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Hot-dip zinc-coated steel sheets and coils

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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)/ Japanese Standards Association (JSA) 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 3302**: 1998 is replaced with this Standard.

This revision has been made based on **ISO 3575**: 1996 *Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities* and **ISO 4998 :** 1996 *Continuous hot-dip zinc-coated carbon steel sheet of structural quality* 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 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.

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

Contents

Hot-dip zinc-coated steel sheets and coils

Introduction This Japanese Industrial Standard has been prepared based on the second edition of **ISO 3575** *Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities* published in 1996 and the third edition of **ISO 4998** *Continuous hot-dip zinc-coated carbon steel sheet of structural quality* published in 1996 with some modifications of the technical contents. In order to promote the diffusion of **ISO** Standards, it is important to broadly provide the users of steel products with information about the contents of **ISO** Standards. From such a perspective, the second edition of **ISO 3575**, published in 1996, and the third edition of **ISO 4998**, published in 1996, have been adopted in annex 4 (informative) and annex 5 (informative) to this Standard without any modification in their technical contents.

In addition, although the specified items of clause **5**, clause **6**, clause **16**, **17.4**, clause **18**, clause **19** and clause **20** are specified without modifying the technical content of the original International Standard, other specified items are specified with some modifications of the original International Standard. A list of modifications of this Standard is given in annex 6 (informative) with the explanations.

1. Scope This Standard specifies the steel sheets and coils (hereafter referred to as "sheet and coil"), equally zinc-coated on both surface by dipping in a bath of molten zinc containing not less than 97 % of zinc in percentage by mass (provided that the aluminium content is normally 0.30 % or less). In this case, the term "sheet" includes not only sheets in flat form but also corrugated sheets of the shapes and dimensions specified in **JIS G 3316.**

Remarks : The International Standards corresponding to this Standard are 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 3575 : 1996 *Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities* **(MOD)**

ISO 4998 : 1996 *Continuous hot-dip zinc-coated carbon steel sheet of structural quality* **(MOD)**

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 G 0594	*Methods of accelerated cyclic corrosion resistance tests for anodic coatings with exposure to salt spray, dry and wet conditions*
JIS G 3316	*Shapes and dimensions of corrugated steel sheets*
JIS H 0401	*Methods of test for hot dip galvanized coatings*
JIS H 8502	*Methods of corrosion resistance test for metallic coatings*
JIS K 0119	*General rules for X-rays fluorescence spectrometric analysis*
JIS K 5621	*Anticorrosive paint for general use*
JIS Z 2201	*Test pieces for tensile test for metallic materials*
JIS Z 2241	*Methods of tensile test for metallic materials*
JIS Z 8401	*Guide to the rounding of numbers*

3 Grade and symboml Sheet and coil shall be classified into 6 grades using hot-rolled sheet coils as the base etal (hereafter referred to as “hot-rolled base metal”) and into 10 grades using cold-reduced sheet coils as the base metal (hereafter referred to as “cold-reduced base metal”), and their symbols shall be as given in tables 1 and 2.

Table 1 Grade and symbol (for hot-rolled base metal used)

Unit : mm

Classified symbol	Nominal thickness (1)	Application
SGHC	1.60 and over, up to and incl.6.00	Commercial quality
SGH340		Structural quality
SGH400		
SGH 440		
SGH 490		
SGH 540		

Table 2 Grade and symbol (for cold-reduced base metal used)

Unit: mm

Classified symbol	Nominal thickness	Application
SGCC	0.25 and over, up to and incl. 3.2	Commercial quality
SGCH	0.11 and over, up to and incl. 1.0	Commercial quality, hard class
SGCD1	0.40 and over, up to and incl. 2.3	Drawing quality, class 1
SGCD2		Drawing quality, class 1
SGCD3	0.60 and over, up to and incl. 2.3	Drawing quality, class 3
SGC340	0.25 and over, up to and incl. 3.2	Structural quality
SGC400		
SGC440		
SGC490		
SGC570	0.25 and over, up to and incl. 2.0	

Note (1) Nominal thickness shall be in accordance with 11 a)

Remarks 1 When non-aging property is to be guaranteed for the sheet and coil of SGCD3 upon request by the purchaser, the symbol N shall be suffixed to their symbols, thus appearing SGCD3N. Non-aging property refers to the property free from stretcher strain during fabrication.

2 Nominal thicknesses other than those listed in table 2 may be agreed upon between the purchaser and the supplier.

3 Sheet and coil for roofing and architectural siding shall be accompanied by the symbol R for roofing and the symbol A for architectural siding after the classified symbol given in table 2. In this case, the nominal thickness and the mass of coating shall be as specified in annex 1.

4 For the sheet and coil subjected to corrugating in accordance with **JIS G 3316**, the symbol W and the shape symbol for corrugated sheets shall be suffixed to the classified symbol given in table 2. In this case, the nominal thickness and the mass of coating shall be as specified in annex 2.

5 For corrugation, the commercial, commercial hard class and structural qualities among those listed in table 2 shall be used.

4 Chemical composition For the chemical composition of base metal of sheet and coil, when the test in 17.1 is performed, the cast analysis shall be as given in table 3 and table 4.

Table 3 Chemical composition (for hot-rolled base metal used)

Unit : %

Classified symbol	C	Mn	P	S
SGHC	0.15 max.	0.80 max.	0.05 max.	0.05 max.
SGH340	0.25 max.	1.70 max.	0.20 max.	0.05 max.
SGH400	0.25 max.	1.70 max.	0.20 max.	0.05 max.
SGH 440	0.25 max.	2.00 max.	0.20 max.	0.05 max.
SGH490	0.30 max.	2.00 max.	0.20 max.	0.05 max.
SGH540	0.30 max.	2.50 max.	0.20 max.	0.05 max.

Remarks : The report of cast analysis of C, Mn, P and S shall be in accordance with the agreement between the purchaser and the supplier.

Table 4 Chemical composition (for cold-reduced base metal used)

Unit : %

Classified symbol	C	Mn	P	S
SGCC	0.15 max.	0.80 max.	0.05 max.	0.05 max.
SGCH	0.18 max.	1.20 max.	0.80 max.	0.05 max.
SGCD1	0.12 max.	0.60 max.	0.04max.	0.04 max.
SGCD2	0.10 max.	0.45 max.	0.03 max.	0.03 max.
SGCD3	0.08 max.	0.45 max.	0.03 max.	0.03 max.
SGC340	0.25max.	1.70 max.	0.20 max.	0.05 max.
SGC400	0.25max.	1.70 max.	0.20 max.	0.05 max.
SGC440	0.25max.	2.00 max.	0.20 max.	0.05 max.
SGC490	0.30max.	2.00 max.	0.20 max.	0.05 max.
SGC570	0.30max.	2.50 max.	0.20 max.	0.05 max.

Remarks : The report of cast analysis of C, Mn, P and S shall be in accordance with the agreement between the purchaser and the supplier.

5 Type of coating The coating shall be to classified into two types ; non-alloyed and iron-zinc alloyed coatings equally coated on both surfaces.

Remarks : The iron-zinc alloyed coating is to produce an alloyed layer of iron and zinc which consists of predominantly δ_1 phase (with iron content ranging from 7 % to 16 %) throughout the whole coating.

6. Coating surface finishes

6.1 Types and symbols of coating surface finish for non-alloyed coating The types and symbols of coating surface finish shall be as specified in table 5.

Table 5 Type of coating surface finish and symbol

Type of coating surface finish	Symbol	Remarks
Normal spangle	R	A coating having spangles as a result of the un-restricted growth of zinc crystals during normal solidification
Minimized spangle	Z	A coating having the spangles obtained by re-stricting normal spangle formation to a minimum.

6.2 Skin-pass Skin-passing to obtain surface smoothness shall be specified by the purchaser. In this case, the symbol shall be S.

7 Coating mass Coating mass shall be tested in accordance with 17.2, and minimum coating mass on both surface (total mass on both surfaces) for equally coated sheet and coil and the symbol thereof shall be as follows:

a) Coating mass for equally coated sheet and coil shall be expressed as the coating mass on both surfaces of the sheet and coil. Minimum coating mass and its symbol shall be as shown in table 6.

Table 6 Minimum coating mass for equally coated sheet and coil (total mass on both surfaces)

Unit : g/m^2

Type of coating	Coating mass symbol	Minimum average coating mass in triple-spot test	Minimum coating mass at a single spot
C	(Z06) (2)	60	51
	Z08	80	68
	Z10	100	85
	Z12	120	102
	Z18	180	153
	Z20	200	170
	Z22	220	187
	Z25	250	213
	Z27	275	234
	Z35	350	298
	Z37	370	315
	Z45	450	383
	Z60	600	510
Alloyed	(F04) (2)	40	34
	F06	60	51
	F08	80	68
	F10	100	85
	F12	120	102
	(F18) (2)	180	153

Note (2) Symbols and values in parentheses may be applied upon agreement between the purchaser and the supplier.

Remarks 1 Coating mass symbols Z35, Z37, Z45, Z60, F10, F12 and F18 shall not be applicable to SGCD1, SGCD2, and SGCD3.

2 The minimum average coating mass in the triple-spot test (total mass on both surface) shall be the average of the measured coating masses of three test pieces cut from the test specimen.

3 The minimum coating mass at a single spot (total mass on both surfaces) shall be the smallest of the measured coating masses of the three test pieces cut from the test specimen.

4 The maximum coating mass (total mass on both surfaces) may be agreed upon between the purchaser and the supplier.

b) Minimum coating mass at a single spot on either side of equally coated sheet and coil shall be about 40 % or more of the minimum coating mass at a single spot on both surfaces (total mass on both surfaces).

8 Chemical treatment Symbols for chemical treatment for flat sheet and coil shall be as given in table 7. Unless otherwise specified, the non-alloyed coating shall be subjected to chromate treatment and the alloyed coating shall be untreated.

Table 7 Type of chemical treatment and symbol

Type of chemical treatment	Symbol
Chromate treatment	C
Phosphate treatment	P
Untreated	M

Remarks : Chemical treatments other than those listed in table 7 may be agreed upon between the purchaser and the supplier.

9 Oiling Symbols for oiling for flat sheet and coil shall be as given in table 8. Unless otherwise specified, the non-alloyed coating shall be unoiled and the alloyed coating shall be oiled.

Table 8 Discrimination of oiling and symbol

Discrimination of oiling	Symbol
Oiled	O
Unoiled	X

10 Mechanical Properties

10.1 Applicable mechanical properties Applicable mechanical properties for flat sheet and coil shall be as given in table 9.

Table 9 Applicable mechanical properties

Classified symbol	Bend ability	Yield point or proof stress, tensile strength and elongation
SGHC	O	-
SGH340	O	O
SGH400	O	O
SGH440	O	O
SGH490	O	O
SGH540	O	O
SGCC	O (3)	-
SGCH	-	-
SGCD1	O	O
SGCD2	O	O
SGCD3	O	O (4)
SGC340	O	O
SGC400	O	O
SGC440	O	O
SGC490	O	O
SGC570	O	O

Note (3) This shall not be applied when sheet and coil are used for corrugation.

(4) For SGCD3, non-ageing properties are applied according to the specification of the purchaser.

Remarks : Test items for roofing and architectural siding shall be those which correspond to the specified symbol among those given in table 9.

10.2 Bendability As to bendability for the flat sheet and coil specified in 10.1, when the sheet and coil are tested in accordance with 17.4 and table 10, there shall not be any flaking of the coating, cracking (visible to the naked eye) or fracture of the base metal on the outside of the bent portion (within an area not less than 7 mm from each side of the test piece).

Table 10 Bendability

Classified symbol		Internal spacing of the bend (number of sheets of the nominal thickness)								
		Up to 1.6 mm in nominal thickness			1.6 mm and over, up to 3.0 mm in nominal thickness			3.0 mm and over in nominal thickness		
		Coating mass symbol			Coating mass symbol			Coating mass symbol		
Hot-rolled base metal	Cold-reduced base metal	Z27 or lighter	Z35	Z45, Z60	Z27 or lighter	Z35, Z37	Z45, Z60	Z27 or lighter	Z35, Z37	Z45, Z60
SGHC	SGCC	1	1	2	1	2	2	2	2	2
-	SGCH	-	-	-	-	-	-	-	-	-
-	SGCD1	1	-	-	1	-	-	-	-	-
-	SGCD2 SGCD3	0	-	-	0	-	-	-	-	-
SGH340	SGC340	1	1	2	1	1	2	2	2	3
SGH400	SGC400	2	2	2	2	2	2	3	3	3
SGH440 SGH490 SGH540	SGC440 SGC490	3	3	3	3	3	3	3	3	3
-	SGC570	-	-	-	-	-	-	-	-	-

Remarks 1 The bendability shall be 180° regardless of the classified symbol.
2 When the hot-rolled base metal is used, 1.6 mm or over in nominal thickness is applied.

10.3 Yield point or proof stress, tensile strength, elongation Tests for the yield point or proof stress, tensile strength and elongation of the sheet and coil shall be made in accordance with 17.5, and the test results shall comply with tables 11 or 12.

The yield point shall be the upper yield point.

Table 11 Yield point or proof stress tensile strength and elongation (for hot-rolled base metal used)

Classified symbol	Yield point or proof stress N/mm^2	Tensile strength N/mm^2	Elongation %					Test piece and direction of tensile test
			Nominal thickness mm					
			1.6 and over, up to and excl. 2.0	2.0 and over, up to and excl. 2.5	2.5 and over, up to and excl. 3.2	3.2 and over, up to and excl. 4.0	Over 4.0, up to and incl. 6.0	
SGHC	(205 min)	(270 min)	-	-	-	-	-	No. 5, in rolling direction
SGH340	245 min.	340 min.	20 min.	20 min.	20 min.	20 min.	20 min.	No. 5, in rolling direction or perpendicular to the rolling direction
SGH400	295 min.	400 min.	18 min.	18 min.	18 min.	18 min.	18 min.	
SGH440	335 min.	440 min.						
SGH490	365 min.	490 min.	16 min.	16 min.	16 min.	16 min.	16 min.	
SGH540	400 min.	540 min.						

Remarks 1 1 N/mm^2 = 1 MPa
2 The values in parentheses in table 11 are shown for reference.

Table 12 Yield point or proof stress tensile strength, elongation (for cold-reduced base metal used)

Classified symbol	Yield point or proof stress N/mm^2	Tensile strength N/mm^2	Elongation %						Test piece and direction of tensile test
			Nominal thickness mm						
			0.25 and over, up to 0.40	0.40 and over, up to 0.60	0.60 and over, up to 1.0	1.0 and over, up to 1.6	1.6 and over, up to 2.5	2.5 and over	
SGCC	(205 min.)	(270 min.)	-	-	-	-	-	-	No. 5, in rolling direction
SGCH	-	-	-	-	-	-	-	-	
SGCD1	-	270 min.	-	34 min.	36 min.	37 min.	38 min.	-	
SGCD2	-	270 min.	-	36 min.	38 min.	39 min.	40 min.	-	
SGCD3	-	270 min.	-	38 min.	40 min.	41 min.	42 min.	-	
SGC340	245 min.	340 min.	20 min.	20 min.	20 min.	20 min.	20 min.	20 min.	No. 5, in rolling direction or perpendicular to the rolling direction
SGC400	295 min.	400 min.	18 min.	18 min.	18 min.	18 min.	18 min.	18 min.	
SGC440	335 min.	440 min.	18 min.	18 min.	18 min.	18 min.	18 min.	18 min.	
SGC490	365 min.	490 min.	16 min.	16 min.	16 min.	16 min.	16 min.	16 min.	
SGC570	560 min.	570 min.	-	-	-	-	-	-	

Remarks 1 When non-aging property is specified for the sheet and coil of SGCD3, this property shall be guaranteed for the period of six months after shipment from the manufacture's factory.

2 For nominal thicknesses less than 0.25 mm, tensile test may be omitted.

3 The values in parentheses in table 12 are shown for reference.

4 1 N / mm^2 = 1 MPa.

Information: SGCH is a material not subjected to annealing, usually having a Rockwell hardness 85 HRB or more or a Vickers hardness of 170 HV or more (the test load may be chosen appropriately).

11 Presentation of dimensions The dimensions of sheet and coil shall be expressed as follows :

a) The thickness of sheet and coil shall be expressed in the thickness of the base metal prior to coating in millimetres, and this shall be regarded as the nominal thickness and the thickness after coating on the base metal shall be regarded as the thickness of a product.

b) The dimensions of sheet shall be expressed in thickness, width and length in millimetres, respectively.

c) The dimensions of coil shall be expressed in thickness and width in millimetres, respectively. When the mass of coil is expressed as theoretical mass, however, the length shall be given in metres.

12 Standard dimensions The standard dimensions of sheet and coil shall be as specified below. However, the standard nominal thickness of corrugated sheet and the

Standard width and length prior to corrugation shall comply with annex 2. Further, the standard length and width of corrugated sheet after corrugation shall comply with **JIS G 3316.**

a) Standard nominal thickness The standard nominal thickness of sheet and coil shall be as given in table 13.

Table 13 Standard nominal thickness

Unit: mm

(0.27)	(0.30)	(0.35)	0.40	0.50	0.60	0.70	0.80	0.90	1.0	1.2	1.4
1.6	1.8	2.0	2.3	2.8	3.2	3.6	4.0	4.5	5.0	5.6	6.0

Remarks 1 The values un parentheses shall be applied to coating mass symbol Z18 or heavier coatings.

2 Upon agreement between the purchaser and the supplier, the thickness of 0.65 mm and 0.75 mm may serve as standard nominal thicknesses.

b) Standard width and standard length of sheet The standard width of sheet and coil and the standard length of sheet shall be as given in table 14.

Table 14 standard width and length

Unit: mm

Standard width	Standard length of sheet						
762	1 829	2 134	2 438	2 743	3 048	3 353	3 658
914	1 829	2 134	2 438	2 743	3 048	3 353	3 658
1 000	2 000						
1 219	2 438	3 048	3 658				
1 524	3 048						
1 829	3 658						

Remarks : As for coil, 610 mm shall also be regarded as the standard width, in addition to those given in the above table.

13 Dimensional tolerances

13.1 Product thickness tolerances Tolerances for the product thickness of sheet and coil shall be as follows:

a) Product thickness tolerance shall apply to nominal thickness rounded to three decimal places plus the equivalent thickness of coating given in table 18.

b) Thickness tolerances shall be as given in table 15, 16 or 17. Thickness shall be measured at any point not less than 25 mm from a side edge.

**Table 15 Product thickness tolerances
(for hot-rolled base metal used for commercial quality)**

Unit: mm

Nominal thickness	Width			
	Up to 1 200	1 200 and over, up to 1 500	1 500 and over, up to 1 800	1 800 and over, up to and incl. 2 300
1.60 and over, up to 2.00	± 0.17	± 0.18	± 0.19	± 0.22 (5)
2.00 and over, up to 2.50	± 0.18	± 0.20	± 0.22	± 0.26 (5)
2.50 and over, up to 3.15	± 0.20	± 0.22	± 0.25	± 0.27
3.15 and over, up to 4.00	± 0.22	± 0.24	± 0.27	± 0.28
4.00 and over, up to 5.00	± 0.25	± 0.27	-	-
5.00 and over, up to 6.00	± 0.27	± 0.29	-	-
6.00	± 0.30	± 0.31	-	-

Note (5) These figures shall apply to widths under 2 000 mm.

**Table 15 Product thickness tolerances
(For hot-rolled base metal used
For structural quality)**

Unit: mm

Nominal thickness	Width	
	Up to 1 600	1 600 and over, up to and excl. 2 000
1.60 and over, up to 2.00	± 0.20	±0.24
2.00 and over, up to 2.50	± 0.21	± 0.26
2.50 and over, up to 3.15	± 0.23	± 0.30
3.15 and over, up to 4.00	± 0.25	± 0.35
4.00 and over, up to 5.00	± 0.46	-
5.00 and over, up to and incl. 6.00	± 0.51	-

Table 17 Product thickness tolerance
(For cold-reduced base metal used)

Unit: mm

Nominal thickness	Width				
	Up to 630	630 and over, up to 1 000	1 000 and over, up to 1 250	1 250 and over, up to 1 600	1 600 and over
Up to 0.25	± 0.04	± 0.04	± 0.04	-	-
0.25 and over, up to 0.40	± 0.05	± 0.05	± 0.05	± 0.06	-
0.40 and over, up to 0.60	± 0.06	± 0.06	± 0.06	± 0.07	± 0.08
0.60 and over, up to 0.80	± 0.07	± 0.07	± 0.07	± 0.07	± 0.08
0.80 and over, up to 1.00	± 0.07	± 0.07	± 0.08	± 0.09	± 0.10
1.00 and over, up to 1.25	± 0.08	± 0.08	± 0.09	± 0.10	± 0.12
1.25 and over, up to 1.60	± 0.09	± 0.10	± 0.11	± 0.12	± 0.14
1.60 and over, up to 2.00	± 0.11	± 0.12	± 0.13	± 0.14	± 0.16
2.00 and over, up to 2.50	± 0.13	± 0.14	± 0.15	± 0.16	± 0.18
2.50 and over, up to 3.15	± 0.15	± 0.16	± 0.17	± 0.18	± 0.21
3.15 and over	± 0.17	± 0.18	± 0.20	± 0.21	-

Table 18 Equivalent coating thickness

Unit: mm

Coating mass symbol	Z06	Z08	Z10	Z12	Z18	Z20	Z22	Z25	Z27	Z35	Z37	Z45	Z60
Equivalent coating thickness	0.013	0.017	0.021	0.026	0.034	0.040	0.043	0.049	0.054	0.064	0.067	0.080	0.102

Coating mass symbol	F04	F06	F08	F10	F12	F18
Equivalent coating thickness	0.008	0.013	0.017	0.021	0.026	0.034

13.2 Width tolerances Tolerances for the width of sheet and coil shall be as given in table **19**. Width shall be measured at a normal position for coil and at any position for sheet. However, tolerances for the width of corrugated sheet after corrugation shall be as specified in **JIS G 3316.**

Table 19 Width tolerances

Unit : mm

Width	For hot-rolled base metal used		For cold-reduced base metal used
	Tolerance (A)	Tolerance (B)	
1 500 and under	+25 0	+ 10 0	+7 0
Over 1 500			+10 0

Remarks : Generally, mill edge is applied to tolerance (A), and cut edge is applied to tolerance (B).

13.3 Length tolerances Tolerances for the length of sheet shall be as given in table 20. Length shall be measured at any position of sheet.

Table 20 Length tolerances

Unit : mm

For hot-rolled base metal used	For cold-reduced base metal used
+15 0	+15 0

14 Shapes

Camber Maximum camber for flat sheet and coil shall be as given in tables **21** or **22.**

Table 21 Maximum camber (for hot-rolled base metal used)

Unit : mm

Width	Flat sheet			Coil
	Length			
	Up to 2 500	2 500 and over, up to 4 000	4 000 and over	
Up to 630	5	8	12	5 in any 2 000 length
630 and over, up to 1 000	4	6	10	
1 000 and over	3	5	8	

Table 22 Maximum camber (for cold-reduced base metal used)

Unit : mm

Width	Flat sheet		Coil
	Length		
	Up to 2 000	2 000 and over	
Up to 630	4	4 in any 2 000 length	
630 and over	2	2 in any 2 000 length	

14.2 Out-of-square Out-of-square for flat sheet shall be expressed as $\frac{l}{b} \times 100$ (%) in figure 1 and shall not exceed 1 %.

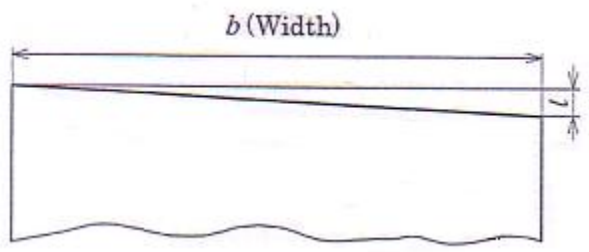


Figure 1 Out-of-square for flat sheet

14.3 Flatness Flatness for flat sheet shall be as given in table 23 or 24. Flatness shall be measured with a sheet lying under its own mass on a flat surface, and the value of flatness shall be obtained by subtracting the sheet thickness from the maximum deviation from the flat horizontal surface. The value thus obtained shall apply to the upper surface of the sheet.

Table 23 Flatness (for hot-rolled base metal used)

Unit : mm

Nominal thickness	Width				
	Up to 1 250	1 250 and over, up to 1 600	1 600 and over, up to 2 000	2 000 and over, up to 3 000	3 000 and over
1.60 and over, up to 3.15	16 max.	18 max.	20 max.	-	-
3.15 and over, up to 4.00	16 max.			-	-
4.00 and over, up to 6.00	14 max.			24 max.	25 max.
6.00	13 max.			21 max.	22 max.

Remarks : Unless otherwise specified, one and half times the maximum deviation from flatness specified in table 23 shall be applied to the sheet of specified minimum tensile strength of 570 N/mm^2, of specified minimum yield point of 430 N/mm^2, or of equivalent one achieved by chemical composition or hardness.

Table 24 Flatness (for cold-reduced base metal used)

Unit : mm

Width	Type		
	Bow	Edge wave (6)	Centre buckle (7)
Up to 1 000	12 max.	8 max.	6 max.
1 000 and over, up to 1 250	15 max.	9 max.	8 max.
1 250 and over, up to 1 600	15 max.	11 max.	8 max.
1 600 and over	20 max.	13 max.	9 max.

Notes (6) It refers to the type of flatness in which a corrugation appears at the edge (the end in the width direction) of sheet and coil.

(7) It refers to the type of flatness in which a corrugation appears at the central part of sheet and coil.

15 Mass and tolerances

15.1 Mass of sheet The mass of sheet shall, as a rule, be given in theoretical mass in kilogrammes.

15.2 Mass of coil The mass of coil shall be given in either actual or theoretical mass in kilogrammes.

15.3 Calculation method of mass The calculation method of the mass of sheet and coil shall comply with table 25 according to nominal dimensions and coating mass.

Table 25 Calculation method of mass

Calculation order		Calculation method	Number of figures in resultant values
Basic mass of base metal kg/mm.m^2		7.85 (1 mm thickness·1 m^2 area)	-
Unit mass of base metal kg/m^2		Basic mass (kg/mm·m^2) × nominal thickness (mm)	Rounded off to 4 significant figures.
Unit mass after coating kg/m^2		Unit mass of base metal (kg/m^2) + coating mass constant (given in table 26)	Rounded off to 4 significant figures.
Sheet	Area of sheet m^2	Width (mm) × length (mm) × 10^{-6}	Rounded off to 4 significant figures.
	Mass of a single sheet kg	Unit mass after coating (kg/m^2) × area (m^2)	Rounded off to 3 significant figures.
	Mass of a single bundle kg	Mass of single sheet (kg) × number of sheets in a single bundle of the same dimensions	Rounded off to integral number of kg.
	Total mass kg	Total mass of each bundle (kg)	Integral number of kg
Coil	Unit mass of coil kg/m	Unit mass after coating (kg/m^2) × width (mm) × 10^{-3}	Rounded off to 3 significant figures.
	Mass of a single coil kg	Unit mass of coil (kg/m) × length (m)	Rounded off to integral number of kg.
	Total mass kg	Total mass of each coil (kg)	Integral number of kg

Remarks 1 The number of sheets, when the bundle mass is specified, shall be obtained by dividing the specified mass by the mass of a single sheet of the same shape, dimensions and coating mass, to be rounded off to an integral number.

2 The width dimensions to be used for calculating the area of corrugated sheet shall be that prior to corrugation.

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

Table 26 Coating mass constants for mass calculation

Coating mass symbol	Z06	Z08	Z10	Z12	Z18	Z20	Z22	Z25	Z27
Coating mass constant	0.090	0.120	0.150	0.183	0.244	0.285	0.305	0.305	0.381

Coating mass symbol	Z35	Z37	Z45	Z60	F04	F06	F08	F10	F12	F18
Coating mass constant	0.458	0.481	0.565	0.722	0.060	0.090	0.120	0.150	0.183	0.244

15.4 Tolerances for theoretical mass of sheet Tolerances for the theoretical mass of sheet, which are expressed as the percentage obtained by dividing the difference between the theoretical mass obtained by **15.3** and the actual mass by the theoretical mass, shall be as given in table **27**.

Table 27 Mass tolerances

Theoretical mass of a single lot kg	Tolerance %	Remarks
Up to 600	± 10	Calculation shall be made regarding a lot of sheets of the same quality, shape, dimensions and coating mass.
600 and over, up to 2 000	± 7.5	
2 000 and over	±5	

16 Appearance Sheet and coil shall be free from defects detrimental to practical use, except the case of coil, which may contain some irregular portions such as welds.

17 Tests

Analysis test of chemical composition

17.1.1 General matter of analysis test and sampling method of analysis sample The chemical composition of base metal of sheet and coil shall be obtained by means of the cast analysis, and the general matter of analysis test and sampling method of analysis sample shall be in accordance with clause **8** of **JIS G 0404.**

17.1.2 Analytical method The analytical method shall be in accordance with **JIS G 0320.**

17.2 Coating mass test

17.2.1 Sampling of test specimen Test specimen shall be taken from a lot of products of the same dimensions and coating mass, and shall comply with the requirements below.

For corrugated sheet, the test specimen shall be taken from flat sheet prior to corrugation.

a) For continuously coated coils or cut lengths therefrom, one test specimen shall be taken from every 50 t or fraction thereof.

b) For sheets manufactured by coating base metal cut to specified lengths, one test specimen shall be taken from every 3 000 sheets or fraction thereof.

17.2.2 Sampling of test piece The sampling of test pieces shall be in accordance with either the tripple-spot test method specified in **4.2.1 b)** (Sampling position and size of test piece) of **JIS H 0401** or the method specified in annex 3.

17.2.3 Test method Coating mass shall be measured on both surfaces of a test piece, and its test method shall be in accordance with **JIS H 0401** using either the antimony-chloride solution, hexamethylene tetramine solution or the method specified in annex 3. A fluorescent X-ray method may be used on the manufacturing line, upon agreement between the purchaser and the supplier.

17.3 Corrosion resistance test of coating The corrosion resistance test of coating shall be performed according to any method of clause **8** of **JIS H 8502**, table 4 of **7.12** of **JIS K 5621** or **JIS G 0594.**

In addition, this test shall be performed in accordance with the agreement between the purchaser and the supplier, and the evaluation criteria (setting of reference value and characteristics) may be as agreed between the purchaser and the supplier.

17.4 Bend test

17.4.1 General requirements for test General requirements for bend test shall comply with clause **9** (Mechanical properties) of **JIS G 0404.**

17.4.2 Sampling of test specimen One test specimen shall be taken from every 50 t or fraction thereof of the products of the same grade, dimensions and coating mass.

17.4.3 Test piece Test pieces shall have a width of 75 mm to 125 mm and a suitable length of about twice the width. Unless otherwide specified, one test piece shall be cut from each test specimen parallel to the rolling direction of the base metal.

17.4.4 Bending of test piece The test piece shall, as a rule, be bent manually with a vise through 180^{o} in the longitudinal direction of the test piece, as shown in figure 2. When a hand vise is not available, other suitable means of testing may be adopted.

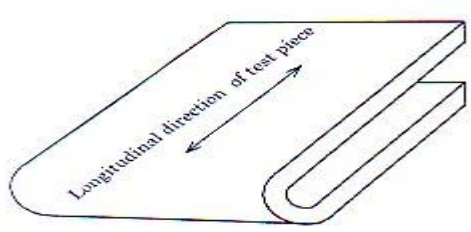


Figure 2 Direction of bend test

17.5 Tensile test

17.5.1 General requirements for test General requirements for tensile test shall comply with clause **9** (Mechanical properties) of **JIS G 0404.**

17.5.2 Sampling of test specimen One test specimen shall be taken from every 50 t or fraction thereof of the products of the same grade, dimensions and coating mass.

17.5.3 Test piece The test piece shall be the No. 5 test piece specified in **JIS Z 2201**, and one test piece shall be cut from each test specimen in the direction specified in table 11 and table 12.

17.5.4 Test method The test method shall be in accordance with **JIS Z 2241.**

17.5.5 Thickness for tensile strength calculation The thickness to be used for tensile strength calculation shall be either the actually measured thickness after the removal of the coating or one obtainable by subtracting the equivalent thickness from the actually measured coated thickness.

18 Inspection

18.1 The inspection shall be as follows:

a) Coating mass shall comply with the requirements of clause **7**.
b) Mechanical properties shall comply with the requirements of clause **10.**
c) Dimensions shall comply with the requirements of clause **13.**
d) Shapes shall comply with the requirements of clause **14.**
e) Mass shall comply with the requirements of clause **15.**
f) Appearance shall comply with the requirements of clause **16.**

18.2 Reinspection When a part of test results for coating mass, bending and tension fails to comply with the requirements, a retest on the relevant items may be carried out in accordance with **9.8** (Retest) of **JIS G 0404**, to determine whether it is acceptable or not.

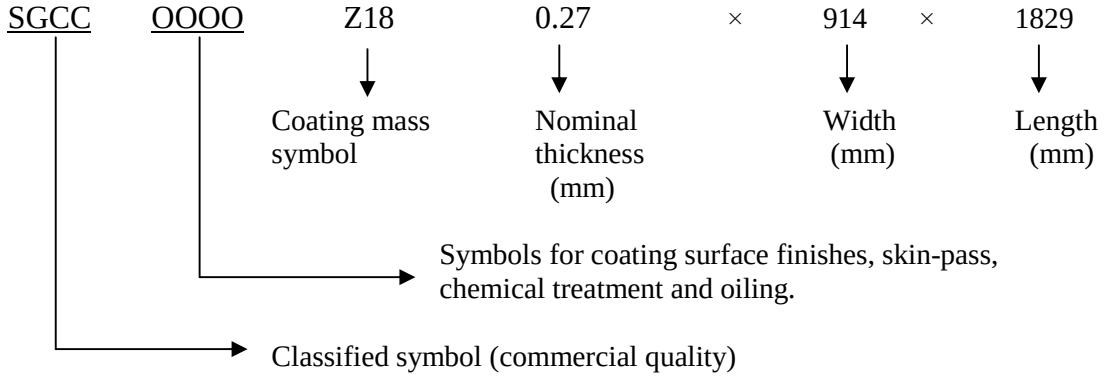
19 Markings For each package or bundle of the sheet and coil that have passed inspection, the following items shall be legibly marked by a suitable means, except that, upon agreement between the purchaser and the supplier, some of these items may be omitted.

a) Classified symbol (including shape symbol for corrugation for corrugated sheets)
b) Symbol for surface finishes, skin-pass treatment, chemical treatment, oiling, etc.
   Remarks: These symbols shall be marked when specified by the purchaser.
c) Coating mass symbol

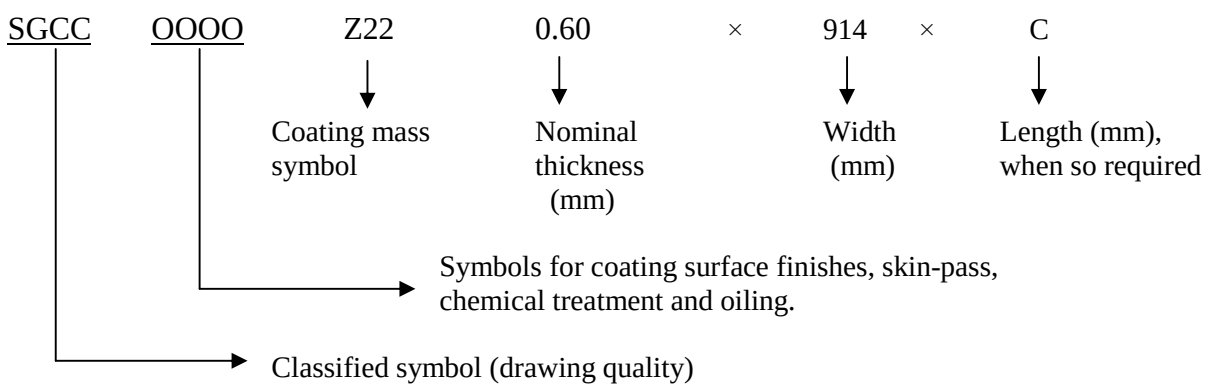
d) Dimensions (for individual sheet, this may be only nominal thickness)
e) Identification number of product
f) Number of sheets or mass (for individual sheet, this may be omitted)
g) Manufacturer's name or its identifying brand

Marking shall be as shown in the following examples.

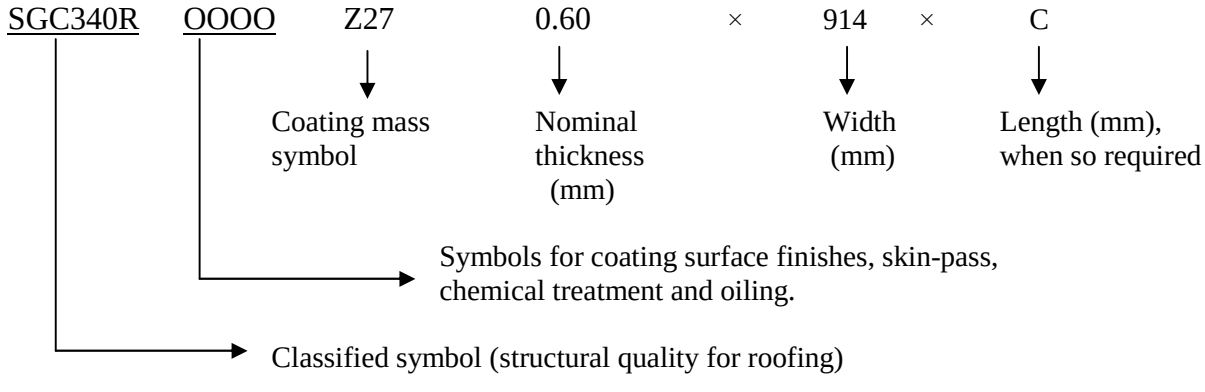
Example 1 **For sheet**



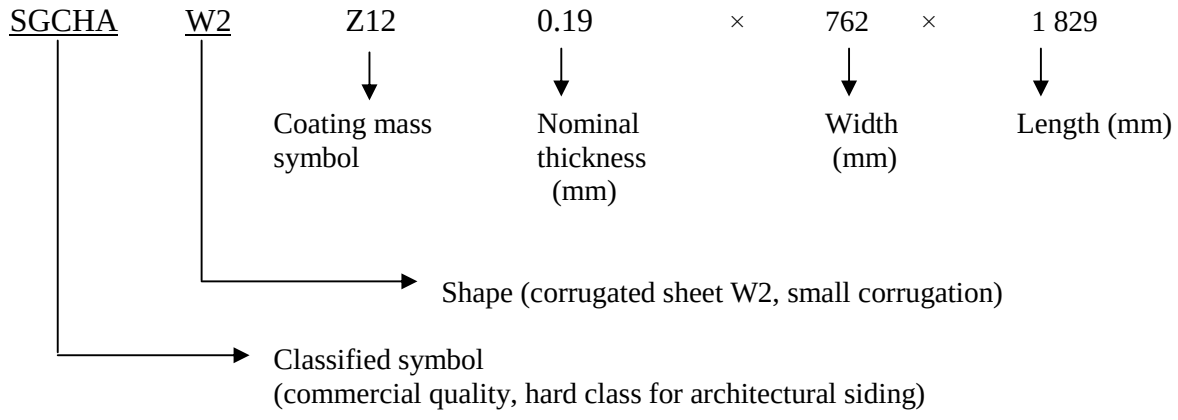
Example 2 **For coil**



Example 3 **For roofing (coil)**



Example 4 **For corrugated sheet for architectural siding, using flat sheet of commercial hard quality**



20 Items to be confirmed at the time of order The purchaser and the supplier should include the following information in an inquiry sheet and an order sheet in order to specify the matter according to this Standard appropriately.

a) Classified symbol (see table 1 and table 2)

b) Dimensions (for standard nominal thickness, standard width and length, see table 13 and table 14)

c) Symbol for coating surface finish (see table 5)

d) Skin-pass treatment

e) Coating mass symbol (see table 6)

f) Symbol for chemical treatment (see table 7)

g) Symbol for oiling (see table 8)

h) Maximum mass and minimum mass of one bundle or one coil of a product

i) Total mass ordered

j) Tolerance on width in the case of hot-rolled base metal (see table 19)

k) Internal diameter or external diameter in the case of a coil

l) Application, processing method, etc. when possible

21 Report When there is a request of the purchaser beforehand, the manufacturer shall submit the inspection document to the purchaser. In this case, the report shall comply with the requirements of clause **13** in **JIS G 0404**. Unless otherwise specified, the specification of inspection document shall be symbol 2.3 or 3.1.B in table 1 of **JIS G 0415.**