

Nickel Chromium Molybdenum Steel Forgings for General Use

1. Scope

This Japanese Industrial Standard specifies the nickel 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.

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. 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.

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
SFNCM 70 S	SFNCM 70 R	SFNCM 70 D
SFNCM 75 S	SFNCM 75 R	SFNCM 75 D
SFNCM 80 S	SFNCM 80 R	SFNCM 80 D
SFNCM 85 S	SFNCM 85 R	SFNCM 85 D
SFNCM 90 S	SFNCM 90 R	SFNCM 90 D
SFNCM 95 S	SFNCM 95 R	SFNCM 95 D
SFNCM 100 S	SFNCM 100 R	SFNCM 100 D
SFNCM 105 S	SFNCM 105 R	SFNCM 105 D
SFNCM 110 S	SFNCM 110 R	SFNCM 110 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
SFNCM 690 S	SFNCM 70 S	SFNCM 690 R	SFNCM 70 R	SFNCM 690 D	SFNCM 70 D
SFNCM 740 S	SFNCM 75 S	SFNCM 740 R	SFNCM 75 R	SFNCM 740 D	SFNCM 75 D
SFNCM 780 S	SFNCM 80 S	SFNCM 780 R	SFNCM 80 R	SFNCM 780 D	SFNCM 80 D
SFNCM 830 S	SFNCM 85 S	SFNCM 830 R	SFNCM 85 R	SFNCM 830 D	SFNCM 85 D
SFNCM 880 S	SFNCM 90 S	SFNCM 880 R	SFNCM 90 R	SFNCM 880 D	SFNCM 90 D
SFNCM 930 S	SFNCM 95 S	SFNCM 930 R	SFNCM 95 R	SFNCM 930 D	SFNCM 95 D
SFNCM 980 S	SFNCM 100 S	SFNCM 980 R	SFNCM 100 R	SFNCM 980 D	SFNCM 100 D
SFNCM 1 030 S	SFNCM 105 S	SFNCM 1 030 R	SFNCM 105 R	SFNCM 1 030 D	SFNCM 105 D
SFNCM 1 080 S	SFNCM 110 S	SFNCM 1 080 R	SFNCM 110 R	SFNCM 1 080 D	SFNCM 110 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	Ni	Cr	Mo
0.50 max.	0.15 [±] 0.35	0.35 [±] 1.00	0.030 max.	0.030 max.	0.40 [±] 3.50	0.40 [±] 3.50	0.15 [±] 0.70

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, Dimension 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 Methods

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 thick- ness 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 in 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 }		
				No. 14 A test piece				No. 3 test piece			
SFNCM 70S	Up to 200	50 min. {490} min.	70 to 85 {686 to 834}	18 min.	—	51 min.	—	8.5 min. {83.4} min.	—	201 min.	31 min.
	200 and over, up to 400	50 min. {490} min.		17 min.	13 min.	48 min.	31 min.	8.0 min. {78.5} min.	5.0 min. {49.0} min.		
	400 and over, up to 700	50 min. {490} min.		16 min.	12 min.	46 min.	29 min.	7.5 min. {73.5} min.	4.5 min. {44.1} min.		
	700 and over, up to 1000	50 min. {490} min.		15 min.	11 min.	43 min.	27 min.	6.5 min. {63.7} min.	4.5 min. {44.1} min.		
SFNCM 75S	Up to 200	55 min. {539} min.	75 to 90 {735 to 883}	17 min.	—	48 min.	—	8.0 min. {78.5} min.	—	217 min.	33 min.
	200 and over, up to 400	54 min. {530} min.		16 min.	12 min.	46 min.	30 min.	7.5 min. {73.5} min.	5.0 min. {49.0} min.		
	400 and over, up to 700	54 min. {530} min.		15 min.	11 min.	43 min.	28 min.	7.0 min. {68.6} min.	4.5 min. {44.1} min.		
	700 and over, up to 1000	53 min. {520} min.		14 min.	10 min.	40 min.	26 min.	6.0 min. {58.8} min.	4.0 min. {39.2} min.		
SFNCM 80S	Up to 200	60 min. {588} min.	80 to 95 {785 to 932}	16 min.	—	46 min.	—	7.5 min. {73.5} min.	—	229 min.	34 min.
	200 and over, up to 400	59 min. {579} min.		15 min.	11 min.	43 min.	29 min.	7.0 min. {68.6} min.	4.5 min. {44.1} min.		
	400 and over, up to 700	58 min. {569} min.		14 min.	10 min.	40 min.	27 min.	6.5 min. {63.7} min.	4.0 min. {39.2} min.		
	700 and over, up to 1000	57 min. {559} min.		13 min.	9 min.	36 min.	25 min.	5.5 min. {53.9} min.	3.5 min. {34.3} min.		
SFNCM 85S	Up to 200	65 min. {637} min.	85 to 100 {834 to 981}	15 min.	—	44 min.	—	7.0 min. {68.6} min.	—	241 min.	36 min.
	200 and over, up to 400	63 min. {618} min.		14 min.	10 min.	41 min.	27 min.	6.5 min. {63.7} min.	4.5 min. {44.1} min.		
	400 and over, up to 700	62 min. {608} min.		13 min.	9 min.	38 min.	25 min.	6.0 min. {58.8} min.	4.0 min. {39.2} min.		
	700 and over, up to 1000	61 min. {598} min.		12 min.	8 min.	34 min.	23 min.	5.0 min. {49.0} min.	3.5 min. {34.3} min.		
SFNCM 90S	Up to 200	70 min. {686} min.	90 to 105 {883 to 1030}	14 min.	—	42 min.	—	7.0 min. {68.6} min.	—	255 min.	38 min.
	200 and over, up to 400	68 min. {667} min.		13 min.	10 min.	39 min.	26 min.	6.5 min. {63.7} min.	4.0 min. {39.2} min.		
	400 and over, up to 700	67 min. {657} min.		12 min.	9 min.	36 min.	24 min.	6.0 min. {58.8} min.	3.5 min. {34.3} min.		
	700 and over, up to 1000	65 min. {637} min.		11 min.	8 min.	33 min.	22 min.	5.0 min. {49.0} min.	3.0 min. {29.4} min.		
SFNCM 95S	Up to 200	75 min. {735} min.	95 to 110 {932 to 1079}	13 min.	—	40 min.	—	6.5 min. {63.7} min.	—	269 min.	40 min.
	200 and over, up to 400	73 min. {716} min.		12 min.	9 min.	37 min.	25 min.	6.0 min. {58.8} min.	3.5 min. {34.3} min.		
	400 and over, up to 700	72 min. {706} min.		11 min.	8 min.	35 min.	24 min.	5.5 min. {53.9} min.	3.5 min. {34.3} min.		
	700 and over, up to 1000	70 min. {686} min.		10 min.	7 min.	32 min.	22 min.	4.5 min. {44.1} min.	3.0 min. {29.4} min.		
SFNCM 100S	Up to 200	80 min. {785} min.	100 to 115 {981 to 1128}	13 min.	—	39 min.	—	6.5 min. {63.7} min.	—	285 min.	42 min.
	200 and over, up to 400	78 min. {765} min.		12 min.	8 min.	36 min.	24 min.	6.0 min. {58.8} min.	3.5 min. {34.3} min.		
	400 and over, up to 700	77 min. {755} min.		11 min.	7 min.	34 min.	23 min.	5.5 min. {53.9} min.	3.5 min. {34.3} min.		
SFNCM 105S	Up to 200	85 min. {834} min.	105 to 120 {1030 to 1177}	11 min.	—	38 min.	—	6.0 min. {58.8} min.	—	302 min.	45 min.
	200 and over, up to 400	83 min. {814} min.		11 min.	7 min.	35 min.	23 min.	5.5 min. {53.9} min.	3.5 min. {34.3} min.		
SFNCM 110S	Up to 200	90 min. {883} min.	110 to 125 {1079 to 1226}	11 min.	—	37 min.	—	6.0 min. {58.8} min.	—	311 min.	46 min.
	200 and over, up to 400	88 min. {863} min.		11 min.	7 min.	35 min.	23 min.	5.5 min. {53.9} min.	3.5 min. {34.3} 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.

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

Type symbol	Diameter or thick- ness of specimen at heat treatment mm	Yield point N/mm ²	Tensile strength (1) N/mm ²	Elongation		Reduction in area		Impact value		Hardness (2)	
				Axial %	Tangen- tial %	Axial	Tangen- tial	Axial {J/cm ² }	Tangen- tial {J/cm ² }	HB	HS
				No. 14 A test piece		%	%	No. 3 test piece			
SFNCM 690 S	Up to 200	490 min.	690 to 830	18 min.	—	51 min.	—	83 min.	—	201 min.	31 min.
	200 and over, up to 400	490 min.		17 min.	13 min.	48 min.	31 min.	78 min.	49 min.		
	400 and over, up to 700	490 min.		16 min.	12 min.	46 min.	29 min.	74 min.	44 min.		
	700 and over, up to 1000	490 min.		15 min.	11 min.	43 min.	27 min.	64 min.	44 min.		
SFNCM 740 S	Up to 200	540 min.	740 to 880	17 min.	—	48 min.	—	78 min.	—	217 min.	33 min.
	200 and over, up to 400	530 min.		16 min.	12 min.	46 min.	30 min.	74 min.	49 min.		
	400 and over, up to 700	530 min.		15 min.	11 min.	43 min.	28 min.	69 min.	44 min.		
	700 and over, up to 1000	520 min.		14 min.	10 min.	40 min.	26 min.	59 min.	39 min.		
SFNCM 780 S	Up to 200	590 min.	780 to 930	16 min.	—	46 min.	—	74 min.	—	229 min.	34 min.
	200 and over, up to 400	580 min.		15 min.	11 min.	43 min.	29 min.	69 min.	44 min.		
	400 and over, up to 700	570 min.		14 min.	10 min.	40 min.	27 min.	64 min.	39 min.		
	700 and over, up to 1000	560 min.		13 min.	9 min.	36 min.	25 min.	54 min.	34 min.		
SFNCM 830 S	Up to 200	635 min.	830 to 980	15 min.	—	44 min.	—	69 min.	—	241 min.	36 min.
	200 and over, up to 400	615 min.		14 min.	10 min.	41 min.	27 min.	64 min.	44 min.		
	400 and over, up to 700	610 min.		13 min.	9 min.	38 min.	25 min.	59 min.	39 min.		
	700 and over, up to 1000	600 min.		12 min.	8 min.	34 min.	23 min.	49 min.	34 min.		
SFNCM 880 S	Up to 200	685 min.	880 to 1 030	14 min.	—	42 min.	—	69 min.	—	255 min.	38 min.
	200 and over, up to 400	665 min.		13 min.	10 min.	39 min.	26 min.	64 min.	39 min.		
	400 and over, up to 700	655 min.		12 min.	9 min.	36 min.	24 min.	59 min.	34 min.		
	700 and over, up to 1000	635 min.		11 min.	8 min.	33 min.	22 min.	49 min.	29 min.		
SFNCM 930 S	Up to 200	735 min.	930 to 1 080	13 min.	—	40 min.	—	64 min.	—	269 min.	40 min.
	200 and over, up to 400	715 min.		12 min.	9 min.	37 min.	25 min.	59 min.	34 min.		
	400 and over, up to 700	705 min.		11 min.	8 min.	35 min.	24 min.	54 min.	34 min.		
	700 and over, up to 1000	685 min.		10 min.	7 min.	32 min.	22 min.	44 min.	29 min.		
SFNCM 980 S	Up to 200	785 min.	980 to 1 130	13 min.	—	39 min.	—	64 min.	—	285 min.	42 min.
	200 and over, up to 400	765 min.		12 min.	8 min.	36 min.	24 min.	59 min.	34 min.		
	400 and over, up to 700	755 min.		11 min.	7 min.	34 min.	23 min.	54 min.	34 min.		
SFNCM 1 030 S	Up to 200	835 min.	1 030 to 1 180	11 min.	—	38 min.	—	59 min.	—	302 min.	45 min.
	200 and over, up to 400	815 min.		11 min.	7 min.	35 min.	23 min.	54 min.	34 min.		
SFNCM 1 080 S	Up to 200	885 min.	1 080 to 1 230	11 min.	—	37 min.	—	59 min.	—	311 min.	46 min.
	200 and over, up to 400	860 min.		11 min.	7 min.	35 min.	23 min.	54 min.	34 min.		

Notes (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.

(3) The tensile strength dispersion of individual pieces of the steel forgings shall not exceed 100 N/mm².

Table 4-1. Mechanical Properties (Ring-shaped Steel Forgings)
(Applicable till the end of 1990)

Type symbol	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 in area	Impact value	Hardness (2)	
				Tangential	Tangential	Tangential	HB	HS
				% 14 A test piece	%	kgf·m/cm ² {J/cm ² } No. 3 test piece		
SFNCM 70 R	Up to 100	50 min. {490} min.	70±85 {686±834}	18 min.	45 min.	7.5 min. {73.5} min.	201 min.	31 min.
	100 and over, up to 200	50 min. {490} min.		17 min.	44 min.	7.0 min. {68.6} min.		
	200 and over, up to 300	50 min. {490} min.		16 min.	42 min.	6.5 min. {63.7} min.		
	300 and over, up to 400	50 min. {490} min.		15 min.	41 min.	6.0 min. {58.8} min.		
SFNCM 75 R	Up to 100	56 min. {549} min.	75±90 {735±883}	17 min.	43 min.	7.0 min. {68.6} min.	217 min.	33 min.
	100 and over, up to 200	55 min. {539} min.		16 min.	42 min.	6.5 min. {63.7} min.		
	200 and over, up to 300	54 min. {530} min.		15 min.	40 min.	6.0 min. {58.8} min.		
	300 and over, up to 400	54 min. {530} min.		14 min.	39 min.	5.5 min. {53.9} min.		
SFNCM 80 R	Up to 100	61 min. {598} min.	80±95 {785±932}	16 min.	40 min.	6.5 min. {63.7} min.	229 min.	34 min.
	100 and over, up to 200	60 min. {588} min.		15 min.	39 min.	6.0 min. {58.8} min.		
	200 and over, up to 300	59 min. {579} min.		14 min.	38 min.	6.0 min. {58.8} min.		
	300 and over, up to 400	58 min. {569} min.		13 min.	37 min.	5.0 min. {49.0} min.		
SFNCM 85 R	Up to 100	67 min. {657} min.	85±100 {834±981}	15 min.	38 min.	6.0 min. {58.8} min.	241 min.	36 min.
	100 and over, up to 200	65 min. {637} min.		14 min.	37 min.	5.5 min. {53.9} min.		
	200 and over, up to 300	63 min. {618} min.		13 min.	35 min.	5.5 min. {53.9} min.		
	300 and over, up to 400	62 min. {608} min.		12 min.	34 min.	5.0 min. {49.0} min.		
SFNCM 90 R	Up to 100	72 min. {706} min.	90±105 {883±1030}	14 min.	36 min.	6.0 min. {58.8} min.	255 min.	38 min.
	100 and over, up to 200	70 min. {686} min.		13 min.	35 min.	5.5 min. {53.9} min.		
	200 and over, up to 300	68 min. {667} min.		12 min.	33 min.	5.5 min. {53.9} min.		
	300 and over, up to 400	67 min. {657} min.		11 min.	32 min.	4.5 min. {44.1} min.		
SFNCM 95 R	Up to 100	77 min. {755} min.	95±110 {932±1079}	13 min.	34 min.	5.5 min. {53.9} min.	269 min.	40 min.
	100 and over, up to 200	75 min. {735} min.		12 min.	33 min.	5.5 min. {53.9} min.		
	200 and over, up to 300	73 min. {716} min.		11 min.	32 min.	5.0 min. {49.0} min.		
	300 and over, up to 400	72 min. {706} min.		10 min.	31 min.	4.5 min. {44.1} min.		
SFNCM 100 R	Up to 100	82 min. {804} min.	100±115 {981±1128}	12 min.	33 min.	5.5 min. {53.9} min.	285 min.	42 min.
	100 and over, up to 200	80 min. {785} min.		11 min.	32 min.	5.0 min. {49.0} min.		
	200 and over, up to 300	78 min. {765} min.		10 min.	32 min.	5.0 min. {49.0} min.		
SFNCM 105 R	Up to 100	87 min. {853} min.	105±120 {1030±1177}	11 min.	32 min.	5.5 min. {53.9} min.	302 min.	45 min.
	100 and over, up to 200	85 min. {834} min.		11 min.	31 min.	5.0 min. {49.0} min.		
SFNCM 110 R	Up to 100	92 min. {902} min.	110±125 {1079±1226}	10 min.	32 min.	5.0 min. {49.0} min.	311 min.	46 min.
	100 and over, up to 200	90 min. {883} min.		10 min.	31 min.	5.0 min. {49.0} 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.

Table 4-2. Mechanical Properties (Ring-shaped Steel forgings)
(Applicable on and after Jan. 1, 1991)

Type symbol	Thickness of specimen at heat treatment mm	Yield point N/mm ²	Tensile strength (3) N/mm ²	Elongation	Reduction in area	Impact value	Hardness (2)	
				Tangential %	Tangential	Tangential J/cm ²	HB	HS
				14 A test piece	%	No. 3 test piece		
SFNCM 690 R	Up to 100	490 min.	690 to 830	18 min.	45 min.	74 min.	201 min.	31 min.
	100 and over, up to 200	490 min.		17 min.	44 min.	69 min.		
	200 and over, up to 300	490 min.		16 min.	42 min.	64 min.		
	300 and over, up to 400	490 min.		15 min.	41 min.	59 min.		
SFNCM 740 R	Up to 100	550 min.	740 to 880	17 min.	43 min.	69 min.	217 min.	33 min.
	100 and over, up to 200	540 min.		16 min.	42 min.	64 min.		
	200 and over, up to 300	530 min.		15 min.	40 min.	59 min.		
	300 and over, up to 400	530 min.		14 min.	39 min.	54 min.		
SFNCM 780 R	Up to 100	600 min.	780 to 930	16 min.	40 min.	64 min.	229 min.	34 min.
	100 and over, up to 200	590 min.		15 min.	39 min.	59 min.		
	200 and over, up to 300	580 min.		14 min.	38 min.	59 min.		
	300 and over, up to 400	570 min.		13 min.	37 min.	49 min.		
SFNCM 830 R	Up to 100	655 min.	830 to 980	15 min.	38 min.	59 min.	241 min.	36 min.
	100 and over, up to 200	635 min.		14 min.	37 min.	54 min.		
	200 and over, up to 300	615 min.		13 min.	35 min.	54 min.		
	300 and over, up to 400	610 min.		12 min.	34 min.	49 min.		
SFNCM 880 R	Up to 100	705 min.	880 to 1030	14 min.	36 min.	59 min.	255 min.	38 min.
	100 and over, up to 200	685 min.		13 min.	35 min.	54 min.		
	200 and over, up to 300	665 min.		12 min.	33 min.	54 min.		
	300 and over, up to 400	655 min.		11 min.	32 min.	44 min.		
SFNCM 930 R	Up to 100	755 min.	930 to 1080	13 min.	34 min.	54 min.	269 min.	40 min.
	100 and over, up to 200	735 min.		12 min.	33 min.	54 min.		
	200 and over, up to 300	715 min.		11 min.	32 min.	49 min.		
	300 and over, up to 400	705 min.		10 min.	31 min.	44 min.		
SFNCM 980 R	Up to 100	805 min.	980 to 1130	12 min.	33 min.	54 min.	285 min.	42 min.
	100 and over, up to 200	785 min.		11 min.	32 min.	49 min.		
	200 and over, up to 300	765 min.		10 min.	32 min.	49 min.		
SFNCM 1030 R	Up to 100	855 min.	1030 to 1180	11 min.	32 min.	54 min.	302 min.	45 min.
	100 and over, up to 200	835 min.		11 min.	31 min.	49 min.		
SFNCM 1080 R	Up to 100	900 min.	1080 to 1230	10 min.	32 min.	49 min.	311 min.	46 min.
	100 and over, up to 200	880 min.		10 min.	31 min.	49 min.		

Notes (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.

(3) The tensile strength dispersion of individual pieces of the steel forgings shall not exceed 100 N/mm².

Table 5-1. Mechanical Properties (Disc-shaped Steel Forgings)
(Applicable till the end of 1990)

Type symbol	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		Impact value Tangential kgf·m/cm ² {J/cm ² }	Hardness (2)	
				Tangential	Reduction in area			
				% 14 A test piece	Tangential %	No. 3 test piece	HB	HS
SFNCM 70 D	Up to 200	50 min. {490} min.	70 to 85 {686 to 834}	16 min.	42 min.	6.5 min. {63.7} min.	201 min.	31 min.
	200 and over, up to 300	50 min. {490} min.		15 min.	41 min.	6.0 min. {58.8} min.		
	300 and over, up to 400	49 min. {481} min.		14 min.	40 min.	5.5 min. {53.9} min.		
	400 and over, up to 600	49 min. {481} min.		13 min.	39 min.	5.5 min. {53.9} min.		
SFNCM 75 D	Up to 200	55 min. {539} min.	75 to 90 {735 to 883}	15 min.	40 min.	6.5 min. {63.7} min.	217 min.	33 min.
	200 and over, up to 300	54 min. {530} min.		14 min.	39 min.	5.5 min. {53.9} min.		
	300 and over, up to 400	54 min. {530} min.		13 min.	38 min.	5.0 min. {49.0} min.		
	400 and over, up to 600	53 min. {520} min.		12 min.	37 min.	5.0 min. {49.0} min.		
SFNCM 80 D	Up to 200	60 min. {588} min.	80 to 95 {785 to 932}	14 min.	37 min.	6.0 min. {58.8} min.	229 min.	34 min.
	200 and over, up to 300	59 min. {579} min.		13 min.	36 min.	5.5 min. {53.9} min.		
	300 and over, up to 400	59 min. {579} min.		12 min.	35 min.	5.0 min. {49.0} min.		
	400 and over, up to 600	58 min. {569} min.		11 min.	34 min.	5.0 min. {49.0} min.		
SFNCM 85 D	Up to 200	65 min. {637} min.	85 to 100 {834 to 981}	13 min.	35 min.	5.5 min. {53.9} min.	241 min.	36 min.
	200 and over, up to 300	63 min. {618} min.		12 min.	34 min.	5.0 min. {49.0} min.		
	300 and over, up to 400	63 min. {618} min.		11 min.	33 min.	4.5 min. {44.1} min.		
	400 and over, up to 600	62 min. {608} min.		10 min.	32 min.	4.5 min. {44.1} min.		
SFNCM 90 D	Up to 200	70 min. {686} min.	90 to 105 {883 to 1 030}	12 min.	33 min.	5.0 min. {49.0} min.	255 min.	38 min.
	200 and over, up to 300	68 min. {667} min.		11 min.	32 min.	4.5 min. {44.1} min.		
	300 and over, up to 400	68 min. {667} min.		10 min.	31 min.	4.5 min. {44.1} min.		
	400 and over, up to 600	66 min. {647} min.		9 min.	30 min.	4.5 min. {44.1} min.		
SFNCM 95 D	Up to 200	75 min. {735} min.	95 to 110 {932 to 1 079}	11 min.	32 min.	5.0 min. {49.0} min.	269 min.	40 min.
	200 and over, up to 300	73 min. {716} min.		10 min.	31 min.	4.5 min. {44.1} min.		
	300 and over, up to 400	72 min. {706} min.		9 min.	30 min.	4.5 min. {44.1} min.		
	400 and over, up to 600	70 min. {686} min.		8 min.	29 min.	4.0 min. {39.2} min.		
SFNCM 100 D	Up to 200	80 min. {785} min.	100 to 115 {981 to 1 128}	10 min.	31 min.	4.5 min. {44.1} min.	285 min.	42 min.
	200 and over, up to 300	78 min. {765} min.		9 min.	30 min.	4.5 min. {44.1} min.		
	300 and over, up to 400	76 min. {745} min.		8 min.	29 min.	4.0 min. {39.2} min.		
SFNCM 105 D	Up to 200	85 min. {834} min.	105 to 120 {1 030 to 1 177}	10 min.	30 min.	4.5 min. {44.1} min.	302 min.	45 min.
	200 and over, up to 300	83 min. {814} min.		9 min.	30 min.	4.0 min. {39.2} min.		
SFNCM 110 D	Up to 200	90 min. {883} min.	110 to 125 {1 079 to 1 226}	9 min.	30 min.	4.5 min. {44.1} min.	311 min.	46 min.
	200 and over, up to 300	90 min. {883} min.		9 min.	30 min.	4.0 min. {39.2} 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.

Table 5-2. Mechanical Properties (Disc-shaped Steel Forgings)
(Applicable on and after Jan. 1, 1991)

Type symbol	Thickness of specimen at heat treatment mm	Yield point N/mm ²	Tensile strength ⁽³⁾ N/mm ²	Elongation	Reduction in area	Impact value	Hardness ⁽²⁾	
				Tangential %	Tangential %	Tangential J/cm ²	HB	HS
				14 A test piece		No. 3 test piece		
SFNCM 690 D	Up to 200	490 min.	690 ⁺ 830	16 min.	42 min.	64 min.	201 min.	31 min.
	200 and over, up to 300	490 min.		15 min.	41 min.	59 min.		
	300 and over, up to 400	480 min.		14 min.	40 min.	54 min.		
	400 and over, up to 600	480 min.		13 min.	39 min.	54 min.		
SFNCM 740 D	Up to 200	540 min.	740 ⁺ 880	15 min.	40 min.	64 min.	217 min.	33 min.
	200 and over, up to 300	530 min.		14 min.	39 min.	54 min.		
	300 and over, up to 400	530 min.		13 min.	38 min.	49 min.		
	400 and over, up to 600	520 min.		12 min.	37 min.	49 min.		
SFNCM 780 D	Up to 200	590 min.	780 ⁺ 930	14 min.	37 min.	59 min.	229 min.	34 min.
	200 and over, up to 300	580 min.		13 min.	36 min.	54 min.		
	300 and over, up to 400	580 min.		12 min.	35 min.	49 min.		
	400 and over, up to 600	570 min.		11 min.	34 min.	49 min.		
SFNCM 830 D	Up to 200	635 min.	830 ⁺ 980	13 min.	35 min.	54 min.	241 min.	36 min.
	200 and over, up to 300	615 min.		12 min.	34 min.	49 min.		
	300 and over, up to 400	615 min.		11 min.	33 min.	44 min.		
	400 and over, up to 600	610 min.		10 min.	32 min.	44 min.		
SFNCM 880 D	Up to 200	685 min.	880 ⁺ 1030	12 min.	33 min.	49 min.	255 min.	38 min.
	200 and over, up to 300	665 min.		11 min.	32 min.	44 min.		
	300 and over, up to 400	665 min.		10 min.	31 min.	44 min.		
	400 and over, up to 600	645 min.		9 min.	30 min.	44 min.		
SFNCM 930 D	Up to 200	735 min.	930 ⁺ 1080	11 min.	32 min.	49 min.	269 min.	40 min.
	200 and over, up to 300	715 min.		10 min.	31 min.	44 min.		
	300 and over, up to 400	705 min.		9 min.	30 min.	44 min.		
	400 and over, up to 600	685 min.		8 min.	29 min.	39 min.		
SFNCM 980 D	Up to 200	785 min.	980 ⁺ 1130	10 min.	31 min.	44 min.	285 min.	42 min.
	200 and over, up to 300	765 min.		9 min.	30 min.	44 min.		
	300 and over, up to 400	745 min.		8 min.	29 min.	39 min.		
SFNCM 1030 D	Up to 200	835 min.	1030 ⁺ 1180	10 min.	30 min.	44 min.	302 min.	45 min.
	200 and over, up to 300	815 min.		9 min.	30 min.	39 min.		
SFNCM 1080 D	Up to 200	880 min.	1080 ⁺ 1230	9 min.	30 min.	44 min.	311 min.	46 min.
	200 and over, up to 300	880 min.		9 min.	30 min.	39 min.		

Notes ⁽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.

⁽³⁾ The tensile strength dispersion of individual pieces of the steel forgings shall not exceed 100 N/mm².

10. Tests

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

When requested by the purchaser, the manufacturer shall have his presence at the tests.

10.2 Analysis Test The general procedures of the analysis tests shall be as specified in 4.1 of JIS G 0306. 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 1219	JIS G 1253	JIS G 1256	JIS G 1257

10.3 Mechanical Test The purchaser may designate in advance B-1, B-2 or B-3 in the divisions in Table 6 of JIS G 0306. However, in the absence of any specification, B-2 shall be selected.

10.3.1 Sampling of Test Specimens and Test Pieces The method of sampling test specimens and test pieces shall be as specified in 4.2.2 (2.1) of JIS G 0306.

10.3.2 Number of Test Specimens The number of test specimens shall be as specified in 4.2.2 (2.2) of JIS G 0306.

10.3.3 Number of Test Pieces The number of test pieces shall be as specified in 4.2.2 (2.3) of JIS G 0306.

10.3.4 Positions and Number of Hardness Measurements The positions and number of measurements in the hardness test shall be as specified in 4.2.2 (2.4) of JIS G 0306.

10.3.5 Test Methods The test method shall be as specified below:

- (1) Tensile test method 4.2.2 (2.5) of JIS G 0306
- (2) Impact test method 4.2.2 (2.6) of JIS G 0306
- (3) Hardness test method 4.2.2 (2.7) of JIS G 0306

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

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

10.6 Ultrasonic Flaw Detection Test The steel forgings shall, as a rule, be subjected to the ultrasonic flaw detection test and the test method shall be as specified in JIS G 0587.

11. Retest

The retest for the mechanical tests shall be as specified in 5.1 of JIS G 0306.

12. Inspection

12.1 The inspection of the steel forgings shall be as specified below:

- (1) General matters of inspection shall be as specified in 6. of JIS G 0306.
- (2) Chemical composition shall comply with 4.
- (3) The mechanical properties shall comply with 5.
- (4) The shapes and dimensions shall comply with 6.
- (5) The appearance shall comply with 7.
- (6) The degree of soundness shall comply with 8.

12.2 In addition to the inspection items listed in 12.1, the purchaser may specify any one of the following inspections.

In such a case, prior agreement shall be made between the purchaser and the manufacturer regarding test items, method of sampling specimens, the test method, and the acceptance criteria.

Magnetic particle flaw detection test ⁽⁴⁾

Liquid penetrant flaw detection test ⁽⁵⁾

Austenitic grain size test ⁽⁶⁾

Macroscopic examination ⁽⁷⁾

Testing for nonmetallic inclusions in steel ⁽⁸⁾

Microscopic structural test

Notes ⁽⁴⁾ In accordance with JIS G 0565.

⁽⁵⁾ In accordance with JIS Z 2343.

⁽⁶⁾ In accordance with JIS G 0551.

⁽⁷⁾ In accordance with JIS G 0553.

⁽⁸⁾ In accordance with JIS G 0555.

13. Marking

The markings for the steel forgings having passed the inspection shall be as specified in 7. of JIS G 0306.

14. Report

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