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Rolled steels for general structure

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Iron and Steel Federation (JISF) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS G 3101** : 2004 has been replaced with this Standard.

In addition, **JIS G 3101** : 2004 may be applied in **JIS** Mark Certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until 19th May, 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.

Rolled steels for general structure

1 Scope

This Japanese Industrial Standard specifies the hot rolled steels used for general structure such as bridges, ships, rolling stocks and other structures (hereafter referred to as "steel product").

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 0416 *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

JIS G 3191 *Dimensions, mass and permissible variations of hot rolled steel bars and bar in coil*

JIS G 3192 *Dimensions, mass and permissible variations of hot rolled steel sections*

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

JIS G 3194 *Dimensions, mass and permissible variations of hot rolled flat steel*

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 symbol, and applicable dimension

The steel product shall be classified into four grades and their symbols and applicable dimension shall be as given in table 1.

Table 1 Symbol of grade and applicable dimension

Symbol of grade	Steel product	Applicable dimension
SS330	Steel plates and sheets, steel strip in coil, flats and bars	—
SS400	Steel plates and sheets, steel strip in coil, sections, flats and bars	—
SS490		
SS540	Steel plates and sheets, steel strip in coil, sections and flats	40 mm or under in thickness
	Steel bars	40 mm or under in diameter, side length or distance across flats
NOTE : Steel bars include bar-in coils.		

4 Chemical composition

The steel product shall be tested in accordance with 8.1 and the cast analysis values thereof shall be as given in table 2.

Table 2 Chemical composition

Unit : %

Symbol of grade	C	Mn	P	S
SS330	—	—	0.050 max.	0.050 max.
SS400				
SS490				
SS540	0.30 max.	1.60 max.	0.040 max.	0.040 max.
Alloying elements other than those given in this table may be added as necessary.				

5 Mechanical properties

The steel product shall be tested in accordance with 8.2 and the yield point or yield strength, tensile strength, elongation and bendability thereof shall be as given in table 3.

In the case of the bendability, the outside surface of the bent portion shall be free from visible crack.

NOTE : For the bend test, see 8.2.1.

Table 3 Mechanical properties

Symbol of grade	Yield point or yield strength N/mm²				Tensile strength	Thickness of steel product [a)]	Test piece for tensile test	Elongation	Bendability		
	Thickness of steel product [a)] mm								Angle of bending	Inside radius	Test piece [c)]
	16 or under	Over 16 up to and incl. 40	Over 40 up to and incl. 100	Over 100	N/mm²	mm		%			
SS330	205 min.	195 min.	175 min.	165 min.	330 to 430	Steel plates and sheets, steel strip in coil and flats 5 or under in thickness	No. 5	26 min.	180°	Half of the thickness	No. 1
						Steel plates and sheets, steel strip in coil and flats over 5 up to and incl. 16 in thickness	No. 1A	21 min.			
						Steel plates and sheets, steel strip in coil and flats over 16 up to and incl. 50 in thickness	No. 1A	26 min.			
						Steel plates and sheets, and flats over 40 in thickness	No. 4	28 min.[b)]			
						Steel bars 25 or under in diameter, side or distance across flats	No. 2	25 min.	180°	Half of the diameter, side or distance across flats	No. 2
						Steel bars over 25 in diameter, side or distance across flats	No. 14A	28 min.			

Table 3 (continued)

Symbol of grade	Yield point or yield strength N/mm²				Tensile strength	Thickness of steel product [a]	Test piece for tensile test	Elongation	Bendability		
	Thickness of steel product [a] mm								Angle of bending	Inside radius	Test piece [c]
	16 or under	Over 16 up to and incl. 40	Over 40 up to and incl. 100	Over 100	N/mm²	mm		%			
SS400	245 min.	235 min.	215 min.	205 min.	400 to 510	Steel plates and sheets, steel strip in coil, flats and sections 5 or under in thickness	No. 5	21 min.	180°	1.5 times the thickness	No. 1
						Steel plates and sheets, steel strip in coil, flats and sections over 5 up to and incl. 16 in thickness	No. 1A	17 min.			
						Steel plates and sheets, steel strip in coil, flats and sections over 16 up to and incl. 50 in thickness	No. 1A	21 min.			
						Steel plates and sheets, flats and sections over 40 in thickness	No. 4	23 min.[b]			
						Steel bars 25 or under in diameter, side or distance across flats	No. 2	20 min.	180°	1.5 times the diameter, side or distance across flats	No. 2
						Steel bars over 25 in diameter, side or distance across flats	No. 14A	22 min.			

Table 3 (continued)

Symbol of grade	Yield point or yield strength N/mm²				Tensile strength	Thickness of steel product [a]	Test piece for tensile test	Elongation	Bendability		
	Thickness of steel product [a] mm								Angle of bending	Inside radius	Test piece [c]
	16 or under	Over 16 up to and incl. 40	Over 40 up to and incl. 100	Over 100	N/mm²	mm		%			
SS490	285 min.	275 min.	255 min.	245 min.	490 to 610	Steel plates and sheets, steel strip in coil, flats and sections 5 or under in thickness	No.5	19 min.	180°	2.0 times the thickness	No. 1
						Steel plates and sheets, steel strip in coil, flats and sections over 5 up to and incl. 16 in thickness	No. 1A	15 min.			
						Steel plates and sheets, steel strip in coil, flats and sections over 16 up to and incl. 50 in thickness	No. 1A	19 min.			
						Steel plates and sheets, flats and sections over 40 in thickness	No. 4	21 min.[b]			
						Steel bars 25 or under in diameter, side or distance across flats	No. 2	18 min.	180°	2.0 times the diameter, side or distance across flats	No. 2
						Steel bars over 25 in diameter, side or distance across flats	No. 14A	20 min.			

Table 3 (concluded)

Symbol of grade	Yield point or yield strength N/mm²				Tensile strength	Thickness of steel product [a]	Test piece for tensile test	Elongation	Bendability		
	Thickness of steel product [a] mm								Angle of bending	Inside radius	Test piece [c]
	16 or under	Over 16 up to and incl. 40	Over 40 up to and incl. 100	Over 100	N/mm²	mm		%			
SS540	400 min.	390 min.	—	—	540 min.	Steel plates and sheets, steel strip in coil, flats and sections 5 or under in thickness	No. 5	16 min.	180°	2.0 times the thickness	No. 1
						Steel plates and sheets, steel strip in coil, flats and sections over 5 up to and incl. 16 in thickness	No. 1A	13 min.			
						Steel plates and sheets, steel strip in coil, flats and sections over 16 up to and incl. 40 in thickness	No. 1A	17 min.			
						Steel bars 25 or under in diameter, side or distance across flats	No. 2	13 min.	180°	2.0 times the diameter, side or distance across flats	No. 2
						Steel bars over 25 up to and incl. 40 in diameter, side or distance across flats	No. 14A	16 min.			

NOTE : 1 N/mm² = 1 MPa

Notes [a] As to the term "thickness of steel product" for sections, it means the thickness at the position of which the test piece(s) are taken. With this respects, in the case of bars, it means the diameter for round bars, the side length (or width) for square bars and distance across flats for hexagonal bars.

[b] For the elongation of No. 4 test piece for steel plates over 90 mm in thickness, subtract 1 from the values of elongation given in this table per each increase of 25.0 mm or its fraction in thickness. However, the limit to be subtracted shall be 3.

[c] No. 3 test piece may be used for the bend test for the steel product of 5 mm or under in thickness.

6 Shape, dimensions, mass and tolerances thereof

The shape, dimensions, mass and tolerances thereof shall be in accordance with **JIS G 3191**, **JIS G 3192**, **JIS G 3193** and **JIS G 3194**.

With this respect, the width tolerances for the cut-edged steel plate, sheet and steel strip in coil, and length tolerances for the steel plate and sheet shall be in accordance with Class A tolerances of table 7 (tolerance on width) and table 8 (tolerance A on length of the steel plate and sheet) given in **JIS G 3193**, unless otherwise specified. Tolerances of thickness division not specified in **JIS G 3193** may be agreed between the purchaser and the supplier.

7 Appearance

Appearance of the steel product shall be in accordance with clause **9** in **JIS G 3191**, clause **9** in **JIS G 3192**, clause **7** in **JIS G 3193** and clause **10** in **JIS G 3194**.

8 Test

8.1 Chemical analysis

The chemical analysis shall be as follows :

a) **General requirement for chemical analysis** The general requirements for chemical analysis and sampling methods for analysis shall be as specified in clause **8** of **JIS G 0404**.

b) **Analytical method** The test method of heat analysis shall be in accordance with **JIS G 0320**.

8.2 Mechanical test

8.2.1 Test in general General requirements for mechanical testing shall be as specified in clause **7** and clause **9** of **JIS G 0404**. The sampling method shall conform to Class A of **7.6** of **JIS G 0404**.

The bend test may be omitted [1)]. However, when the purchaser designates, the test shall be performed.

Note [1)] It means that the test may be omitted by the manufacturer's decision, but it means that the bendability shall satisfy the specification.

8.2.2 Number of test pieces for tensile test and bend test

The number of test pieces for tensile test and bend test shall be as follows :

a) **Steel plate and flat** A test lot shall consist of the steel product from one heat where the maximum thickness of the steel product is within twice the minimum thickness, and one test piece shall be taken from each. When the mass of one test lot exceeds 50 t, however, two test pieces shall be taken from each. With this re-

spect, if mass of a single steel plate exceeds 50 t, one test piece shall be taken from each said plate.

b) **Steel coil and cut-to-length there from** A test lot shall consist of the steel product from one heat rolled to the same thickness, and one test piece shall be taken from each. When the mass of one test lot exceeds 50 t, however, two test pieces shall be taken from each.

c) **Steel section** A test lot shall consist of the section from one heat rolled to the same sectional profile group where the maximum thickness of the section is within twice the minimum thickness, and one test piece shall be taken from each. When the mass of one test lot exceeds 50 t, however, two test pieces shall be taken from each.

d) **Steel bar** A test lot shall consist of the steel bar from one heat rolled to the same sectional profile group where the maximum diameter (side length or distance across flats) is within twice the minimum diameter (side length or distance across flats), and one test piece shall be taken from each. When the mass of one test lot exceeds 50 t, however, two test pieces shall be taken from each.

e) **Number of test pieces for heat-treated steel product** The number of test pieces for the heat-treated steel product composed of the same heat rolled to the same sectional profile group where it is subjected to heat treatment under the same conditions shall be determined in accordance with **a)**, **b)**, **c)**, and **d)** in this item, respectively.

8.2.3 Sampling position of the test piece for tensile tests and bend test

Sampling position of the test piece for tensile tests and bend tests shall be in accordance with **JIS G 0416**. However, the centre in the width direction of test piece of steel plate, steel strip and flat shall be 1/4 of the width from the edge or close position to this.

8.2.4 Test piece

The tensile test piece and the bend test piece shall be as follows :

a) The tensile test piece is No. 1A, 2, 4, 5 or 14A test piece specified in **JIS Z 2201**.

b) The bend test piece is No. 1, 2 or 3 test piece specified in **JIS Z 2248**.

8.2.5 Test method

The methods for tensile test and bend test shall be as follows :

a) The method for tensile test shall be in accordance with **JIS Z 2241**.

b) The method for bend test shall be in accordance with **JIS Z 2248**.

8.2.6 Tensile test in the case where tensile test piece having specified dimensions can not be taken

In the case where it is infeasible to secure the specified dimensions of the test piece, matters on execution of tensile test, the test result values, etc. shall be agreed upon between the purchaser and the supplier.

9 Inspection

The inspection shall be carried out as follows :

a) General requirements for inspection shall be in accordance with **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 **7**.

10 Re-inspection

The steel product which has not passed the tensile test and bend test may be subjected to a retest in accordance with **9.8** in **JIS G 0404** to determine whether it is acceptable or not.

11 Marking

The steel product which has passed the inspection shall be marked on each piece or each bundle with the following details by suitable means. However, a part of them may be omitted subjected to the agreement between the purchaser and the supplier.

a) Symbol of grade

NOTE : Additional mark, which is decided on the order form or upon the agreement between the purchaser and the supplier, may be suffixed for the purpose of discrimination at the purchaser side.

b) Heat number or inspection number

c) Dimensions Marking of dimension shall be in accordance with clause 4 of **JIS G 3191**, clause 4 of **JIS G 3192**, clause 3 of **JIS G 3193**, and clause 4 of **JIS G 3194**.

d) Quantity or mass of each bundle (for steel plate, sheet and steel strip in coil)

e) Manufacturer's name or its identifying brand

12 Report

The report shall conform to the requirement of clause 13 in **JIS G 0404**. However, unless otherwise specified at the time of ordering, the type of inspection document shall conform to either standard designation **2.3** or **3.1.B** in table 1 of **JIS G 0415**.

For chemical composition, when alloy elements other than those in table 2 are added, the content of added alloy element shall be reported in the result table.

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Errata will be provided upon request, please contact:

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