

JIS

JAPANESE INDUSTRIAL STANDARD

**Chromium Molybdenum Steel
Forgings for General Use**

JIS G 3221—1988

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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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Chromium Molybdenum Steel Forgings
for General use

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1. Scope

This Japanese Industrial Standard specifies the chromium molybdenum steel forgings, hereinafter referred to as the "steel forgings", formed into rod, ring and disc shapes for general use as rods, shafts, cranks, pinions, gears, flanges, rings, wheels, discs, etc.

Remarks: 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. Definition of Terms

The definitions of the major terms of rod shape, ring shape and disc shape used in this Standard shall be as given in 2. of JIS G 0306.

3. Type Symbols

The steel forgings shall be classified into the rod-shaped, ring-shaped and disc-shaped steel forgings according to their shapes, and shall further be subclassified each into nine types according to their tensile strength. The symbols denoting the types shall be as shown in Table 1-1 or Table 1-2. However, the cylindrical steel forgings shall be classified as the rod-shaped forgings.

Applicable Standards: See page 14.

Table 1-1. Type Symbols
(Applicable till the end of 1990)

Type symbol		
Rod-shaped steel forgings	Ring-shaped steel forgings	Disc-shaped steel forgings
SFCM 60 S	SFCM 60 R	SFCM 60 D
SFCM 65 S	SFCM 65 R	SFCM 65 D
SFCM 70 S	SFCM 70 R	SFCM 70 D
SFCM 75 S	SFCM 75 R	SFCM 75 D
SFCM 80 S	SFCM 80 R	SFCM 80 D
SFCM 85 S	SFCM 85 R	SFCM 85 D
SFCM 90 S	SFCM 90 R	SFCM 90 D
SFCM 95 S	SFCM 95 R	SFCM 95 D
SFCM 100 S	SFCM 100 R	SFCM 100 D

Table 1-2. Type Symbols
(Applicable on and after Jan. 1, 1991)

Type symbol					
Rod-shaped steel forgings		Ring-shaped steel forgings		Disc-shaped steel forgings	
SI unit	(Reference) Traditional unit	SI unit	(Reference) Traditional unit	SI unit	(Reference) Traditional unit
SFCM 590 S	SFCM 60 S	SFCM 590 R	SFCM 60 R	SFCM 590 D	SFCM 60 D
SFCM 640 S	SFCM 65 S	SFCM 640 R	SFCM 65 R	SFCM 640 D	SFCM 65 D
SFCM 690 S	SFCM 70 S	SFCM 690 R	SFCM 70 R	SFCM 690 D	SFCM 70 D
SFCM 740 S	SFCM 75 S	SFCM 740 R	SFCM 75 R	SFCM 740 D	SFCM 75 D
SFCM 780 S	SFCM 80 S	SFCM 780 R	SFCM 80 R	SFCM 780 D	SFCM 80 D
SFCM 830 S	SFCM 85 S	SFCM 830 R	SFCM 85 R	SFCM 830 D	SFCM 85 D
SFCM 880 S	SFCM 90 S	SFCM 880 R	SFCM 90 R	SFCM 880 D	SFCM 90 D
SFCM 930 S	SFCM 95 S	SFCM 930 R	SFCM 95 R	SFCM 930 D	SFCM 95 D
SFCM 980 S	SFCM 100 S	SFCM 980 R	SFCM 100 R	SFCM 980 D	SFCM 100 D

4. Chemical composition

The steel forgings shall be tested in accordance with 10.2 and the resulting ladle analysis values shall conform to Table 2.

Table 2. Chemical Composition

Unit: %

C	Si	Mn	P	S	Cr	Mo
0.48 max.	0.15 to 0.35	0.30 to 0.85	0.030 max.	0.030 max.	0.90 to 1.50	0.15 to 0.30

Remarks 1. Cu as an impure content shall not exceed 0.03 %.

2. The chemical composition may be decided within the ranges shown in Table 2 by agreement between the purchaser and the manufacturer.

5. Mechanical Properties

The steel forgings shall be tested in accordance with 10.3 and the resulting proof stress or yield point, tensile strength, elongation, reduction in area, Charpy impact value and hardness shall conform to Table 3-1 or Table 3-2 for the rod-shaped forgings, conform to Table 4-1 or Table 4-2 for the ring-shaped forgings and conform to Table 5-1 or Table 5-2 for the disc-shaped forgings.

The mechanical properties of the steel forgings subjected to heat treatments other than hardening and tempering shall be decided by agreement between the purchaser and the manufacturer.

6. Shapes, Dimensions and Tolerances

The steel forgings shall be tested in accordance with 10.4 and the shapes, dimensions and the tolerances shall be as agreed upon by the parties concerned.

7. Appearance

The steel forgings shall be tested in accordance with 10.5 and they shall be externally well-finished and shall be free from cracks, flaws, etc. harmful to practical use.

8. Soundness

The steel forgings shall be subjected to the ultrasonic flaw detection test in accordance with 10.6 or by other suitable methods, and shall have no internal defects harmful to practical use.

Further, the soundness conformance criteria of the steel forgings shall be as agreed upon by the parties concerned.

9. Manufacturing Method

9.1 General Matters of Manufacturing Methods General matters of the manufacture of the steel forgings shall be as specified in 3. of JIS G 0306. However, when part of the steel forgings is formed by means of gas cutting, agreement shall be made between the purchaser and the manufacturer.

9.2 Heat Treatment The steel forgings shall be subjected to heat treatments of hardening and tempering at the tempering temperature of 550°C or higher.

When heat treatments other than the above are to be carried out, agreement shall be made between the purchaser and the manufacturer.

Table 3-1. Mechanical Properties (Rod-shaped Steel Forgings)
(Applicable till the end of 1990)

Type symbol	Diameter or thickness of specimen at heat treatment mm	Yield point kgf/mm ² {N/mm ² }	Tensile strength (1) kgf/mm ² {N/mm ² }	Elongation		Reduction of area		Impact value		Hardness (2)	
				Axial	Tangen- tial	Axial	Tangen- tial	Axial	Tangential	HB	HS
				%	%	%	%	kgf·m/cm ² {J/cm ² }	kgf·m/cm ² {J/cm ² }		
				14 A test piece				No. 3 test piece			
SFCM 60 S	Up to 200	37 min. {363} min.	60 to 75 {588 to 735}	20 min.	—	54 min.	—	9.0 min. {88.3} min.	—	170 min.	26 min.
	200 or over up to 400	37 min. {363} min.		19 min.	14 min.	51 min.	33 min.	8.0 min. {78.5} min.	5.5 min. {53.9} min.		
	400 or over up to 700	37 min. {363} min.		18 min.	13 min.	48 min.	31 min.	7.0 min. {68.6} min.	4.5 min. {44.1} min.		
SFCM 65 S	Up to 200	42 min. {412} min.	65 to 80 {637 to 785}	18 min.	—	51 min.	—	8.0 min. {78.5} min.	—	187 min.	28 min.
	200 or over up to 400	42 min. {412} min.		17 min.	13 min.	48 min.	31 min.	7.0 min. {68.6} min.	5.0 min. {49.0} min.		
	400 or over up to 700	42 min. {412} min.		16 min.	12 min.	45 min.	29 min.	6.0 min. {58.8} min.	4.0 min. {39.2} min.		
SFCM 70 S	Up to 200	47 min. {461} min.	70 to 85 {686 to 834}	17 min.	—	48 min.	—	7.0 min. {68.6} min.	—	201 min.	31 min.
	200 or over up to 400	46 min. {451} min.		16 min.	12 min.	45 min.	29 min.	6.5 min. {63.7} min.	4.5 min. {44.1} min.		
	400 or over up to 700	46 min. {451} min.		15 min.	11 min.	43 min.	27 min.	5.5 min. {53.9} min.	3.5 min. {34.3} min.		
SFCM 75 S	Up to 200	52 min. {510} min.	75 to 90 {735 to 883}	16 min.	—	45 min.	—	6.5 min. {63.7} min.	—	217 min.	33 min.
	200 or over up to 400	51 min. {500} min.		15 min.	11 min.	43 min.	28 min.	5.5 min. {53.9} min.	4.0 min. {39.2} min.		
	400 or over up to 700	50 min. {490} min.		14 min.	10 min.	40 min.	26 min.	5.0 min. {49.0} min.	3.0 min. {29.4} min.		
SFCM 80 S	Up to 200	57 min. {559} min.	80 to 95 {785 to 932}	15 min.	—	43 min.	—	5.5 min. {53.9} min.	—	229 min.	34 min.
	200 or over up to 400	56 min. {549} min.		14 min.	10 min.	40 min.	27 min.	5.0 min. {49.0} min.	3.5 min. {34.3} min.		
	400 or over up to 700	55 min. {539} min.		13 min.	9 min.	38 min.	25 min.	4.5 min. {44.1} min.	3.0 min. {29.4} min.		
SFCM 85 S	Up to 200	62 min. {608} min.	85 to 100 {834 to 981}	14 min.	—	41 min.	—	5.0 min. {49.0} min.	—	241 min.	36 min.
	200 or over up to 400	60 min. {588} min.		13 min.	9 min.	38 min.	25 min.	4.5 min. {44.1} min.	3.0 min. {29.4} min.		
	400 or over up to 700	59 min. {579} min.		12 min.	8 min.	35 min.	23 min.	4.0 min. {39.2} min.	2.5 min. {24.5} min.		
SFCM 90 S	Up to 200	67 min. {657} min.	90 to 105 {883 to 1 030}	13 min.	—	39 min.	—	5.0 min. {49.0} min.	—	255 min.	38 min.
	200 or over up to 400	65 min. {637} min.		12 min.	9 min.	36 min.	24 min.	4.5 min. {44.1} min.	3.0 min. {29.4} min.		
	400 or over up to 700	64 min. {628} min.		11 min.	8 min.	33 min.	22 min.	4.0 min. {39.2} min.	2.5 min. {24.5} min.		
SFCM 95 S	Up to 200	72 min. {706} min.	95 to 110 {932 to 1 079}	12 min.	—	37 min.	—	4.5 min. {44.1} min.	—	269 min.	40 min.
	200 or over up to 400	70 min. {686} min.		11 min.	8 min.	34 min.	22 min.	4.0 min. {39.2} min.	3.0 min. {29.4} min.		
SFCM 100 S	Up to 200	77 min. {755} min.	100 to 115 {981 to 1 128}	11 min.	—	36 min.	—	4.5 min. {44.1} min.	—	285 min.	42 min.

Notes (1) The tensile strength dispersion of individual pieces of the steel forgings shall not exceed 10 kgf/mm² {98.1 N/mm²}.

(2) The hardness dispersion of the steel forgings of one lot shall not exceed HB 50 or HS 8, and the hardness dispersion of individual pieces of the steel forgings shall not exceed HB 30 or HS 5.