

JIS

JAPANESE INDUSTRIAL STANDARD

Nickel Chromium Molybdenum Steels

④ JIS G 4103 —1979

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



JAPANESE INDUSTRIAL STANDARD

J I S

Nickel Chromium Molybdenum Steels

G 4103-1979

(Reaffirmed: 1994)

1. Scope

This Japanese Industrial Standard specifies nickel chromium molybdenum steels mainly for machine structural use manufactured by hot forming, such as hot rolling and forging, ordinarily used after further processes of forging, cutting, and heat treatment, hereinafter referred to as the "steel".

2. Classification and Symbol

The steel shall be classified into 11 classes and the respective symbol shall be as given in Table 1.

Table 1. Classes and Symbols

Symbol of class	Reference	Application
	Previous symbol	
SNCM 220	SNCM 21	SNCM 220, SNCM 415, SNCM 420, SNCM 616 and SNCM 815 are used mainly for case-hardening.
SNCM 240	SNCM 6	
SNCM 415	SNCM 22	
SNCM 420	SNCM 23	
SNCM 431	SNCM 1	
SNCM 439	SNCM 8	
SNCM 447	SNCM 9	
SNCM 616	SNCM 26	
SNCM 625	SNCM 2	
SNCM 630	SNCM 5	
SNCM 815	SNCM 25	

3. Method of Manufacture

3.1 The steel shall be manufactured from killed steel ingot.

3.2 The steel shall be rolled or forged from steel ingot to forging ratio not less than 4 S. However, when the forging ratio of the billet for forging or rolling is less than 4 S, a prior agreement between the purchaser and the manufacturer is necessary.

3.3 Unless otherwise specified, the steel shall be left in the state as rolled or as forged.

4. Chemical Composition

The chemical composition of the steel shall be determined by the ladle analysis and the value shall be as given in Table 2.

Applicable Standards and Reference Standard: See page 10.

Table 2. Chemical Composition

Symbol of class	Reference	Chemical composition %							
	Previous symbol	C	Si	Mn	P	S	Ni	Cr	Mo
SNCM 220	SNCM 21	0.17 ± 0.23	0.15 ± 0.35	0.60 ± 0.90	0.030 max.	0.030 max.	0.40 ± 0.70	0.40 ± 0.65	0.15 ± 0.30
SNCM 240	SNCM 6	0.38 ± 0.43	0.15 ± 0.35	0.70 ± 1.00	0.030 max.	0.030 max.	0.40 ± 0.70	0.40 ± 0.65	0.15 ± 0.30
SNCM 415	SNCM 22	0.12 ± 0.18	0.15 ± 0.35	0.40 ± 0.70	0.030 max.	0.030 max.	1.60 ± 2.00	0.40 ± 0.65	0.15 ± 0.30
SNCM 420	SNCM 23	0.17 ± 0.23	0.15 ± 0.35	0.40 ± 0.70	0.030 max.	0.030 max.	1.60 ± 2.00	0.40 ± 0.65	0.15 ± 0.30
SNCM 431	SNCM 1	0.27 ± 0.35	0.15 ± 0.35	0.60 ± 0.90	0.030 max.	0.030 max.	1.60 ± 2.00	0.60 ± 1.00	0.15 ± 0.30
SNCM 439	SNCM 8	0.36 ± 0.43	0.15 ± 0.35	0.60 ± 0.90	0.030 max.	0.030 max.	1.60 ± 2.00	0.60 ± 1.00	0.15 ± 0.30
SNCM 447	SNCM 9	0.44 ± 0.50	0.15 ± 0.35	0.60 ± 0.90	0.030 max.	0.030 max.	1.60 ± 2.00	0.60 ± 1.00	0.15 ± 0.30
SNCM 616	SNCM 26	0.13 ± 0.20	0.15 ± 0.35	0.80 ± 1.20	0.030 max.	0.030 max.	2.80 ± 3.20	1.40 ± 1.80	0.40 ± 0.60
SNCM 625	SNCM 2	0.20 ± 0.30	0.15 ± 0.35	0.35 ± 0.60	0.030 max.	0.030 max.	3.00 ± 3.50	1.00 ± 1.50	0.15 ± 0.30
SNCM 630	SNCM 5	0.25 ± 0.35	0.15 ± 0.35	0.35 ± 0.60	0.030 max.	0.030 max.	2.50 ± 3.50	2.50 ± 3.50	0.50 ± 0.70
SNCM 815	SNCM 25	0.12 ± 0.18	0.15 ± 0.35	0.30 ± 0.60	0.030 max.	0.030 max.	4.00 ± 4.50	0.70 ± 1.00	0.15 ± 0.30

Remarks 1. As impurities, Cu shall not exceed 0.30 % throughout all classes.

2. When the product analysis on steel is requested by the purchaser, the tolerance for the product analysis shall conform to Table 3 in JIS G 0321.

5. Appearance, Shape, Dimension and Dimensional Tolerance

5.1 Hot Rolled Steel Bar and Wire Rod

5.1.1 Appearance The appearance of the hot rolled steel bar and wire rod shall be well finished and free from harmful defects in use. However, the steel bar which is supplied in coil is possibly inclusive of some abnormal points.

5.1.2 Reference of Flaw Dressing The reference of flaw dressing of the hot rolled steel bar shall be as follows:

- (1) Steel Bar for General Forging Use The reference of flaw dressing of the steel bar for general forging use shall be made smoothly to the depth not exceeding 4 % of nominal size (maximum value 5 mm) below nominal size, and to the total width not exceeding 1/4 of the circumferential length of the same section. If the dressed portions are within the dimensional tolerance, they shall not be considered as the portions dressed.

The permissible amount of remaining flaws shall be as agreed upon between the purchaser and the manufacturer.

- (2) Round Bar for Direct Machining The permissible depth of flaw on round bar for direct machining shall conform to the value given in Table 3 deducted from the nominal size.

Table 3. Permissible Depth of Flaw on Round Bar for Direct Machining (Hot Rolled Steel Bar)

Diameter mm	Permissible depth of flaw
Under 16	Not exceeding 4 % of nominal size with the maximum of 0.5 mm
16 to 50 excl.	Not exceeding 3 % of nominal size with the maximum of 1.0 mm
50 to 100 excl.	Not exceeding 2 % of nominal size with the maximum of 1.5 mm
100 and over	Not exceeding 1.5 % of nominal size with the maximum of 3.0 mm

- (3) Steel Bar for Cold Drawing The flaw dressing of the steel bar for cold drawing shall be made smoothly, and the repair shall be limited to the depth ranging from the lower limit of the dimensional tolerance to the dimension given in Table 4.

The permissible amount of remaining flaws shall be as agreed upon between the purchaser and the manufacturer.

Table 4. Permissible Limit for Repair of Steel Bar for Cold Drawing (Hot Rolled Steel Bar)

Diameter or width across flats mm	Permissible limit for repair
Under 16	0.15 mm
16 to 50 excl.	Not exceeding 1 % of nominal size with the maximum of 0.35 mm
50 to 100 excl.	Not exceeding 0.7 % of nominal size with the maximum of 0.50 mm
100 to 130 incl.	Not exceeding 0.5 % of nominal size

5.1.3 Standard Dimension The standard dimensions of the hot rolled steel bar (round, square, hexagonal) and wire rod shall conform to Table 5.

Table 5. Standard Dimensions of Hot Rolled Steel Bar and Wire Rod

Unit: mm

Round bar (dia.)			Square bar (width across flats)		Hexagonal bar (width across flats)		Wire rod (dia.)	
(10)	32	90	40	130	(12)	67	5.5	22
11	34	95	45	140	13	71	6	(24)
(12)	36	100	50	150	14	(75)	7	25
13	38	(105)	55	160	17	(77)	8	(26)
(14)	40	110	60	180	19	(81)	9	28
(15)	42	(115)	65	200	22		9.5	30
16	44	120	70		24		(10)	32
(17)	46	130	75		27		11	
(18)	48	140	80		30		(12)	
19	50	150	85		32		13	
(20)	55	160	90		36		(14)	
22	60	(170)	95		41		(15)	
(24)	65	180	100		46		16	
25	70	(190)	(105)		50		(17)	
(26)	75	200	110		55		(18)	
28	80		(115)		60		19	
30	85		120		63		(20)	

Remark: It is desirable to avoid using values in parentheses.

5.1.4 Shape and Dimensional Tolerance The shape and dimensional tolerance of the hot rolled steel bar and wire rod shall conform to (1) to (3) with exception of steel subjected to heat treatment.

- (1) The shape and dimensional tolerance of the hot rolled round bar and square bar shall conform to Table 6.

Table 6. Shape and Dimensional Tolerances of Hot Rolled Round Bar and Square Bar

Item	Shape and dimensional tolerance	
Tolerance on diameter or width across flats	$\pm 1.5\%$, with the minimum value of 0.4 mm	
Deviation of diameter or deviation	Not exceeding 70 % of range of tolerance on diameter or width across flats	
Tolerance on length	For length not exceeding 7 m	$+ 40$ 0 mm
	For length exceeding 7 m	Add 5 mm to plus side tolerance for every 1 m or fraction thereof
Roundness of corners (R)	10 to 20 % of width across flats, as standard	
Twist	To be practically straight	
Bend	Not exceeding 3 mm for every 1 m and not exceeding $3 \text{ mm} \times \text{length(m)}/1 \text{ m}$ for total length	

- (2) The shape and dimensional tolerance of the hot rolled hexagonal bar shall conform to Table 7.

Table 7. Shape and Dimensional Tolerance of Hot Rolled Hexagonal Bar

Item	Width across flats	Tolerance on width across flats	Deviation of width across flats	
Tolerance on width across flats and deviation of width across flats mm	(12) 13 14 17	± 0.7	1.0 max.	
	19 22 24 27 30	± 0.8	1.1 max.	
	32 36 41 46 50	± 1.0	1.4 max.	
	55 60 63 67 71 (75) (77) (81)	± 1.2	1.7 max.	
	Tolerance on length	For length not exceeding 7 m	$+ 40$ 0 mm	
		For length exceeding 7 m	Add 5 mm to plus side tolerance for every 1 m or fraction thereof	
	Twist	To be practically straight		
	Bend	Not exceeding 3 mm for every 1 m and not exceeding 3 mm x length(m)/1 m for total length		

Remark: It is desirable to avoid using values in parentheses.

- (3) The dimensional tolerance of hot rolled wire rod shall conform to Table 8.

Table 8. Dimensional Tolerance of Hot Rolled Wire Rod

Unit: mm

Diameter	Tolerance on diameter	Deviation of diameter
Under 16	± 0.4	0.5 max.
16 and over	± 0.5	0.6 max.

5.2 Hot Rolled Steel Plate, Sheet and Strip

5.2.1 Appearance The appearance of the hot rolled steel plate, sheet and strip shall conform to 7. in JIS G 3193.

5.2.2 Reference of Flaw Dressing The reference of flaw dressing of the hot rolled steel plate and sheet shall conform to 7. in JIS G 3193. However, the application of repairing by welding and permissible amount of remaining flaw shall be as agreed upon between the purchaser and the manufacturer.

5.2.3 Standard Dimension The standard dimension of the hot rolled steel plate, sheet and strip shall be as described in (1) and (2) below:

- (1) The standard thickness of the hot rolled steel plate, sheet and strip shall conform to 4.1 in JIS G 3193.
- (2) The standard width and length of the hot rolled steel plate, sheet and strip shall conform to 4.2 and 4.3 in JIS G 3193.

5.2.4 Shape and Dimensional Tolerance The shape and dimensional tolerance of the hot rolled steel plate, sheet and strip shall be as described in (1) and (2) below:

- (1) The shape and dimensional tolerance of the hot rolled steel plate, sheet and strip shall conform to 5. in JIS G 3193. In this case, the tolerance on thickness shall be applied to thickness under 160 mm, and in the case of 160 mm and over, it shall be as agreed upon between the purchaser and the manufacturer.
- (2) The permissible maximum values for flatness of the hot rolled steel plate and sheet shall conform to Table 9. In this case, the tolerance on thickness shall be applied to thickness under 160 mm, and, in this case of 160 mm and over, it shall be as agreed upon between the purchaser and the manufacturer.

Table 9. Permissible Maximum Values for Flatness of Hot Rolled Steel Plate and Sheet

Unit: mm

Width Thickness	Under 1 250	1 250 to 1 600 excl.	1 600 to 2 000 excl.	2 000 to 2 500 excl.	2 500 to 3 000 excl.	3 000 and over
Under 1.60	27	30	—	—	—	—
1.60 to 4.00 excl.	24	27	30	—	—	—
4.00 to 6.30 excl.	21	24	27	33	39	42
6.30 to 10.0 excl.	18	21	24	30	36	39
10.0 to 25.0 excl.	15	18	21	24	27	30
25.0 to 63.0 excl.	12	15	18	21	24	27
63.0 to 160 excl.	12	12	15	18	21	24

- Remarks 1. Not applicable to steel plate and sheet supplied after treated by stretcher leveller.
2. The above table shall be applicable to 4000 mm length of steel plates and sheets, and to full length of plates under 4000 mm in length.

3. The values for flatness of steel plates and sheets shall be obtained by reducing the thickness from the maximum warping of the upper surface of the plates and sheets.
4. Not applicable to as-rolled steel plates and sheets having rims.
5. The measurement of flatness of steel plates and sheets shall generally be done on a level table.

5.3 Hot Rolled Flat Steel

5.3.1 Appearance The appearance of the hot rolled flat steel shall be free from injurious defects in use.

5.3.2 Flaw Dressing The flaw dressing of the hot rolled flat steel shall conform to (1) and (2) of 8.2.1 in JIS G 3194.

5.3.3 Standard Dimension The standard dimension of the hot rolled flat steel shall conform to 4. in JIS G 3194.

5.3.4 Shape and Dimensional Tolerance The shape and dimensional tolerance of the hot rolled flat steel shall conform to 5. in JIS G 3194.

5.4 The appearance, reference of flaw dressing, shape, dimension and dimensional tolerance of the steel other than those specified in 5.1, 5.2 and 5.3 shall be as agreed upon between the purchaser and the manufacturer.

6. Test

6.1 The general requirements for analysis test and the method of sampling for the ladle analysis shall conform to 3. in JIS G 0303.

6.2 The method of sampling for the product analysis shall comply with 3. in JIS G 0321.

6.3 The method of analysis shall comply with the appropriate standard of the following:

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 1219	JIS G 1252	JIS G 1253	JIS G 1256
JIS G 1257			

7. Inspection

7.1 The general requirements for the inspection shall comply with JIS G 0303.

7.2 The result of inspection for the chemical composition, the appearance, the shape and the dimension shall satisfy the requirements specified in 4. and 5.

7.3 Besides the inspection and tests specified in 7.2, it is possible to specify, in addition, the inspection and tests listed below. In this case, the purchaser shall have previous agreement with the manufacturer upon inspection items, method of sampling, test method and the criterion of acceptance or rejection.

Magnetic particle inspection⁽¹⁾, ultrasonic inspection⁽²⁾, decarburization inspection⁽³⁾, nonmetallic inclusions inspection⁽⁴⁾, grain size inspection⁽⁵⁾, hardenability inspection⁽⁶⁾, mechanical properties inspection⁽⁷⁾, macrostructure detecting inspection⁽⁸⁾, macro-streak flaw inspection⁽⁹⁾ and microscopic structure inspection.

- Notes (1) This shall be in compliance with JIS G 0565.
- (2) This shall be in compliance with JIS Z 2344.
- (3) This shall be in compliance with JIS G 0558.
- (4) This shall be in compliance with JIS G 0555.
- (5) This shall be in compliance with JIS G 0551.
- (6) This shall be in compliance with JIS G 0561.
- (7) This shall be in compliance with JIS Z 2201, JIS Z 2241, JIS Z 2202, JIS Z 2242, JIS Z 2243 and JIS Z 2245.
- (8) This shall be in compliance with JIS G 0553. However, this standard shall apply mainly to the steel bar.
- (9) This shall be in compliance with JIS G 0556. However, this standard shall apply mainly to the steel bar.

8. Marking

8.1 Flat Steel, Steel Bar and Wire Rod The marking on each flat steel, steel bar and wire rod shall be legibly made with the following particulars by a suitable means. The flat steel and the steel bar under 30 mm in diameter or in width across flats may be bound up, and the marking may be made on each bundle by a suitable means. A part of the following particulars may be omitted when approved by the purchaser.

- (1) Symbol of class
- (2) Heat No. or other manufacturing No.
- (3) Name of manufacturer or its abbreviation

8.2 Steel Plate, Sheet and Strip The marking on the steel plate, sheet and strip shall be legibly made with the following particulars by a suitable means on each steel or bundle. A part of the following particulars may be omitted when approved by the purchaser.

- (1) Symbol of class
- (2) Heat No. or other manufacturing No.
- (3) Dimension
- (4) Name of manufacturer or its abbreviation

9. Report

The report shall conform to 8. in JIS G 0303. Submitting the test result specified in 7.3 shall be made after the agreement between the purchaser and the manufacturer.

Applicable Standards:

- JIS G 0303-General Rules for Inspection of Steel
- JIS G 0321-Product Analysis and Its Tolerance for Wrought Steel
- JIS G 0551-Method of Austenite Grain Size Test for Steel
- JIS G 0553-Macro-Structure Detecting Method for Steel
- JIS G 0555-Microscopic Testing Method for the Non-metallic Inclusions in Steel
- JIS G 0556-Method of Macro-Streak Flaw Test for Steel
- JIS G 0558-Methods of Measuring Decarburized Depth for Steel
- JIS G 0561-Method of Hardenability Test for Steel (End Quenching Method)
- JIS G 0565-Methods for Magnetic Particle Testing of Ferromagnetic Materials and Classification of Magnetic Particle Indication
- 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 1252-Emission-Spectroscopic Analysis for Carbon Steel and Low Alloy Steel
- JIS G 1253-Method for Photoelectric Emission Spectrochemical Analysis of Iron and Steel
- JIS G 1256-Method for Fluorescent X-ray Analysis of Iron and Steel
- JIS G 1257-Atomic Absorption Spectrochemical Analysis of Iron and Steel
- JIS G 3193-Dimensions, Weight and Permissible Variations of Hot Rolled Steel Plates, Sheets and Strip
- JIS G 3194-Shape, Dimension, Weight and Tolerance for Hot Rolled Steel Flats
- JIS Z 2201-Tension Test Pieces for Metallic Materials
- JIS Z 2202-Impact Test Pieces for Metallic Materials
- JIS Z 2241-Method of Tension Test for Metallic Materials
- JIS Z 2242-Method of Impact Test for Metallic Materials
- JIS Z 2243-Method of Brinell Hardness Test
- JIS Z 2245-Method of Rockwell Hardness Test
- JIS Z 2344-Ultrasonic Testing of Metals by the Pulse Echo Technique

Reference Standard:

- JIS G 0701-Symbols of Forming Ratio for Steel Forging

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