

Spring Steel*

1. Scope This standard specifies steel material mainly for hot working spring as laminated spring, coil spring, torsion spring, etc., hereinafter referred to as the "steel".

5. Chemical Composition The chemical composition of steel shall be found by ladle analysis to the value given in Table 2.

Table 2

Class	Notation	Chemical composition %							
		C	Si	Mn	P	S	Cr	V	B
3 Class	SUP 3	0.75~0.90	0.15~0.35	0.30~0.60	0.035 Max.	0.035 Max.	—	—	—
4 Class	SUP 4	0.90~1.10	0.15~0.35	0.30~0.60	0.035 Max.	0.035 Max.	—	—	—
6 Class	SUP 6	0.55~0.65	1.50~1.80	0.70~1.00	0.035 Max.	0.035 Max.	—	—	—
7 Class	SUP 7	0.55~0.65	1.80~2.20	0.70~1.00	0.035 Max.	0.035 Max.	—	—	—
✓ 9 Class	SUP 9	0.50~0.60	0.15~0.35	0.65~0.95	0.035 Max.	0.035 Max.	0.65~0.95	—	—
10 Class	SUP 10	0.45~0.55	0.15~0.35	0.65~0.95	0.035 Max.	0.035 Max.	0.80~1.10	0.15~0.25	—
11 Class	SUP 11	0.50~0.60	0.15~0.35	0.65~0.95	0.035 Max.	0.035 Max.	0.65~0.95	—	0.0005 Min.

✓ Remarks: 1. Throughout classes, the value of Cu as impurities shall not exceed 30%.

2. When the products analysis for wrought steel is required by purchaser, it shall conform to Tables 2 and 3 in JIS G 0321-Products Analysis and its Tolerance for Wrought Steel.

6. Mechanical Properties By selecting a suitable temperature within the range given in Table 3, apply it to the test piece representing the steel, and subject it to the tests of tensile strength, elongation, reduction of area and hardness in heat treated condition specified in Table 3.

Table 3

Class	Notation	Heat treatment °C		Tension test				Hardness test
		Hardening	Tempering	Yield strength kg/mm ² (Reference)	Tensile strength kg/mm ²	Elongation % No.4 or No.7 test pieces	Reduction of area % No.4 test piece	Hardness H _B
3 Class	SUP 3	830 ~ 860 Oil cooled	450 ~ 500	85 Min.	110 Min.	8 Min.	—	341 ~ 401
4 Class	SUP 4	830 ~ 860 Oil cooled	450 ~ 500	90 Min.	115 Min.	7 Min.	10 Min.	352 ~ 415
6 Class	SUP 6	830 ~ 860 Oil cooled	480 ~ 530	110 Min.	125 Min.	9 Min.	20 Min.	363 ~ 429
7 Class	SUP 7	830 ~ 860 Oil cooled	490 ~ 540	110 Min.	125 Min.	9 Min.	20 Min.	363 ~ 429
9 Class	SUP 9	830 ~ 860 Oil cooled	460 ~ 510	110 Min.	125 Min.	9 Min.	20 Min.	363 ~ 429
10 Class	SUP 10	840 ~ 870 Oil cooled	470 ~ 540	110 Min.	125 Min.	10 Min.	30 Min.	363 ~ 429
11 Class	SUP 11	830 ~ 860 Oil cooled	460 ~ 510	110 Min.	125 Min.	9 Min.	20 Min.	363 ~ 429

- ✓ **Remarks:** 1. The above test may be omitted when agreed by purchaser and manufacturer.
2. The yield strength shall be determined at 0.2% of permanent set.
3. No. 4 test piece shall be used for tensile testing. For flat bar steel of under 13mm thick, however, No. 7 test piece may be used.

7. Dimension and Tolerance

7.1 Round Bar and Wire

7.1.1 The dimensions and tolerances for round bar and wire shall conform to Table 4.

Table 4

Diameter	Tolerance on diameter		Diameter	Tolerance on diameter		Diameter	Tolerance on diameter	
	As rolled or forged	As turned, ground or drawn		As rolled or forged	As turned, ground or drawn		As rolled or forged	As turned, ground or drawn
6	± 0.20	± 0.06	(19)	± 0.30	± 0.08	40	± 0.50	± 0.10
7	± 0.20	± 0.06	20	± 0.30	± 0.08	(42)	± 0.50	± 0.10
8	± 0.20	± 0.06	(21)	± 0.40	± 0.08	45	± 0.50	± 0.10
9	± 0.20	± 0.06	22	± 0.40	± 0.08	48	± 0.70	± 0.15
10	± 0.25	± 0.06	(24)	± 0.40	± 0.08	50	± 0.70	± 0.15
11	± 0.25	± 0.06	25	± 0.40	± 0.08	(53)	± 0.70	± 0.15
12	± 0.25	± 0.06	(26)	± 0.40	± 0.10	56	± 0.70	± 0.15
(13)	± 0.25	± 0.08	28	± 0.40	± 0.10	(60)	± 0.70	± 0.15
14	± 0.25	± 0.08	(30)	± 0.40	± 0.10	63	± 0.70	± 0.15
(15)	± 0.25	± 0.08	32	± 0.40	± 0.10	(65)	± 0.70	± 0.15
16	± 0.30	± 0.08	(34)	± 0.50	± 0.10	70	± 0.70	± 0.15
(17)	± 0.30	± 0.08	36	± 0.50	± 0.10	(75)	± 1.00	± 0.15
18	± 0.30	± 0.08	(38)	± 0.50	± 0.10	80	± 1.00	± 0.15

- Remarks:**
1. As far as possible, the diameters given in parenthesis should be avoided from use in new design.
 2. As a rule, for a diameter of under 25 mm, wire shall be used.
 3. The eccentricity of diameter shall not exceed the value of tolerance specified in Table 4.
 4. The tolerance on length of round bar shall not exceed $+25_0$ mm over the dimension specified by purchaser.
 5. "As rolled or forged" stated above, shall indicate those capable of being worked hot as they are. The tolerance on dimensions of steel traded as base material for machining shall be determined by agreement made between purchaser and manufacturer.

7.2 Flat Bar Steel

7.2.1 The flat bar steel shall be classified into 3 kinds A, B and C according to their shapes of sections, with the dimensions and tolerances as given in the following.

- (1) A Section The shape of section is shown in Fig. 1 with the dimensions and tolerances as given in Table 5.

Fig. 1

Unit: mm

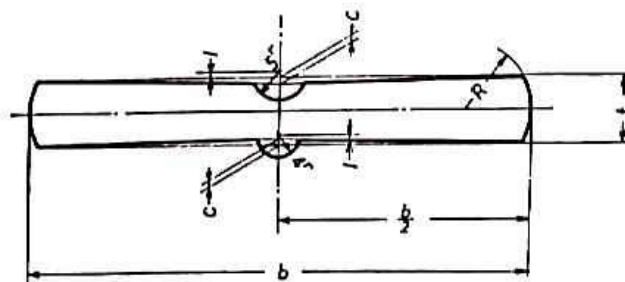


Table 5

Unit: mm

Width b	Tolerance on width	Thickness t		
		10	11	13
		Tolerance on thickness		
75	± 0.80	± 0.30	—	(± 0.30)
90	± 1.00	—	(± 0.30)	(± 0.30)
100	± 1.00	± 0.30	—	± 0.30
125	± 1.00	—	—	± 0.30

- Remarks:**
1. As far as possible, the thickness given in parenthesis should be avoided from use for new design.
 2. The thickness shall be measured at both ends of width, with the permissible difference in thickness at each end of not exceeding $\frac{1}{2}$ the value of tolerance specified in Table 5.
 3. The both faces shall be slightly dished at centre with a certain

flat portion at each end. As a rule, the dished amount of $1/1000 \times b$ shall be provided at the center.

4. The deviation of centre line of the groove shall not exceed 0.5 mm.
5. No numerical values of R for both ends are specified.

(2) B Section The shape of section is shown in Fig. 2 with the dimensions and tolerances as given in Table 6.

Fig. 2

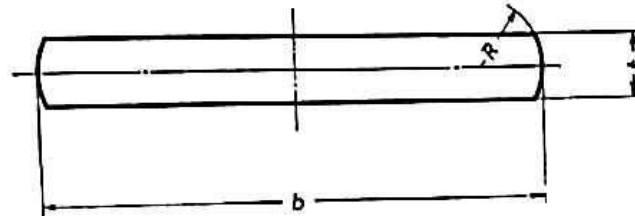


Table 6

Unit : mm

Width <i>b</i>	Tolerance on width	Thickness <i>t</i>												
		5	6	7	8	9	10	11	12	13	16	20	25	30
		Tolerance on thickness												
45	±0.50	±0.15	±0.15											
50	±0.60	±0.15	±0.15	±0.18	±0.20									
60	±0.60	±0.18	±0.15	±0.18	±0.20									
70	±0.80	±0.18	±0.18	±0.18	±0.20	±0.25	±0.25	±0.25		±0.30				
80	±0.80		±0.20	±0.20	±0.20	±0.25	±0.25	±0.30	±0.30	±0.30				
90	±1.00			±0.20	±0.20	±0.25	±0.25	±0.30	±0.30	±0.30	±0.35			
100	±1.00							±0.30		±0.30	±0.35			
115	±1.00										±0.35	±0.40	±0.50	
125	±1.00										±0.40	±0.40	±0.50	±0.50
150	±1.00													±0.50
180	±1.00													

Remarks : 1. The thickness shall be measured at both ends of width with the permissible difference in thickness at each end of not exceeding $1/2$ the value of the tolerance specified in Table 6 (with a minimum value of 0.1 mm).

2. As a rule, both faces shall be flat with no crown at the centre.
3. No numerical values of R for both ends are specified.

(3) C Section The shape of section is shown in Fig. 3 with the dimensions and tolerances as given in Table 7.

Fig. 3

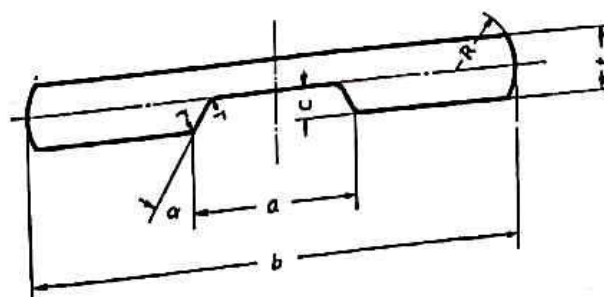


Table 7

Unit : mm

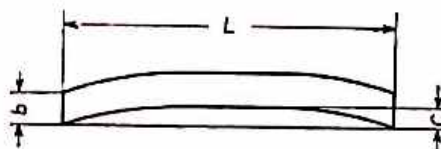
Width b	Tolerance on width	Thickness z					
		8	9	10	11	12	13
		Tolerance on thickness					
70	± 0.80	$\approx \pm 0.20$	± 0.25	$\approx \pm 0.25$	± 0.25		
80	± 0.80		± 0.25	$\approx \pm 0.25$	± 0.30	$\approx \pm 0.30$	
90	± 1.00			± 0.25	$\approx \pm 0.30$	± 0.30	
100	± 1.00				± 0.30	± 0.30	$\approx \pm 0.30$

- Remarks :**
1. The thickness shall be measured at both ends of width with the permissible difference in thickness at each end of not exceeding $\frac{1}{2}$ the value of tolerance specified in Table 7.
 2. As a rule, the width a shall be $\frac{1}{3}$ of width b , and the depth of groove c $\frac{1}{2}$ of the thickness z with the angle of inclination α of the side of groove at 30 degrees. The value of tolerance for figures with $\approx$ shall have the depth of groove less than 0.5 mm of the standard dimension ($\frac{1}{2}$ of thickness).
 3. No numerical value of R for both ends and the corners of groove r are specified.
 4. The deviation of the centre line of groove shall, as a rule, not exceed $\frac{1}{100} \times b$.

7.2.2 The deviation in horizontal plane of flat bar steel⁽¹⁾ shall neither be more than 15 mm in the length of 5 m nor exceeds 3 mm within 1 m of any arbitrary portion of the length.

Note : (1) The deviation in horizontal plane refers to the bend in right or left hand direction of the length, and is specified as indicated in Fig. 4.

Fig. 4



b = width of flat bar steel L = length of flat bar steel
 c = deviation

10 Marking The material which had passed the inspection shall have the inspection mark stamped at the works with class notation, melt number, and name of manufacturer or manufacturer's symbol on each bundle made up. When the material is supplied as rolled or forged in diameter of over 30 mm, marking shall be made on each item if required. A part of the above particulars may be omitted when agreed by purchaser.