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Hot-rolled mild steel plates, sheet and strip

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

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Contents

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 3131**:2005 is replaced with this Standard.

However, **JIS G 3131**:2005 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 19th October, 2011.

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.

Hot-rolled mild steel plates, sheet and strip

Introduction

This Japanese Industrial Standard has been prepared based on the fourth edition of **ISO 3573** published in 2008 with some modifications of the technical contents.

The portions with continuous sidelines or dotted underlines are the matters in which the content of the corresponding International Standard has been modified. A list of modifications with explanations is given in Annex JA.

1 Scope

This Standard specifies the hot-rolled mild steel plates, sheets and strips (hereafter referred to as "steel sheets and strips") intended for general fabricating purposes and processing.

NOTE 1 The steel sheet and strip may be descaled by pickling or shot blasting after the hot-rolling operation on request by the purchaser.

NOTE 2 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 3573:2008 *Hot-rolled carbon steel sheet of commercial and drawing qualities* (MOD)

The 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

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 3193 *Dimensions, mass and permissible variations of hot rolled steel plates, sheets and strips*

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

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

JIS Z 2248 *Metallic materials—Bend test*

3 Grade and symbols

The steel sheet and strip shall be classified into 4 grades, and their symbols shall be as given in table 1.

Table 1 Symbol of grade

Symbol of grade	Application thickness mm	Application
SPHC	1.2 or over up to and incl. 14	For commercial
SPHD	1.2 or over up to and incl. 14	For processing
SPHE	1.2 or over up to and incl. 8	
SPHF	1.4 or over up to and incl. 8	

4 Chemical composition

The steel sheet and strip shall be tested in accordance with **9.1**, and their heat analysis values shall be as given in table 2.

Table 2 Chemical composition

Unit: %

Symbol of grade	C	Mn	P	S
SPHC	0.12 max.	0.60 max.	0.045 max.	0.035 max.
SPHD	0.10 max.	0.45 max.	0.035 max.	0.035 max.
SPHE	0.08 max.	0.40 max.	0.030 max.	0.030 max.
SPHF	0.08 max.	0.35 max.	0.025 max.	0.025 max.

5 Mechanical properties

5.1 Tensile strength and elongation

The steel sheet and strip shall be tested in accordance with **9.2** and their tensile strength and elongation shall be as specified in table 3. However, the values in table 3 shall be applied to those for delivery inspection [1)].

Note [1)] Steel sheets and strips may decrease the elongation by age hardening.

5.2 Bendability

When the SPHC steel sheet and strip are tested in accordance with **9.2** and the bend test conditions specified in table 3, there shall not be any cracks on the outer surface of the test piece.

NOTE : See **9.2.3** for the operation of bend test.

Table 3 Mechanical properties [a)]

Symbol of grade	Tensile strength [b)] N/mm²	Elongation %						Tensile test piece	Bendability			
		Thickness 1.2 mm or over to and excl. 1.6 mm	Thickness 1.6 mm or over to and excl. 2.0 mm	Thickness 2.0 mm or over to and excl. 2.5 mm	Thickness 2.5 mm or over to and excl. 3.2 mm	Thickness 3.2 mm or over to and excl. 4.0 mm	Thickness 4.0 mm or over		Bendability angle	Inside radius		Test piece
										Thickness under 3.2 mm	Thickness 3.2 mm or over	
SPHC	270 min.	27 min.	29 min.	29 min.	29 min.	31 min.	31 min.	No. 5, in rolling direction	180°	Flat on itself	Thickness × 0.5	No. 3, in rolling direction
SPHD	270 min.	30 min.	32 min.	33 min.	35 min.	37 min.	39 min.		—	—	—	
SPHE	270 min.	32 min.	34 min.	35 min.	37 min.	39 min.	41 min.		—	—	—	
SPHF	270 min.	37 min.	38 min.	39 min.	39 min.	40 min.	42 min.		—	—	—	

NOTE : 1 N/mm² = 1 MPa

Notes [a)] The value specified in table 3 shall not be applied to the irregular portions of both ends of the steel strip.

[b)] The following may be applied as the upper limit of tensile strength as agreed between the purchaser and the manufacturer.

SPHC: 440 N/mm², SPHD: 420 N/mm², SPHE: 400 N/mm², SPHF: 380 N/mm²

6 Shape, dimensions, mass and tolerances

The shape, dimensions, mass and their tolerances of the steel sheet and strip shall conform to **JIS G 3193**. However, the tolerances on thickness shall be in accordance with table 4 and the measurement of edge camber shall be carried out when requested by the purchaser.

With this respect, tolerances on length for the steel sheet and those on width for the cut-edge steel sheet shall, unless otherwise specified, be in accordance with the tolerance A of **JIS G 3193**. However, as for the width tolerance for slit material of width less than 600 mm, tolerance C of **JIS G 3193** shall be applied.

Table 4 Tolerances on thickness

Unit: mm

Thickness	Width			
	Under 1 200	1 200 or over to and excl. 1 500	1 500 or over to and excl. 1 800	1 800 or over to and incl. 2 300
Under 1.60	±0.14	±0.15	±0.16 [a)]	—
1.60 or over to and excl. 2.00	±0.16	±0.17	±0.18	±0.21 [b)]
2.00 or over to and excl. 2.50	±0.17	±0.19	±0.21	±0.25 [b)]
2.50 or over to and excl. 3.15	±0.19	±0.21	±0.24	±0.26
3.15 or over to and excl. 4.00	±0.21	±0.23	±0.26	±0.27
4.00 or over to and excl. 5.00	±0.24	±0.26	±0.28	±0.29
5.00 or over to and excl. 6.00	±0.26	±0.28	±0.29	±0.31
6.00 or over to and excl. 8.00	±0.29	±0.30	±0.31	±0.35
8.00 or over to and excl. 10.0	±0.32	±0.33	±0.34	±0.40
10.0 or over to and excl. 12.5	±0.35	±0.36	±0.37	±0.45
12.5 or over to and encl. 14.0	±0.38	±0.39	±0.40	±0.50

Tolerances on thickness shall be as follows.

— The thickness shall be measured at any point on the steel sheet and strip not less than 20 mm from a side edge (width direction end part). For the steel sheet and strip under 40 mm in width, measurement shall be made at the mid-width thereof.

— The values specified in table 4 shall not be applied to the irregular portions of both ends of the steel strip.

— The tolerance on thickness of the steel sheet which is not manufactured from the steel strip may be agreed between the purchaser and the manufacturer.

Notes [a)] The value shall be applied to the steel sheet and strip under 1 600 mm in width.

[b)] The value shall be applied to the steel sheet and strip under 2 000 mm in width.

As for the squareness of cut-edge steel sheet, the following method using the diagonal line may be applied. However, when question arises, **JIS G 3193** shall be applied.

Obtain 1/2 of absolute value of the difference of two diagonal lines of steel sheet (X_1 and X_2 in figure 1) ($|X_1 - X_2|/2$), and this value shall not exceed 0.7 % of measured width W.

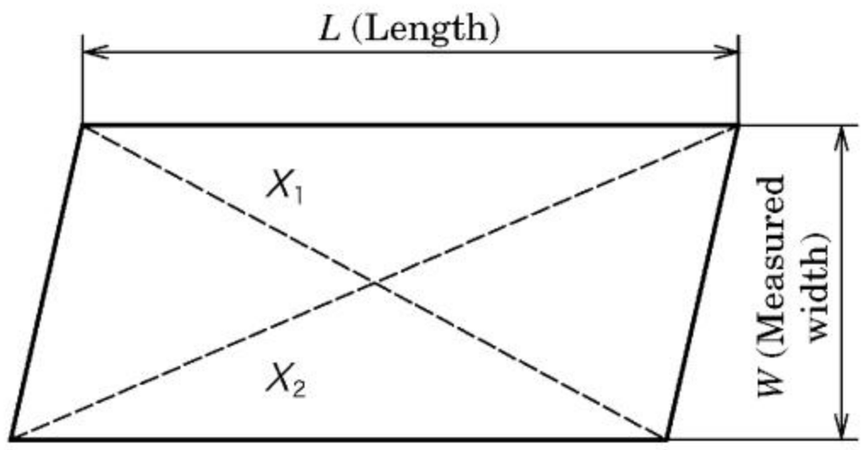

Figure 1 Squareness of steel sheet (using diagonal line)

7 Oiling

Oiling shall be as follows unless otherwise specified.

a) Steel sheets and strips descaled by acid pickling or shot-blasting shall be oiled.

b) Steel sheets and strips as rolled shall not be oiled.

8 Appearance

The appearance of the steel sheet and strip shall be in accordance with clause **7** of **JIS G 3193**. The repair by welding shall not be performed.

If necessary, the treatment of irregular portions of steel strip may be agreed between the manufacturer and the purchaser.

9 Tests

9.1 Chemical analysis

9.1.1 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 shall be as specified in clause **8** of **JIS G 0404**.

9.1.2 Analysis method

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

9.2 Mechanical test

9.2.1 General requirements for mechanical test

The general requirements for mechanical testing shall be in accordance with the specifications in clause **7** and clause **9** of **JIS G 0404**. With this respect, the sampling method shall conform to Class A of **7.6** of **JIS G 0404**, and the number of test pieces and the sampling position shall be as follows:

a) **Number of test pieces** The number of test pieces shall be as follows.

1) **For steel strip and cut lengths thereof** One test piece each for tensile and bend tests shall be taken from each test lot of the same heat rolled to the same thickness. When the mass of one test lot exceeds 50 t, however, two sets of test pieces shall be taken from the lot.

2) **For steel sheet** (excluding cut lengths thereof) One test piece each for tensile and bend tests shall be taken from each test lot of the same heat where the maximum thickness of the steel sheet is within twice the minimum thickness thereof. When the mass of one test lot exceeds 50 t, however, two sets of test pieces shall be taken from the lot.

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

9.2.2 Tensile test

The tensile test shall be carried out as given in the following:

a) No. 5 test piece specified in **JIS Z 2201** shall be used.

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

9.2.3 Bend test

The bend test shall be carried out as given in the following:

a) No. 3 test piece specified in **JIS Z 2248** shall be used.

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

The bend test may be omitted[2)]. However, when especially designated by the purchaser, the test shall be performed.

Note [2)] The test may be omitted by the decision of the manufacturer, but bendability shall be satisfied.

10 Inspection and reinspection

10.1 Inspection

The inspection shall be carried out as follows.

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

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

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

d) The shape, dimensions and mass shall conform to the requirements specified in clause **6**.

e) The appearance shall conform to the requirements specified in clause **8**.

10.2 Re-inspection

The steel sheet and strip having failed to meet the requirements of the mechanical test may be subjected to a retest for final acceptance according to the specifications of **9.8** in **JIS G 0404**.

11 Marking

The steel sheet and strip having passed the inspection shall be marked with the following details for each bundle by suitable means. The steel sheets which are not bundled shall be marked for each sheet.

a) Symbol of grade

b) Heat number or inspection number

c) Dimensions

d) The number of sheets for each bundle or mass

e) Manufacturer's name or its abbreviation

12 Items to be confirmed at the time of order

To specify the requirement items specified in this Standard suitably, the following information should be added to the specified items at the time of contract.

a) Necessary or not of pickling or shot-blast for descaling,

b) Type of edge (mill edge or cut edge),

c) Necessary or not of skin-pass,

d) Usage, method of forming (if possible) and so on.

13 Report

When requested by the purchaser in advance, the manufacturer shall submit an inspection document including the test results. In the case, the report shall be in accordance with the requirements of clause **13** in **JIS G 0404**. The type of inspection document shall be, unless otherwise specified, 2.3 or 3.1.B in table 1 of **JIS G 0415**.

Annex JA (informative)

Comparison table between JIS and corresponding International Standard

JIS G 3131:2010 *Hot-rolled mild steel plates, sheet and strip*			**ISO 3573**:2008 *Hot-rolled carbon steel sheet of commercial and drawing qualities*				
(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		Clause No.	Content	Classification by clause	Detail of technical deviation	
1 Scope	Hot-rolled mild steel plates, sheets and strips intended for general fabricating purposes and processing are specified.		1	Hot-rolled mild plates, sheets and strips intended for general fabricating purposes and drawing are specified.	Alteration		**JIS** has changed "for drawing" to "for processing".
2 Normative references							
3 Grade and symbols	Four types of grades are specified.		1	Four types of grades are specified.	Identical		
4 Chemical composition	Chemical composition of four elements C, Mn, P, S are specified.		5.2	Chemical composition of four elements C, Mn, P, S and additional alloy elements are specified.	Deletion	Four elements are almost corresponding to **JIS** by the **ISO** standard.	**JIS** has deleted regulations of the alloy element.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		Clause No.	Content	Classification by clause	Detail of technical deviation	
5 Mechanical properties	Tensile strength, elongation and bendability are specified.		5.6	Tensile strength and elongation are specified.	Addition	In **ISO**, bendability was deleted at the revision.	Responding to the deletion of bendability in **ISO**, bendability was specified in **JIS** to be applied when required.
					Alteration	**JIS** and **ISO** differ in tensile strength and elongation. **ISO** specifies tensile strength by the upper limit, contrary to the lower limit in **JIS**. It was permitted in **JIS** to apply the upper limit values of **ISO** according to the agreement.	**JIS** and **ISO** also differ in the shape of the test piece and the tensile direction.
6 Shape, dimensions, mass and tolerances	The shape, dimensions, mass and their tolerances are specified.		6	Tolerances of the shape and dimensions are specified.	Alteration	In **JIS**, some tolerances are greater or smaller compared to those in **ISO**.	**JIS** and **ISO** differ in the tolerances.
			13	It is required to specify the inside diameter, the maximum outside diameter and the maximum mass of the coil.	Deletion	In **JIS** there is no description of the inside diameter and the maximum outside diameter of the coil.	The inside diameter and the maximum outside diameter of the coil are the matters of contract and deleted.
7 Oiling	The oiling is specified.		4.4	The oiling is specified.	Identical		
8 Appearance	The appearance is specified.		11	The appearance is specified.	Addition	In **JIS** treatment of irregular portions is specified.	

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		Clause No.	Content	Classification by clause	Detail of technical deviation	
9 Tests	Analytical test, tensile test and bend test are specified.		5.3	Analytical test is specified.	Identical		
			7	Sampling frequency of the tensile test piece is specified.	Identical		
			8	Tensile test method is specified.	Alteration	The tensile direction is the rolling direction in **JIS** and perpendicular to the rolling direction in **ISO**.	Modification of the tensile direction will cause the confusion in the market.
10.1 Inspection	Inspection is specified.		—	—	Addition	**JIS** specifies inspection in one integrated clause, while **ISO** specifies it in each clause.	This is the unique configuration to **JIS**.
10.2 Reinspection	Reinspection and the judgement are specified.		9	Reinspection is specified.	Identical		
			10	Judgement of the reinspection is specified.	Identical		
11 Marking	Marking of five items is specified.		14	Marking of seven items is specified.	Deletion	In **ISO**, marking of the number of the standard and the order number are specified in addition to five items in **JIS**.	In **JIS**, the number of the standard can be replaced by the symbol of grade. The order number is a matter of contract and is deleted.
12 Items to be confirmed at the time of order	Confirming items at the time of ordering as four items are specified.		15	Information of 12 items to be supplied by the purchaser is specified.	Deletion	In **JIS**, a part of items are deleted.	In **JIS**, items related to quality are specified.

(I) Requirements in **JIS**		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between **JIS** and the International Standard by clause		(V) Justification for the technical deviation and future measures
No. and title of clause	Content		Clause No.	Content	Classification by clause	Detail of technical deviation	
13 Report	The report is specified.		—	No item	Addition	In **JIS**, the report is specified.	For addition of the specification of the report, proposal will be submitted to **ISO**.
—	—		3	Terms and definitions are specified.	Deletion	In **JIS**, terms and definitions are deleted.	Terms are defined in **JIS G 0203**.
—	—		12	Inspection observed by the purchaser is specified.	Deletion	Inspection observed by the purchaser is deleted in **JIS**.	The products covered by this Standard are for general use and it is not required.

Overall degree of correspondence between **JIS** and International Standard (**ISO 3573**:2008): MOD

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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