise specified, the type of inspection document shall comply with either standard designation 2.3 or 3.1.B in table 1 of **JIS G 0415**.

## Annex JA (informative)

### Additional information

#### Introduction

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

#### JA.1 Hardness of standard temper grade and as-annealed

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

NOTE 1 **JIS Z 2245** specifies so that "After the test, no deformation shall be visible on the surface of the sample opposite the indentation." Since the influence of the test can be detected on the backside of the sample of the standard temper grade and as-annealed easier than of the hard materials, sufficient attention is required in selecting the scales for Rockwell hardness.

NOTE 2 HRB should not be used because the deformation of the test can easily be observed on the backside of the sample.

**Table JA.1 Rockwell hardness of standard temper grade and as-annealed**

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

**Table JA.2 Vickers hardness of standard temper grade and as-annealed**

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

#### JA.2 Tensile strength and elongation of hard materials

The tensile strength and the elongation of hard materials should be as given in table JA.3. The test method should be in accordance with **13.2** of the text.

**Table JA.3 Tensile strength and elongation of hard materials**

Temper grade	Symbol	Tensile strength N/mm <sup>2</sup>	Elongation %	Test piece for tensile test
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.	—	
NOTE : This table applies to the steel sheet and strip of 0.25 mm or over in thickness and 30 mm or over in width.				

**JA.3 Notes on contract**

It is recommended that the purchaser specifies the following items on the contract.

a) **General matters to be specified on ordering**

- 1) Distinction of steel sheet and steel strip <sup>6)</sup>
- 2) Symbol of grade
- 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 of total quantity of shipment to ordered quantity
- 9) Delivery date, delivery method and destination
- 10) Maximum mass for strip
- 11) Inside diameter for strip (if required)
- 12) Designation of uncoiling (if required)
- 13) Use

Note <sup>6)</sup> When ordering the cold-reduced carbon steel sheet and strip of under 600 mm in width, they should be designated as the "cold-rolled strip steel" at the time of ordering.

b) **Temper grade and surface finish** The steel sheet and strip should be shipped with the following conditions, unless otherwise specified.

- 1) The cold-reduced carbon steel sheet and strip of 600 mm or over in width  
Standard temper grade and dull finish
- 2) The cold-reduced carbon steel sheet and strip of under 600 mm in width  
Standard temper grade and bright finish

c) **Dimensional tolerance and flatness** Unless otherwise specified, the following dimensional tolerances and flatness should be applied. In other cases, the purport should be indicated.

- 1) The cold-reduced carbon steel sheet and strip of 600 mm or over in width  
Thickness tolerance A, width tolerance A, length tolerance A and flatness A
  - 2) The cold-reduced carbon steel sheet and strip of under 600 mm in width  
Thickness tolerance B, width tolerance B and length tolerance B
- d) **Others** Where denotation of the date of temper rolling for the standard temper grade is required, the purport should be indicated.

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#### Bibliography

- [1] **ASTM E140** *Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness*
- [2] **SAE J417** *Hardness tests and hardness number conversions*

**Annex JB (informative)**  
**Comparison table between JIS and corresponding International Standard**

<b>JIS G 3141 : 2009</b> <i>Cold-reduced carbon steel sheet and strip</i>		<b>ISO/DIS 3574 : 2007</b> <i>Cold-reduced carbon steel sheet of commercial and drawing qualities</i>					
(I) Requirements in <b>JIS</b>		(II) Inter- national Standard number	(III) Requirements in Interna- tional Standard		(IV) Classification and details of technical deviation between <b>JIS</b> and International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		Clause	Content	Evaluation respect to clauses	Details of technical deviation	
1	Scope		1	The cold-reduced carbon steel sheet and strips for commercial and drawing use are specified.	Identical		
2	Normative references						
3	Grade and symbol		1	Five types of steel grade are specified.	Addition	In <b>JIS</b> , the division of temper grade and surface finish is added.	Wider range of cold-reduced carbon steel sheets are specified in <b>JIS</b> than those in <b>ISO</b> Standard.
4	Chemical composition		5.2	Chemical compositions of five elements C, Mn, P, S and Ti are specified for five types of steel grade.	Alteration	P in SPCC is higher than that in <b>ISO</b> Standard. Ti is not specified for SPCG, while specified in <b>ISO</b> Standard.	SPCC requires higher composition of P than that in <b>ISO</b> Standard because it is often applied to the hard material which is not specified in <b>ISO</b> Standard. It is specified in <b>JIS</b> that other alloying elements may be added as necessary.



(I) Requirements in <b>JIS</b>		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between <b>JIS</b> and International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		Clause	Content	Evaluation respect to clauses	Details of technical deviation	
10 Mass	The mass is specified.		—		Addition	In <b>JIS</b> , the theoretical mass and the actual mass are specified.	Two types of mass are required according to the custom on business and they are specified in <b>JIS</b> .
11 Oiling	The oiling is specified.		4.6	The oiling is specified.	Identical		
12 Appearance	The appearance is specified.		4.4 11	The appearance is specified.	Identical		
13 Tests	Chemical analysis, tensile test, hardness test, bend test and plastic strain ratio test are specified.		5.3 7 8	Chemical analysis and tensile test are specified.	Addition	In <b>JIS</b> , hardness test, bend test and plastic strain ratio test are added.	In <b>JIS</b> , provisions for hardness test, bend test and plastic strain ratio test are added.
14.1 Inspection	The inspection is specified.		—	No clause in <b>ISO</b> Standard.	Addition	<b>JIS</b> specifies inspection in one integrated clause, while <b>ISO</b> Standard specifies it in each clause.	This is the unique configuration of <b>JIS</b> and is kept as it is.
14.2 Re-inspection	The re-inspection and the judgment are specified.		9 10	Reinspection is specified. Judgment of the re-inspection is specified.	Identical		
15 Packaging and marking	Packaging and eight items to be marked are specified.		14	Seven items to be marked are specified.	Addition	In <b>JIS</b> , the packaging is added.	Since packaging is required according to the custom on business, it is specified in <b>JIS</b> .
16 Report	Items to be reported according to the request by the purchaser are specified.		15	Report is submitted on the items requested by the purchaser.	Addition	In <b>JIS</b> , the inspection document is added.	This is the unique configuration of <b>JIS</b> and is kept as it is.

(I) Requirements in <b>JIS</b>		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between <b>JIS</b> and International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		Clause	Content	Evaluation respect to clauses	Details of technical deviation	
Annex JA (informative)	Hardness of the standard temper grade and as-annealed, tensile strength of the hard material as well as the notes on the contract are described for reference.		13	The determination of the inside diameter, outside diameter of the coil and the maximum mass is specified.	Addition	In <b>JIS</b> , the hardness of the standard temper grade and as-annealed and tensile strength of the hard material are added.	Since the hardness of the standard temper grade and as-annealed and the tensile strength of the hard material may be used according to the custom on business, they are added in <b>JIS</b> .
			15	Matters to be supplied by the purchaser are specified.			
			3	Terms and definitions are specified.	Deletion	In <b>JIS</b> , terms and definitions are deleted.	
			12	Acceptance inspection prior to shipment is specified.	Deletion	In <b>JIS</b> , acceptance inspection is deleted.	Since products of <b>JIS</b> are for general use and acceptance inspection prior to shipment is not carried out normally, it is deleted.

Overall degree of correspondence between **JIS** and International Standard (**ISO/DIS 3574 : 2007**) MOD

Laws and regulations | Industrial Standardization Law, Fire Service Law, Electrical Appliance and Material Safety Law

NOTE 1 Symbols in sub-columns of classification by clause in the above table indicate as follows :

- Identical : Identical in technical contents.
- Deletion : Deletes the specification item(s) or content(s) of International Standard.
- Addition : Adds the specification item(s) or content(s) which are not included in International Standard.
- Alteration : Alters the specification content(s) which are included in International Standard.

NOTE 2 Symbol in column of overall degree of correspondence between **JIS** and International Standard in the above table indicates as follows :

- MOD : Modifies International Standard.

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