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Hot-dip 55 % aluminium-zinc alloy-coated steel sheet and strip

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Foreword

This Japanese Industrial Standard has been 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 3321:2017** is replaced with this Standard.

However, **JIS G 3321:2017** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until March 19, 2020.

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Hot-dip 55 % aluminium-zinc alloy-coated steel sheet and strip

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 9364:2017**, Edition 5, with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JF. Annex JA to Annex JE are unique to **JIS** and not given in the corresponding International Standard.

1 Scope

This Standard specifies requirements for hot-dip 55 % aluminium-zinc alloy-coated steel sheet (hereafter referred to as sheets), steel strip (hereafter referred to as coils), and corrugated sheet manufactured by processing sheets into the shapes and dimensions specified in **JIS G 3316** (hereafter referred to as corrugated sheets).

NOTE The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 9364:2017 *Steel sheet, 55 % aluminium-zinc alloy-coated by the continuous hot-dip process, of commercial, drawing and structural qualities (MOD)*

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

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 method 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 3316 *Shapes and dimensions of corrugated steel sheets*

JIS K 0119 *General rules for X-ray fluorescence analysis*

JIS K 8847 *Hexamethylenetetramine (Reagent)*

JIS Z 2241 *Metallic materials—Tensile testing—Method of test at room temperature*

JIS Z 8401 *Guide to the rounding of numbers*

3 Symbol of grade and applicable nominal thickness¹⁾

The symbol of grade and applicable nominal thickness shall be as follows.

Note ¹⁾ The nominal thickness indicates the base metal thickness before coating [see 9.1.1 a)].

- a) The sheets and coils are classified into 3 grades of hot-rolled steel strip (hereafter referred to as hot-rolled base metal) and into 7 grades of cold-reduced steel strip (hereafter referred to as cold-reduced base metal). The symbols of grade and applicable nominal thicknesses shall be as given in Tables 1 and 2.
- b) The corrugated sheets are classified into 5 grades of commercial quality and high strength commercial quality among those given in Table 2. The symbols of grade and applicable nominal thicknesses shall be as given in Table 2.
- c) For sheets, coils and corrugated sheets used for roofing and architectural siding, the symbols shall be as given in Table 3.
- d) The classification and symbol of the shape of corrugated sheets and their symbols shall be as given in Table 4.

Table 1 Symbol of grade and applicable nominal thickness (hot-rolled base metal)

Unit: mm

Symbol of grade	Applicable nominal thickness	Application
SGLHC	1.6 or over up to and incl. 2.3	Commercial
SGLH400		High strength commercial
SGLH490		
Unless the use of hot-rolled base metal is specifically required, the cold-reduced base metal which satisfies the specifications for hot-rolled base metal may be used.		

Table 2 Symbol of grade and applicable nominal thickness (cold-reduced base metal)

Unit: mm

Symbol of grade	Applicable nominal thickness	Application
SGLCC	0.24 or over up to and incl. 2.3	Commercial
SGLCD	0.27 or over up to and incl. 1.6	Drawing
SGLCDD	0.40 or over up to and incl. 1.6	Deep drawing
SGLC400	0.25 or over up to and incl. 2.3	High strength commercial
SGLC440		
SGLC490		
SGLC570	0.19 or over up to and incl. 2.0	

Table 3 Symbol for roofing and architectural siding

Application	Symbol
Roofing	R
Architectural siding	A

Table 4 Classification and symbol of shape of corrugated sheet

Shape of corrugated sheet	Symbol
Corrugated sheet No. 1 (long pitch) ^{a)}	W1
Corrugated sheet No. 2 (short pitch) ^{a)}	W2
Note ^{a)} The shapes and dimensions of long pitch and short pitch corrugated sheets shall be as specified in JIS G 3316 .	

4 Chemical composition

The base metal of sheets, coils and corrugated sheets shall be tested for chemical composition in accordance with **13.1**, and the heat analysis values shall be as given in Table 5.

Table 5 Chemical composition

Unit: %				
Symbol of grade	C	Mn	P	S
SGLHC	0.15 max.	0.80 max.	0.05 max.	0.05 max.
SGLH400	0.25 max.	1.70 max.	0.20 max.	0.05 max.
SGLH490	0.30 max.	2.00 max.	0.20 max.	0.05 max.
SGLCC	0.15 max.	0.80 max.	0.05 max.	0.05 max.
SGLCD	0.10 max.	0.45 max.	0.03 max.	0.03 max.
SGLCDD	0.08 max.	0.45 max.	0.03 max.	0.03 max.
SGLC400	0.25 max.	1.70 max.	0.20 max.	0.05 max.
SGLC440	0.25 max.	2.00 max.	0.20 max.	0.05 max.
SGLC490	0.30 max.	2.00 max.	0.20 max.	0.05 max.
SGLC570	0.30 max.	2.50 max.	0.20 max.	0.05 max.
Alloy elements other than those given in this table may be added as required.				

5 Coating

5.1 Plating bath composition

Plating bath shall be tested for composition in accordance with **13.2** and shall be as given in Table 6.

NOTE In the hot-dip coating process, the base metal is immersed in a molten metal bath at a high temperature, and then cooled to form a coating on the base metal surface. This molten metal bath is called plating bath.

Table 6 Plating bath composition

Unit: %

Al	Si	Elements other than Al, Si and Zn	Zn
50.0 or over up to and incl. 60.0	1.0 or over up to and incl. 3.0	5.0 max. ^{a)}	Remainder ^{b)}
Notes ^{a)} The figure indicates the total amount of elements which are added intentionally. ^{b)} The remainder may include elements which are mixed unavoidably.			

5.2 Coating mass

5.2.1 Symbol for coating mass

The coating applied shall be of equivalent thickness on both surfaces. The symbols for coating mass shall be as given in Table 7.

5.2.2 Coating mass

The sheets, coils and corrugated sheets shall be tested for coating mass in accordance with **13.3.2** and shall satisfy the following requirements.

- a) The coating mass of sheets, coils and corrugated sheets shall be expressed by the total mass on both surfaces and shall meet the minimum triple-spot average coating mass value and the minimum single-spot coating mass value given in Table 7. The minimum triple-spot average coating mass shall apply to the average of the measured values of three test pieces taken from the sample, and the minimum single-spot coating mass shall apply to the smallest value among the measured values of the three test pieces of which the average value is obtained. When coating mass is measured in accordance with Annex JD, the minimum coating mass values in the table shall apply to the average coating mass and minimum coating mass obtained according to **JD.6.5**.

NOTE It is desirable that the coating mass on one side be not less than 40 % of the required value for the minimum single-spot coating mass (total mass on both surfaces).

- b) For sheets and coils used for roofing and architectural siding, the coating mass shall be as given in Table JA.1.
- c) The coating mass for corrugated sheets shall apply to pre-corrugated sheets. The coating mass applied to corrugated sheets shall be as given in Table JB.1.
- d) The upper limit value of the coating mass (total mass on both surfaces) of sheets, corrugated sheets and coils may be as agreed between the purchaser and the manufacturer.

Table 7 Coating mass (total mass on both surfaces)Unit: g/m²

Symbol for coating mass	Minimum triple-spot average coating mass	Minimum single-spot coating mass
AZ70 ^{a)}	70	60
AZ90	90	76
AZ120	120	102
AZ150	150	130
AZ170	170	145
AZ185 ^{a)}	185	160
AZ200 ^{a)}	200	170
The coating masses corresponding to the designations AZ170, AZ185 and AZ200 shall not apply to SGLCD and SGLCDD.		
Note ^{a)} Applicable by agreement between the purchaser and the manufacturer		

5.3 Coating surface finishes

5.3.1 Coating surface finishes

The coating surface finish shall be regular spangle. Regular spangle means a surface finish with coating formed as a result of growth of alloy crystals (spangle) during normal solidification.

5.3.2 Skin pass

When requested by the purchaser, skin-pass treatment, designated as S, shall be performed.

NOTE Skin-pass treatment is usually performed to produce smooth surfaces.

5.4 Coating adherence

The coating adherence shall be as follows.

- Sheets and coils, when tested for coating adherence in accordance with **13.3.3** under the bend test conditions given in Tables 8 and 9, shall be free from flaking of the coating on the external surface of the test piece (not less than 7 mm from both side edges of test piece).
- The requirements for coating adherence shall not apply to SGLC570.
- In the case of corrugated sheets, requirements in **a)** and **b)** shall apply to pre-corrugated sheets.
- The coating adherence may be evaluated by other evaluation test methods than that specified in **13.3.3**, instead of fulfilling the requirement in **a)**, at the discretion of the manufacturer. In this case, the evaluated coating adherence shall be at least equivalent to that obtained by the test method specified in **13.3.3**.

Table 8 Coating adherence and bendability (hot-rolled base metal)

Symbol of grade	Bend angle	Internal spacing ^{a)} Number of sheets	
		Symbol for coating mass	
		AZ90	AZ120 AZ150
SGLHC	180°	1	2
SGLH400		2	3
SGLH490		3	4
Note ^{a)} The figures indicate the number of sheets of nominal thickness. The test piece shall be bent with the internal spacing not more than the total layer thickness of indicated number of sheets.			

Table 9 Coating adherence and bendability (cold-reduced base metal)

Symbol of grade	Bend angle	Internal spacing ^{a)} Number of sheets		
		Symbol for coating mass		
		AZ70 AZ90	AZ120 AZ150	AZ170, AZ185, AZ200
SGLCC	180°	1	2	2
SGLCD		0 (flat on itself)	1	—
SGLCDD		0 (flat on itself)	1	—
SGLC400		2	3	3
SGLC440		3	4	4
SGLC490		3	4	4
Note ^{a)} The figures indicate the number of sheets of nominal thickness. The test piece shall be bent with the internal spacing not more than the total layer thickness of indicated number of sheets.				

6 Chemical treatment

The classification and symbols of chemical treatment for sheets, coils and corrugated sheets shall be as given in Table 10. Unless otherwise specified, the chromate-free treatment ²⁾ shall be applied.

Note ²⁾ Chromate-free indicates that the coating formed by chemical treatment is free from hexavalent chromium.

Table 10 Classification and symbols of chemical treatment

Classification of chemical treatment	Symbol
Chromate-free treatment	^{a)} ...
Untreated	M
Note ^{a)} The symbol of chromate-free treatment shall be as agreed between the purchaser and the manufacturer. The symbol NC may be used for chromate-free treatment that is specified in JIS G 3321:2012.	

7 Oiling

The classification and symbols of oiling for sheets, coils and corrugated sheets shall be as given in Table 11. Unless otherwise specified, the sheets, coils and corrugated sheets shall be unoiled.

Table 11 Classification and symbol of oiling

Classification of oiling	Symbol
Oiled	O
Unoiled	X

8 Mechanical properties

8.1 Applicable mechanical properties

Mechanical properties applicable to sheets and coils shall be as given in Table 12. The mechanical properties of the corrugated sheets shall apply to pre-corrugated sheets and shall be as given in Table 12.

Table 12 Applicable mechanical properties

Symbol of grade	Bendability	Tensile test characteristics
SGLHC	○	—
SGLH400	○	○
SGLH490	○	○
SGLCC	○ ^{a)}	—
SGLCD	○	○
SGLCDD	○	○
SGLC400	○	○
SGLC440	○	○
SGLC490	○	○
SGLC570	—	○
Note ^{a)} In the case of corrugated sheets, the bendability does not apply.		

8.2 Bendability

When sheets, coils and pre-corrugated sheets are tested for bendability in accordance with 13.4.2, the external surface of the test piece (not less than 7 mm from both side edges of test piece) shall be free from cracks and breakage that are visible to the naked eye.

NOTE For the details of bend test, see 13.4.2.

8.3 Tensile test characteristics

The sheets, coils and pre-corrugated sheets shall be tested for tensile test characteristics in accordance with 13.4.3 and shall satisfy the requirements given in Table 13 or

Table 14. The values given in Table 13 or Table 14 shall apply to those which undergo delivery inspection³⁾.

Note ³⁾ Age-hardening of sheets, coils and corrugated sheets may cause an increase in yield point or proof stress and a decrease in elongation.

Table 13 Tensile test characteristics (hot-rolled base metal)

Symbol of grade	Yield point or proof stress N/mm ²	Tensile strength N/mm ²	Elongation %	Test piece and direction
SGLHC	—			
SGLH400	295 min.	400 min.	18 min.	No. 5 in rolling direction or perpendicular to rolling direction
SGLH490	365 min.	490 min.	16 min.	
NOTE 1 For SGLHC, a yield point or proof stress of 205 N/mm ² or over and a tensile strength of 270 N/mm ² or over may be used.				
NOTE 2 1 N/mm ² = 1 MPa				

Table 14 Tensile test characteristics (cold-reduced base metal)

Symbol of grade	Yield point or proof stress	Tensile strength	Elongation %					Test piece and direction
			Nominal thickness mm					
			0.25 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 up to and incl. 2.3	
SGLCC			—					
SGLCD	—	270 min.	a)	27 min.	31 min.	32 min.	33 min.	No. 5 in rolling direction
SGLCDD	—	270 min.	—	29 min.	32 min.	34 min.	35 min.	
SGLC400	295 min.	400 min.	16 min.	17 min.	18 min.	18 min.	18 min.	No. 5 in rolling direction or perpendicular to rolling direction
SGLC440	335 min.	440 min.	14 min.	15 min.	16 min.	18 min.	18 min.	
SGLC490	365 min.	490 min.	12 min.	13 min.	14 min.	16 min.	16 min.	
SGLC570	560 min.	570 min.	—					
NOTE 1 For SGLCC, a yield point or proof stress of 205 N/mm ² or over and a tensile strength of 270 N/mm ² or over may be used.								
NOTE 2 1 N/mm ² = 1 MPa								
Note a) Applicable by agreement between the purchaser and the manufacturer								

9 Dimensions

9.1 Expression of dimensions

9.1.1 Denomination of thickness

The denomination of thickness of sheets, coils and corrugated sheets shall be as follows. For corrugated sheets, the following denominations of thickness shall be applied to pre-corrugated sheets.

- a) The thickness of base metal before coating shall be taken as the nominal thickness.
- b) The thickness of base metal after coating shall be taken as the product thickness. The product thickness, which is the base of tolerances, shall be the nominal thickness plus the equivalent coating thickness and shall be obtained by adding the equivalent coating thickness given in Table 15 to the nominal thickness expressed to the third decimal place. The resultant value shall be rounded to the second decimal place according to Rule A of **JIS Z 8401**.

Table 15 Equivalent coating thickness

Unit: mm

Symbol for coating mass	AZ70	AZ90	AZ120	AZ150	AZ170	AZ185	AZ200
Equivalent coating thickness	0.026	0.033	0.043	0.054	0.062	0.067	0.072

9.1.2 Unit of dimensions

The unit of dimensions for sheets, coils and corrugated sheets shall be as follows.

- a) For sheets and corrugated sheets, the nominal thickness, width and length shall be expressed in millimetres.
- b) For coils, the nominal thickness and width shall be expressed in millimetres. If theoretical mass is used as the mass of coil, the length of the coil shall be expressed in metres.

9.2 Standard dimensions

9.2.1 Standard dimensions of sheets and coils

The standard dimensions of sheets and coils shall be as follows.

- a) **Standard nominal thickness** The standard nominal thickness of sheets and coils shall be as given in Table 16.