

JIS

JAPANESE INDUSTRIAL STANDARD

**Carbon Steel Forgings
for Pressure Vessels**

JIS G 3202—1988

Translated and Published

by

Japanese Standards Association

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

JAPANESE INDUSTRIAL STANDARD

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Carbon Steel Forgings for Pressure Vessels G 3202-1988
(Reaffirmed: 1994)1. Scope

This Japanese Industrial Standard specifies the carbon steel forgings of good weldability, hereinafter referred to as the "forgings", to be used as pressure vessels and their components intended mainly for intermediate or normal temperature service.

Remark: The units and numerical values given in { } in this Standard are based on the International System of Units (SI) and are appended for informative reference.

Further, the traditional units accompanied by numerical values in this Standard shall be converted to the SI units and numerical values on Jan. 1, 1991.

2. Class symbols

The class symbols of the forgings shall be as shown in Table 1.

Table 1. Class Symbols

Class symbols
SFVC 1
SFVC 2 A
SFVC 2 B

3. Chemical Composition

The forgings shall be tested in accordance with 9.2, and the resulting chemical composition shall conform to the following:

- (1) The chemical composition of the forgings shall, as represented by ladle analysis values, conform to Table 2.
- (2) In the case where product analysis on the forgings is performed at the request of the purchaser, the allowable variables shall be as specified either in Table 1 or Table 2 in JIS G 0321.

Table 2. Chemical Composition

Class symbol	C	Si	Mn	P	S
SFVC 1	0.30 max.	0.35 max.	0.40 to 1.35	0.030 max.	0.030 max.
SFVC 2 A	0.35 max.	0.35 max.	0.40 to 1.10	0.030 max.	0.030 max.
SFVC 2 B	0.30 max.	0.35 max.	0.70 to 1.35	0.030 max.	0.030 max.

Unit: %

Remarks 1. SFVC 2 A may contain within 1.35 % of Mn when the content of C is within 0.30 %.

2. For components of a nuclear reactor, the upper limits of P, S, Ni, Cr, Mo and V may be specified as 0.025 %, 0.025 %, 0.40 %, 0.25 %, 0.10 % and 0.05 %, respectively.

4. Mechanical Property

The forgings shall be tested in accordance with 9.3, and the resulting yield point or proof stress, tensile strength, elongation, reduction of area and Charpy absorbed energy shall conform to Table 3-1 or Table 3-2.

Table 3-1. Mechanical Properties
(Applicable till the end of 1990)

Class symbol	Yield point or proof stress kgf/mm ² {N/mm ² }	Tensile strength kgf/mm ² {N/mm ² }	Elongation %	Reduction of area %	Impact test temperature °C	Charpy absorbed energy kgf·m {J}	
						Mean value of 3 test pieces	Individual value
			No. 14 A test piece			No. 4 test piece	
SFVC 1	21 min. {206} min.	42 to 57 {412 to 559}	21 min.	38 min.	—	—	—
SFVC 2A	25 min. {245} min.	50 to 65 {490 to 637}	18 min.	33 min.	—	—	—
SFVC 2B	25 min. {245} min.	50 to 65 {490 to 637}	18 min.	38 min.	0	2.8 min. {27} min.	2.1 min. {21} min.

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

Class symbol	Yield point or proof stress N/mm ²	Tensile strength N/mm ²	Elongation %	Reduction of area %	Impact test temperature °C	Charpy absorbed energy J	
						Mean value of 3 test pieces	Individual value
			No. 14 A test piece			No. 4 test piece	
SFVC 1	205 min.	410 to 560	21 min.	38 min.	—	—	—
SFVC 2A	245 min.	490 to 640	18 min.	33 min.	—	—	—
SFVC 2B	245 min.	490 to 640	18 min.	38 min.	0	27 min.	21 min.

5. Shapes, Dimensions and Tolerances

The forgings shall be tested in accordance with 9.4, and the resulting shapes, dimensions, and tolerances shall be as agreed upon by the purchaser and the manufacturer.

6. Appearance

The forgings shall be tested in accordance with 9.5 and shall be externally well-finished with no cracks or flaws detrimental to use.

7. Soundness

When required by the purchaser, the forgings shall be subjected to the ultrasonic examination in accordance with 9.6 or other suitable methods and, in terms of soundness, the forgings shall be free from defects detrimental to use.

The acceptance criteria for the soundness of the forgings shall be as agreed upon by the purchaser and the manufacturer.

8. Manufacturing Methods

8.1 Generals for Manufacture General matters of manufacturing methods shall be as specified in 3. of JIS G 0306. However, the vacuum process of molten steel shall be subject to agreement between the purchaser and the manufacturer.

8.2 Heat Treatment

- (1) The forgings shall be preliminarily heat-treated. In the heat-treating process after forging, the preliminarily heat-treated forgings shall be so adjusted to cool as to complete the transformation of austenite before the reheating is commenced.
- (2) The forgings shall undergo heat treatments of annealing, normalizing, normalizing and tempering, or quenching and tempering.

In the case of tempering, its temperature shall be not less than 590°C, and its duration time shall be not less than 30 min per 25 mm of the largest thickness (mm).

- (3) When the purchaser designates a heat treatment of stress relieving, etc. for the test piece, the manufacturer shall cut out a test piece from a test specimen in accordance with 9.3, and further perform the heat treatment as specified by the purchaser. In this case, the purchaser shall specify the details of heat treatment conditions such as heat treating temperature, duration of time, cooling rate, and the number of times of heat treatment.

8.3 Repair by Welding Repairing of defects detected through the inspection shall be as specified in 3.4 of JIS G 0306.

9. Tests

9.1 Test Site The site for test shall, as a rule, be the place of manufacture.

When requested by the purchaser, the manufacturer shall have the presence of the purchaser at the test.

9.2 Chemical Analysis

9.2.1 Generals for Chemical Analysis The general matters of chemical analysis shall be as specified in 4.1 of JIS G 0306.

9.2.2 Analysis Method The analysis method shall be in accordance with one of the following Standards:

JIS G 1211	JIS G 1212	JIS G 1213	JIS G 1214
JIS G 1215	JIS G 1216	JIS G 1217	JIS G 1218
JIS G 1221	JIS G 1253	JIS G 1256	JIS G 1257

9.3 Mechanical Tests

9.3.1 Sampling of specimen The method of sampling the specimens shall be as specified in 4.2.2 (1.1) of JIS G 0306.

9.3.2 Taking of Test Pieces The test piece shall be taken in accordance with 4.2.2 (1.2) of JIS G 0306.

9.3.3 Number of Specimens and Test Pieces The number of specimens and test pieces shall be as specified in 4.2.2 (1.3) of JIS G 0306.

9.3.4 Test Method

- (1) The method for tensile test shall be as specified in 4.2.2 (1.4) of JIS G 0306.
- (2) The method for impact test shall be as specified in 4.2.2 (1.5) of JIS G 0306.

9.4 Shapes and Dimensions The measurement of shapes and dimensions of the forgings shall be as specified in 4.5 of JIS G 0306.

9.5 Appearance Test The appearance test of the forgings shall be as specified in 4.3 of JIS G 0306.

9.6 Ultrasonic Examination The purchaser may designate an ultrasonic examination. The method shall be in accordance with JIS G 0587, as appropriate.

10. Retest

10.1 Mechanical Test The retest of mechanical test shall be as specified in 5.1 of JIS G 0306.

10.2 Test after Repairs by Welding In case of repairs by welding in accordance with 8.3, the test shall be as specified in 5.2 of JIS G 0306.

11. Inspection

11.1 The inspection of the forgings shall be as follows:

- (1) General matters of inspection shall be as specified in 6. of JIS G 0306.
- (2) The chemical composition shall conform to the requirements of 3.
- (3) The mechanical properties shall conform to the requirements of 4.
- (4) The shapes and dimensions shall conform to the requirements of 5.
- (5) The appearance shall conform to the requirements of 6.
- (6) Soundness shall conform to the requirements of 7.

11.2 In addition to the tests of 11.1, the purchaser may designate the tests listed below: In this case, such items as inspection items, sampling method, test method, and acceptance criteria shall be previously agreed upon between the purchaser and manufacturer.

Hardness test ⁽¹⁾, magnetic particle test ⁽²⁾, liquid penetrant test ⁽³⁾, macrostructural test ⁽⁴⁾, austenite grain size test ⁽⁵⁾, nonmetallic inclusion test ⁽⁶⁾, microscopic structure test

Notes ⁽¹⁾ Follow JIS Z 2243 or JIS Z 2246.

⁽²⁾ Follow JIS G 0565.

⁽³⁾ Follow JIS Z 2343.

⁽⁴⁾ Follow JIS G 0553.

⁽⁵⁾ Follow JIS G 0551.

⁽⁶⁾ Follow JIS G 0555.

12. Marking

The forgings having passed the inspection shall be legibly marked in accordance with 7. of JIS G 0306.

13. Report

The report shall be as specified in 8. of JIS G 0306.

Applicable Standards:

- JIS G 0306-General Rules for Inspection of Steel Forgings
- JIS G 0321-Product Analysis and its Tolerance for Wrought Steel
- JIS G 0551-Methods of Austenite Grain Size Test for Steel
- JIS G 0553-Macrostructure Detecting Method for Steel
- JIS G 0555-Microscopic Testing Method for the Non-Metallic Inclusions in Steel
- JIS G 0565-Methods for Magnetic Particle Testing of Ferromagnetic Materials and Classification of Magnetic Particle Indication
- JIS G 0587-Methods for Ultrasonic Examination for Carbon and Low Alloy Steel Forgings
- 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 1221-Methods for Determination of Vanadium in Iron and 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 Z 2243-Method of Brinell Hardness Test
- JIS Z 2246-Method of Shore Hardness Test
- JIS Z 2343-Methods for Liquid Penetrant Testing and Classification of Indication

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