



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 0004 : 2007

(JSMA/JSA)

Technical representation of springs

ICS 01.100.20

Reference number : JIS B 0004 : 2007 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Spring Manufacturers Association (JSMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS B 0004:1995** is replaced with this Standard.

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Date of Establishment: 1956-01-19

Date of Revision: 2007-04-20

Date of Public Notice in Official Gazette: 2007-04-20

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Machine Elements

JIS B 0004:2007, First English edition published in 2007-11

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Printed in Japan

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Technical representation of springs

1 Scope This Japanese Industrial Standard specifies the graphical representation methods and the indication methods of design and product specifications of springs.

NOTE : Unlike other parts of machine elements, springs and spring elements are often designed and produced according to the designation of the dimension under the prescribed force or of the force generated by the prescribed dimension. Therefore, simple indication of the dimensional shape is insufficient and the principal technical specifications are also provided in this Standard.

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0001 *Technical drawings for Mechanical Engineering*

JIS B 0103 *Glossary of terms used in springs*

JIS Z 8114 *Technical product documentation—Terms relating to technical drawings*

ISO 2162-1 *Technical product documentation—Springs—Part 1: Simplified representation*

3 Terms and definitions For the purposes of this Standard, the definitions given in **JIS B 0103** and **JIS Z 8114**, and the following definition shall apply.

- a) **tabular** common name of the table which describes the details of the design and product specification items difficult to be expressed as a figure

4 Graphical representation method of spring

4.1 Classification and example of spring The classification of springs and examples thereof shall be as follows. The graphical representation method of springs shall be in accordance with **JIS B 0001** and attached figures 1 to 53.

Further, the simplified figures (attached figures 11, 12, 15, 18, 20, 22, 27, 30, 32, 34 and 36) shall be in accordance with **ISO 2162-1**.

- a) Helical compression spring (hot formed, cold formed) (attached figures 1 to 12)
- b) Helical extension spring (attached figures 13 to 15)
- c) Helical torsion spring (attached figures 16 to 18)
- d) Leaf spring (attached figures 19 to 25)
- e) Torsion bar spring (attached figures 26 and 27)
- f) Stabilizer (attached figure 28)
- g) Volute spring (attached figures 29 and 30)

- h) Spiral spring (attached figures 31 to 34)
- i) Disc spring (attached figures 35 and 36)
- j) Snap ring (attached figures 37 to 41 and 48 to 51)
- k) Washer (attached figures 42 to 47)
- l) Spring pin (attached figures 52 and 53)

4.2 Basic conditions When illustrating springs, basic conditions shall be in accordance with the following.

- a) Springs shall generally be illustrated under the no force condition, and when the free dimension is for reference value, it shall be shown in the parentheses.
- b) When specifying the force to obtain the prescribed dimension or the dimension originated by the prescribed force, the explanation thereof shall be clarified in the figure, and the prescribed force or prescribed dimension shall be described. If necessary, the direction of force and the point of application shall be shown with a thick arrow. The informative figure shall be attached as appropriate, and the graphical representation method of the indication explanation and the force, such as the force of specified dimension and the dimension of specified force, shall be shown.
- c) Leaf springs shall generally be illustrated under the condition where the spring leaves are deformed to the linear state, and the explanation thereof shall be clarified in the figure. The state with no force shall be shown by the dashed two-dotted line.

4.3 Expression method The expression method shall be as follows.

- a) In the case where the whole spring is illustrated, it shall be in accordance with **JIS B 0001**. However, the front elevation of the coiled spring shall not be expressed in a spiral shape but by a straight line, and the transition part from the effective part to the portion of seat shall be expressed by a bent straight line.
- b) In the case where the continuous same shape parts are omitted, the centre position of the section of the spring material of omitted parts shall be expressed by a thin dashed dotted line.
- c) In the case where only the shape of the spring is expressed by the simplified figure, only the centre line of spring material shall be described by a thick continuous line.

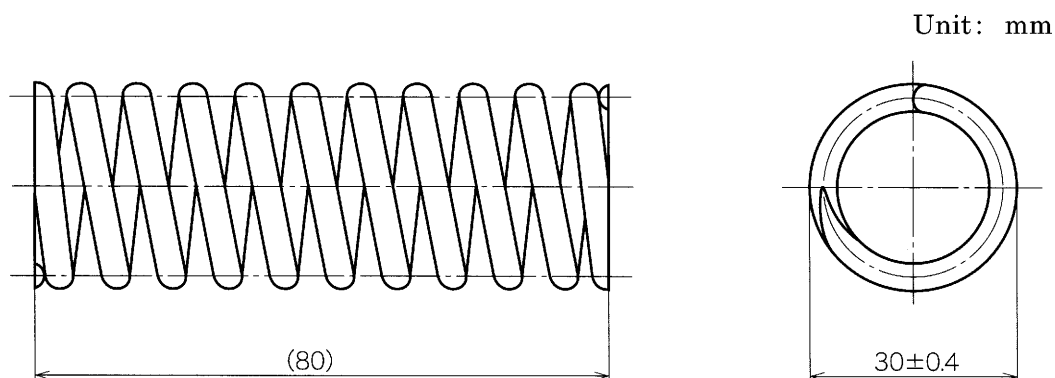
4.4 Others If necessary, shapes and dimensions of materials prior to forming to springs shall be shown as the development view. To show the combined mechanism of springs and other parts, the section of the spring material only may be shown (see attached figure 12).

5 Expression method of tabular Items shown in table 1 shall be expressed. Expression examples of typical springs shall be shown in attached figures 1 to 53.

Table 1 Technical specification items to be expressed

Division of specification	Item	Example
Material	Name, material Dimension Others	Specification symbol, hardness Wire diameter or plate thickness Surface treatment, etc.
Dimension and shape	Dimension Shape Others	Coil diameter (mean diameter, outside diameter, inside diameter), free height, solid length Number of coils (total coils, end turns, active coils), direction of helix, pitch Shape of coil end part, inclination of outside face of coil, etc.
Specified condition	Spring characteristics (plural possible)	Dimension originated by the prescribed force Force to obtain the prescribed dimension Stress under the prescribed condition
Others	Treatment after spring formation Using condition of spring, etc.	Surface treatment, setting, anti corrosion treatment Using temperature, type of force (repeat), etc.

NOTE : Items in the table shall be subdivided and concretely described according to the actual conditions. For example, the coil diameter of the coiled spring is expressed by the mean diameter and the prescribed outside diameter (or inside diameter) separately, or the helical torsion spring is expressed by the free angle instead of the free height. Items of specified conditions are also expressed according to the actual conditions. For the details, see 4.1.



Tabular

Material		SWOSC-V
Diameter of material	mm	4
Mean diameter of coil	mm	26
Outside diameter of coil	mm	30 ± 0.4
Total coils		11.5
End turns		Each 1
Active coils		9.5
Direction of helix		Right
Free height	mm	(80)
Spring constant		N/mm 15.0
Designation	Load	N —
	Height at time of load	mm —
	Height	mm 70
	Load at time of height	N 150 ± 10 %
	Stress	N/mm ² 191
Maximum compression	Load	N —
	Height at time of load	mm —
	Height	mm 55
	Load at time of height	N 375
	Stress	N/mm ² 477
Solid length		mm (44)
Thickness at the top		mm (1)
Inclination of outside face of coil		mm 4 or under
Shape of coil end part		Closed end (grinding)
Surface treatment	Surface working after forming	Shot peening
	Corrosion preventing treatment	Application of corrosion preventing oil

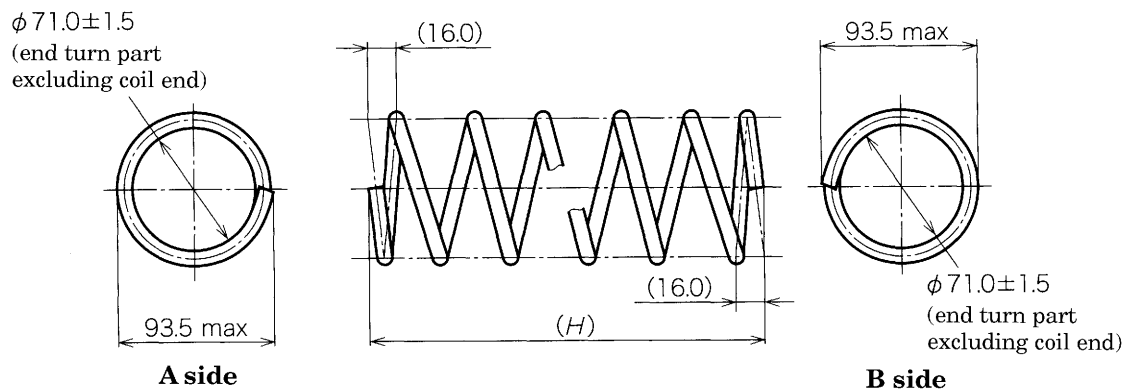
NOTES 1 Other essentials: Setting shall be carried out.

2 Usage or working conditions: Ordinary temperature, repeated load

3 $1 \text{ N/mm}^2 = 1 \text{ MPa}$

Attached Figure 1 Helical compression spring (appearance)

Unit: mm

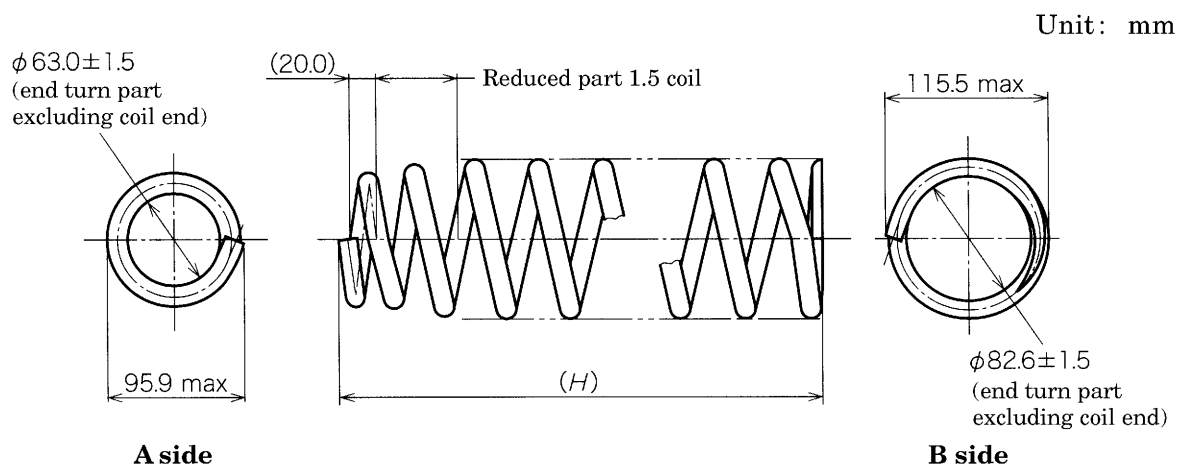


Tabular

Material		SUP9
Diameter of material	mm	9.0
Mean diameter of coil	mm	80
Inside diameter of coil	mm	71.0 ± 1.5
Total coils		(6.5)
End turns		A side: 0.75, B side: 0.75
Active coils		5.13
Direction of helix		Right
Free height (<i>H</i>)	mm	(238.5)
Spring constant		N/mm 24.5 ± 5 %
Designation	Load	N —
	Height at time of load	mm —
	Height	mm 152.5
	Load at time of height	N 2 113 ± 123
	Stress	N/mm ² 687
Maximum compression	Load	N —
	Height at time of load	mm —
	Height	mm 95.5
	Load at time of height	N 3 510
	Stress	N/mm ² 1 142
Solid length		mm (79.0)
Inclination of outside face of coil		mm 11.9 or under
Hardness		HBW 388 to 461
Shape of coil end part		A side As cut, pitch end
		B side As cut, pitch end
Surface treatment	Surface working of material Grinding	
	Surface working after forming Shot peening	
	Corrosion preventing treatment Black powder coating	

- NOTES 1 Other essentials: Setting shall be carried out.
2 Usage or working conditions: Ordinary temperature, repeated load
3 Shear modulus = 78 450 N/mm²
4 1 N/mm² = 1 MPa

Attached Figure 2 Helical compression spring



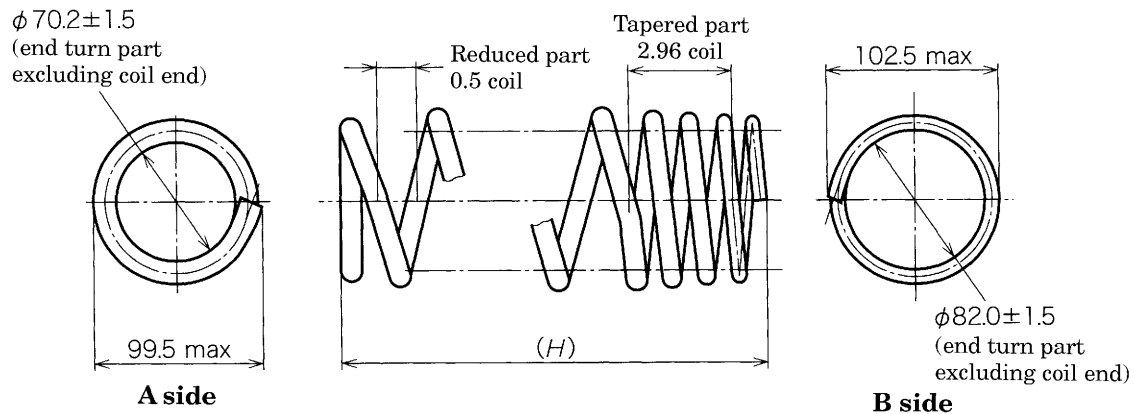
Tabular

Material		SUP9	
Diameter of material	mm	14.2	
Mean diameter of coil	mm	77.2 – 96.8	
Inside diameter of coil	mm	63.0 ± 1.5 (82.6 ± 1.5)	
Total coils		(9.0)	
End turns		A side: 1, B side: 1	
Active coils		7.19 (1.50 ± 5.69) Cone + cylindrical part	
Direction of helix		Right	
Free height (<i>H</i>)	mm	(341.5)	
Spring constant	N/mm	64.7 ± 5 %	
Designation	Load	N	—
	Height at time of load	mm	—
	Height	mm	226.5
	Load at time of height	N	7 453 ± 324
	Stress	N/mm ²	782
Maximum compression	Load	N	—
	Height at time of load	mm	—
	Height	mm	168.5
	Load at time of height	N	11 206
	Stress	N/mm ²	1 176
Solid length		mm	(138.0)
Inclination of outside face of coil		mm	17.0 or under
Hardness		HBW	388 to 461
Shape of coil end part		A side	As cut, pitch end
		B side	Tapered, pitch end
Surface treatment	Surface working of material		Grinding
	Surface working after forming		Shot peening
	Corrosion preventing treatment		Black powder coating

- NOTES 1 Other essentials: Setting shall be carried out.
 2 Usage or working conditions: Ordinary temperature, repeated load
 3 Shear modulus = 78 450 N/mm²
 4 1 N/mm² = 1 MPa

Attached Figure 3 Helical compression spring

Unit: mm



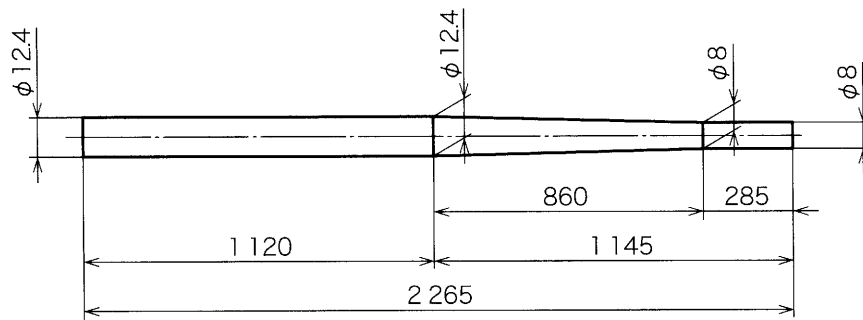
Tabular

Material		SUP9	
Diameter of material	mm	12.4 – 12.4 – 8.0	
Mean diameter of coil	mm	82.6 – 94.4 – 90.0	
Inside diameter of coil	mm	70.2 ± 1.5 (82 ± 1.5)	
Total coils		(8.35)	
End turns		A side: 1, B side: 1	
Active coils		6.35 (0.50 + 2.89 + 2.96) Cone + cylindrical part + tapered part	
Direction of helix		Right	
Free height (<i>H</i>)	mm	(256.0)	
Spring constant (K1)	N/mm	27.0 ± 7 %	
Spring constant (K2)	N/mm	83.4 ± 10 %	
Designation	Load	N	—
	Height at time of load	mm	—
	Height	mm	195.0
	Load at time of height	N	2 370 ± 417
	Stress	N/mm ²	357
Maximum compression	Load	N	—
	Height at time of load	mm	—
	Height	mm	144.0
	Load at time of height	N	6 624
	Stress	N/mm ²	997
Solid length		mm	(109.0)
Inclination of outside face of coil		mm	12.8 or under
Hardness		HBW	388 to 461
Shape of coil end part		A side	As cut, flat end
		B side	As cut, pitch end
Surface treatment	Surface working of material		Grinding
	Surface working after forming		Shot peening
	Corrosion preventing treatment		Black powder coating

- NOTES 1 Other essentials: Setting shall be carried out.
 2 Usage or working conditions: Ordinary temperature, repeated load
 3 Shear modulus = 78 450 N/mm²
 4 1 N/mm² = 1 MPa

Attached Figure 4 Helical compression spring

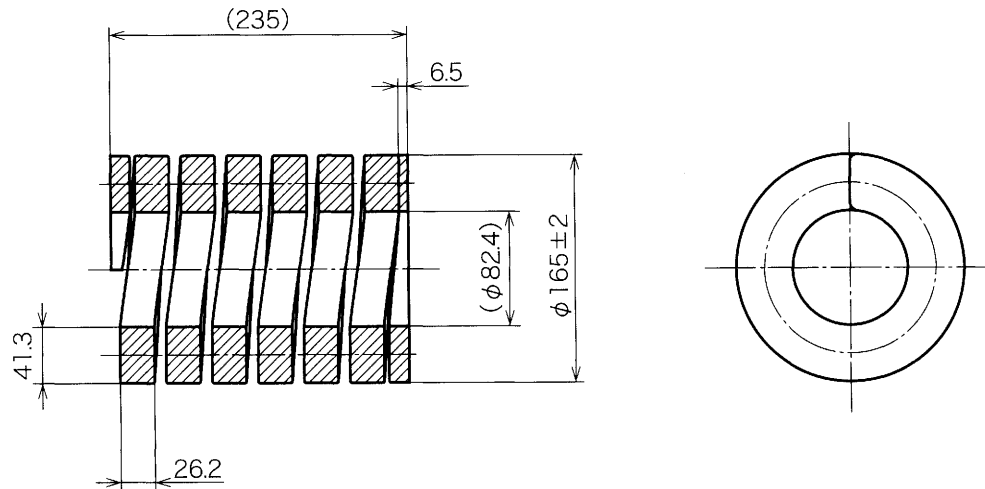
Unit: mm



Developed shape of material

Attached Figure 4 (concluded)

Unit: mm



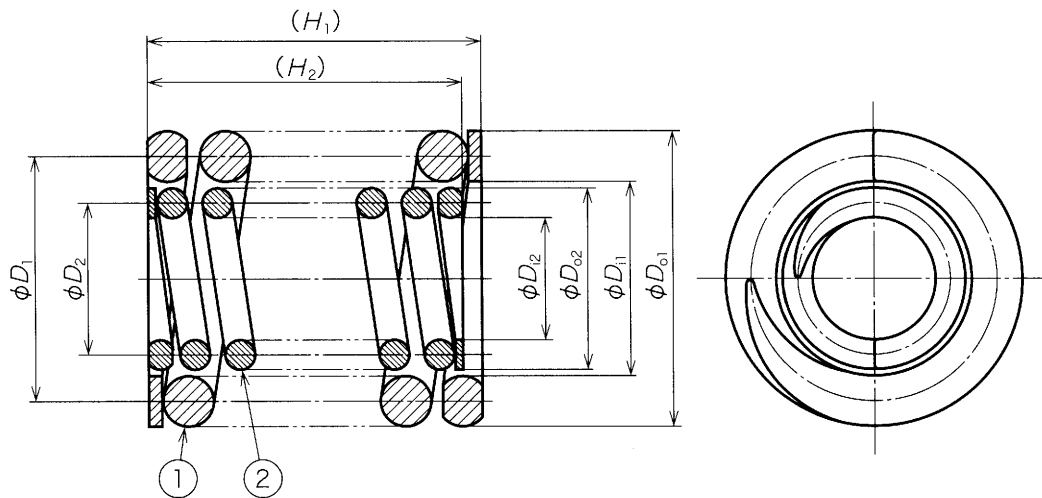
Tabular

Material		SUP9	
Diameter of material	mm	41.3×26.2	
Mean diameter of coil	mm	123.8	
Outside diameter of coil	mm	165±2	
Total coils		7.25±0.25	
End turns		Each 0.75	
Active coils		5.75	
Direction of helix		Right	
Free height	mm	(235)	
Spring constant		N/mm 1 570	
Designation	Load	N 49 000	
	Height at time of load	mm 203±3	
	Height	mm —	
	Load at time of height	N —	
	Stress	N/mm ² 596	
Maximum compression	Load	N 73 500	
	Height at time of load	mm 188	
	Height	mm —	
	Load at time of height	N —	
	Stress	N/mm ² 894	
Solid length		mm (177)	
Hardness		HBW 388 to 461	
Shape of coil end part		Closed end (grinding after tapering)	
Surface treatment	Surface working of material		Grinding
	Surface working after forming		Shot peening
	Corrosion preventing treatment		Black enamel coating

- NOTES 1 Other essentials: Setting shall be carried out.
2 Usage or working conditions: Ordinary temperature, repeated load
3 1 N/mm² = 1 MPa

Attached Figure 5 Helical compression spring (cross section)

Unit: mm



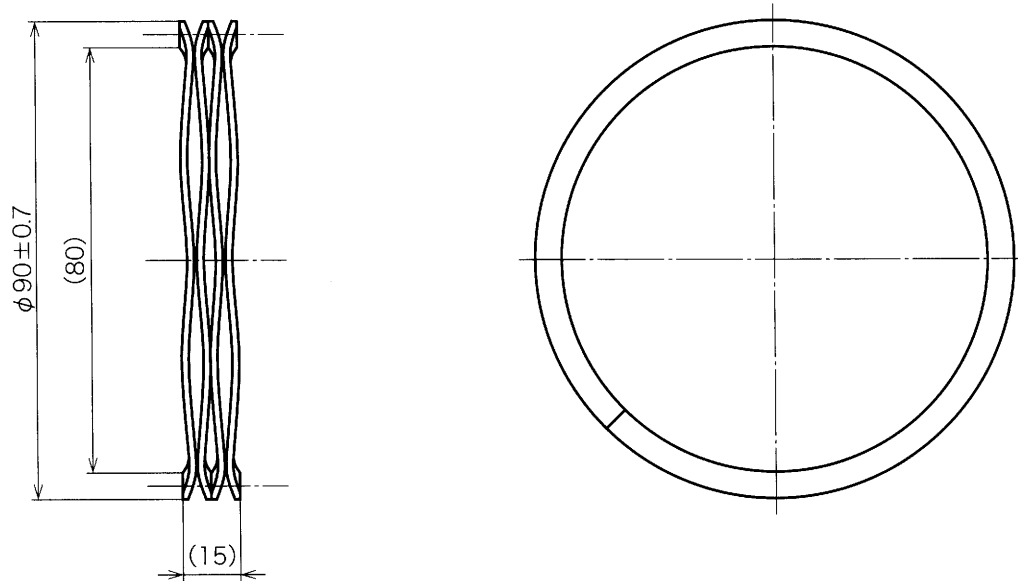
Tabular

Corresponding No.		①	②
Material		SUP9A	SUP9A
Diameter of material	mm	38	24
Mean diameter of coil (D)	mm	192	122
Inside diameter of coil (D_i)	mm	154^{+2}_{-1}	98
Outside diameter of coil (D_o)	mm	230	146^{+1}_{-2}
Total coils		(5.50)	(7.50)
End turns		A side: 1, B side: 1	A side: 1, B side: 1
Active coils		3.50	5.50
Direction of helix		Right	Left
Free height (H)	mm	(255.0)	(250.0)
Spring constant		1 151	
		825	326
Designation	Load	49 500	
		35 500	14 000
		212	207
	Height at time of load	212 ± 2	
	Height	—	
	Load at time of height	—	
Maximum compression	Load	413	411
		68 600	
		49 200	19 400
	Height at time of load	195.5	
	Height	—	
	Load at time of height	—	
Solid length		573	570
Inclination of outside face of coil		5.0 or under	
Hardness		388 to 461	
Shape of coil end part		Tapered end	
Surface treatment	Surface working of material	Grinding	
	Surface working after forming	Shot peening	
	Corrosion preventing treatment	Black coating	

- NOTES 1 Other essentials: Setting shall be carried out.
2 Usage or working conditions: Ordinary temperature, repeated load
3 The load test shall be performed with a liner of 5 mm to ②.
4 1 N/mm² = 1 MPa

Attached Figure 6 Helical compression spring

Unit: mm



Tabular

Material		SWC	
Sheet thickness	mm	1.5	
Sheet width	mm	5	
Outside diameter	mm	90 ± 0.7	
Inside diameter	mm	(80)	
Height		(15)	
Direction of helix		Right	
Active coils		4	
Number of peaks		5.5	
Designation	Height	mm	10
	Load	N	208.8 ± 31.3
	Stress	N/mm ²	744.5
Maximum compression	Height	mm	7.5
	Load	N	(313.2)
	Stress	N/mm ²	(1 116.7)
Hardness		HV	400 to 500
Surface treatment	Surface working after forming		—
	Corrosion preventing treatment		Application of corrosion preventing oil

NOTE : 1 N/mm² = 1 MPa

Attached Figure 7 Helical compression spring (coiled wave spring)