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Spring lock washers

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Foreword

This Japanese Industrial Standard has been 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 1251:2001** is replaced with this Standard.

However, **JIS B 1251: 2001** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until July 19, 2019.

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Spring lock washers

1 Scope

This Japanese Industrial Standard specifies requirements for spring lock washers, conical spring washers, toothed lock washers and waved spring washers (hereafter generically referred to as washers) to be used for bolts, screws and nuts for general use (JIS B 1101, JIS B 1111, JIS B 1176, JIS B 1180, JIS B 1181, etc.).

NOTE Annex A provides classification, shapes and dimensions of washers intended for screw and washer assemblies.

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 0103	<i>Springs — Vocabulary</i>
JIS B 0156	<i>Springs — Symbols</i>
JIS B 1001	<i>Diameter of clearance holes and counterbores for bolts and screws</i>
JIS B 1091	<i>Fasteners — Acceptance inspection</i>
JIS B 1101	<i>Slotted head screws</i>
JIS B 1111	<i>Cross recessed head screws</i>
JIS B 1176	<i>Hexagon socket head cap screws</i>
JIS B 1180	<i>Hexagon head bolts and hexagon head screws</i>
JIS B 1181	<i>Hexagon nuts and hexagon thin nuts</i>
JIS B 4620	<i>Parallel bench vices (Square jaw type)</i>
JIS B 4621	<i>Parallel bench vices (round jaw type)</i>
JIS B 7184	<i>Profile projectors</i>
JIS B 7502	<i>Micrometers</i>
JIS B 7503	<i>Mechanical dial gauges</i>
JIS B 7507	<i>Vernier, dial and digital callipers</i>
JIS B 7513	<i>Precision surface plates</i>
JIS B 7533	<i>Dial test indicators (lever type)</i>
JIS B 7738	<i>Verification of helical compression and extension springs testing machines</i>
JIS G 0201	<i>Glossary of terms used in iron and steel (Heat treatment)</i>

JIS G 0558	<i>Steels — Determination of depth of decarburization</i>
JIS G 3311	<i>Cold rolled special steel strip</i>
JIS G 3506	<i>High carbon steel wire rods</i>
JIS G 3521	<i>Hard drawn steel wires</i>
JIS G 4308	<i>Stainless steel wire rods</i>
JIS G 4802	<i>Cold-rolled steel strip for springs</i>
JIS H 3110	<i>Phosphor bronze and nickel silver sheets, plates and strips</i>
JIS H 3270	<i>Copper beryllium alloy, phosphor bronze and nickel silver rods, bars and wires</i>
JIS Z 2244	<i>Vickers hardness test — Test method</i>
JIS Z 2245	<i>Rockwell hardness test — Test method</i>

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS B 0103, JIS G 0201, and the following apply.

3.1

light duty

application of washers for bolts and screws of property class 4.8 and nuts of property class 5

3.2

heavy duty

application of washers for bolts and screws of property class 8.8 and nuts of property class 8

4 Symbols

4.1 Quantity symbols for washer dimensions

Table 1 shows the quantity symbols for washer dimensions.

Table 1 Quantity symbols for washer dimensions

Unit: mm

Symbol	Definition	Figure
b	Width of spring lock washer and waved spring washer	Tables 4, 5 and 13
D	Outside diameter of washer	Tables 4 to 13
d	Inside diameter of washer	Tables 4 to 13
e	Rim width including the teeth of the toothed lock washer (countersunk)	Table 11
H_0	Free height of washer	Tables 4 to 10, 12 and 13
H_f	Free height of spring lock washer, conical spring washer and waved spring washer after compression test	Tables 4 to 9, and 13
l	Distance between vice and wrench	Figure 26
m	Gap between the cut ends of waved spring washers	Table 13
r	Amount of chamfering or rounding, after machining, at inside of spring lock washer and waved spring washer	Tables 4, 5 and 13
t	Thickness of conical spring washer, toothed lock washer and waved spring washer	Tables 6 to 13
t_e	Thickness at outside diameter of lock washer	Tables 4 and 5
t_i	Thickness at inside diameter of lock washer	Tables 4 and 5

4.2 Symbols for washer materials

Table 2 shows the symbols for washer materials.

Table 2 Symbols for washer materials

Material	Symbol
Steel	S
Stainless steel	SUS
Phosphor bronze	PB

4.3 Symbols for classification, application or shape of washers

Table 3 shows the symbols for classification, application or shape of washers. See also JIS B 0156.

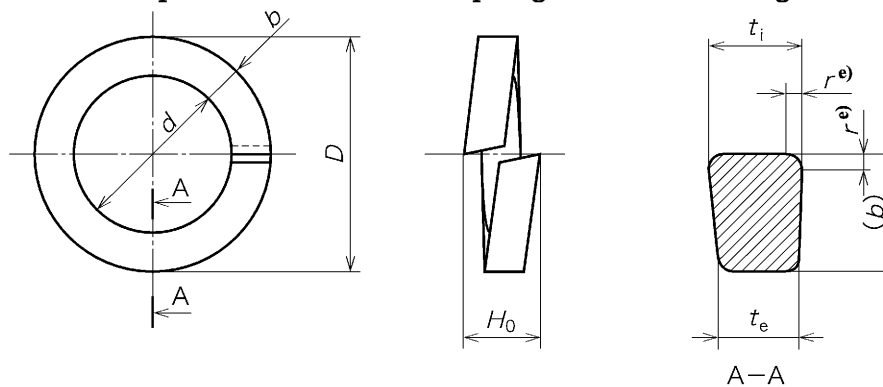
Table 3 Symbols for classification, application or shape of washers

Classification		Application or shape		Applicable threaded fastener	Dimensions table
Designation	Sym- bol	Application/shape	Sym- bol		
Spring lock washer	SW	General use	No. 2	Bolts, nuts and screws for general use	Table 4
		Heavy duty	No. 3	Bolts, nuts and screws for general use	Table 5
Conical spring washer	CW	Class 1 light duty	1L	Bolts, nuts and screws for general use	Table 6
		Class 1 heavy duty	1H		Table 7
		Class 2 light duty	2L	Hexagon socket head bolts, nuts and screws, hexalobular socket head cap screws, or other fasteners with counterbored holes	Table 8
		Class 2 heavy duty	2H		Table 9
Toothed lock washer	TW	Internal tooth	A	Bolts, nuts and screws for general use	Table 10
		External tooth	B		Table 10
		Countersunk	C	Countersunk screw	Table 11
		Internal-external tooth	AB	Bolts, nuts and screws for general use	Table 12
Waved spring washer	WW	Heavy duty ^{a)}	No. 3	Bolts, nuts and screws for general use	Table 13
Note ^{a)} Applicable to property class of up to 8.8 for steel bolts.					

5 Shape and dimensions of washers

Tables 4 to 13 show shapes and dimensions of washers.

Table 4 Shape and dimensions of spring lock washer for general use



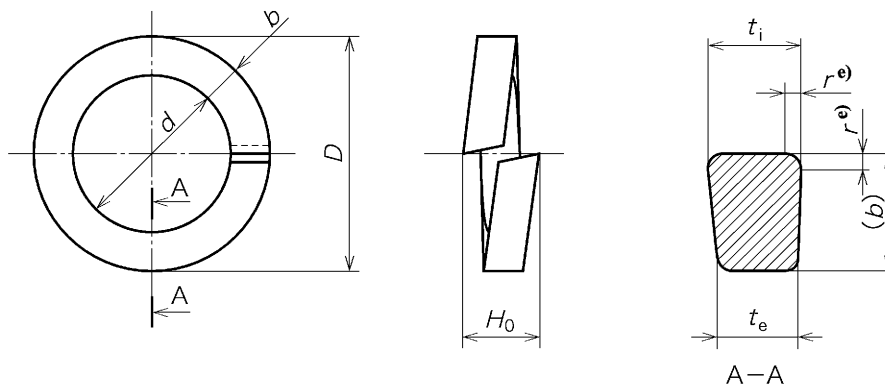
Unit: mm

Nom- inal size ^{a)}	Inside diameter ^{b)}		Sectional size (min.)		Outside diameter D (max.)	Free height H_0 (approx. 2 t)	Free height after compression test H_f (min.) ^{d)}		Test force (load) (kN)
	Basic size	Toler- ance	Width b	Thick- ness t ^{c)}			Carbon steel	Stainless steel	
2	2.1	+0.25 0	0.9	0.5	4.4	1.0	0.85	0.75	0.42
2.5	2.6	+0.3 0	1.0	0.6	5.2	1.2	1.00	0.90	0.69
3	3.1	+0.3 0	1.1	0.7	5.9	1.4	1.20	1.05	1.03
(3.5)	3.6	+0.3 0	1.2	0.8	6.6	1.6	1.35	1.20	1.37
4	4.1	+0.4 0	1.4	1.0	7.6	2.0	1.70	1.50	1.77
(4.5)	4.6	+0.4 0	1.5	1.2	8.3	2.4	2.00	1.80	2.26
5	5.1	+0.4 0	1.7	1.3	9.2	2.6	2.20	1.95	2.94
6	6.1	+0.4 0	2.7	1.5	12.2	3.0	2.50	2.25	4.12
(7)	7.1	+0.4 0	2.8	1.6	13.4	3.2	2.70	2.40	5.88
8	8.2	+0.5 0	3.2	2.0	15.4	4.0	3.35	3.00	7.45
10	10.2	+0.5 0	3.7	2.5	18.4	5.0	4.20	3.75	11.8
12	12.2	+0.6 0	4.2	3.0	21.5	6.0	5.00	4.50	17.7
(14)	14.2	+0.6 0	4.7	3.5	24.5	7.0	5.85	5.25	23.5
16	16.2	+0.8 0	5.2	4.0	28.0	8.0	6.70	6.00	32.4
(18)	18.2	+0.8 0	5.7	4.6	31.0	9.2	7.70	6.90	39.2
20	20.2	+0.8 0	6.1	5.1	33.8	10.2	8.50	7.65	49.0
(22)	22.5	+1.0 0	6.8	5.6	37.7	11.2	9.35	8.40	61.8
24	24.5	+1.0 0	7.1	5.9	40.3	11.8	9.85	8.85	71.6
(27)	27.5	+1.2 0	7.9	6.8	45.3	13.6	11.3	10.20	93.2
30	30.5	+1.2 0	8.7	7.5	49.9	15.0	12.5	11.25	118
(33)	33.5	+1.4 0	9.5	8.2	54.7	16.4	13.7	12.30	147
36	36.5	+1.4 0	10.2	9.0	59.1	18.0	15.0	13.50	167
(39)	39.5	+1.4 0	10.7	9.5	63.1	19.0	15.8	14.25	197

Table 4 (concluded)

Notes	a) Sizes in brackets should be avoided.
	b) The minimum value determined in accordance with 12.2.2.
	c) $t = (t_e + t_i)/2$, where $t_i - t_e : 0.064 b$ max. and b : the minimum value specified in this Table.
	d) Tested in accordance with 12.2.3 and 12.2.5.
	e) $r \doteq t/4$

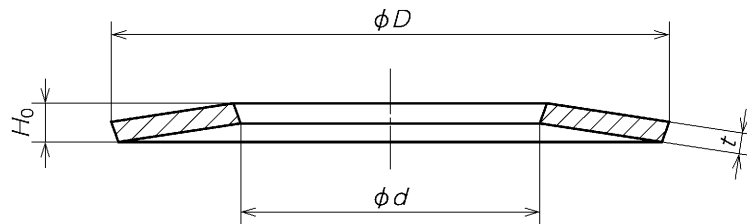
Table 5 Shape and dimensions of spring lock washer for heavy duty applications



Unit: mm

Nominal size a)	Inside diameter $d^{b)}$		Sectional size (min.)		Outside diameter D (max.)	Free height H_0 (approx. $2 t$)	Free height after compression test H_f (min.) d)		Test force (load) (kN)
	Basic size	Tolerance	Width b	Thickness $t^c)$			Carbon steel	Stainless steel	
6	6.1	$+0.4/0$	2.7	1.9	12.2	3.8	3.2	2.85	4.12
(7)	7.1	$+0.4/0$	2.8	2.0	13.4	4.0	3.4	3.00	5.88
8	8.2	$+0.5/0$	3.3	2.5	15.6	5.0	4.2	3.75	7.45
10	10.2	$+0.5/0$	3.9	3.0	18.8	6.0	5.0	4.50	11.8
12	12.2	$+0.6/0$	4.4	3.6	21.9	7.2	6.0	5.40	17.7
(14)	14.2	$+0.6/0$	4.8	4.2	24.7	8.4	7.0	6.30	23.5
16	16.2	$+0.8/0$	5.3	4.8	28.2	9.6	8.0	7.20	32.4
(18)	18.2	$+0.8/0$	5.9	5.4	31.4	10.8	9.0	8.10	39.2
20	20.2	$+0.8/0$	6.4	6.0	34.4	12.0	10.0	9.00	49.0
(22)	22.5	$+1.0/0$	7.1	6.8	38.3	13.6	11.3	10.20	61.8
24	24.5	$+1.0/0$	7.6	7.2	41.3	14.4	12.0	10.80	71.6
(27)	27.5	$+1.2/0$	8.6	8.3	46.7	16.6	13.8	12.50	93.2

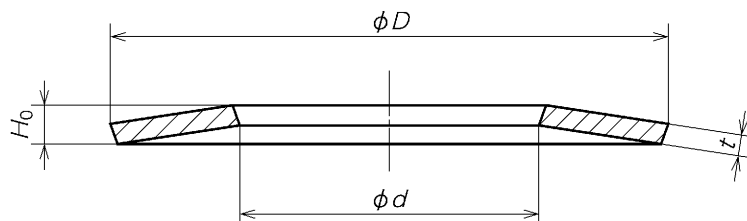
Notes	a) Sizes in brackets should be avoided.
	b) The minimum value determined in accordance with 12.2.2.
	c) $t = (t_e + t_i)/2$, where $t_i - t_e : 0.064 b$ max. and b : the minimum value specified in this Table.
	d) Tested in accordance with 12.2.3 and 12.2.5.
	e) $r \doteq t/4$

Table 6 Shape and dimensions of conical spring washer for Class 1 light duty applications

Unit: mm

Nom- inal size ^{a)}	Inside diameter $d^{b), c)}$		Outside diame- ter $D^{d)}$		Light duty (1L)				
	Basic size	Tol- erance	Basic size	Tol- erance	Thickness t		Free height (ref.) H_0	Free height after compres- sion test H_f (min.) ^{e)}	Test force (load) (kN)
					Basic size	Tol- erance			
3	3.2	+0.20 0	7.0	0 -0.25	0.5	±0.035	0.75	0.60	1.03
4	4.3	+0.20 0	9.0	0 -0.25	0.7	±0.045	0.95	0.80	1.77
(4.5)	4.8	+0.20 0	10.0	0 -0.25	0.8	±0.050	1.05	0.90	2.26
5	5.3	+0.20 0	10.0	0 -0.25	0.8	±0.050	1.10	0.90	2.94
6	6.4	+0.25 0	12.5	0 -0.30	1.0	±0.055	1.35	1.15	4.12
8	8.4	+0.25 0	17.0	0 -0.30	1.4	±0.070	1.85	1.60	7.45
10	10.5	+0.30 0	21.0	0 -0.40	1.8	±0.085	2.30	2.00	11.8
12	13.0	+0.30 0	24.0	0 -0.40	2.2	±0.100	2.70	2.45	17.7
(14)	15.0	+0.30 0	28.0	0 -0.40	2.5	±0.100	3.15	2.80	23.5
16	17.0	+0.30 0	30.0	0 -0.40	2.8	±0.100	3.50	3.10	32.4
(18)	19.0	+0.35 0	34.0	0 -0.50	3.0	±0.110	3.90	3.35	39.2
20	21.0	+0.35 0	37.0	0 -0.50	3.5	±0.110	4.40	3.85	49.0
(22)	23.0	+0.35 0	39.0	0 -0.50	3.5	±0.110	4.70	3.90	61.8
24	25.0	+0.35 0	44.0	0 -0.50	4.0	±0.110	5.20	4.45	71.6
(27)	28.0	+0.35 0	50.0	0 -0.50	4.5	±0.140	5.90	5.00	93.2
30	31.0	+0.40 0	56.0	0 -0.70	5.0	±0.140	6.60	5.60	118

- Notes ^{a)} Sizes in brackets should be avoided.
^{b)} Corresponding to Grade 1 specified in **JIS B 1001**.
^{c)} The minimum value determined in accordance with **12.2.2**.
^{d)} The maximum value determined in accordance with **12.2.2**.
^{e)} Tested in accordance with **12.2.3** and **12.2.5**.

Table 7 Shape and dimensions of conical spring washer for Class 1 heavy duty applications

Unit: mm

Nom- inal size ^{a)}	Inside diameter $d^{b), c)}$		Outside diame- ter $D^{d)}$		Heavy duty (1H)				
					Thickness t		Free height (ref.) H_0	Free height after compression test H_f (min.) ^{e)}	Test force (load) (kN)
	Basic size	Tol- erance	Basic size	Tol- erance	Basic size	Tol- erance			
6	6.4	+0.25 0	12.5	0 -0.30	1.2	±0.065	1.55	1.30	8.24
8	8.4	+0.25 0	17.0	0 -0.30	1.8	±0.085	2.15	1.95	14.7
10	10.5	+0.30 0	21.0	0 -0.40	2.2	±0.100	2.65	2.40	23.5
12	13.0	+0.30 0	24.0	0 -0.40	2.5	±0.100	3.05	2.70	34.3
(14)	15.0	+0.30 0	28.0	0 -0.40	3.0	±0.110	3.65	3.25	47.1
16	17.0	+0.30 0	30.0	0 -0.40	3.5	±0.110	4.10	3.70	63.7
(18)	19.0	+0.35 0	34.0	0 -0.50	4.0	±0.110	4.64	4.25	78.5
20	21.0	+0.35 0	37.0	0 -0.50	4.5	±0.140	5.20	4.75	98.1
(22)	23.0	+0.35 0	39.0	0 -0.50	5.0	±0.140	5.65	5.25	123
Notes ^{a)} Sizes in brackets should be avoided. ^{b)} Corresponding to Grade 1 specified in JIS B 1001. ^{c)} The minimum value determined in accordance with 12.2.2. ^{d)} The maximum value determined in accordance with 12.2.2. ^{e)} Tested in accordance with 12.2.3 and 12.2.5.									