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Stainless steel for building structure

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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 Japanese Society of Steel Construction (JSSC)/Japanese Standards Association (JSA) 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 4321 : 2000**), which has been technically revised.

However, **JIS G 4321 : 2000** 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 March 2023.

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Stainless steel for building structure

1 Scope

This Japanese Industrial Standard specifies the requirements for stainless steels used for building structures (hereafter referred to as steels).

- a) Hot-formed H sections
- b) Hot-formed equal-leg angles
- c) Hot-formed U sections
- d) Cold-formed equal-leg angles
- e) Hot-rolled steel bars and cold-finished steel bars (round bars, square bars, hexagonal bars and flat bars)
- f) Circular steel tubes and centrifugally cast steel tubes
- g) Square and rectangular tubes
- h) Hot-rolled steel sheets and strips
- i) Cold-rolled steel sheets and strips

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 0320 *Standard test method for heat analysis of steel products*
- JIS G 0321 *Product analysis and its tolerance for wrought steel*
- JIS G 0404 *Steel and steel products — General technical delivery requirements*
- JIS G 0415 *Steel and steel products — Inspection documents*
- JIS G 0571 *Method of oxalic acid etching test for stainless steels*
- JIS G 0572 *Method of ferric sulfate-sulfuric acid test for stainless steel*
- JIS G 0573 *Method of 65 per cent nitric acid test for stainless steels*
- JIS G 0575 *Method of copper sulfate-sulfuric acid test for stainless steels*
- JIS G 3446 *Stainless steel tubes for machine and structural purposes*
- JIS G 3466 *Carbon steel square and rectangular tubes for general structure*

- JIS G 3468 *Large diameter welded stainless steel pipes*
JIS G 3475 *Carbon steel tubes for building structure*
JIS G 4303 *Stainless steel bars*
JIS G 4304 *Hot-rolled stainless steel plate, sheet and strip*
JIS G 4305 *Cold-rolled stainless steel plate, sheet and strip*
JIS G 4317 *Hot-formed stainless steel sections*
JIS G 4318 *Cold finished stainless steel bars*
JIS G 4320 *Cold-formed stainless steel sections*
JIS G 5121 *Corrosion-resistant cast steels for general applications*
JIS Z 2241 *Metallic materials — Tensile testing — Method of test at room temperature*
JIS Z 3121 *Methods of tensile test for butt welded joints*
JIS Z 8401 *Rounding of numbers*

3 Terms and definitions

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

4 Symbols of grades

Steels shall be classified into four grades, and the symbols of the grades shall be as given in Table 1.

Table 1 Symbols of grades

Symbol of grade
SUS304A
SUS304N2A
SUS316A
SCS13AA-CF ^{a)}
Note ^{a)} SCS13AA-CF is applicable to centrifugally cast steel tubes only. "CF" denotes a centrifugally cast steel tube.

5 Manufacturing method

The manufacturing method shall be as follows.

- The manufacturer shall produce the steels by an appropriate method to meet the quality required in this Standard.
- If required, the manufacturing method shall be as agreed between purchaser and

manufacturer.

6 Chemical composition

6.1 Heat analysis values

When tested in accordance with **13.1**, the steels shall satisfy the heat analysis values given in Table 2.

6.2 Product analysis values

When the product analysis of steels is requested by the purchaser, the test shall be carried out in accordance with **13.1**. The resultant product analysis values shall satisfy the requirements specified in Table 2 within tolerances given in Table 5 of **JIS G 0321**.

Table 2 Chemical composition

Symbol of grade	Unit: %									
	C	Si	Mn	P	S	Ni	Cr	Mo	N	Others
SUS304A	0.08 max.	1.00 max.	2.00 max.	0.045 max.	0.030 max.	8.00 to 10.50	18.00 to 20.00	—	—	—
SUS304N2A	0.08 max.	1.00 max.	2.50 max.	0.045 max.	0.030 max.	7.50 to 10.50	18.00 to 20.00	—	0.15 to 0.30	Nb : 0.15 max.
SUS316A	0.08 max.	1.00 max.	2.00 max.	0.045 max.	0.030 max.	10.00 to 14.00	16.00 to 18.00	2.00 to 3.00	—	—
SCS13AA-CF	0.08 max.	2.00 max.	1.50 max.	0.040 max.	0.040 max.	8.00 to 11.00	18.00 to 21.00	—	—	—

7 Mechanical properties

7.1 0.1 % proof stress, tensile strength, yield ratio and elongation

When tested in accordance with **13.2**, the steels shall satisfy the 0.1 % proof stress, tensile strength, yield ratio and elongation given in Table 3.

Table 3 0.1 % proof stress, tensile strength, yield ratio and elongation

Symbol of grade	0.1 % proof stress ^{a)} N/mm ²	Tensile strength ^{b)} N/mm ²	Yield ratio ^{c)} %	Elongation %	
				Type of test piece in accordance with JIS Z 2241	
				No. 4, No. 5, No. 10, No. 11, No. 12A, No. 12B, No. 12C, No. 13B	No. 14A, No. 14B
SUS304A	235 min.	520 min.	60 max. ^{d)}	40 min. ^{e)}	35 min.
SUS304N2A	325 min.	690 min.	60 max. ^{d)}	35 min.	30 min.
SUS316A	235 min.	520 min.	60 max. ^{d)}	40 min. ^{e)}	35 min.
SCS13AA-CF	235 min.	520 min.	60 max.	40 min.	35 min.
Note ^{a)} The 0.1 % proof stress is the value of the force (N) producing 0.1 % permanent elongation divided by the sectional area (mm²) at parallel part in tensile test, which shall be obtained according to the offset method specified in JIS Z 2241. Note ^{b)} The weld zone of circular steel tubes shall also satisfy the required tensile strength. When agreed between the purchaser and the manufacturer, the weld zone of square and rectangular tubes shall also satisfy the required tensile strength. Note ^{c)} The yield ratio refers to the ratio of 0.1 % proof stress to tensile strength. Note ^{d)} The yield ratio of angle steels, flat steels, circular steel tubes and square and rectangular tubes as cold-formed shall be 80 % or under. At this time, “-C” shall be suffixed to the symbol of grade. Note ^{e)} The elongation of the circular steel tubes and the square and rectangular tubes of SUS304A and SUS316A shall be at least 35 %.					

7.2 Flattening resistance test

The weld zone of circular steel tubes shall be tested in accordance with **13.2.3**, and the test piece shall not generate cracks until the distance between the platens reaches the value given in Table 4. For the tubes with a wall thickness 10 % or over of the tube outside diameter, the distance between the platens shall be as agreed between the purchaser and the manufacturer.

Table 4 Flattening property

Manufacturing method	Distance between platens
Solution treatment	1/3D ^{a)}
As cold-formed	2/3D ^{a)}
Note ^{a)} “D” stands for the outside diameter of tube.	

8 Corrosion resistance

When the purchaser designates the corrosion resistance according to the intergranular corrosion test, the test method to be applied in accordance with **13.3** shall be agreed between the purchaser and the manufacturer, and the corrosion resistance shall be as agreed between the purchaser and the manufacturer.

9 Surface finish

The surface finish of hot-formed H sections, hot-formed equal-leg angles, hot-formed U sections, hot-rolled steel sheets and strips, and cold-rolled steel sheets and strips shall be as given in Table 5.

Table 5 Surface finish

Symbol of surface finish	Remarks
No. 1	Finished by heat treatment, pickling or similar treatment after hot-rolled or hot-formed.
No. 2D	Finished by heat treatment, pickling or similar treatment after cold-rolled. Surfaces lightly given final cold-rolling by matting roll are included.
No. 2B	Finished by heat treatment, pickling or similar treatment after cold-rolled, and then cold-rolled to gain an appropriate gloss.
HL	Finished by grinding so as to gain a continuous polished-pattern using an abrasive of appropriate grain size.
Surface finishes other than those listed in this table, such as the type of polishing finish (#400) shall be in accordance with the manufacturer's method.	

10 Profiles and dimensions, and tolerances thereof

10.1 Section profiles

The section profiles, standard sectional dimensions or representative sectional dimensions, sectional area and sectional characteristics of hot-formed H sections, hot-formed equal-leg angles, hot-formed U sections, cold-formed equal-leg angles, circular steel tubes and square and rectangular tubes are shown in Annex A as reference.

10.2 Standard lengths

The standard lengths of hot-formed H sections, hot-formed equal-leg angles, hot-formed U sections and cold-formed equal-leg angles shall be 4.0 m and 6.0 m. The standard lengths of square and rectangular tubes shall be 6.0 m, 8.0 m and 9.0 m.

Other length shall be as agreed between the purchaser and the manufacturer.

10.3 Standard dimensions

The standard dimensions of hot-rolled steel sheets and strips shall be in accordance with **JIS G 4304**, and of cold-rolled steel sheets and strips **JIS G 4305**.

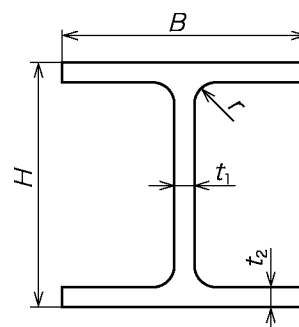
10.4 Tolerances on dimensions, profiles and lengths

The tolerances on dimensions, profiles and lengths of steels shall be as follows.

- a) **Hot-formed H sections** The tolerances on dimensions, profiles and lengths of hot-formed H sections shall be in accordance with **JIS G 4317**. The bend shall be as given in Table 6.

Table 6 Bend of hot-formed H sections

Height (H)	Bend
300 mm or under	Not more than 0.20 % of length
Over 300 mm	Not more than 0.10 % of length
Applicable to both vertical and lateral bends.	

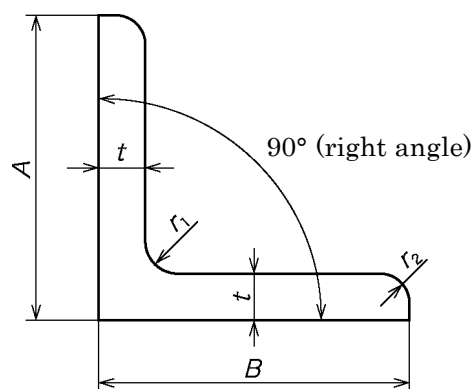


- b) **Hot-formed equal-leg angles** The tolerances on dimensions, profiles and lengths of hot-formed equal-leg angles shall be in accordance with **JIS G 4317**. The tolerances on wall thickness shall be as given in Table 7.

Table 7 Tolerances on wall thickness of hot-formed equal-leg angles

Unit: mm

Division		Tolerances on wall thickness
Legs ($A \times B$)	Wall thickness (t)	
20 × 20 to 30 × 30	6 or under	+0.7 -0.3
40 × 40 to 80 × 80	9 or under	+1.0 -0.4
90 × 90 to 100 × 100	8 or over up to and incl. 9	+1.0 -0.4
	10 or over	+11 % -5 %
The value expressed by “%” is obtained by multiplying this numeral by the wall thickness (t). The tolerances on wall thickness other than those specified in this table shall be as agreed between the purchaser and the manufacturer.		



- c) **Hot-formed U sections** The tolerances on dimensions, profiles and lengths of hot-formed U sections shall be in accordance with **JIS G 4317**. The tolerances on wall thickness shall be as given in Table 8.