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**Electrolytic zinc-coated steel sheet and
strip**

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In the event of any doubts arising as to the contents,
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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 a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS G 3313**: 2017), which has been technically revised.

However, **JIS G 3313**: 2017 may be applied in the **JIS** mark certification based on the relevant provisions of Article 30, paragraph (1), etc. of the Industrial Standardization Act until 21 February 2022.

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Electrolytic zinc-coated steel sheet and strip

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 5002:2013**, Edition 4, 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 JJ.

1 Scope

This Standard specifies the requirements for electrolytic zinc-coated steel sheets (hereafter referred to as sheets) and strips (hereafter referred to as coils).

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

ISO 5002 : 2013 *Hot-rolled and cold-reduced electrolytic zinc-coated 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 21-1**.

2 Normative references

Part or all of the provisions of the following standards, 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 0201 *Glossary of terms used in iron and steel (Heat treatment)*

JIS G 0202 *Glossary of terms used in iron and steel (Testing)*

JIS G 0203 *Glossary of terms used in iron and steel (Products and quality)*

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

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

JIS G 1257-0 *Iron and steel — Atomic absorption spectrometric method — Part 0 : General rules*

JIS G 1258-0 *Iron and steel — ICP atomic emission spectrometric method — Part 0 : General rules*

JIS G 3101 *Rolled steels for general structure*

JIS G 3113 *Hot-rolled steel plates, sheet and strip for automobile structural uses*

JIS G 3131 *Hot-rolled mild steel plates, sheet and strip*

JIS G 3134 Hot-rolled high strength steel plates, sheet and strip with improved formability for automobile uses

JIS G 3135 Cold-reduced high strength steel sheet and strip with improved formability for automobile uses

JIS G 3141 Cold-reduced carbon steel sheet and strip

JIS K 0119 General rules for X-ray fluorescence analysis

JIS K 8001 General rules for test methods of reagents

JIS K 8847 Hexamethylenetetramine (Reagent)

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

JIS Z 2244-1 Vickers hardness test — Part 1 : Test method

JIS Z 2245 Rockwell hardness test — Test method

JIS Z 2248 Metallic materials — Bend test

JIS Z 8401 Rounding of numbers

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions, and those given in **JIS G 0201**, **JIS G 0202** and **JIS G 0203** apply.

3.1

chromate-free treatment

chemical treatment free from hexavalent chromium

3.2

preliminary strain stress, R_{WH}

in the tensile test to apply the strain to the test piece preliminarily, the value obtained by dividing the test force when the total elongation of 2 % is applied to the test piece by the original cross-sectional area of the parallel portion of the test piece before giving a preliminary strain

Note 1 to entry Unit: N/mm²

Note 2 to entry See Figure JG.1.

3.3

strain ageing yield stress, R_{SA}

the value obtained by dividing the test force at the yield point of air-cooled test piece after heating at 170 °C for 20 min after giving a total elongation of 2 % by the original cross-sectional area of the parallel portion of the test piece before giving a preliminary strain

Note 1 to entry Unit: N/mm²

Note 2 to entry See Figure JG.2.

3.4

amount of bake hardening, BH amount, σ_{BH}

the value obtained by subtracting the preliminary strain stress R_{WH} from the strain ageing yield stress R_{SA}

Note 1 to entry Unit: N/mm²

Note 2 to entry See Figure JG.2.

4 Symbols of grade, applicable nominal thicknesses¹⁾, base metals and temper grades

The symbols of grade, applicable nominal thicknesses, base metals and temper grades shall be as follows.

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

- a) The sheets and coils are classified into 16 grades manufactured by using hot-rolled strip (hereafter referred to as hot-rolled base metal) and into 18 grades manufactured by using cold-reduced strip (hereafter referred to as cold-reduced base metal). The symbols of grade and applicable nominal thicknesses shall be as given in Table 1 and Table 2.
- b) The hot-rolled base metals used for sheet and coil shall be the steel strips specified in JIS G 3101, JIS G 3113, JIS G 3131 and JIS G 3134, and cold-reduced base metals shall be the steel strips specified in JIS G 3135 and JIS G 3141. The symbols of grade of base metals shall be as given in Table 1 and Table 2, respectively. The steel strips specified in JIS G 3141 shall be dull finished.
- c) For steels of grades SECC, SECD, SECE, SECF and SECG given in Table 2, the temper grades and the symbols shall be as given in Table 3.

**Table 1 Symbols of grade and applicable nominal thicknesses
[hot-rolled base metal ^{a)}]**

Unit: mm

Symbol of grade	Applicable nominal thickness	Symbol of grade for hot-rolled base metal to be used	Applicable standard of base metal	Application (informative)
SEHC	1.5 or over up to and incl. 4.5	SPHC	JIS G 3131	Commercial
SEHD	1.6 or over up to and incl. 4.5	SPHD		Drawing
SEHE		SPHE		Deep drawing
SEFH490		SPFH490	JIS G 3134	Forming
SEFH540		SPFH540		
SEFH590		SPFH590		Improved forming
SEFH540Y		SPFH540Y		
SEFH590Y	2.0 or over up to and incl. 4.0	SPFH590Y		
SE330	1.6 or over up to and incl. 4.5	SS330	JIS G 3101	Commercial use (high strength)
SE400		SS400		
SE490		SS490		
SE540		SS540		
SEPH310		SAPH310	JIS G 3113	General forming (high strength)
SEPH370		SAPH370		
SEPH400		SAPH400		
SEPH440		SAPH440		

Note ^{a)} For those with a nominal thickness of 1.5 mm or over up to and including 3.2 mm, 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 Symbols of grade and applicable thicknesses (cold-reduced base metal)

Unit: mm

Symbol of grade	Applicable nominal thickness	Symbol of grade for cold-reduced base metal to be used	Applicable standard of base metal	Application (informative)
SECC ^{a)}	0.3 or over up to and incl. 3.2	SPCC	JIS G 3141	Commercial
SECD		SPCD		Drawing
SECE		SPCE		Deep drawing
SECF	0.4 or over up to and incl. 3.2	SPCF		Deep drawing (non-ageing)
SECG		SPCG		Extra deep drawing (non-ageing)
SEFC340	0.6 or over up to and incl. 2.3	SPFC340	JIS G 3135	Drawing forming
SEFC370		SPFC370		Forming
SEFC390		SPFC390		
SEFC440		SPFC440		
SEFC490		SPFC490		
SEFC540		SPFC540		Lower yield ratio type
SEFC590		SPFC590		
SEFC490Y		SPFC490Y		
SEFC540Y		SPFC540Y		
SEFC590Y		SPFC590Y		
SEFC780Y	0.8 or over up to and incl. 2.0	SPFC780Y		Bake hardening type
SEFC980Y	0.6 or over up to and incl. 1.6	SPFC980Y		
SEFC340H		SPFC340H		

Note ^{a)} Where the purchaser specifies a tensile test for SECC of standard temper grade and as-annealed state, the symbol of grade shall be SECC-T with T suffixed to SECC [see b) of Clause 15].

Table 3 Temper grade and symbol for temper grade

Temper grade	Symbol for temper grade	Applicable symbol of grade
As-annealed	A	SECC, SECD, SECE, SECF and SECG
Standard temper grade	S	
$\frac{1}{8}$ hard	8	SECC
$\frac{1}{4}$ hard	4	
$\frac{1}{2}$ hard	2	
Full hard	1	

5 Coating

5.1 Types of coating

The coating is classified into two types : non-alloy coating and alloy coating. Alloy coating indicates the coating obtained in such a way that the zinc-iron alloy ²⁾ is electroplated.

Note ²⁾ Normally, zinc-iron alloy contains at least 3 % of iron.

5.2 Coating mass

The coating mass shall be tested in accordance with 13.1.2 or 13.1.3, and the coating mass on one side of each test piece shall be at least the minimum coating mass given in Table 4. The minimum coating mass herein shall apply to the average of measured values of three test pieces taken from the sample. When the coating mass is measured in accordance with Annex JE, Table 4 shall apply to each of the measured values obtained in accordance with JE.6.5.

There are sheet and coil equally coated on both surfaces (hereafter referred to as equal coating), those differentially coated on each surface (hereafter referred to as differential coating), and those with only one side coated (hereafter referred to as one-side coating).

5.3 Symbol for coating mass

The symbol for coating mass shall be a combination of symbols for one-side coating mass as given in Table 4, to be expressed as follows.

- For sheets, the symbol for one-side coating mass shall be indicated in the order of top/bottom of the sheet piled.

Example 1 E16/E16

- For coils, the symbol for one-side coating mass shall be indicated in the order of external/internal surface of the coil.

Example 2 E16/E32

- For one-side coating, the symbol for one-side coating mass shall be indicated in the order of ferrous surface/coated surface.

Example 3 ES/E40

- d) When a mark indicating differential coating is required on a sheet or a coil, a symbol D shall be suffixed to the symbol for one-side coating mass.

Example 4 E8/E16D

Table 4 Symbol for one-side coating mass and minimum one-side coating mass

Unit: g/m²

Coating	Symbol for one-side coating mass	Minimum coating mass (one-side)		(Informative) Standard coating mass ^{a)} (one-side)
		Equal coating	Differential coating	
Non-alloy coating	ES ^{b)}	—	— ^{c)}	—
	EB	2.5	—	3
	E8	8.5	8.0	10
	E16	17.0	16.0	20
	E24	25.5	24.0	30
	E32	34.0	32.0	40
	E40	42.5	40.0	50
Alloy coating	GS ^{b)}	—	— ^{c)}	—
	GB	2.5	—	3
	G8	8.5	8.0	10
	G16	17.0	16.0	20
	G24	25.5	24.0	30
	G32	34.0	32.0	40
	G40	42.5	40.0	50
Note ^{a)} The standard coating mass is an informative value of coating mass per surface, which is derived from the practical production results. Note ^{b)} ES and GS are the symbols for one-side coating mass on ferrous surface in the case of one-side coating. Note ^{c)} The upper limit of coating mass shall be specified, and the value shall be not more than 50 mg/m² at any position excluding the edges (end parts in the width direction).				

5.4 Coating adherence

The sheets and coils, when tested in accordance with **13.1.4** and as given in Table 5 or Table 6, shall be free from flaking of the coating on the external surface of test piece (not less than 7 mm from both side edges of the test piece).

NOTE For the testing of coating adherence, see **13.1.4**.

Table 5 Coating adherence and bendability (hot-rolled base metal)

Symbol of grade	Bend- ing angle	Internal spacing ^{a)} Number of sheets				Test piece and direction
		Nominal thickness mm				
		1.5 or over to and excl. 1.6	1.6 or over to and excl. 2.0	2.0 or over to and excl. 3.2	3.2 or over	
SEHC	180°	0 (flat on itself)	0 (flat on itself)	0 (flat on itself)	1	No. 3, rolling di- rection
SEHD		—	0 (flat on itself)	0 (flat on itself)	0 (flat on itself)	
SEHE		—	0 (flat on itself)	0 (flat on itself)	0 (flat on itself)	
SEFH490		—	1	1	2	No. 3, perpen- dicular to rolling direction
SEFH540		—	2	2	3	
SEFH590		—	3	3	3	
SEFH540Y		—	2	2	3	
SEFH590Y		—	3	3	3	
SE330		—	1	1	1	No. 3, rolling di- rection/No. 3, perpendicular to rolling direction
SE400		—	3	3	3	
SE490		—	4	4	4	
SE540		—	4	4	4	
SEPH310		—	0 (flat on itself)	2	2	No. 3, perpen- dicular to rolling direction
SEPH370		—	1	2	2	
SEPH400		—	2	2	2	
SEPH440		—	2	3	3	
Note ^{a)} The number of sheets of nominal thickness. The test piece shall be bent with the in- ternal spacing not more than the total layer thickness of indicated number of sheets.						

Table 6 Coating adherence and bendability (cold-reduced base metal)

Symbol of grade	Temper grade	Bending angle	Internal spacing ^{a)} Number of sheets	Test piece and direction
SECC SECD SECE SECF SECG	As-annealed	180°	0 (flat on itself)	No. 3, rolling direction
	Standard temper grade		0 (flat on itself)	
SECC	$\frac{1}{8}$ hard		0 (flat on itself)	
	$\frac{1}{4}$ hard		1	
	$\frac{1}{2}$ hard		2	
	Full hard	—	—	—
SEFC340	—	180°	0 (flat on itself)	No. 3, perpendicular to rolling direction
SEFC370	—		0 (flat on itself)	
SEFC390	—		0 (flat on itself)	
SEFC440	—		0 (flat on itself)	
SEFC490	—		0 (flat on itself)	
SEFC540	—		1	
SEFC590	—		2	
SEFC490Y	—		0 (flat on itself)	
SEFC540Y	—		1	
SEFC590Y	—		2	
SEFC780Y	—		6	
SEFC980Y	—		8	
SEFC340H	—		0 (flat on itself)	
Note ^{a)} 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 sheet and coil shall be as given in Table 7. Unless otherwise specified, the chromate-free treatment shall apply.

Table 7 Classification and symbols for chemical treatment

Classification of chemical treatment	Symbol for chemical treatment
Chromate-free treatment	^{a)}
Untreated	M
Note ^{a)} The symbol for chromate-free treatment shall be as agreed between the purchaser and the manufacturer.	

7 Oiling

The classification and symbols for oiling for sheet and coil shall be as given in Table 8. Unless otherwise specified, sheets and coils shall be unoiled.

Table 8 Classification and symbols of oiling

Classification of oiling	Symbol for oiling
Oiled	O
Unoiled	X

8 Mechanical properties

8.1 Applicable mechanical properties

The mechanical properties applicable to sheet and coil shall be the bendability, yield point or proof stress, tensile strength, elongation, amount of bake hardening and hardness.

8.2 Bendability

The bendability of sheet and coil shall be tested in accordance with 13.2.2 and as given in Table 5 or Table 6, and the external surface of test piece (not less than 7 mm from both side edges of the test piece) shall be free from cracks and breakage that are visible to the naked eye on the base metal.

NOTE For the details of bend test, see 13.2.2.

8.3 Yield point or proof stress, tensile strength and elongation, and amount of bake hardening

The yield point or proof stress, tensile strength and elongation of sheet and coil shall be tested in accordance with 13.2.3, and the values shall satisfy the requirements in Table 9 or Table 10. The values given in Table 9 or Table 10 shall apply to the values for acceptance inspection ³⁾.

The amount of bake hardening of SEFC340H shall be tested in accordance with 13.2.4, and the value shall satisfy the requirements in given in Table 10.

Note ³⁾ Age-hardening of sheet and coil may cause an increase in yield point or proof stress and a decrease in elongation.

**Table 9 Yield point or proof stress, tensile strength and elongation
(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
			Nominal thickness mm						
			1.5 or over to and excl. 1.6	1.6 or over to and excl. 2.0	2.0 or over to and excl. 2.5	2.5 or over to and excl. 3.2	3.2 or over to and excl. 4.0	4.0 or over up to and incl. 4.5	
SEHC	—	270 min.	27 min.	29 min.	29 min.	29 min.	31 min.	31 min.	No. 5, rolling direction
SEHD	—	270 min.	—	32 min.	33 min.	35 min.	37 min.	39 min.	
SEHE	—	270 min.	—	33 min.	35 min.	37 min.	39 min.	41 min.	
SEFH490	325 min.	490 min.	—	22 min.	23 min.	24 min.	25 min.	25 min.	No. 5, perpendicular to rolling direction
SEFH540	355 min.	540 min.	—	21 min.	22 min.	23 min.	24 min.	24 min.	
SEFH590	420 min.	590 min.	—	19 min.	20 min.	21 min.	22 min.	22 min.	
SEFH540Y	295 min.	540 min.	—	—	24 min.	25 min.	26 min.	26 min.	
SEFH590Y	325 min.	590 min.	—	—	22 min.	23 min.	24 min.	24 min.	
SE330	205 min.	330 to 430	—	26 min.	26 min.	26 min.	26 min.	26 min.	No. 5, rolling direction or No. 5, perpendicular to rolling direction
SE400	245 min.	400 to 510	—	21 min.	21 min.	21 min.	21 min.	21 min.	
SE490	285 min.	490 to 610	—	19 min.	19 min.	19 min.	19 min.	19 min.	
SE540	400 min.	540 min.	—	16 min.	16 min.	16 min.	16 min.	16 min.	
SEPH310	—	310 min.	—	33 min.	34 min.	36 min.	38 min.	40 min.	No. 5, rolling direction
SEPH370	225 min.	370 min.	—	32 min.	33 min.	35 min.	36 min.	37 min.	
SEPH400	255 min.	400 min.	—	31 min.	32 min.	34 min.	35 min.	36 min.	
SEPH440	305 min.	440 min.	—	29 min.	30 min.	32 min.	33 min.	34 min.	
NOTE 1	For SEPH310, a yield point or proof stress of 185 N/mm ² or over may be used upon the agreement between the purchaser and the manufacturer.								
NOTE 2	1 N/mm ² = 1 MPa								

Table 10 Yield point or proof stress, tensile strength and elongation, and amount of bake hardening (cold-reduced base metal)

Symbol of grade	Yield point or proof stress N/mm ²	Tensile strength N/mm ²	Elongation %						Amount of bake hardening N/mm ²	Test piece and direction
			Nominal thickness mm							
			0.30 or over to and excl. 0.40	0.40 or over to and excl. 0.60	0.60 or over to and excl. 1.0	1.0 or over to and excl. 1.6	1.6 or over to and excl. 2.5	2.5 or over up to and incl. 3.2		
SECC ^{a)}	—	270 min.	31 min.	34 min.	36 min.	37 min.	38 min.	39 min.	—	No. 5 ^{c)} , rolling direction
SECD	—	270 min.	33 min.	36 min.	38 min.	39 min.	40 min.	41 min.	—	
SECE	—	270 min.	35 min.	38 min.	40 min.	41 min.	42 min.	43 min.	—	
SECF ^{b)}	—	270 min.	—	40 min.	42 min.	43 min.	44 min.	45 min.	—	
SECG ^{b)}	—	270 min.	—	42 min.	44 min.	45 min.	46 min.	46 min.	—	
SEFC340	175 min.	340 min.	—	—	34 min.	35 min.	35 min. ^{d)}	—	—	No. 5, perpendicular to rolling direction
SEFC370	205 min.	370 min.	—	—	32 min.	33 min.	33 min. ^{d)}	—	—	
SEFC390	235 min.	390 min.	—	—	30 min.	31 min.	31 min. ^{d)}	—	—	
SEFC440	265 min.	440 min.	—	—	26 min.	27 min.	27 min. ^{d)}	—	—	
SEFC490	295 min.	490 min.	—	—	23 min.	24 min.	24 min. ^{d)}	—	—	
SEFC540	325 min.	540 min.	—	—	20 min.	21 min.	21 min. ^{d)}	—	—	
SEFC590	355 min.	590 min.	—	—	17 min.	18 min.	18 min. ^{d)}	—	—	
SEFC490Y	225 min.	490 min.	—	—	24 min.	25 min.	25 min. ^{d)}	—	—	
SEFC540Y	245 min.	540 min.	—	—	21 min.	22 min.	22 min. ^{d)}	—	—	
SEFC590Y	265 min.	590 min.	—	—	18 min.	19 min.	19 min. ^{d)}	—	—	
SEFC780Y	365 min.	780 min.	—	—	13 min. ^{e)}	14 min.	14 min. ^{f)}	—	—	
SEFC980Y	490 min.	980 min.	—	—	6 min. ^{e)}	7 min.	7 min. ^{f)}	—	—	
SEFC340H	185 min.	340 min.	—	—	34 min.	35 min.	—	—	30 min.	
The yield point or proof stress, tensile strength and elongation of SECD, SECE, SECF and SECG shall apply to as-annealed or standard temper grade sheet and coil.										
NOTE 1 N/mm ² = 1 MPa										
Note ^{a)} Applicable to SECC when the purchaser specifies a tensile test [see Note ^{a)} to Table 2].										
Note ^{b)} The sheets and coils of SECF and SECG shall be free from stretcher strain marks during forming for a period of six months after manufacture.										
Note ^{c)} When it is impracticable to take Test piece No. 5, the shape and elongation of test piece shall be as agreed between the purchaser and the manufacturer.										
Note ^{d)} The nominal thickness to which the elongation is applied shall be 1.6 mm or over up to and including 2.3 mm.										
Note ^{e)} The nominal thickness to which the elongation is applied shall be 0.8 mm or over to and excluding 1.0 mm.										
Note ^{f)} The nominal thickness to which the elongation is applied shall be 1.6 mm or over up to and including 2.0 mm.										

8.4 Hardness

The hardness of sheet and coil of SECC shall be tested in accordance with **13.2.5**, and the value shall satisfy the requirements in Table 11 or Table 12. Unless otherwise specified, the hardness shall be as given in Table 11. If a sheet or coil is so thin that the hardness cannot be measured using Rockwell hardness scale B (hereafter referred to as HRB), the hardness may be determined using 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 the value may be converted to that of HRB in accordance with the conversion table of Table 13 to Table 15. Examples of HRB and minimum thickness are shown in Table 16. The hardness not given in the conversion table shall be converted by interpolation.

When a diamond anvil is used to measure the hardness of HR15T or HR30T, the influence by indentation on the rear surface of test piece is permissible.

The hardness shall not apply to as-annealed or standard temper grade SECC.

NOTE In some cases, the measurement result of hardness is incorrect if a thin test piece is used. **JIS Z 2245** specifies that “In general, no deformation should be visible on the back of the test piece after the test”, and shows, for reference, the formula for calculating the minimum thickness of sample in the case of using a spherical indenter as given in Table 17.

Table 11 Rockwell hardness of SECC (HRB)

Temper grade	Symbol for temper grade	HRBS or HRBW ^{a)}
$\frac{1}{8}$ hard	8	50 to 71
$\frac{1}{4}$ hard	4	65 to 80
$\frac{1}{2}$ hard	2	74 to 89
Full hard	1	85 or over
Note ^{a)} Either HRBS or HRBW may be measured. In case of dispute, HRBS shall apply.		

Table 12 Vickers hardness of SECC (HV)

Temper grade	Symbol for temper grade	HV
$\frac{1}{8}$ hard	8	95 to 130
$\frac{1}{4}$ hard	4	115 to 150
$\frac{1}{2}$ hard	2	135 to 185
Full hard	1	170 or over

Table 13 Hardness conversion from HR30TS to HRBS

HR30TS	Converted HRBS	HR30TS	Converted HRBS	HR30TS	Converted HRBS	HR30TS	Converted HRBS
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 ^{a)}	98.3

This table is applicable to the conversion from HR30TW to HRBW. In case of dispute, HR30TS shall apply.

NOTE Converted values in this table are derived from Table 2 of **ASTM E140**. Hardness not in the table of **ASTM** is obtained by interpolation.

Note ^{a)} When HR30TS exceeds 82.0, the converted value of HRBS shall be expressed as “over 98.3”. Alternatively, the converted value of HRBS obtained by extrapolation may be reported as an approximation.

Table 14 Conversion table from HR15TS to HRBS

HR15TS	Converted HRBS	HR15TS	Converted HRBS	HR15TS	Converted HRBS	HR15TS	Converted HRBS
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 ^{a)}	99.7
75.5	45.7	81.5	64.2	87.5	82.7		

This table may be applied to a conversion from HR15TW to HRBW. In case of dispute, HR15TS shall apply.

NOTE Converted values in this table are derived from Table 2 of **ASTM E140**. Hardness not in the table of **ASTM** is obtained by interpolation.

Note ^{a)} When HR15TS exceeds 93.0, the converted value of HRBS shall be expressed as “over 99.7”. Alternatively, the converted value of HRBS obtained by extrapolation may be reported as an approximation.

Table 15 Hardness conversion from HV to HRBS

HV	Converted HRBS	HV	Converted HRBS	HV	Converted HRBS	HV	Converted HRBS
85	41.0	145	76.6	210	93.4	330	—
90	48.0	150	78.7	220	95.0	340	(108.0) ^{a)}
95	52.0	155	79.9	230	96.7	350	—
100	56.2	160	81.7	240	98.1	360	(109.0) ^{a)}
105	59.4	165	83.1	250	99.5	370	—
110	62.3	170	85.0	260	(101.0) ^{a)}	380	(110.0) ^{a)}
115	65.0	175	86.1	270	(102.0) ^{a)}		
120	66.7	180	87.1	280	(103.5) ^{a)}		
125	69.5	185	88.8	290	(104.5) ^{a)}		
130	71.2	190	89.5	300	(105.5) ^{a)}		
135	73.2	195	90.7	310	—		
140	75.0	200	91.5	320	(107.0) ^{a)}		

NOTE Converted values in this table are derived from Table 1 of **SAE J417**. Hardness not in the table of **SAE** is obtained by interpolation.

Note ^{a)} The values in parentheses are outside the scope of HRBS, and shown for reference. It may be reported as an approximation.

Table 16 HRB and example of minimum thickness

HRBS or HRBW	50	65	74	85
Minimum thickness mm	2.40	1.95	1.68	1.35

Table 17 Calculation formula for minimum thickness of test piece (mm)

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 (mm) H : hardness value		

9 Dimensions and dimensional tolerances

9.1 Expression of dimensions

9.1.1 Denomination of thickness

The denomination of thickness of sheet and coil shall be as follows.

- The thickness of base metal before coating shall be taken as the nominal thickness.
- 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 of each surface (total of both surfaces) given in Table 18 to the nominal thickness expressed to the third decimal place. The resultant value shall be rounded off to the second decimal place according to Rule A of **JIS Z 8401**.

Table 18 Equivalent coating thickness

Unit: mm

Symbol for one-side coating mass	EB GB	E8 G8	E16 G16	E24 G24	E32 G32	E40 G40
Equivalent coating thickness (one-side)	0	0.001	0.003	0.004	0.005	0.006

9.1.2 Unit of dimensions

The unit of dimensions for sheet and coil shall be as follows.

- The dimensions of sheet shall be expressed by the nominal thickness, width and length in millimetres.
- The dimensions of coil shall be expressed by the nominal thickness and width in millimetres. If the mass of coil is the theoretical value, its length shall be expressed in metres.

9.2 Standard nominal thicknesses

The standard nominal thickness of sheet and coil shall be as given in Table 19.

Table 19 Standard nominal thickness

Unit: mm

Standard nominal thickness										
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	2.5	2.6	2.8	2.9	3.2	3.6	4.0	4.5	

9.3 Dimensional tolerances

The dimensional tolerances shall be as follows.

- Tolerances on product thickness** The tolerances on product thickness of sheet and coil shall be as follows.
 - The tolerances on product thickness shall apply to the thickness specified in **9.1.1 b)**.
 - The tolerances on product thickness shall be as given in Table JA.1.
 - The tolerances on product thickness shall apply to the thickness at a position not less than 15 mm from the edge (end part in the width direction), or at the centre in the width direction if the width is under 30 mm.
 - The tolerances on product thickness shall not apply to any defective portions in welds of coil or others.
- Tolerances on width** The tolerances on width of sheet and coil shall be as given in Table JA.1. The tolerances on width shall apply to a normal portion of coil and an arbitrary portion of sheet.
- Tolerances on length** The tolerances on length of sheet shall be as given in Table