

JIS

JAPANESE INDUSTRIAL STANDARD

**Stainless steel forgings
for pressure vessels**

JIS G 3214—1991

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

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Stainless steel forgings for pressure vessels

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G 3214-1991

1. Scope

This Japanese Industrial Standard specifies the stainless steel forgings mainly used for corrosion resistant and high temperature pressure vessels and their parts (hereafter referred to as the "forgings"). However, pertaining to austenitic stainless steel forgings, this Standard is also applicable to low temperature pressure vessels and low temperature service parts.

Remarks: Applicable standards to this Standard are shown as follows.

JIS B 0601-Definitions and Designation of Surface Roughness

JIS G 0306-Steel Forgings — General Technical Requirements

JIS G 0321-Product Analysis and its Tolerance for Wrought Steel

JIS G 0565-Methods for Magnetic Particle Testing of Ferromagnetic
Materials and Classification of Magnetic Particle Indication

JIS G 0567-Method of High Temperature Tensile Test for Steels and Heat-
Resisting Alloys

JIS G 0571-Method of 10 Per Cent Oxalic Acid Etch Test for Stainless
Steels

JIS G 0575-Method of Copper Sulfate-Sulfuric Acid Test for Stainless
Steels

JIS G 1211-Methods for Determination of Carbon in Iron and Steel

JIS G 1212-Methods for Determination of Silicon in Iron and Steel

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-Methods for Determination of Sulfur in Iron and Steel

JIS G 1216-Methods for Determination of Nickel in Iron and Steel

JIS G 1217-Methods for Determination of Chromium in Iron and Steel

JIS G 1218-Methods for Determination of Molybdenum in Iron and Steel

JIS G 1219-Methods for Determination of Copper in Iron and Steel

JIS G 1223-Methods for Determination of Titanium in Iron and Steel

JIS G 1228-Methods for Determination of Nitrogen in Iron and Steel

JIS G 1237-Methods for Determination of Niobium in Steel

JIS G 1253-Method for Photoelectric Emission Spectrochemical Analysis of
Iron and Steel

JIS G 1256-Method for X-Ray Fluorescence Spectrometric Analysis of Iron
and Steel

JIS G 1257-Methods for Atomic Absorption Spectrochemical Analysis of
Iron and Steel

JIS K 2238-Machine Oils

JIS Z 2343-Methods for Liquid Penetrant Testing and Classification of Indication

JIS Z 2344-General Rule of Ultrasonic Testing of Metals by the Pulse Echo Technique

2. Symbol of grade and classification

The symbols of grades and classification of forgings shall be as given in Table 1.

3. Chemical composition

Forgings shall be subjected to the analytical test of 9.2 and their chemical compositions shall be as follows:

- (1) The chemical compositions of forgings shall be ladle analyses and they shall be as given in Tables 2, 3 or 4.
- (2) In the case where the product analysis of forgings is requested by the purchaser, their permissible variation shall be as given in Table 4 (permissible variation of product analysis) of JIS G 0321.

Table 1. Symbol of grade and classification

Symbol of grade	Classification	Symbol of grade	Classification	Symbol of grade	Classification
SUS F 304	Austenitic series	SUS F 316L	Austenitic series	SUS F 347H	Austenitic series
SUS F 304H		SUS F 316N		SUS F 410-A	Martensitic series
SUS F 304L		SUS F 316LN		SUS F 410-B	
SUS F 304N		SUS F 317		SUS F 410-C	
SUS F 304LN		SUS F 317L		SUS F 410-D	
SUS F 310		SUS F 321		SUS F 6B	
SUS F 316		SUS F 321H		SUS F 6NM	
SUS F 316H		SUS F 347		SUS F 630	Precipitation hardening series

Table 2. Chemical composition of austenitic stainless steel forgings

Unit: %

Symbol of grade	C	Si	Mn	P ⁽¹⁾	S	Ni	Cr	Mo	N	Others
SUS F 304	0.08 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	8.00 to 11.00	18.00 to 20.00	—	—	—
SUS F 304H	0.04 to 0.10	1.00 max.	2.00 max.	0.040 max.	0.030 max.	8.00 to 12.00	18.00 to 20.00	—	—	—
SUS F 304L	0.030 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	9.00 to 13.00	18.00 to 20.00	—	—	—
SUS F 304N	0.08 max.	0.75 max.	2.00 max.	0.040 max.	0.030 max.	8.00 to 11.00	18.00 to 20.00	—	0.10 to 0.16	—
SUS F 304LN	0.030 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	8.00 to 11.00	18.00 to 20.00	—	0.10 to 0.16	—
SUS F 310	0.15 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	19.00 to 22.00	24.00 to 26.00	—	—	—
SUS F 316	0.08 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	10.00 to 14.00	16.00 to 18.00	2.00 to 3.00	—	—
SUS F 316H	0.04 to 0.10	1.00 max.	2.00 max.	0.040 max.	0.030 max.	10.00 to 14.00	16.00 to 18.00	2.00 to 3.00	—	—
SUS F 316L	0.030 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	12.00 to 15.00	16.00 to 18.00	2.00 to 3.00	—	—
SUS F 316N	0.08 max.	0.75 max.	2.00 max.	0.040 max.	0.030 max.	11.00 to 14.00	16.00 to 18.00	2.00 to 3.00	0.10 to 0.16	—
SUS F 316LN	0.030 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	10.00 to 14.00	16.00 to 18.00	2.00 to 3.00	0.10 to 0.16	—
SUS F 317	0.08 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	11.00 to 15.00	18.00 to 20.00	3.00 to 4.00	—	—
SUS F 317L	0.030 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	11.00 to 15.00	18.00 to 20.00	3.00 to 4.00	—	—
SUS F 321	0.08 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	9.00 to 12.00	17.00 min.	—	—	Ti 5 × C% to 0.60
SUS F 321H	0.04 to 0.10	1.00 max.	2.00 max.	0.040 max.	0.030 max.	9.00 to 12.00	17.00 min.	—	—	Ti 4 × C% to 0.60
SUS F 347	0.08 max.	1.00 max.	2.00 max.	0.040 max.	0.030 max.	9.00 to 13.00	17.00 to 20.00	—	—	Nb 10 × C% to 1.00
SUS F 347H	0.04 to 0.10	1.00 max.	2.00 max.	0.040 max.	0.030 max.	9.00 to 13.00	17.00 to 20.00	—	—	Nb 8 × C% to 1.00

Note ⁽¹⁾ The content of P for parts for reactor pressure vessels may be specified as 0.030 % max.

Table 3. Chemical composition of martensitic stainless steel forgings

Unit: %

Symbol of grade	C	Si	Mn	P	S	Ni	Cr	Mo	Cu
SUS F 410-A SUS F 410-B SUS F 410-C SUS F 410-D	0.15 max.	1.00 max.	1.00 max.	0.040 max.	0.030 max.	0.50 max.	11.50 to 13.50	—	—
SUS F 6B	0.15 max.	1.00 max.	1.00 max.	0.020 max.	0.020 max.	1.00 to 2.00	11.50 to 13.50	0.40 to 0.60	0.50 max.
SUS F 6NM	0.05 max.	0.60 max.	0.50 to 1.00	0.030 max.	0.030 max.	3.50 to 5.50	11.50 to 14.00	0.50 to 1.00	—

Table 4. Chemical composition of precipitation hardening stainless steel forgings

Unit: %

Symbol of grade	C	Si	Mn	P	S	Ni	Cr	Cu	Nb
SUS F 630	0.07 max.	1.00 max.	1.00 max.	0.040 max.	0.030 max.	3.00 to 5.00	15.00 to 17.50	3.00 to 5.00	0.15 to 0.45

4. Mechanical properties

Forgings shall be subjected to the mechanical tests of 9.3 and their mechanical properties shall be as follows:

- (1) The proof stress, tensile strength, elongation, reduction of area, and hardness of austenitic stainless steel forgings shall be as given in Table 5.
- (2) The proof stress, tensile strength, elongation, reduction of area, and hardness of martensitic stainless steel forgings shall be as given in Table 6.
- (3) The proof stress, tensile strength, elongation, reduction of area, hardness, and Charpy absorbed energy of precipitation hardening stainless steel forgings shall be as given in Table 7.