UDC 669.14.018.29:669.14-12

# JIS

## JAPANESE INDUSTRIAL STANDARD

# Rolled steels for general structure

## JIS G 3101–1995

**Translated and Published**

**by**

**Japanese Standards Association**

Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

UDC 669.14.018.29:669.14-12

JAPANESE INDUSTRIAL STANDARD J I S

# Rolled steels for general structure G 3101-1995

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").

Remarks: The standards cited in this Standard are given in Attached Table 1.

2. Grade and symbol The steel product shall be classified into four categories and their symbols shall be as given in Table 1.

Table 1. Symbol of grade

| Symbol of grade | Applicable steel product |
|---|---|
| SS330 | Steel plates and sheets, coils, flats and bars |
| SS400 | Steel plates and sheets, coils, sections, flats and bars |
| SS490 | |
| SS540 | Steel plates and sheets, coils, sections and flats 40 mm or under in thickness and steel bars 40 mm or under in diameter, side length or distance across flats |

Remarks: Steel bars include bar-in-coils.

3. Chemical composition The steel product shall be tested in accordance with 7.1 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. |

Remarks: Alloying elements other than those given in Table 2 may be added as necessary.

4. Mechanical properties The steel product shall be tested in accordance with 7.2 and the yield point or yield strength, tensile strength, elongation and bendability thereof shall be as given in Table 3. As to the bendability, the outside surface of the bent portion shall be free from visible crack.

Table 3. Mechanical properties

| Symbol of grade | Yield point or yield strength N/mm² | | | Tensile strength | Thickness of steel product(1) | Test piece | Elongation | Bendability | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thickness of steel product(1) mm | | | | | | | Angle of bending | Inside radius | Test piece |
| | 16 or under | Over 16 up to 40 | Over 40 | N/mm² | mm | | % | | | |
| SS330 | 205 min. | 195 min. | 175 min. | 330 to 430 | Steel plates and sheets, coils and flats 5 or under in thickness | No. 5 | 26 min. | 180° | Half of the thickness | No. 1 |
| | | | | | Steel plates and sheets, coils and flats over 5 up to 16 in thickness | No. 1A | 21 min. | | | |
| | | | | | Steel plates and sheets, coils and flats over 16 up to 50 in thickness | No. 1A | 26 min. | | | |
| | | | | | Steel plates and sheets, and flats over 40 in thickness | No. 4 | 28 min. | | | |
| | | | | | 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. 3 | 30 min. | | | |

Table 3. (continued)

| Symbol of grade | Yield point or yield strength N/mm² | | | Tensile strength | Thickness of steel product(1) | Test piece | Elongation | Bendability | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thickness of steel product(1) mm | | | | | | | Angle of bending | Inside radius | Test piece |
| | 16 or under | Over 16 up to 40 | Over 40 | N/mm² | mm | | % | | | |
| SS400 | 245 min. | 235 min. | 215 min. | 400 to 510 | Steel plates and sheets, coils, flats and sections 5 or under in thickness | No. 5 | 21 min. | 180° | 1.5 times the thickness | No. 1 |
| | | | | | Steel plates and sheets, coils, flats and sections over 5 up to 16 in thickness | No. 1A | 17 min. | | | |
| | | | | | Steel plates and sheets, coils, flats and sections over 16 up to 50 in thickness | No. 1A | 21 min. | | | |
| | | | | | Steel plates and sheets, flats and sections over 40 in thickness | No. 4 | 23 min. | | | |
| | | | | | 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. 3 | 24 min. | | | |

Table 3. (continued)

| Symbol of grade | Yield point or yield strength N/mm² | | | Tensile strength | Thickness of steel product(1) | Test piece | Elongation | Bendability | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thickness of steel product(1) mm | | | | | | | Angle of bending | Inside radius | Test piece |
| | 16 or under | Over 16 up to 40 | Over 40 | N/mm² | mm | | % | | | |
| SS490 | 285 min. | 275 min. | 255 min. | 490 to 610 | Steel plates and sheets, coils, flats and sections 5 or under in thickness | No. 5 | 19 min. | 180° | 2.0 times the thickness | No. 1 |
| | | | | | Steel plates and sheets, coils, flats and sections over 5 up to 16 in thickness | No. 1A | 15 min. | | | |
| | | | | | Steel plates and sheets, coils, flats and sections over 16 up to 50 in thickness | No. 1A | 19 min. | | | |
| | | | | | Steel plates and sheets, flats and sections over 40 in thickness | No. 4 | 21 min. | | | |
| | | | | | 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. 3 | 21 min. | | | |

Table 3. (continued)

| Symbol of grade | Yield point or yield strength N/mm² | | | Tensile strength | Thickness of steel product(1) | Test piece | Elongation | Bendability | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thickness of steel product(1) mm | | | | | | | Angle of bending | Inside radius | Test piece |
| | 16 or under | Over 16 up to 40 | Over 40 | N/mm² | mm | | % | | | |
| SS540 | 400 min. | 390 min. | - | 540 min. | Steel plates and sheets, coils, flats and sections 5 or under in thickness | No. 5 | 16 min. | 180° | 2.0 times the thickness | No. 1 |
| | | | | | Steel plates and sheets, coils, flats and sections over 5 up to 16 in thickness | No. 1A | 13 min. | | | |
| | | | | | Steel plates and sheets, coils, flats and sections over 16 up to 50 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 in diameter, side or distance across flats | No. 3 | 17 min. | | | |

Note (1) As to the term "thickness of steel product" for sections, it means the thickness at the position of which the test piece(s) is taken as shown in Fig. 1.

With this respect, 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 polygonal bars such as hexagonal bars.

Remarks 1. The values given in Table 3 shall not be applied to the both ends of the steel coil.

2. The yield point or yield strength for the product SS330, SS400 and SS490 over 100 mm in thickness, diameter, side length or distance across flats shall be 165 $N/mm^2$ or over, 205 $N/mm^2$ or over and 245 $N/mm^2$, respectively.

3. For the elongation of No. 4 test piece for steel plates over 90 mm in thickness, it shall be subracted 1 % from the values of elongation given in Table 3 per each increase of 25.0 mm or its fraction in thickness. However, the limit to be subtracted shall be 3 %.

4. No. 3 test piece may be used for the bend test for the steel product 5 mm or under in thickness.

5. Shape, dimensions, mass and tolerances thereof The shape, dimensions, mass and tolerances thereof shall be in accordance with the following standards.

JIS G 3191, JIS G 3192, JIS G 3193, JIS G 3194

With this respect, the width tolerances for the cut-edged steel plate, sheet and coil, and length tolerances for the steel plate and sheet shall be in accordance with Class A tolerances given in JIS G 3193, unless otherwise specified.

6. Appearance Appearance of the steel product shall be in accordance with 8. in JIS G 3191, 9. in JIS G 3192, 6. in JIS G 3193 and 8. in JIS G 3194.

7. Test

7.1 Chemical analysis

7.1.1 General requirement for chemical analysis and sampling method of specimen for analysis The chemical composition of the steel product shall be determined by cast analysis, and the general requirements for chemical analysis and sampling methods of specimen for analysis shall be as specified in 3. of JIS G 0303.

7.1.2 Analytical method The method for chemical analysis shall be in accordance with any 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, JIS G 1258

7.2 Mechanical test

7.2.1 Test in general General requirements for mechanical testing shall be as specified in 4. of JIS G 0303. With this respect the sampling method of specimen shall conform to Class A, and the number of test pieces and the sampling position shall be as follows.

(1) 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 respective one test piece shall be taken therefrom. When the mass of one test lot exceeds 50 t, however, respective two test pieces shall be taken. With this respect, if mass of a single steel plate exceeds 50 t, respective one test piece shall be taken from the said plate.

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

(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 respective one test piece shall be taken therefrom. When the mass of one test lot exceeds 50 t, however, respective two test pieces shall be taken.

(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 respective one test piece shall be taken therefrom. When the mass of one test lot exceeds 50 t, however, respective two test pieces shall be taken.

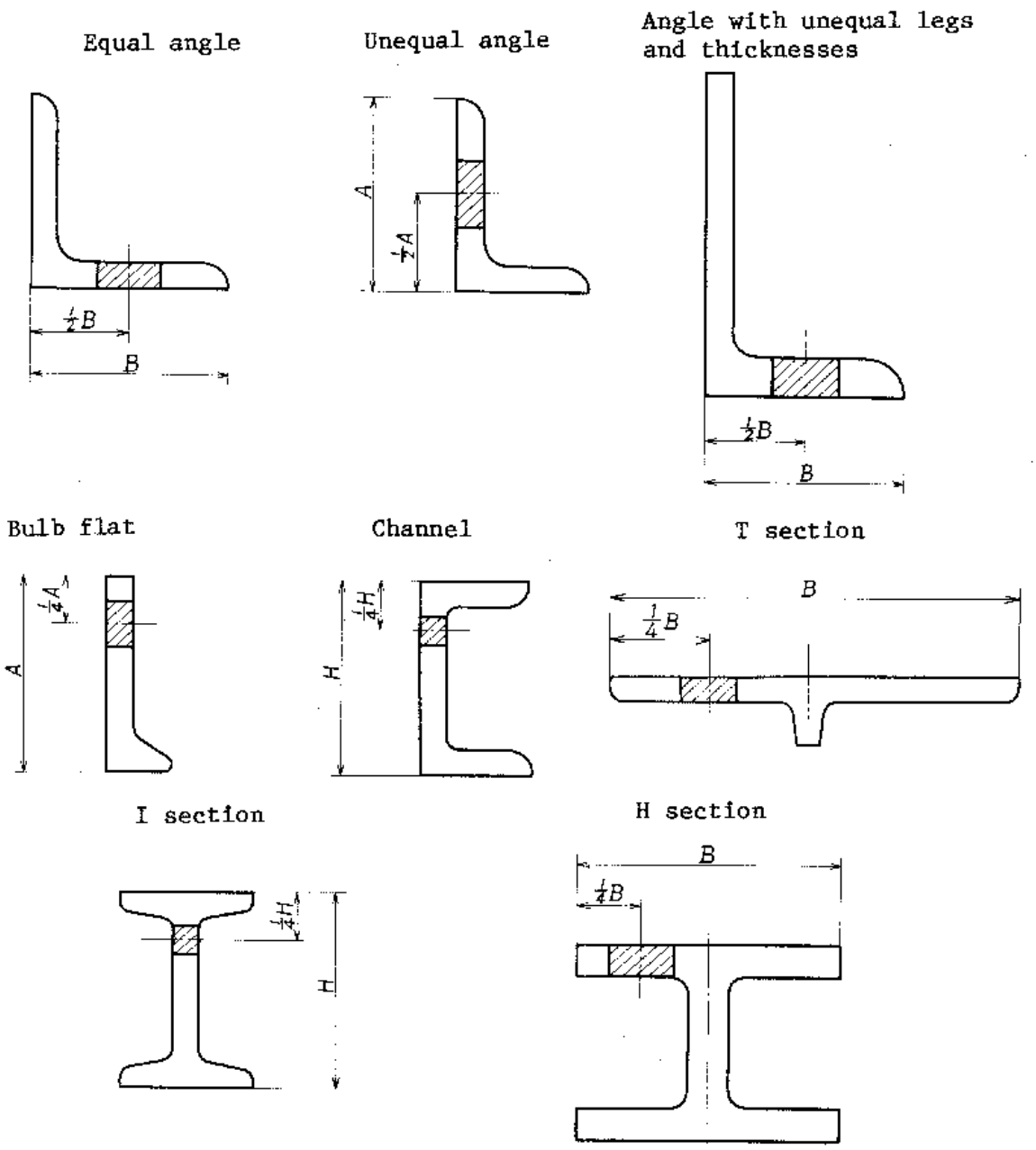
(e) Number of test pieces for heat-treated steel product The number of test pieces for the heat-treated steel product composed of the same heat rolled to the same sectional profile group subjected to heat treatment under the same heat treatment conditions shall be determined in accordance with (a), (b),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

(2) Sampling position of test piece for tensile test and bend test Sampling position of test pieces for tensile test and bend test shall be as follows:

(a) Steel plate, sheet, coil and flat The centre of the test piece shall be at a quarter-width position from a side edge, and further in the case of No. 4 test piece, it shall be at a quarter-thickness position from a surface as well as at a quarter-width position from a side edge. When it is infeasible to allow the centre of the test piece to be at a quarter-width position from a side edge or at a quarter-thickness position from a surface, however, the sampling should be performed as close to the aforementioned position as possible.

(b) Steel section The sampling position shall be as shown in Fig. 1. When it is infeasible to take a specimen as shown in Fig. 1, the sampling position should be as close to the aforementioned position as possible. In the case of the steel section from which a specimen is unable to take in the same manner as shown in Fig. 1, the sampling position for the I section should be applied mutatis mutandis. For other steel sections, it should be agreed between the purchaser and supplier.

Fig. 1. Sampling position of test pieces for tensile test and bend test for steel section



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

(1) No. 1A, 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 Test method The methods for tensile test and bend test shall be as follows:

(1) JIS Z 2241

(2) JIS Z 2248

7.2.4 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 testing, test result values or the like shall be agreed upon between the purchaser and supplier.

7.2.5 Omission of tensile test of steel coil The tensile test of the steel coil may be omitted when approved by the purchaser.

7.2.6 Omission of bend test The bend test may be omitted when approved by the purchaser.

8. Inspection

8.1 Inspection The inspection shall be carried out as follows:

(1) General requirements for inspection shall be as specified in JIS G 0303.

(2) The chemical composition shall conform to the requirements specified in 3.

(3) The mechanical properties shall conform to the requirements specified in 4.

(4) The shape, dimensions and mass shall conform to the requirements specified in 5.

(5) The appearance shall conform to the requirements specified in 6.

8.2 Reinspection The steel product which has not passed the tensile test and bend test may be subjected to a retest according to the specification of 4.4 in JIS G 0303 to determine whether it is acceptable or not.

9. 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 supplier.

(1) Symbol of grade

(2) heat number or inspection number

(3) Dimensions

(4) Quantity or mass of each bundle (for steel plate, sheet and coil)

(5) Manufacturer's name or its identifying brand

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

In the case where the Remarks of Table 2 is applied, the content of added element(s) shall be additively described in the test report.

Attached Table 1. Cited standards

| | |
|---|---|
| JIS G 0303 | General rules for inspection of steel |
| JIS G 1211 | Iron and steel - Methods for determination of carbon content |
| JIS G 1213 | Methods for determination of manganese in iron and steel |
| JIS G 1214 | Methods for determination of phosphorus in iron and steel |
| JIS G 1215 | Iron and steel - Methods for determination of sulfur content |
| JIS G 1253 | Iron and steel - Method for spark discharge atomic emission spectrometric analysis |
| JIS G 1256 | Method for X-ray fluorescence spectrometric analysis of iron and steel |
| JIS G 1257 | Iron and steel - Methods for atomic absorption spectrometric analysis |
| JIS G 1258 | Methods for inductively coupled plasma emission spectrochemical analysis of steel |
| JIS G 3191 | Shape, dimensions, weight and tolerance for hot rolled steel bar 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 strip |
| JIS G 3194 | Shape, dimensions, weight and tolerance for hot rolled flat steel |
| JIS Z 2201 | Test pieces for tensile test for metallic materials |
| JIS Z 2204 | Bend test pieces for metallic materials |
| JIS Z 2241 | Method of tensile test for metallic materials |
| JIS Z 2248 | Method of bend test for metallic materials |

G 3101-1995
Edition 5

Japanese Text

Established by Minister of International Trade and Industry

Date of Establishment: 1952-11-25

Date of Revision: 1995-11-01

Date of Public Notice in Official Gazette: 1995-11-01

Investigated by: Japanese Industrial Standards Committee

Divisional Council on Iron and Steel

Technical Committee on General Steel Products

This English translation is published by:
Japanese Standards Association
1-24, Akasaka 4, Minato-ku,
Tokyo 107 Japan


Printed in Tokyo by
Hohbunsha Co., Ltd.