Rolled Steel for General Structure

1. Scope

This Japanese Industrial Standard specifies the hot rolled steel used for general structure such as buildings, bridges, ships, rolling stocks and other structures, hereinafter referred to as the "rolled steel".

Remark: Units and numerical values indicated in { } in this Standard are based on the International System of Unit (SI) and are appended as reference.

Further, the customary units and numerical values shown in this Standard shall be unified into the SI units on and after Jan. 1, 1991.

2. Classification and Symbols

The rolled steel shall be classified into four classes and their symbols are shown in Table 1-1 and Table 1-2.

Table 1-1. Classification and Symbols
(applicable till the end of 1990)

Symbol	Remarks
SS 34	Steel plates and sheets, strips, flats and bars
SS 41	Steel plates and sheets, strips, flats, bars and shapes
SS 50	
SS 55	Steel plates and sheets, strips, flats, and shapes of 40 mm or under in thickness and steel bars of 40 mm or under in diameter, side or distance between flats

Remark: Steel bars include bar-in-coils.

Table 1-2. Classification and Symbols
(applicable on and after Jan. 1, 1991)

Symbol		Remarks
SI units	(Reference) Customary units	
SS 330	SS 34	Steel plates and sheets, strips, flats and bars
SS 400	SS 41	Steel plates and sheets, strips, flats, bars and shapes
SS 490	SS 50	
SS 540	SS 55	Steel plates and sheets, strips, flats, and shapes of 40 mm or under in thickness and steel bars of 40 mm or under in diameter, side or distance between flats

Remark: Steel bars include bar-in-coils.

3. Chemical Composition

Rolled steel shall be tested in accordance with 7.1 and the values of the ladle analysis shall conform to Table 2-1 or Table 2-2.

Table 2-1. Chemical Composition
(applicable till the end of 1990)

Symbol	Chemical composition %			
	C	Mn	P	S
SS 34	–	–	0.050 max.	0.050 max.
SS 41				
SS 50				
SS 55	0.30 max.	1.60 max.	0.040 max.	0.040 max.

Remark: Alloy elements other than shown in the above Table may be added to the rolled steel of SS 55 as required.

Table 2-2. Chemical compostion
(Applicable on and after Jan. 1, 1991)

Symbol	Chemical compostion %			
	C	Mn	P	S
SS 330	–	–	0.050 max.	0.050 max.
SS 400				
SS 490				
SS 540	0.30 max.	1.60 max.	0.040 max.	0.040 max.

Remark: Alloy elements other than shown in the above Table may be added to the rolled steel of SS 540 as required.

4. Mechanical Properties

Rolled steel shall be tested in accordance with 7.2 and the yield point or strength, tensile strength, elongation and bend of the rolled steel shall conform to Table 3-1 or Table 3-2, and there shall arise no cracks on the external surface of rolled steel when bent.

Table 3-1. Mechanical properties (Applicable until the end of 1990)

Symbol	Yield point or yield strength kgf/mm² (N/mm²) Thickness of rolled steel(¹) mm			Tensile strength kgf/mm² (N/mm²)	Dimensions of rolled steel mm	Test piece	Elongation %	Bend property		
	16 or under	Over 16 up to 40	Over 40					Angle of bending	Inside radius	Test piece
SS 34	21 min. (206) min.	20 min. (196) min.	18 min. (177) min.	34 to 44 (333 to 431)	Steel plates and sheets, strips and flat steel of 5 or under in thickness	No. 5	26 min.	180°	Half of the thickness	No. 1
					Steel plates and sheets, strips and flat steel of over 5 up to 16 in thickness	No. 1A	21 min.			
					Steel plates and sheets, strips and flat steel of over 16 up to 50 in thickness	No. 1A	26 min.			
					Steel plates and sheets and flat steel of over 40 in thickness	No. 4	28 min.			
					Steel bars of 25 or under in diameter, side or distance across flats	No. 2	25 min.	180°	Half of the diameter, side or distance between flats	No. 2
					Steel bars of over 25 in diameter, side or distance across flats	No. 3	30 min.			
SS 41	25 min. (245) min.	24 min. (235) min.	22 min. (216) min.	41 to 52 (402 to 510)	Steel plates and sheets, strips, flats and shapes of 5 or under in thickness	No. 5	21 min.	180°	1.5 times the thickness	No. 1
					Steel plates and sheets, strips, flats and shapes of over 5 up to 16 in thickness	No. 1A	17 min.			
					Steel plates and sheets, strips, flats and shapes of over 16 up to 50 in thickness	No. 1A	21 min.			
					Steel plates and sheets, flats and shapes of over 40 in thickness	No. 4	23 min.			
					Steel bars of 25 or under in diameter, side or distance across flats	No. 2	20 min.	180°	1.5 times the diameter, side or distance between flats	No. 2
					Steel bars of over 25 in diameter, side or distance across flats	No. 3	24 min.			

Table 3-1 (Continued)

Symbol	Yield point or yield strength kgf/mm² (N/mm²) Thickness of rolled steel(1) mm: 16 or under	Over 16 up to 40	Over 40	Tensile strength kgf/mm² (N/mm²)	Dimensions of rolled steel mm	Test piece	Elongation %	Bend property: Angle of bending	Inside radius	Test piece
SS 50	29 min. (284) min.	28 min. (275) min.	26 min. (255) min.	50 to 62 (490 to 608)	Steel plates and sheets, strips, flats and shapes of 5 or under in thickness	No. 5	19 min.	180°	2.0 times the thickness	No. 1
					Steel plates and sheets, strips, flats and shapes of over 5 up to 16 in thickness	No. 1 A	15 min.			
					Steel plates and sheets, strips, flats and shapes of over 16 up to 50 in thickness	No. 1 A	19 min.			
					Steel plates and sheets, flat bars and shapes of over 40 in thickness	No. 4	21 min.			
					Steel bars of 25 or under in diameter, side or distance between flats.	No. 2	18 min.	180°	2.0 times the diameter, side or distance between flats	No. 2
					Steel bars of over 25 in diameter side or distance between flats.	No. 3	21 min.			
SS 55	41 min. (402) min.	40 min. (392) min.	—	55 min. (539) min.	Steel plates and sheets, strips, flats and shapes of 5 or under in thickness	No. 5	16 min.	180°	2.0 times the thickness	No. 1
					Steel plates and sheets, strips, flats and shapes of over 5 up to 16 in thickness	No. 1 A	13 min.			
					Steel plates and sheets, strips, flats and shapes of over 16 up to 40 in thickness	No. 1 A	17 min.			
					Steel bars of 25 or under in diameter, side or distance between flats	No. 2	13 min.	180°	2.0 times the diameter, side or distance between flats	No. 2
					Steel bars of over 25 up to 40 in diameter, side or distance between flats	No. 3	17 min.			

Note (1) Where thickness of bar steel is concerned, thickness shall be based on the diameter in the case of round bars, on the side in the case of square bars and on the distance between flats in the case of polygonal bars such as hexagonal bars.

Remarks 1. The requirements prescribed in Table 3-1 shall not be applied to either end of strips.
2. The yield point or yield strength for rolled steel SS 34, SS 41 and SS 50 over 100 mm in thickness, diameter, side or distance between flats shall be 17 kgf/mm² or over, 21 kgf/mm² or over and 25 kgf/mm², respectively.
3. The elongation of the No. 4 test piece for steel plates over 90 mm in thickness shall be obtained by reducing the vavalue of 1 % from the values of elongation given in Table 3-1 for every increase of 25.0 mm or its fraction in thickness up to the limit of 3 %.
4. No. 3 test piece may be used in the bend test for the rolled steel 5 mm or under in thickness.

Table 3-2. Mechanical Properties (applicable on and after Jan. 1, 1991)

Symbol	Yield point or yield strength (N/mm²) Thickness of rolled steel(1) mm: 16 or under	Over 16 up to 40	Over 40	Tensile strength (N/mm²)	Dimensions of rolled steel mm	Test piece	Elongation %	Bend property: Angle of bending	Inside radius	Test piece
SS 330	205 min.	195 min.	175 min.	330 to 430	Steel plates and sheets, strips and flats steel of 5 or under in thickness	No. 5	26 min.	180°	Half of the thickness	No. 1
					Steel plates and sheets, strips and flat steel of over 5 up to 16 in thickness	No. 1 A	21 min.			
					Steel plates and sheets, strips and flat steel of over 16 up to 50 in thickness	No. 1 A	26 min.			
					Steel plates and sheets and flat steel of over 40 in thickness	No. 4	28 min.			
					Steel bars of 25 or under in diameter, side or distance across flats	No. 2	25 min.	180°	Half of the diameter, side or distance between flats	No. 2
					Steel bars of over 25 in diameter, side or distance across flats	No. 3	30 min.			
SS 400	245 min.	235 min.	215 min.	400 to 510	Steel plates and sheets, strips, flats and shapes of 5 or under in thickness	No. 5	21 min.	180°	1.5 times the thickness	No. 1
					Steel plates and sheets, strips, flats and shapes of over 5 up to 16 in thickness	No. 1 A	17 min.			
					Steel plates and sheets, strips, flats and shapes of over 16 up to 50 in thickness	No. 1 A	21 min.			
					Steel plates and sheets, flats and shapes of over 40 in thickness	No. 4	23 min.			
					Steel bars of 25 or under in diameter, side or distance across flats	No. 2	20 min.	180°	1.5 times the diameter, side or distance between flats	No. 2
					Steel bars of over 25 in diameter, side or distance across flats	No. 3	24 min.			

Table 3-2 (Continued)

Symbol	Yield point or yield strength kgf/mm² (N/mm²) Thickness of rolled steel(1) mm: 16 or under	Over 16 up to 40	Over 40	Tensile strength kgf/mm² (N/mm²)	Dimensions of rolled steel mm	Test piece	Elongation %	Bend property: Angle of bending	Inside radius	Test piece
SS 490	285 min.	275 min.	255 min.	490 to 610	Steel plates and sheets, strips, flats and shapes of 5 or under in thickness	No. 5	19 min.	180°	2.0 times the thickness	No. 1
					Steel plates and sheets, strips, flats and shapes of over 5 up to 16 in thickness	No. 1 A	15 min.			
					Steel plates and sheets, strips, flats and shapes of over 16 up to 50 in thickness	No. 1 A	19 min.			
					Steel plates and sheets, flat bars and shapes of over 40 in thickness	No. 4	21 min.			
					Steel bars of 25 or under in diameter, side or distance between flats.	No. 2	18 min.	180°	2.0 times the diameter, side or distance between flats	No. 2
					Steel bars of more than 25 in dia., side or distance between flats.	No. 3	21 min.			
SS 540	400 min.	390 min.	—	540 min.	Steel plates and sheets, strips, flats and shapes of 5 or under in thickness	No. 5	16 min.	180°	2.0 times the thickness	No. 1
					Steel plates and sheets, strips, flats and shapes of over 5 up to 16 in thickness	No. 1 A	13 min.			
					Steel plates and sheets, strips, flats and shapes of over 16 up to 40 in thickness	No. 1 A	17 min.			
					Steel bars of 25 or under in diameter, side or distance between flats	No. 2	13 min.	180°	2.0 times the diameter, side or distance between flats	No. 2
					Steel bars of over 25 up to 40 in diameter, side or distance between flats	No. 3	17 min.			

Note (1) Where thickness of bar steel is concerned, thickness shall be based on the diameter in the case of round bars, on the side in the case of square bars and on the distance between flats in the case of polygonal bars such as hexagonal bars.

Remarks
1. The requirements prescribed in Table 3-2 shall not be applied to either end of strips.
2. The yield point or yield strength for rolled steel SS 330, SS 400 and SS 490 over 100 mm in thickness, diameter, side or distance between flats shall be 165 N/mm² or over, 205 N/mm² or over and 245 N/mm², respectively.
3. The elongation of the No. 4 test piece for steel plates over 90 mm in thickness shall be obtained by reducing the value of 1 % from the values of elongation given in Table 3-2 for every increase of 25.0 mm or its fraction in thickness up to the limit of 3 %.
4. No. 3 test piece may be used in the bend test for the rolled steel 5 mm or under in thickness.

5. Shape, Dimensions, Weight and Tolerance

The shape, dimensions, weight and tolerance of the rolled steel shall conform to the following Standards.

JIS G 3191

JIS G 3192

JIS G 3193

JIS G 3194

Unless otherwise specified, the tolerance on the length of the steel plates and strips and the tolerance on the width of the cut-edged steel plates and strips shall conform to the tolerance A.

6. Appearance

Appearance of steel plates and strips shall conform to 8 of JIS G 3191, 9 of JIS G 3192, 7 of JIS G 3193 and 8 of JIS G 3194.

7. Test

7.1 Chemical Analysis

(1) The general requirements and the sampling method for the chemical analysis shall conform to the specifications in 3. of JIS G 0303.

(2) The method of chemical analysis shall conform to one of the following Standards:

JIS G 1211 JIS G 1213 JIS G 1214 JIS G 1215
JIS G 1253 JIS G 1256 JIS G 1257

7.2 Mechanical Test

7.2.1 The general requirements for the mechanical test shall conform to 4. of JIS G 0303. The method of sampling test specimen shall conform to Group A and the number of test pieces and the sampling position shall be as follows.

(1) Numbers of Test Pieces for Tensile Test and Bend Test

(a) Steel Plates and Flat Steels One test piece shall be sampled from each lot of steel plates and flat steels of the same heat the maximum thickness of which is within twice the minimum thickness. Two test pieces shall be taken from each lot when the weight of the lot exceeds 50 tons.

(b) Steel Strips and Plates Cut from Steel Strips One test piece shall be sampled from each lot of steel strips and plates cut from the steel strips of the same heat and the same thickness. Two test pieces shall be taken from each lot when the weight of the lot exceeds 50 tons.

(c) Steel Bars One test piece shall be sampled from each lot of steel bars of the same heat and same section of which the maximum diameter, side or distance between flats are within twice the minimum diameter, side or distance between flats, respectively. Two test pieces shall be taken from each lot when the weight of the lot exceeds 50 tons.

(d) Steel Shapes One test piece shall be sampled from each lot of steel shapes of the same heat and section of which the maximum thickness is within twice the minimum thickness. Two test pieces shall be taken from each lot when the weight of the lot exceeds 50 tons.

(e) Number of Test Pieces The number of rolled steel test pieces which are further heat-treated shall conform to (a), (b), (c) and (d) for the same heat, cross section and heat-treating conditions.

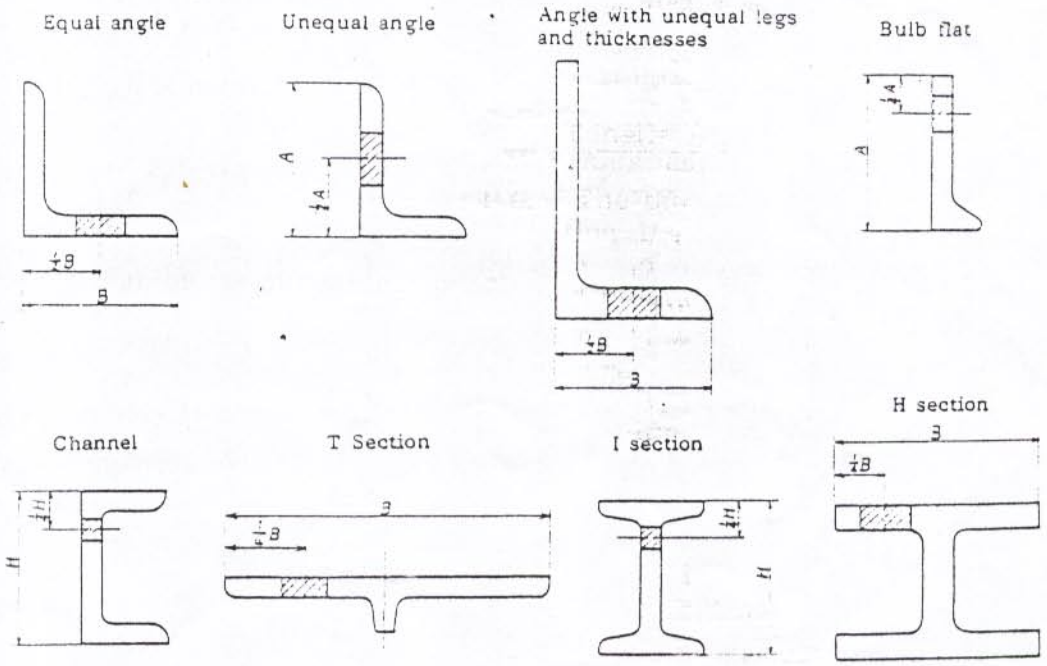
(2) Sampling Positions of Test Pieces for Tensile Test and Bend Test

(a) Steel Plates, Strips and Flat Steel The test pieces shall be sampled with their centers at a position 1/4 of the width away from the edge. In case it is impossible to find the center of the test piece at the above-mentioned position, select the location nearest to such position.

(b) Steel Shapes The sampling position shall conform to Figure. In case Figure is not applicable, the location nearest to the position shall be selected. In case of the H section from which the test piece cannot be sampled as shown in Figure, conform to the example of the I section.

The sampling positions of other shapes shall be in accordance with the agreement between the parties concerned on acceptance.

Fig. 1. Sampling Positions of Test Pieces for Tensile Test and Bend Test of Steel Shapes



7.2.2 The tensile test piece and the bend test piece shall conform to the following specifications:

(1) No. 1 A, 2, 3, 4 or 5 test piece specified in JIS Z 2201.

(2) No. 1, 2 or 3 test piece specified in JIS Z 2204.

7.2.3 The methods of the tensile test and the bend test shall conform to the following Standards:

JIS Z 2241 JIS Z 2248

8. Inspection

(1) The results of inspection with respect to the chemical composition mechanical properties, shape, dimensions mass and appearance shall conform to the specifications prescribed in 3., 4., 5. and 6.

(2) The tensile test of steel strips may be omitted with approval of the purchaser.

(3) The performance of the tensile test or the values of the tension test when the tension test piece of specified dimensions is unavailable shall be determined in accordance with the agreement between the purchaser and the manufacturer.

(4) The steel which has not been qualified in the tensile test and the bend test may be retested in accordance with the specification in 4.4 of JIS G 0303.

9. Marking

Each piece or group of rolled steel which has passed the inspection shall be marked with the following items by appropriate method. Part of the items may be omitted with the approval of the purchaser.

(1) Symbol indicating the class

(2) Heat number or inspection number

(3) Dimensions

(4) Quantity or weight of each bundle in the case of steel plates and strips

(5) Name of manufacturer or its abbreviation

10. Report

The report shall conform to the specifications in 8. of JIS G 0303.

In the case where the Remark of Table 2-1 or 2-2 is applied, the report shall contain the amounts of alloy elements added.