OCHIAI
OF INDUSTRIAL FASTENERS

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OCHIAI
OF INDUSTRIAL FASTENERS

Making Progress from
the International Perspective

Global Supplier OCHIAI

Since its foundation, Ochiai has made efforts to
achieve technological improvements and
modernization of equipment and to establish the business organization with
a corporate philosophy of “supplying users with higher-quality products,
lower in price and faster in delivery”.
Ochiai has expanded its market not only in Japan but also to America,
Europe and Southeast Asia as a full-line manufacture of
industrial fasteners including a variety of retaining rings,
spring pins and steel nuts and now it keeps on
growing to be a global supplier with high industrial and
as well social expectations.
Our products are widely used for fastener component applications
in all areas such as home electric appliances,
automobiles, communication equipment,
industrial machines and precision instruments.
And they are acknowledged in excellence of product quality for each area.

Table of Contents

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OCHIAI OF INDUSTRIAL FASTENERS

Types of Retaining Rings (Characteristics and Instructions for Use)

TYPE 1 Thrust Direction Mounting Types (Groove required to be machined)

(1) Basic Internal Ring (2) Basic External Ring

Characteristics

- This is a basic retaining ring that is mounted from the thrust direction (parallel to the hole or shaft) onto the mating hole (shaft) with a grooved surface.

(3) Inverted Internal Ring (4) Inverted External Ring

Characteristics

- Compared to C-type retaining rings, the inner diameter (outer diameter) of the retaining ring after installation in the groove is smaller, allowing it to be used in more space-efficient locations.
- Compared to C-type retaining rings, the contact area with the groove is smaller, resulting in a thrust load of approximately 2/3.

(5) Beveled Internal Ring (6) Beveled External Ring

Characteristics

- The Beveled Rings can reduce looseness and unsteadiness resulting from the accuracy of machining to the groove position and variation of their retained parts.
- See page 9, “ (3) Beveled Ring” for details.

Instructions for Use

(1) Do not reuse these retaining rings.

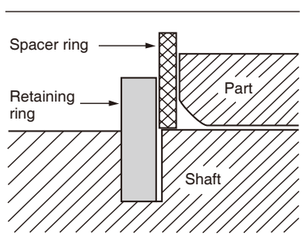
(2) When installing the retaining ring, do not compress (spread) more than 1% of the hole (shaft) diameter. Doing so may prevent it from returning to the mating groove diameter, leading to the risk of play and potential dislodgment from the groove. However, for the Beveled Ring, the amount of compression (spread) is up to the applied hole (shaft) diameter.

(3) Retaining rings are generally compressed (or spreaded) and inserted using specialized pliers (insertion with taper tools reduces permanent deformation).

(4) When fitting the retaining ring on or into retained parts, there is a danger that it may drop out of a jig and spring out causing injury. Take enough care to prevent the ring from falling off the jig.

(5) When using the external retaining ring on a rotating shaft, the ring may drop off since it will spread as the shaft is rotated at a high speed. Be sure to verify the conditions by using the actual machine.

(6) When retained parts have large corner radii or chamfers, the supporting point of load applied to the retaining ring will vary resulting in a danger that the ring may fall off the groove. In this case, fit an angular plain washer-like insert having enough rigidity in between the parts and the ring to prevent deformation.



TYPE 2 Radial Direction Mounting Type (Groove required to be machined)

(1) E-Ring

Characteristics

- This is a basic retaining ring that is mounted from the radial direction (perpendicular to the axis) onto the mating shaft with a grooved surface.

(2) Bowed E-Ring

Characteristics

- Can prevent looseness in the thrust direction.

Notes

- The retaining ring may be crushed out to prevent removal of looseness if undue load is applied since the portion acting as a spring is short.
- There will be reverse warps (flips) or settling if undue load is applied.
- The bowed ring may be hard to be fit with the fitting load larger from the following reasons:The retained part is scraped during fitting depending on the material (hardness) of the part. And the ring is fit on as the portion acting as a spring is being compressed.

(3) C-Ring

Characteristics

- The C Ring has smaller outside diameters and can be applied where space is limited. (This ring is effective where the outside diameter is restricted.)

(4) U-Ring

Characteristics

- It has higher thrust loads than the E-rings since it has a large area of contact with the groove.
- This snap ring can be removed using a screwdriver or other tool. However, the snap ring after removed cannot be reused.

Instructions for Use

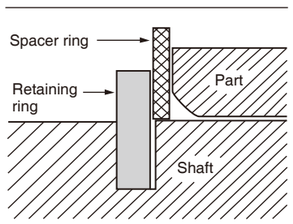
(1) Ensure that the Ring is set in the groove. Do not use any retaining ring that has been deformed by incorrect fitting. There is a danger that the ring being not gripped in the groove may fall off.

(2) Do not reuse these retaining rings.

(3) When selecting the retaining ring, check both the shaft diameter and the groove diameter before use.

(4) When using the retaining ring on a rotating shaft, the ring may drop off since it will spread due to centrifugal force. Be sure to verify the conditions by using the actual machine.

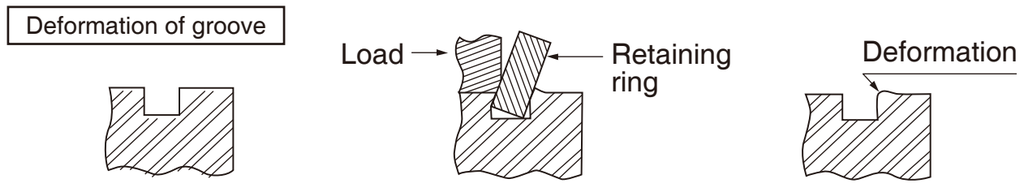
(5) When retained parts have large corner radii or chamfers, the supporting point of load applied to the retaining ring will vary resulting in a danger that the ring may fall off the groove. In this case, fit an angular plain washer-like insert having enough rigidity in between the parts and the ring to prevent deformation.



Calculations for Retaining Rings (Reference)

1 Allowable Thrust Load

The allowable thrust load is a load specified when the groove is not deformed and the retaining ring is not sheared.



(1) Allowable Thrust Load of Retaining Ring

The allowable thrust load where static load is applied to a retaining ring can be calculated according to the following formula:

$$R_S = \frac{ADTS_s\pi}{S}$$

R_S: Allowable thrust load of retaining ring (N)

A: Shape factors of retaining ring (See Table 1)

D: Shaft diameter or housing diameter (mm)

T: Plate thickness of retaining ring (mm)
The Beveled Rings need to allow for the plate thickness when fit since they may be fit at half of the groove depth in relation to the retained work.

π: Circumference ratio

S_S: Strength in shear of retaining ring (N/mm²)
Basic External Ring (Carbon steel) : Approx. 980N/mm² as a guideline. (According to the JIS B 2804)

S: Safety factors
General safe factors are listed in a table.
(See Table 2)

Using the formula provided above, it is possible to calculate the thrust load of the retaining ring. However, in order to generate the calculated thrust load, it is essential to design the groove in accordance with the thrust load. (If the thrust load in the groove is lower than that of the retaining ring, the groove may deform, causing the retaining ring to disengage, and you won't be able to obtain sufficient thrust load.)

Table 1 Shape factors of retaining rings

Shape of ring	A (Retaining ring)	B (Groove)
Basic External Ring	1.0	1.0
Beveled External Ring	1.0	1.0
Basic Internal Ring	1.0	1.0
Beveled Internal Ring	1.0	1.0
Inverted Internal Ring	0.7	0.5
Inverted External Ring	0.7	0.5
E-Ring	0.3	0.3
C-Ring	0.5	0.5
U-Ring	0.5	0.5

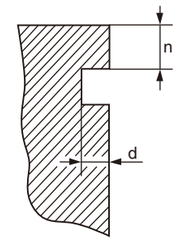
Table 2 Guideline on safe factors (S)

Type of load	Safety factors
Static load	3 or 4
Cyclic load	5
Alternate load	8
Shock load	12

(2) Thrust Load of Groove

It is necessary to design the groove to obtain a sufficient thrust load of retaining ring.
It is important to set the edge margin in this design. We recommend that the margin be set as given below to increase the through load of groove.

$$n/d \geqq 3$$



n: Edge margin (mm)
d: Depth of groove (mm)

If the value n/d is less than 3, attention should be paid to since the thrust load in the groove is reduced.
Please refer to the table of ring dimensions for the recommended dimension.

If n/d is equal or more than 3, the allowable thrust load can be calculated according to the following formula:

$$G_1 = \frac{BDdG_y\pi}{Sq}$$

G_1: Static thrust load in groove (N)

B: Shape factors of retaining ring (See Table 1)

D: Shaft diameter or housing diameter (mm)

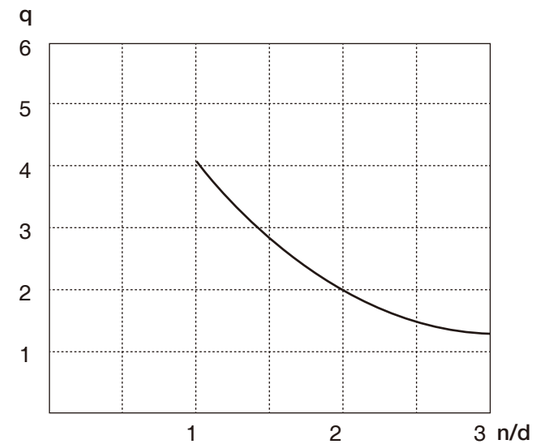
d: Depth of groove (mm)

G_y: Yield strength of groove (N/mm²) See Note

π: Circumference ratio

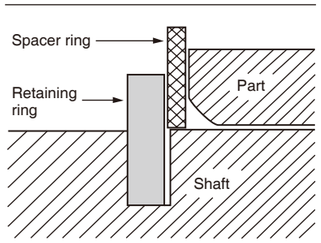
S: Safety factors (See Table 2)

q: Decreasing factor, a value obtained from the value n/d using the graph. However, if the value n/d is 3 or more, the value q is 1.



Note: Since the retaining rings will come off if the groove deforms, the formula takes Yield strength of groove considering the safetiness.

The above formula assumes that retained parts have sharp corners. For retained parts having corner radii, care must be taken as the thrust load is reduced.
If the thrust load does not satisfy the requirement because of retained parts having corner radii or chamfers, the thrust load can be improved by inserting a spacer ring like a rigid flat washer in the groove.



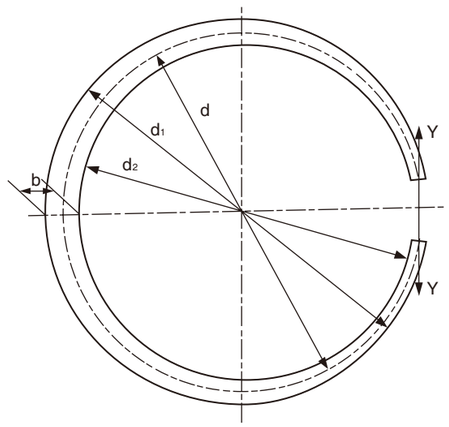
2 Calculation of Stress

This section calculates the maximum stress where a retaining ring is fit.

Basic Ring

When the retaining ring (Basic External Ring) that is circumscribed by two eccentric circles is to be spread in the Y directions as shown in the figure:

M: Bending moment (N·mm)
E: Longitudinal elastic modulus (Carbon spring steel: 206000N/mm^2)
I: Second moment of area (mm^4)
r: Average curvature radius (mm)
ρ: Average curvature radius after (mm)
ξ: Rate of change
d: Average diameter (mm)
d_1: Diameter of outer periphery (mm)
d_2: Diameter of inner periphery (mm)
Z: Section modulus
t: Plate thickness (mm)
b: Maximum rim width (mm)



If the average curvature radius in the free condition is changed to ρ by spreading the ring in the Y directions as shown in the figure, this relationship is given by the following equation.

$$\frac{1}{r}-\frac{1}{\rho}=\frac{M}{EI}$$

Here, if I is the maximum second moment of area in the section having the maximum width and t is the plate thickness, the value I can be expressed as $tb^3/12$.
In the above equation, assume that $\rho = r(1+\xi)$ (ξ : Rate of change from r to ρ).
From the equation of the maximum stress, $\sigma max = M/Z$, M is given to be $\sigma maxZ$.
From the equation of the section modulus, $Z=tb^2/6$, substituting these relations into the above equation yields:

$$\sigma max=\frac{\xi}{1+\xi}\cdot\frac{Eb}{d}$$

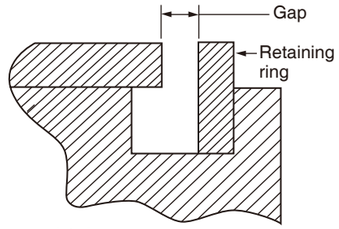
For the Internal Ring, assume that $\frac{1}{\rho}-\frac{1}{r}=\frac{M}{EI}$ and $\rho = r(1-\xi)$.
Substituting these relations in the same manner indicates the maximum stress by following formula:

$$\sigma max=\frac{\xi}{1-\xi}\cdot\frac{Eb}{d}$$

3 Beveled Rings

(1) Purpose of Use:

When using the Basic Rings, the accuracy of machining in the groove position and variation of retained parts may cause a gap between the ring and the part to be retained resulting in looseness and unsteadiness (Fig. 1). This gap will cause abnormal sound and damage to the ring.



(Fig. 1)

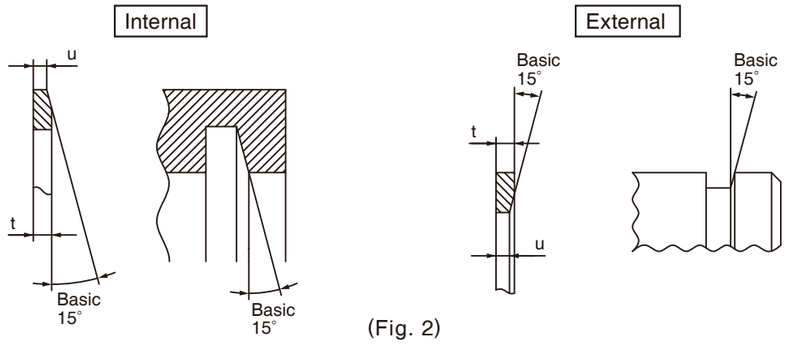
The conventional measures of eliminating looseness are as follows:

- By using the retaining ring with the gap adjusted by shims having a different thickness.
- By using the Wave Washer or other pressurized spring.
- By using the retaining ring that has a different plate thickness.
- By using the Bowed Ring and the like in which the ring is worked on an arched line.

However, there are limitations of a more quantity of parts, the need of a wide variety of rings and weak spring force. Thus the Beveled Ring products are developed.

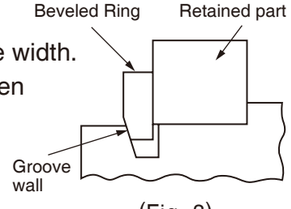
(2) Characteristics of the Rings:

The Beveled Rings basically have the same structure with the Basic Rings. However, their ring segments to be fit in the groove have a bevel of 15 degrees differently from the basic ones. This bevel is provided on the outer periphery for Internal Ring and on the inner periphery for External Ring. These rings are designed to be set in the groove that basically has a slant of 15 degrees of the groove wall supporting the load (Fig. 2).



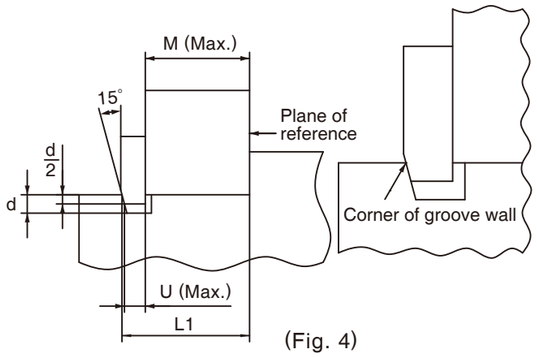
(Fig. 2)

It is necessary to keep such an area that is sufficiently in contact with the groove wall. The Beveled Ring needs to be inserted at least half the groove width. When the Beveled Ring is inserted in the groove, it acts as a wedge between the outer groove wall and the retained part. When there is a gap between the Ring and the adjacent face of the retained part, the spring action of the ring will correct the gap and slide it deeply into the groove (Fig. 3).

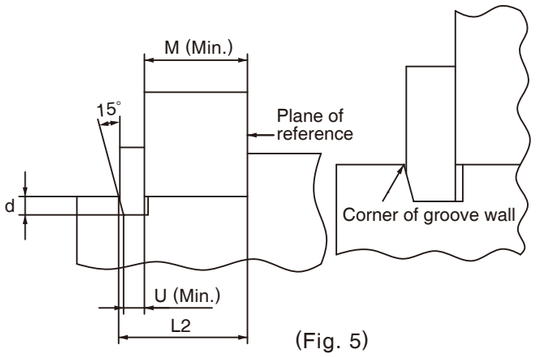


(Fig. 3)

(3) Positioning: L



(Fig. 4)



(Fig. 5)

1) If the distance from the corner of the outer groove wall to the plane of reference is at minimum with M (Max.) and U (Max.), the retaining ring should engage at least half the depth of the groove (Fig. 4).

$$L1 \geqq M(\mathrm{Max.}) + U(\mathrm{Max.}) + \frac{d}{2}\tan 15^\circ$$

2) If the distance from the corner of the outer groove wall to the plane of reference is at maximum with M (Min.) and U (Min.), the retaining ring should engage the full depth of the groove (Fig. 5).

$$L2 \leqq M(\mathrm{Min.}) + U(\mathrm{Min.}) + d\tan 15^\circ$$

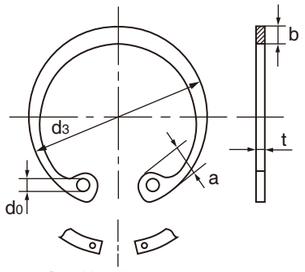
(4) Take-up (End-play Take-up)

To allow the Beveled Ring to function properly, its take-up must equal or exceed the total of the tolerances.

$$\text{Take-up} = \frac{d}{2}\tan 15^\circ \geqq \triangle L + \triangle M + \triangle U$$

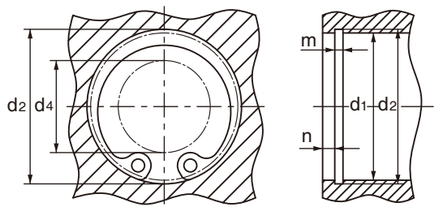
$$\triangle L = L\ (\mathrm{Max.}) - L\ (\mathrm{Min.})$$
$$\triangle M = M\ (\mathrm{Max.}) - M\ (\mathrm{Min.})$$
$$\triangle U = U\ (\mathrm{Max.}) - U\ (\mathrm{Min.})$$

Basic Internal Ring [RTW-6 through 65]

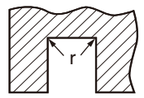


Size No.170 or over

Groove dimention



The dimention d_4 is the minimum diameter of the inner periphery when the retaining ring is set in the hole. (Clearance inner diameter)



Size No.	r (Max.)
26 under	0.13
26 or over	0.25

Unit: mm

Size No.	Retaining rings							d_4 (Ref.)	Groove dimention					
	d_3		t		b	a	d_0		d_1	d_2		m		Ref. n
	Basic	Tol.	Basic	Tol.	Approx.	Approx.	Min.			Basic	Tol.	Basic	Tol.	Min.
RTW- 6	6.7		0.4		0.7	1.6	0.8	2.5	6	6.25	+0.04 0	0.5		0.5
7	7.7		0.4	±0.03	0.8	1.7	0.8	3	7	7.3		0.5	+0.1 0	0.5
8	8.8		0.4		0.9	1.7	0.8	3.5	8	8.4	+0.06 0	0.5		0.6
9	9.8		0.6	±0.04	1.1	2.2	0.8	4	9	9.4		0.7		0.6
10	10.7		1		1.5	2.8	1.2	4	10	10.4		1.15		0.6
11	11.8	±0.18	1		1.5	3	1.2	4	11	11.4		1.15		0.6
12	13		1		1.7	3.1	1.5	5	12	12.5		1.15		0.8
13	14.1		1		1.7	3.1	1.5	6	13	13.6	+0.11 0	1.15		0.9
14	15.1		1		1.9	3.6	1.7	6.4	14	14.6		1.15		0.9
15	16.2		1		1.9	3.6	1.7	7.4	15	15.7		1.15		1.1
16	17.3		1	±0.05	1.9	3.7	1.7	8	16	16.8		1.15		1.2
17	18.3		1		1.9	3.8	1.7	9	17	17.8		1.15		1.2
18	19.5		1		2.4	4	1.7	10	18	19		1.15		1.5
19	20.5		1		2.5	4	2	11	19	20		1.15		1.5
20	21.5		1		2.5	4	2	12	20	21		1.15		1.5
21	22.5	±0.2	1		2.5	4.1	2	12	21	22	+0.21 0	1.15		1.5
22	23.5		1		2.5	4.1	2	13	22	23		1.15		1.5
24	25.9		1.2		2.5	4.3	2	15	24	25.2		1.35		1.8
25	26.9		1.2		3	4.4	2	16	25	26.2		1.35		1.8
26	27.9		1.2		3	4.6	2	16	26	27.2		1.35		1.8
27	29.1		1.2		3	4.6	2	17	27	28.4		1.35		2.1
28	30.1		1.2		3	4.6	2	18	28	29.4		1.35		2.1
30	32.1		1.2		3	4.7	2	20	30	31.4		1.35		2.1
32	34.4		1.2	±0.06	3.5	5.2	2.5	21	32	33.7		1.35	+0.14 0	2.6
34	36.5	±0.25	1.5		3.5	5.2	2.5	23	34	35.7		1.65		2.6
35	37.8		1.5		3.5	5.2	2.5	24	35	37		1.65		3.0
36	38.8		1.5		3.5	5.2	2.5	25	36	38	+0.25 0	1.65		3.0
37	39.8		1.5		3.5	5.2	2.5	26	37	39		1.65		3.0
38	40.8		1.5		4	5.3	2.5	27	38	40		1.65		3.3
40	43.5	±0.4	1.75		4	5.7	2.5	28	40	42.5		1.9		3.8
42	45.5		1.75		4	5.8	2.5	30	42	44.5		1.9		3.8
45	48.5		1.75		4.5	5.9	2.5	33	45	47.5		1.9		3.8
46	49.7		1.75		5	6.1	2.5	33	46	48.5		1.9		3.8
47	50.5		1.75		4.5	6.1	2.5	34	47	49.5		1.9		3.8
48	51.5		1.75		4.5	6.2	2.5	35	48	50.5		1.9		4.5
50	54.2		2	±0.07	4.5	6.5	2.5	37	50	53		2.2		4.5
52	56.2		2		5.1	6.5	2.5	39	52	55		2.2		4.5
55	59.2		2		5.1	6.5	2.5	41	55	58		2.2		4.5
56	60.2	±0.45	2		5.1	6.6	2.5	42	56	59	+0.3 0	2.2		4.5
58	62.2		2		5.1	6.8	2.5	44	58	61		2.2		4.5
60	64.2		2		5.5	6.8	2.5	46	60	63		2.2		4.5
62	66.2		2		5.5	6.9	2.5	48	62	65		2.2		4.5
63	67.2		2		5.5	6.9	2.5	49	63	66		2.2		4.5
65	69.2		2.5	±0.08	5.5	7	2.5	50	65	68		2.7		4.5

Basic Internal Ring [RTW-68 through 300]

Unit: mm

Size No.	Retaining rings							d_4 (Ref.)	Groove dimention					
	d_3		t		b	a	d_0		d_1	d_2		m		Ref. n
	Basic	Tol.	Basic	Tol.	Approx.	Approx.	Min.			Basic	Tol.	Basic	Tol.	Min.
RTW- 68	72.5		2.5		6	7.4	2.5	53	68	71		2.7		4.5
70	74.5	±0.45	2.5		6	7.4	2.5	55	70	73	+0.3 0	2.7		4.5
72	76.5		2.5		6.6	7.4	2.5	57	72	75		2.7	+0.14 0	4.5
75	79.5		2.5	±0.08	6.6	7.8	2.5	59.2	75	78		2.7		4.5
78	82.5		2.5		6.6	8	2.5	62	78	81		2.7		4.5
80	85.5		2.5		7	8	2.5	64	80	83.5		2.7		5.3
82	87.5		2.5		7	8	3	66	82	85.5		2.7		5.3
85	90.5		3		7	8	3	69	85	88.5		3.2		5.3
88	93.5		3		7.6	8.2	3	71	88	91.5	+0.35 0	3.2		5.3
90	95.5		3		7.6	8.3	3	73	90	93.5		3.2		5.3
92	97.5		3		8	8.3	3	74	92	95.5		3.2		5.3
95	100.5	±0.55	3		8	8.5	3	77	95	98.5		3.2		5.3
98	103.5		3		8.3	8.7	3	80	98	101 .5		3.2		5.3
100	105.5		3		8.3	8.8	3	82	100	103.5		3.2	+0.18 0	5.3
102	108		4		8.9	9	3	83	102	106		4.2		6.0
105	112		4		8.9	9.1	3	86	105	109		4.2		6.0
108	115		4		8.9	9.5	3	87	108	112	+0.54 0	4.2		6.0
110	117		4		8.9	10.2	3	89	110	114		4.2		6.0
112	119		4		8.9	10.2	3	90	112	116		4.2		6.0
115	122		4		9.5	10.2	3	94	115	119		4.2		6.0
120	127	±0.65	4		9.5	10.7	3	98	120	124		4.2		6.0
125	132		4		10	10.7	3.5	103	125	129		4.2		6.0
130	137		4	±0.09	10	10.7	3.5	108	130	134		4.2		6.0
135	142		4		10.8	11	3.5	113	135	139		4.2		6.0
140	147		4		10.8	11	3.5	118	140	144		4.2		6.0
145	152	+1.26 -0.63	4		10.8	11	3.5	123	145	149	+0.63 0	4.2		6.0
150	158		4		11.5	11.8	3.5	126	150	155		4.2		7.5
155	164		4		11.5	11.8	3.5	130	155	160		4.2		7.5
160	169		4		12	12.5	3.5	134	160	165		4.2	+0.2 0	7.5
165	174.5		4		12	12.7	3.5	139	165	170		4.2		7.5
170	179.5		4		12	—	3.5	145	170	175		4.2		7.5
175	184.5		4		12.5	—	3.5	149	175	180		4.2		7.5
180	189.5		4		13	—	4	153	180	185		4.2		7.5
185	194.5		4		13.5	—	4	157	185	190		4.2		7.5
190	199.5	+1.44 -0.72	4		13.5	—	4	162	190	195		4.2		7.5
195	204.5		4		13.5	—	4	167	195	200	+0.72 0	4.2		7.5
200	209.5		4		14	—	4	171	200	205		4.2		7.5
210	222		5		14	—	4	181	210	216		5.2		9.0
220	232		5		14	—	4	191	220	226		5.2		9.0
230	242		5		14	—	4	201	230	236		5.2		9.0
240	252		5		14	—	4	211	240	246		5.2		9.0
250	262		5	±0.15	14	—	4	221	250	256		5.2	+0.25 0	9.0
260	275	+1.62 -0.81	5		16	—	4	227	260	268		5.2		12.0
270	285		5		16	—	4	237	270	278	+0.81 0	5.2		12.0
280	295		5		16	—	4	247	280	288		5.2		12.0
290	305		5		16	—	4	257	290	298		5.2		12.0
300	315		5		16	—	4	267	300	308		5.2		12.0

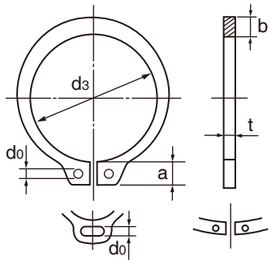
Material = Carbon spring steel - Up to RTW-200
Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)
- RTW-210 or over
Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

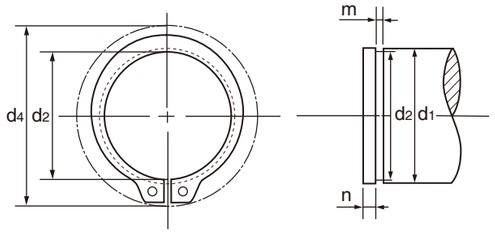
Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Basic External Ring [STW-3 through 56]

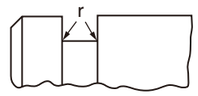
Applicable shaft



Size No.9 or under Size No.170 or over



The dimension d_4 is the maximum diameter of the outer periphery when the retaining ring is set in the shaft. (Clearance outer diameter)



Size No.	r (Max.)
7 under	Acute angle
7-10 under	0.08
10-26 under	0.13
26 or over	0.25

Unit: mm

Size No.	Retaining rings							d_4 (Ref.)	Groove dimention					
	d_3		t		b	a	d_0		d_1	d_2		m		Ref.n
	Basic	Tol.	Basic	Tol.	Approx.	Approx.	Min.			Basic	Tol.	Basic	Tol.	Min.
STW- 3	2.7	+0.04 -0.15	0.25	±0.025	0.5	1.7	0.7	7	3	2.85	0 -0.04	0.35	+0.1 0	0.3
4	3.7		0.4	±0.03	0.9	2.2	0.8	9	4	3.8		0.5		0.3
5	4.7		0.6	±0.04	1.1	2.4	0.8	10.5	5	4.8		0.7		0.3
6	5.6	+0.06 -0.2	0.7		1.3	2.8	1	12	6	5.7		0.8		0.5
7	6.5		0.8		1.4	3	1	14	7	6.7	0 -0.06	0.9		0.5
8	7.4		0.8		1.6	3	1	15	8	7.6		0.9		0.6
9	8.4	±0.15	1	±0.05	1.8	3.2	1	16	9	8.6		1.15		0.6
10	9.3		1		1.8	3	1.2	17	10	9.6	0 -0.09	1.15		1.5
11	10.2		1		2	3.1	1.2	18	11	10.5	0 -0.11	1.15		1.5
12	11.1	± 0.18	1		2.1	3.2	1.5	19	12	11.5		1.15		1.5
13	12		1		2.1	3.3	1.5	20	13	12.4		1.15		1.5
14	12.9		1		2.2	3.4	1.7	22	14	13.4		1.15		1.5
15	13.8		1		2.2	3.5	1.7	23	15	14.3		1.15		1.5
16	14.7		1		2.2	3.6	1.7	24	16	15.2		1.15		1.5
17	15.7		1		2.2	3.7	1.7	25	17	16.2		1.15		1.5
18	16.5		1.2	±0.06	2.6	3.8	1.7	26	18	17		1.35		1.5
19	17.5		1.2		2.7	3.8	2	27	19	18		1.35		1.5
20	18.5	±0.2	1.2		2.7	3.9	2	28	20	19	0 -0.21	1.35		1.5
21	19.5		1.2		2.7	4	2	30	21	20		1.35		1.5
22	20.5		1.2		2.7	4.1	2	31	22	21		1.35		1.5
23	21.4		1.2		2.9	4.5	2	32.5	23	22		1.35		1.5
24	22.2		1.2		3.1	4.2	2	33	24	22.9		1.35		1.7
25	23.2		1.2		3.1	4.3	2	34	25	23.9		1.35		1.7
26	24.2		1.2		3.1	4.4	2	35	26	24.9		1.35		1.7
27	25		1.2		3.3	4.5	2	36	27	25.8		1.35		1.8
28	25.9		1.5		3.1	4.6	2	38	28	26.6		1.65		2.1
29	26.9		1.5		3.5	4.7	2	39	29	27.6		1.65		2.1
30	27.9		1.5		3.5	4.8	2	40	30	28.6		1.65		2.1
32	29.6		1.5		3.5	5	2.5	43	32	30.3		1.65		2.6
34	31.5	±0.25	1.5		4	5.3	2.5	45	34	32.3		1.65		2.6
35	32.2		1.5		4	5.4	2.5	46	35	33		1.65		3
36	33.2		1.75	±0.07	4	5.4	2.5	47	36	34		1.9		3
38	35.2		1.75		4.5	5.6	2.5	50	38	36		1.9		3
40	37	±0.4	1.75		4.5	5.8	2.5	53	40	38	0 -0.25	1.9		3
42	38.5		1.75		4.5	6.2	2.5	55	42	39.5		1.9		3.8
45	41.5		1.75		4.8	6.3	2.5	58	45	42.5		1.9		3.8
47	43.4		1.75		5	6.6	2.5	61	47	44.5		1.9		3.8
48	44.5		1.75		4.8	6.5	2.5	62	48	45.5		1.9		3.8
50	45.8		2		5	6.7	2.5	64	50	47		2.2		4.5
52	47.8		2		5	6.8	2.5	66	52	49		2.2		4.5
55	50.8	±0.45	2		5	7	2.5	70	55	52	0 -0.3	2.2		4.5
56	51.8		2		5	7	2.5	71	56	53		2.2		4.5

Basic External Ring [STW-58 through 300]

OCHIAI OF INDUSTRIAL FASTENERS

Unit: mm

Size No.	Retaining rings							d_4 (Ref.)	Groove dimention					
	d_3		t		b	a	d_0		d_1	d_2		m		Ref.n
	Basic	Tol.	Basic	Tol.	Approx.	Approx.	Min.			Basic	Tol.	Basic	Tol.	Min.
STW- 58	53.8	±0.45	2	±0.07	5.5	7.1	2.5	73	58	55	0 -0.3	2.2	+0.14 0	4.5
60	55.8		2		5.5	7.2	2.5	75	60	57		2.2		4.5
62	57.8		2		5.5	7.2	2.5	77	62	59		2.2		4.5
63	58.8		2		5.5	7.3	2.5	78	63	60		2.2		4.5
65	60.8		2.5	±0.08	6.4	7.4	2.5	81	65	62		2.7		4.5
68	63.5		2.5		6.4	7.8	2.5	84	68	65		2.7		4.5
70	65.5		2.5		6.4	7.8	2.5	86	70	67		2.7		4.5
72	67.5		2.5		7	7.9	2.5	88	72	69		2.7		4.5
75	70.5		2.5		7	7.9	2.5	92	75	72		2.7		4.5
78	73.5		2.5		7.4	8.1	2.5	95	78	75		2.7		4.5
80	74.5		2.5		7.4	8.2	2.5	97	80	76.5		2.7		5.3
82	76.5		2.5		7.4	8.3	3	99	82	78.5		2.7		5.3
85	79.5		3	±0.09	8	8.4	3	103	85	81.5	0 -0.35	3.2	+0.18 0	5.3
88	82.5	±0.55	3		8	8.6	3	106	88	84.5		3.2		5.3
90	84.5		3		8	8.7	3	108	90	86.5		3.2		5.3
95	89.5		3		8.6	9.1	3	114	95	91.5		3.2		5.3
100	94.5		3		9	9.5	3	119	100	96.5		3.2		5.3
105	98		4		9.5	9.8	3	125	105	101	0 -0.54	4.2		6
110	103		4		9.5	10	3	131	110	106		4.2		6
115	108		4		9.5	10.5	3	137	115	111		4.2		6
120	113		4		10.3	10.9	3	143	120	116		4.2		6
125	118		4		10.3	11.3	3.5	148	125	121		4.2		6
130	123	+0.63 -1.26	4		11	11.5	3.5	154	130	126	0 -0.63	4.2	+0.2 0	6
135	128		4		11	11.5	3.5	159	135	131		4.2		6
140	133		4		11	11.8	3.5	164	140	136		4.2		6
145	138		4		11.6	11.8	3.5	170	145	141		4.2		6
150	142		4		11.6	12.3	3.5	175	150	145		4.2		7.5
155	146		4		12.2	12.7	3.5	181	155	150		4.2		7.5
160	151		4		12.2	12.9	3.5	186	160	155		4.2		7.5
165	155.5		4		12.9	13.1	3.5	192	165	160		4.2		7.5
170	160.5		4		12.9	—	4	197	170	165		4.2		7.5
175	165.5		4		12.9	—	4	202	175	170		4.2		7.5
180	170.5		4		13.5	—	4	208	180	175		4.2		7.5
185	175.5	+0.72 -1.44	4		13.5	—	4	213	185	180		4.2		7.5
190	180.5		4		14	—	4	219	190	185	0 -0.72	4.2		7.5
195	185.5		4		14	—	4	224	195	190		4.2		7.5
200	190.5		4		14	—	4	229	200	195		4.2		7.5
210	198		5	±0.15	14	—	4	239	210	204		5.2	+0.25 0	9
220	208		5		14	—	4	249	220	214		5.2		9
230	218		5		14	—	4	259	230	224		5.2		9
240	228		5		14	—	4	269	240	234		5.2		9
250	238		5		14	—	4	279	250	244		5.2		9
260	245		5		16	—	4	293	260	252	0 -0.81	5.2		12
270	255	+0.81 -1.62	5		16	—	4	303	270	262		5.2		12
280	265		5		16	—	4	313	280	272		5.2		12
290	275		5		16	—	4	323	290	282		5.2		12
300	285		5		16	—	4	333	300	292		5.2		12

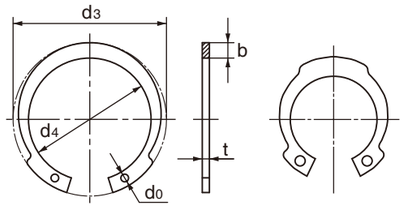
Material = Carbon spring steel

- Up to STW200
  Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)
- STW-210 or over
  Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Instructions

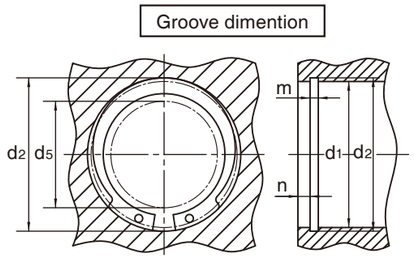
Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Inverted Internal Ring

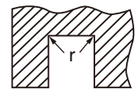


Size No.12 or under

Groove dimention



The dimention d_5 is the minimum diameter of the inner periphery when the retaining ring is set in the hole. (Clearance inner diameter)



Size No.	r (Max.)
26 under	0.13
26 or over	0.25

Unit: mm

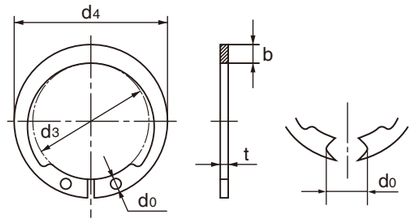
Size No.	Retaining rings								Groove dimention						
	d_3		d_4 (Ref.)	t		b	d_0	Tol.	d_5	d_1	d_2		m		n
	Basic	Tol.		Basic	Tol.						Basic	Tol.	Basic	Tol.	Min.
IRTW-10	11.1		7.7	1		1.7	0.9		5.9	10	10.4		1.15		1.5
11	12.2		8.6	1		1.8	0.9		6.6	11	11.4		1.15		1.5
12	13.3		9.7	1		1.8	0.9		7.6	12	12.5	+0.11	1.15		1.5
13	14.1	±0.18	10.9	1		1.6	0.9		9	13	13.6	0	1.15		1.5
14	15.1		11.7	1		1.7	0.9		9.8	14	14.6		1.15		1.5
15	16.2		12.6	1		1.8	0.9	±0.3	10.6	15	15.7		1.15		1.5
16	17.3		13.5	1	±0.05	1.9	0.9		11.4	16	16.8		1.15		1.5
17	18.3		14.3	1		2	0.9		12.2	17	17.8		1.15		1.5
18	19.5		15.3	1		2.1	1		13	18	19		1.15		1.5
19	20.5		16.1	1		2.2	1		13.8	19	20		1.15		1.5
20	21.5		16.9	1		2.3	1		14.5	20	21		1.15		1.5
21	22.5	±0.2	17.7	1		2.4	1.2		15	21	22	+0.21	1.15		1.5
22	23.5		18.7	1		2.4	1.2		16	22	23	0	1.15		1.5
24	25.9		20.7	1.2		2.6	1.2		17.5	24	25.2		1.35		1.8
25	26.9		21.5	1.2		2.7	1.2		18.5	25	26.2		1.35		1.8
26	27.9		22.3	1.2		2.8	1.2		19	26	27.2		1.35		1.8
28	30.1		24.1	1.2		3	1.2		20.5	28	29.4		1.35		2.1
30	32.1		25.7	1.2		3.2	1.4	±0.4	22.5	30	31.4		1.35		2.1
32	34.4		27.4	1.2	±0.06	3.5	1.6		23.5	32	33.7		1.35		2.55
34	36.5	±0.25	29.1	1.5		3.7	1.6		25	34	35.7		1.65		2.55
35	37.8		30	1.5		3.9	1.6		26	35	37		1.65	+0.14	3
36	38.8		30.8	1.5		4	1.6		26.5	36	38		1.65	0	3
37	39.8		31.6	1.5		4.1	1.6		27.5	37	39	+0.25	1.65		3
38	40.8		32.4	1.5		4.2	1.6		28	38	40	0	1.65		3
40	43.5		34.7	1.75		4.4	2		30	40	42.5		1.9		3.75
42	45.5	±0.4	36.3	1.75		4.6	2		31	42	44.5		1.9		3.75
45	48.5		38.9	1.75		4.8	2		33	45	47.5		1.9		3.75
47	50.5		40.7	1.75		4.9	2		35	47	49.5		1.9		3.75
48	51.5		41.5	1.75		5	2		36	48	50.5		1.9		3.75
50	54.2		44	2	±0.07	5.1	2.2		38	50	53		2.2		4.5
52	56.2		45.8	2		5.2	2.2		40	52	55		2.2		4.5
55	59.2		48	2		5.6	2.2	±0.5	42	55	58		2.2		4.5
56	60.2		48.8	2		5.7	2.5		43	56	59		2.2		4.5
58	62.2	±0.45	50.4	2		5.9	2.5		44	58	61	+0.3	2.2		4.5
60	64.2		52	2		6.1	2.5		46	60	63	0	2.2		4.5
62	66.2		53.6	2		6.3	2.8		47	62	65		2.2		4.5
65	69.2		55.8	2.5		6.7	3.2		49	65	68		2.7		4.5
68	72.5		58.5	2.5		7	3.2		52	68	71		2.7		4.5
72	76.5		61.7	2.5	±0.08	7.4	3.2		55	72	75		2.7		4.5
75	79.5		63.9	2.5		7.8	3.2		57	75	78		2.7		4.5
78	82.5		66.3	2.5		8.1	3.2		59	78	81		2.7		4.5
80	85.5		68.9	2.5		8.3	3.2	±0.7	61	80	83.5	+0.35	2.7		5.25
85	90.5	±0.55	72.7	3		8.9	4		64	85	88.5	0	3.2		5.25
90	95.5		76.7	3	±0.09	9.4	4		68	90	93.5		3.2	+0.18	5.25
100	105.5		84.5	3		10.5	4		76	100	103.5		3.2	0	5.25

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

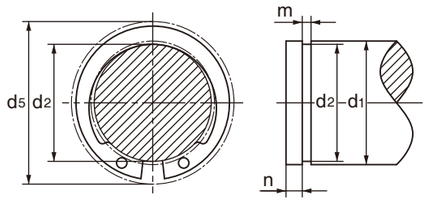
1. Size Nos. IRTW-56 or over are available on a production by order basis.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Inverted External Ring

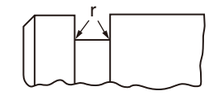


Size No.9 or under

Applicable shaft



The dimention d_5 is the minimum diameter of the inner periphery when the retaining ring is set in the hole. (Clearance inner diameter)



Size No.	r (Max.)
9 under	Acute angle
9-10 under	0.08
10-26 under	0.13
26 or over	0.25

Unit: mm

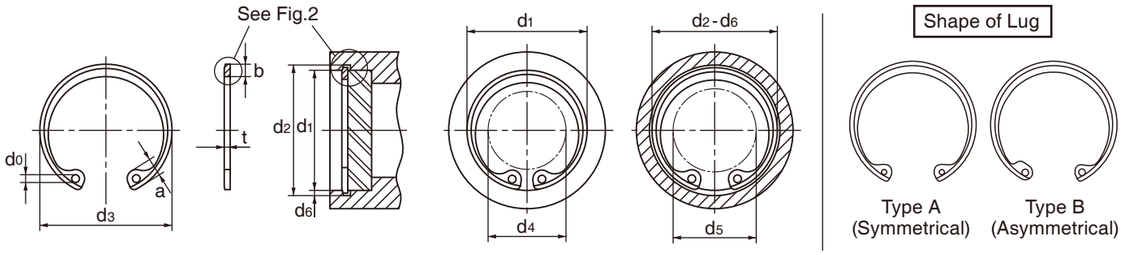
Size No.	Retaining rings								Groove dimention						
	d_3		d_4 (Ref.)	t		b	d_0	Tol.	d_5	d_1	d_2		m		n
	Basic	Tol.		Basic	Tol.						Basic	Tol.	Basic	Tol.	Min.
ISTW- 6	5.6		8	0.5	±0.03	1.2	2.2		8.9	6	5.7	0 -0.04	0.6	+0.1	1.5
7	6.5	+0.1	9.3	0.6		1.4	2.6		10	7	6.7		0.7	0	1.5
8	7.4	-0.2	10.6	0.7	±0.04	1.6	3	±0.2	12	8	7.6	0 -0.06	0.8		1.5
9	8.4		12	0.8		1.8	3.4		13	9	8.6		0.95		1.5
10	9.3	±0.15	13.3	1		2	1.2		15	10	9.6	0 -0.09	1.15		1.5
11	10.2		14.4	1		2.1	1.2		16	11	10.5		1.15		1.5
12	11.1		15.5	1		2.2	1.2		17	12	11.5		1.15		1.5
13	12		16.6	1		2.3	1.2		18	13	12.4		1.15		1.5
14	12.9		17.5	1	±0.05	2.3	1.2		19	14	13.4	0	1.15		1.5
15	13.8	±0.18	18.6	1		2.4	1.2	±0.3	21	15	14.3	-0.11	1.15		1.5
16	14.7		19.7	1		2.5	1.2		22	16	15.2		1.15		1.5
17	15.7		20.9	1		2.6	1.2		23	17	16.2		1.15		1.5
18	16.5		21.9	1.2		2.7	1.5		24	18	17		1.35		1.5
19	17.5		23.1	1.2		2.8	1.5		25	19	18		1.35		1.5
20	18.5		24.3	1.2		2.9	1.5		27	20	19		1.35		1.5
21	19.5		25.5	1.2		3	1.5		28	21	20		1.35		1.5
22	20.5		26.5	1.2		3	1.5		29	22	21		1.35		1.5
24	22.2		28.6	1.2		3.2	1.5		32	24	22.9	0	1.35		1.7
25	23.2	±0.2	29.8	1.2	±0.06	3.3	1.5		33	25	23.9	-0.21	1.35		1.7
26	24.2		31	1.2		3.4	1.5		34	26	24.9		1.35		1.7
28	25.9		33.1	1.5		3.6	1.8		37	28	26.6		1.65		2.1
30	27.9		35.3	1.5		3.7	1.8	±0.4	39	30	28.6		1.65	+0.14	2.1
32	29.6		37.4	1.5		3.9	1.8		41	32	30.3		1.65	0	2.6
34	31.5		39.7	1.5		4.1	1.8		44	34	32.3		1.65		2.6
35	32.2	±0.25	40.6	1.5		4.2	1.8		45	35	33		1.65		3
36	33.2		41.6	1.75		4.2	2		46	36	34		1.9		3
38	35.2		44	1.75		4.4	2		48	38	36		1.9		3
40	37		46.2	1.75		4.6	2		51	40	38	0	1.9		3
42	38.5		48.1	1.75		4.8	2		54	42	39.5	-0.25	1.9		3.8
45	41.5	±0.4	51.3	1.75		4.9	2		57	45	42.5		1.9		3.8
48	44.5		55.1	1.75		5.3	2		61	48	45.5		1.9		3.8
50	45.8		56.8	2	±0.07	5.5	2.5		63	50	47		2.2		4.5
52	47.8		59	2		5.6	2.5		65	52	49		2.2		4.5
55	50.8		62.6	2		5.9	2.5	±0.5	69	55	52		2.2		4.5
58	53.8		66	2		6.1	2.5		72	58	55		2.2		4.5
60	55.8		68.4	2		6.3	2.5		75	60	57		2.2		4.5
62	57.8		70.8	2		6.5	2.5		77	62	59		2.2		4.5
63	58.8	±0.45	72	2		6.6	2.5		78	63	60	0	2.2		4.5
65	60.8		74.4	2.5		6.8	3		81	65	62	-0.3	2.7		4.5
68	63.5		77.5	2.5		7	3		84	68	65		2.7		4.5
70	65.5		79.9	2.5	±0.08	7.2	3		87	70	67		2.7		4.5
75	70.5		85.7	2.5		7.6	3	±0.7	92	75	72		2.7		4.5
80	74.5		90.5	2.5		8	3		98	80	76.5		2.7		5.3

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

1. Size Nos. IRTW-56 or over are available on a production by order basis.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Beveled Internal Ring



Unit: mm

Size No.	Retaining rings									Shape of Lug	Groove dimention					
	d_3		t		u		a	b	d_0		d_1	d_2		m		d_6
	Basic	Tol.	Basic	Tol.	Basic	Tol.						Basic	Tol.	Basic	Tol.	
MT-26	28.9	$^{+0.4}_{-0.25}$	1	±0.05	0.84	±0.025	4	2.7	1.5	B	26	28	$^{+0.08}_{0}$	0.9	+0.1 0	1
28	31.1	+0.65 -0.5	1.3	±0.06	1.02	±0.03	4.6	2.95	1.9	B	28	30.1	+0.1 0	1.1		1.05
30	33.4		1.3		1.02		4.6	3.05	1.9	B	30	32.1		1.1		1.05
32	35.35		1.3		0.99		4.6	3.15	1.9	A	32	34.3		1.1		1.15
35	38.75		1.3		0.97		4.6	3.3	1.9	B	35	37.5		1.1		1.25
40	44.25	+0.9 -0.65	1.6	±0.08	1.22		5.1	4	1.9	B	40	42.8	+0.13 0	1.3	+0.15 0	1.4
42	46.6		1.6		1.19		5.75	4.25	1.93	A	42	45		1.3		1.5
47	52.15		1.6		1.17		5.94	4.3	2.31	B	47	50.4		1.3		1.7
52	57.9	$^{+1}_{-0.75}$	2	±0.07	1.52	±0.04	6.4	4.7	2.3	B	52	55.7	+0.15 0	1.6		1.85
80	89.1	±1.4	2.77		2.1	±0.06	7.9	6.65	3.2	A	80	85.9		2.3		2.95

Material = Carbon spring steel Hardness = 44 through 52HRC, Finish = Phosphate coating (ACP)

Notes

Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Fig. 1

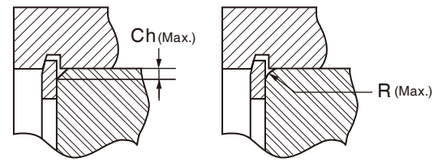
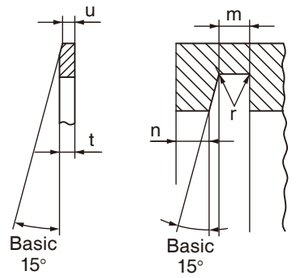


Fig. 2

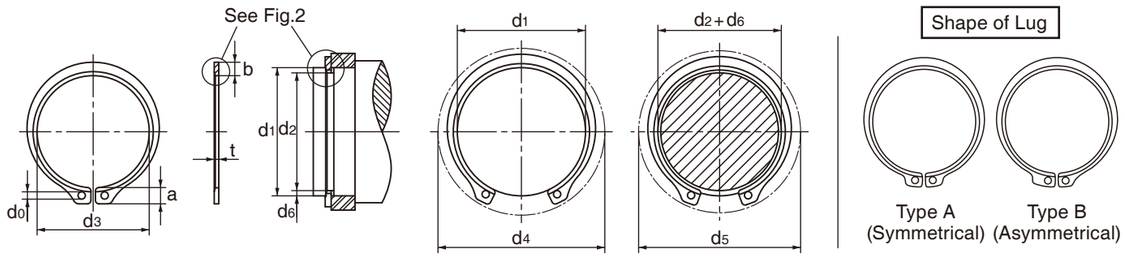


Size No.	r (Max.)
52 under	0.13
52 or over	0.25

Unit: mm

Size No.	Data					
	Clearance diameter		Maximum allowable corner radii and chamfers of retained parts (Fig. 1)		Take-up (End-play Take-up)	n (Min.)
	When sprung into d_1	When sprung into d_2 (d_6/2)				
	d_4	d_5	R (Max.)	Ch (Max.)		
MT-26	17.4	18.4	1	0.8	0.13	1.6
28	18.2	19.2	1	0.8	0.14	1.6
30	20	21	1	0.8	0.14	1.7
32	22	23.1	1	0.8	0.15	1.9
35	25	26.2	1	0.8	0.16	2.1
40	29.2	30.4	1.6	1.3	0.18	2.3
42	29.7	30.9	1.6	1.3	0.2	2.6
47	34.3	36	1.6	1.3	0.22	2.8
52	38.6	40.3	2	1.6	0.24	3.1
80	63	66	2.5	2	0.39	4.4

Beveled External Ring



Unit: mm

Size No.	Retaining rings									Shape of Lug	Applicable shaft					
	d_3		t		u		a	b	d_0		d_1	d_2		m		d_6
	Basic	Tol.	Basic	Tol.	Basic	Tol.						Basic	Tol.	Basic	Tol.	
NT-30	27.9	+0.25	1.3	±0.06	1.04	±0.03	4.9	3.3	1.9	B	30	28.15	0	1.1	+0.1 0	0.93
35	32.3	-0.4	1.3		0.99		4.6	3.9	1.9	B	35	32.55	-0.1	1.1		1.23
50	46.2	$^{+0.35}_{-0.5}$	1.6	±0.08	1.19		6.2	5.1	3.12	B	50	46.8	0	1.3	+0.15 0	1.6
60	55.8	$^{+0.35}_{-0.65}$	2		1.52	±0.04	6.75	5.7	3.12	A	60	56.2	-0.15	1.7		1.9

Material = Carbon spring steel Hardness = 44 through 52HRC, Finish = Phosphate coating (ACP)

Notes

Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Fig. 1

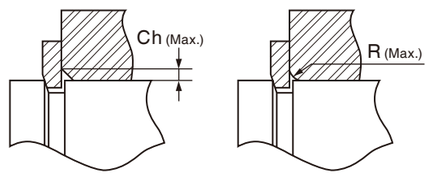
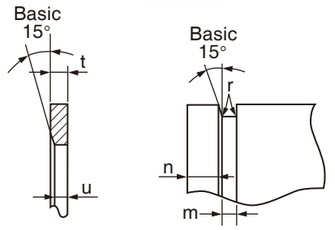


Fig. 2

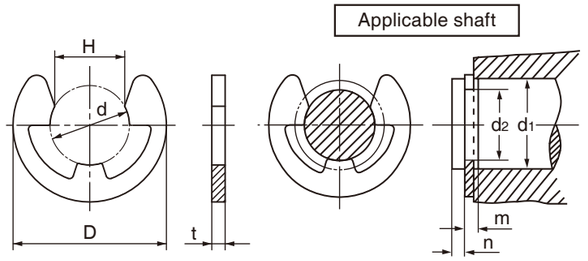


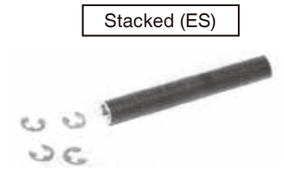
Size No.	r (Max.)
52 under	0.13
52 or over	0.25

Unit: mm

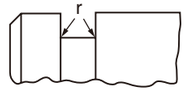
Size No.	Data					
	Clearance diameter		Maximum allowable corner radii and chamfers of retained parts (Fig. 1)		Take-up (End-play Take-up)	n (Min.)
	When sprung into d_1	When sprung into d_2 (d_6/2)				
	d_4	d_5	R (Max.)	Ch (Max.)		
NT-30	40.8	39.8	1.6	1	0.12	1.6
35	45.9	44.6	1.8	1.1	0.16	1.8
50	64.4	63.0	2	1.2	0.21	2.6
60	76.3	74.7	2.5	1.5	0.25	3.1

E-Ring





The stack contains retaining rings arrayed in the shape of a rod.
ES-1 or below are railed stacks while stacks ES-2 through 12 are taped stacks.
To order a stack, specify ES-3 for example.



Size No.	r (Max.)
1.5 under	Acute angle
1.5-7 under	0.13
7-12 under	0.25
12 or over	0.38

Unit: mm

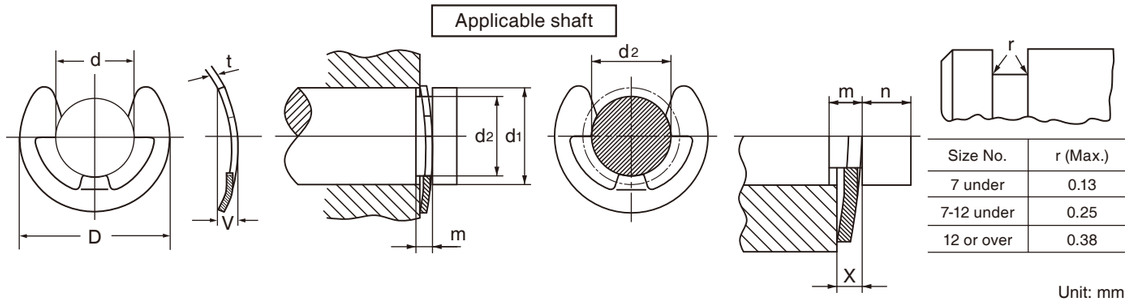
Size No.	Retaining rings								Applicable shaft						
	d		D		H		t		Class of d_1		d_2		m		n
	Basic	Tol.	Basic	Tol.	Basic	Tol.	Basic	Tol.	Or over	Under	Basic	Tol.	Basic	Tol.	Min.
ETW- 0.6	0.6	±0.02	1.5		0.45	±0.02	0.2		0.8	1	0.65		0.3		0.4
0.7	0.67	0 -0.08	2		0.55	0 -0.1	0.2		0.9	1.2	0.7	+0.05 0	0.3		0.4
0.8	0.8		2	±0.1	0.7		0.2	±0.02	1	1.4	0.82		0.3		0.4
1	0.98		2.8		0.88		0.2		1.3	1.7	1		0.3		0.5
1.2	1.2		3		1		0.3	±0.025	1.4	2	1.23		0.4	+0.05 0	0.6
1.5	1.5		4		1.3	0 -0.25	0.4		2	2.5	1.53		0.5		0.8
1.9	1.9	0 -0.09	4.5		1.7		0.4		2.5	3	1.93		0.5		1
2	2		5		1.7		0.4	±0.03	2.5	3.2	2.05	+0.06 0	0.5		1
2.3	2.3		6		2		0.4		3	4	2.35		0.5		1
2.5	2.5		6		2.1		0.4		3.2	4	2.55		0.5		1
3	3		7		2.6		0.6		4	5	3.05		0.7		1
3.2	3.2		7	±0.2	2.8		0.6		4	5	3.25		0.7		1.2
4	4	0 -0.12	9		3.5	0 -0.3	0.6		5	7	4.05	+0.075 0	0.7		1.2
5	5		11		4.3		0.6	±0.04	6	8	5.05		0.7	+0.1 0	1.2
6	6		12		5.2		0.8		7	9	6.05		0.9		1.2
7	7		14		6.1		0.8		8	11	7.1		0.9		1.5
8	8	0 -0.15	16		6.9	0 -0.35	0.8		9	12	8.1	+0.09 0	0.9		1.8
9	9		18		7.8		0.8		10	14	9.1		0.9		2
10	10		20		8.7		1	±0.05	11	15	10.15		1.15		2
12	12	0 -0.18	23	±0.3	10.4	0 -0.45	1		13	18	12.15	+0.11 0	1.15	+0.14 0	2.5
15	15		29		13		1.5	±0.06	16	24	15.15		1.65		3
19	19	0 -0.21	37		16.5		1.5		20	31	19.15	+0.13 0	1.65		3.5
24	24		44		20.8	0 -0.5	2	±0.07	25	38	24.15		2.2		4

Material = Carbon spring steel Hardness = 44 through 53HRC, Finish =Zinc Plate plus Chromate Phosphate coating (ACP)
Material = Stainless steel for spring

Notes

1. ETW is bulk in small bags, ES is stacked.
2. The stack packages for the E Ring include 3 types of stacks according to the size and material.
   1) The package for ES-0.6 to ES-1 is stacked in a rail.
   2) The package for ES-1.2 to ES-12 is stacked with paper tape.
   3) The stainless package consists of rings of up to 10 dia. stacked with vinyl tape.
   4) When requesting stack products, specify them.
3. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Bowed E-Ring



Size No.	r (Max.)
7 under	0.13
7-12 under	0.25
12 or over	0.38

Unit: mm

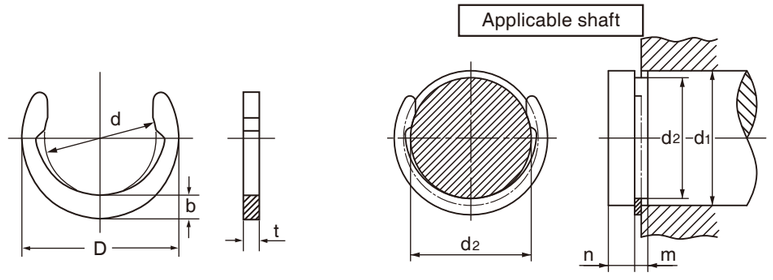
Size No.	Retaining rings					Applicable shaft								
	d	D	t	V		d_1		d_2		m		X		n
				Basic	Tol.	Min.	Max.	Basic	Tol.	Basic	Tol.	Min.	Max.	Min.
BETW- 1.5	1.5	4	0.4	0.8	+0.15 -0.1	2	2.5	1.53		0.8		0.55	0.65	0.8
2	2	5	0.4	0.8		2.5	3.2	2.05	+0.06 0	0.8		0.55	0.65	1
2.5	2.5	6	0.4	0.8		3.2	4	2.55		0.8		0.55	0.65	1
3	3	7	0.6	1.1	+0.25 0	4	5	3.05		1.1		0.85	1	1
4	4	9	0.6	1.1		5	7	4.05	+0.075 0	1.1		0.85	1	1.2
5	5	11	0.6	1.1		6	8	5.05		1.1	+0.1 0	0.85	1	1.2
6	6	12	0.8	1.3		7	9	6.05		1.3		1	1.2	1.2
7	7	14	0.8	1.3		8	11	7.1		1.3		1	1.2	1.5
8	8	16	0.8	1.3	+0.4 0	9	12	8.1	+0.09 0	1.3		1	1.2	1.8
9	9	18	0.8	1.3		10	14	9.1		1.3		1	1.2	2
10	10	20	1	1.7		11	15	10.15		1.7		1.3	1.6	2
12	12	23	1	1.7		13	18	12.15	+0.11 0	1.7		1.3	1.6	2.5
15	15	29	1.5	2.3	+0.6 0	16	24	15.15		2.3		1.8	2.2	3

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish =Zinc Plate plus Chromate

Notes

Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

C-Ring



Size No.	r (Max.)
12-43	0.13
46-81	0.25

Unit: mm

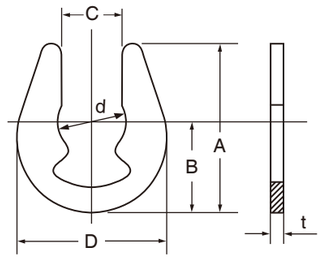
Size No.	Retaining rings						Applicable shaft						
	d		D	b	t		d_1	d_2		m		n
	Basic	Tol.			Basic	Tol.		Basic	Tol.	Basic	Tol.	Min.
5103- 12	2.59	+0.05 -0.1	4.17	0.79	0.4	±0.03	3.2	2.69	±0.04	0.48	+0.04 0	0.8
18	4.09		6.19	1.05	0.4		4.8	4.19		0.48		0.9
21	4.75	+0.07 -0.13	6.99	1.12	0.6	±0.04	5.6	4.9	±0.05	0.7	+0.06 0	1.1
25	5.36		7.9	1.27	0.6		6.4	5.59		0.7		1.2
31	6.86		9.56	1.35	0.6		7.9	7.01		0.7		1.3
37	8.33		11.37	1.52	0.6		9.5	8.51		0.7		1.5
40	9.12		12.32	1.6	0.6		10.3	9.25		0.7		1.6
43	9.8		13.1	1.65	0.6		11.1	9.98		0.7		1.7
46	10.54		14	1.73	0.6		11.9	10.69	±0.07	0.7		1.8
50	11.2	±0.15	14.76	1.78	0.9	±0.05	12.7	11.43		1	+0.08 0	1.9
56	12.62		16.56	1.98	0.9		14.3	12.88		1		2.1
81	18.31	±0.18	23.23	2.46	1.4	±0.06	20.6	18.59		1.5		3

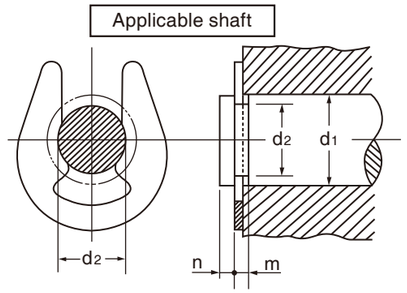
Material = Carbon spring steel Hardness = 44 through 52HRC, Finish =Zinc Plate plus Chromate

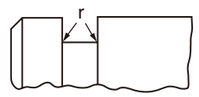
Notes

1. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.
2. When requesting stack products, specify them.(5103-81 available only as a bulk package)

U-Ring







r (Max.): 0.13

Unit: mm

Size No.	Retaining rings									Applicable shaft						
	d		A	D	C		B	t		Class of d_1		d_2		m		n
	Basic	Tol.			Basic	Tol.		Basic	Tol.	Or over	Under	Basic	Tol.	Basic	Tol.	(Min.)
UTW-3.2	3.2	+0.03 -0.1	8.7	8	2.8	0 -0.2	4.6	0.6	±0.04	4	5	3.26	+0.05 0	0.7	+0.1 0	1
4	4		10	9	3.6		5.3	0.7		5	7	4.08		0.8		1.4
5	5		12.8	11.6	4.4		6.8	0.7		6	8	5.1		0.8		1.4
6	6	+0.05 -0.15	14.8	13.5	5.3	0 -0.3	8	0.7		7	9	6.1	+0.08 0	0.8		1.4
7	7		17	15	6.2		9	0.9	±0.05	8	11	7.1		1		1.4
8	8	+0.05 -0.2	19.5	17.5	7.1		10.5	1		9	12	8.1		1.1		1.4

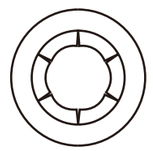
Material = Carbon spring steel Hardness = 44 through 52HRC, Finish = Phosphate coating (ACP)

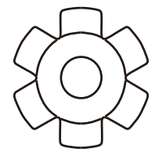
Notes

1. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.
2. It will be packaged in small bags or stack packaging.

Types of Push Nuts (Characteristics and Instructions for Use)

(1) Self-locking External Nut (2) Self-locking Internal Nut

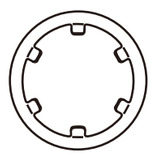


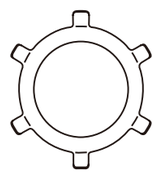


Characteristics

- By fitting the Self-locking Nuts on the shaft (groove) in the thrust direction that is parallel with the shaft (groove), their prongs bite into the retained part so as to prevent dropping off.
- There is no need of machining a groove and the Nuts can be freely positioned and fixed.
- The product is structured so that its prongs bite into the shaft.

(3) Circular External Nut (4) Circular Internal Nut





Characteristics

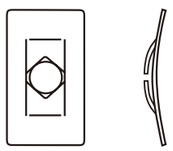
- The Circular Nuts have lower fitting force and are profiled to be less prone to damage the shaft than the Self-locking Nuts.
- The Circular Nuts have smaller outside diameters than the Self-locking Nuts.
- These nuts have smaller thrust loads than the Self-locking Nuts.

(5) Circular Push-on Nut

Characteristics

- The thrust load is between that of the Self-locking Nuts and that of the Circular External Nut.
- There is no need of taking care of misalignment during fitting since the Nut has longer prongs than the Circular External Nut.
- External product only.

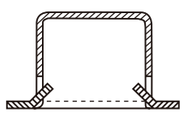
(6) P-Type Push-on Nut



Characteristics

- The spring action is given by curving the whole nut on an arched line. The retained part can be fastened with the Nut pushed in (without looseness).
- External product only.

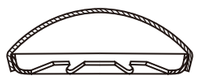
(7) Cap Nut F-Type



Characteristics

- The Nut avoids snag issues (scratches and injury) on the axial end face by protecting the end face of the retained shaft.
- Used for decoration.

(8) Cap Nut D-Type



Characteristics

- The Nut avoids snag issues (scratches and injury) on the axial end face by protecting the end face of the retained shaft.
- Used for decoration.
- Combined product of the Self-locking Nuts and the Cap Nuts.

(9) Flat Push Nut

Characteristics

- Unlike push nuts, Circular External Nut, and Circular Push-on Nut, this type of retaining ring does not have bent tabs, making it easy to use without distinguishing between the front and back, and facilitating automation.
- The thrust load falls between that of push nuts and Circular External Nut.
- It includes guides to prevent misalignment during insertion.
- External product only.

Instructions for Use

(1) If the retained part is rigid in hardness or applied with such surface treatment as produces a hard coating (nickel plating, chrome plating), there is no difference in hardness between the retaining ring and the retained part. Then the prongs will not bite into the retained part causing the thrust load to be reduced.

(2) The purpose is to prevent dropping off of retained parts. And the parts are not pressurized (no force to continuously push on them). However, for the P-Type Push-on Nut, force to push on the retained part will be produced.

(3) For repairing and maintenance of the retained part, the product cannot be reused since it is removed as deformed (destroyed) from the part.

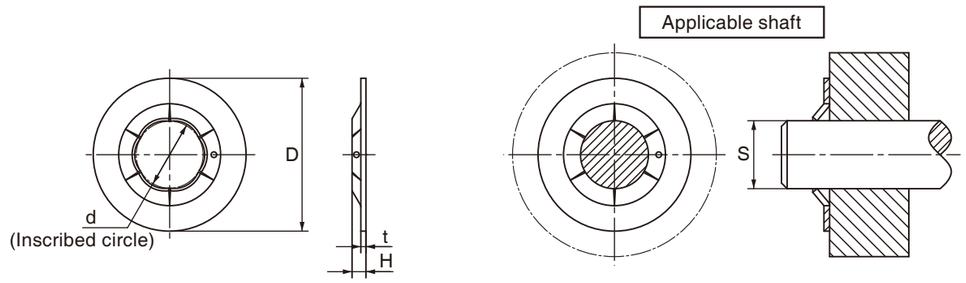
(4) When fitting the product on the retained part, install it with care to prevent the fitting jig from being caught. Otherwise, the retained part may not be allowed to be fixed due to deformed prongs. (Except for the Grip Ring) Be sure to verify the conditions by using the actual machine.

(5) When fitting the product on the retained part, do not install it obliquely. The thrust load (drop off force) may be reduced as compared to the case where the product is correctly installed.

(6) Never insert your finger(s) into any of the external products. The product will not slip off from your finger(s) and this is very dangerous.

Self-locking External Nut

OCHIAI OF INDUSTRIAL FASTENERS



Unit: mm

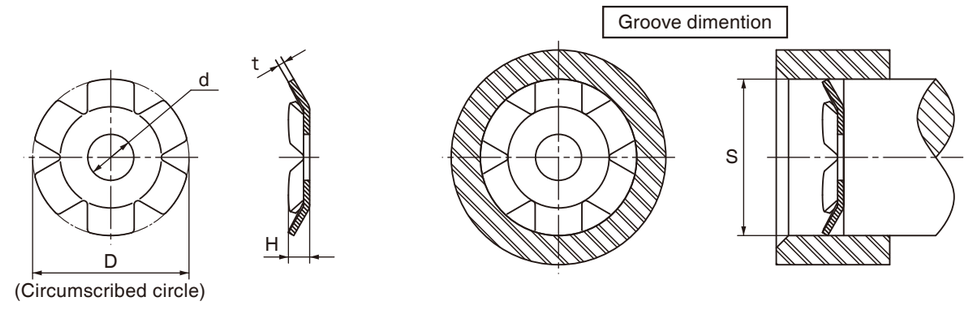
Size No.	Nuts					Applicable shaft	
	d		D	H (Ref.)	t	S	
	Basic	Tol.				Basic	Tol.
SPN- 1.2	1.1	0 -0.1	4.5	0.8	0.25	1.2	+0.04 -0.03
1.5	1.4		5.2	0.8	0.25	1.5	
2	1.9		6	0.8	0.25	2	
2.4	2.3	0 -0.15	7	0.85	0.25	2.4	
2.6	2.5		7	0.85	0.25	2.6	
3	2.9		10	1.15	0.3	3	+0.05 -0.03
4	3.9		12	1.3	0.3	4	
5	4.9		14	1.5	0.4	5	
6	5.9		16	1.75	0.4	6	+0.06 -0.03
8	7.9		17.5	1.4	0.5	8	
10	9.9		21	1.8	0.7	10	+0.07 -0.03
12	11.9		27	2.45	0.9	12	

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)
Material = Stainless steel for spring

Notes

1. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Self-locking Internal Nut



Unit: mm

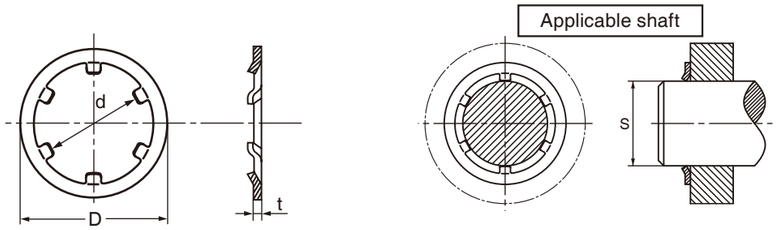
Size No.	Nuts					Groove dimention	
	D		d	H (Ref.)	t	S	
	Basic	Tol.				Basic	Tol.
RPN- 6	6.2	±0.1	1	1	0.3	6	+0.03 -0.06
8	8.2		1.8	1.2	0.3	8	
10	10.2		3	1.4	0.4	10	+0.03 -0.07

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

1. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Circular External Nut



Unit: mm

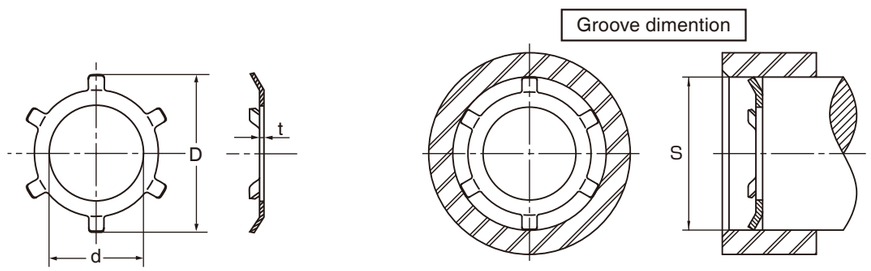
Size No.	Retaining rings						Applicable shaft	
	d		D		t	Number of teeth	S	
	Basic	Tol.	Basic	Tol.			Basic	Tol.
CSTW- 2	1.9	±0.05	6	±0.2	0.25	3	2	$^{+0.03}_{0}$
2.4	2.2	+0.1	6.4		0.25	3	2.4	±0.03
3	2.8	0	8		0.25	4	3	
3.5	3.3	$^{0}_{-0.1}$	7.5		0.25	4	3.5	
4	3.8	+0.1 0	9		0.25	4	4	
4.5	4.3		10		0.25	5	4.5	
5	4.8		10		0.25	5	5	
6	5.8		11		0.25	5	6	
8	7.8		13		0.25	5	8	
10	9.8		15.4		0.25	6	10	
12	11.8		17.8	±0.3	0.4	6	12	±0.05
14	13.8		20.3		0.4	6	14	
16	15.8		22.8		0.4	6	16	
18	17.8		25		0.4	8	18	
20	19.8		28		0.4	8	20	

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)
Material = Stainless steel for spring

Notes

1. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Circular Internal Nut



Unit: mm

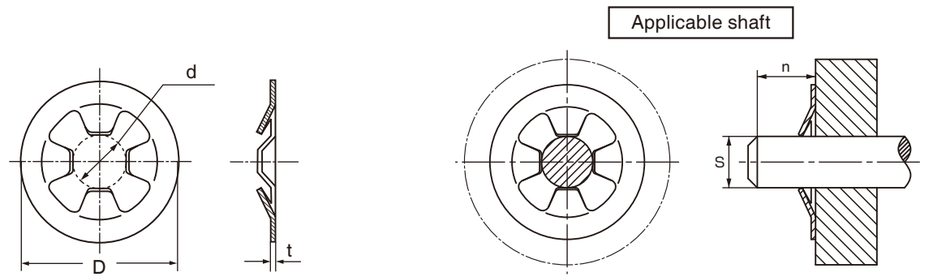
Size No.	Retaining rings						Groove dimention	
	D		d		t	Number of teeth	S	
	Basic	Tol.	Basic	Tol.			Basic	Tol.
CRTW- 6	6.2	0 -0.1	2.2	±0.2	0.25	6	6	±0.03
8	8.2		3.6		0.25	6	8	
10	10.2		5		0.25	6	10	
12	12.2		6.6		0.25	6	12	
14	14.2		8.2		0.25	6	14	
16	16.2		9.8		0.25	6	16	
18	18.2		11		0.4	8	18	

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)
Material = Stainless steel for spring

Notes

1. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Circular Push-on Nut



Unit: mm

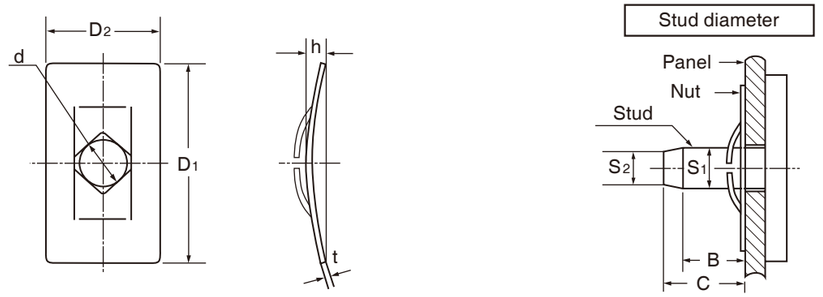
Size No.	Nuts					Applicable shaft		
	d		D		t	S		n
	Basic	Tol.	Basic	Tol.		Basic	Tol.	Min.
CSN- 3	2.7	±0.2	12	±0.3	0.3	3	±0.05	4.8
4	3.7		12		0.3	4		6
5	4.7		14		0.4	5		6.6

Material = Stainless steel for spring

Notes

1. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

P-Type Push-on Nut



Unit: mm

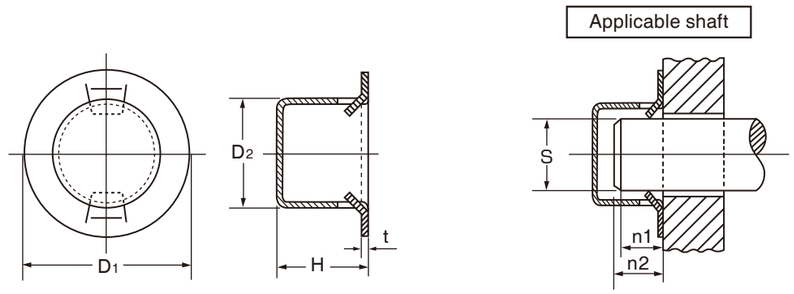
Size No.	Nuts								Stud diameter				
	d		D1	D2	Tol.	h		t	S1		S2	B	C
	Basic	Tol.				Basic	Tol.		Basic	Tol.			
PSN- ○1.2	1.1	±0.1	12	6	±0.15	0.95	±0.25	0.3	1.3	±0.05	1	4.5	6
○1.5	1.38		12	6		0.95		0.3	1.57		1.2	4.5	6
○1.8	1.68		12	6		1.05		0.4	1.87		1.5	4.5	6
2	1.85		12	6		1		0.4	2.07		1.6	4.5	6
3	2.8	+0.2 -0.1	14	8	±0.25	1.2		0.4	3.1		2.6	6	8
4	3.8		16	9		1.5		0.4	4.1		3.6	6	8
5	4.8		18	11		1.6		0.4	5.1		4.6	6	8
○6	5.8		20	12		1.7		0.4	6.1		5.6	8	10
○8	7.8		23	15		2.2		0.5	8.1		7.6	8	10

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish =Zinc Plate plus Chromate

Notes

1. The ○ marked Size-Nos. of nuts are manufactured on request.
2. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
3. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Cap Nut F-Type



Unit: mm

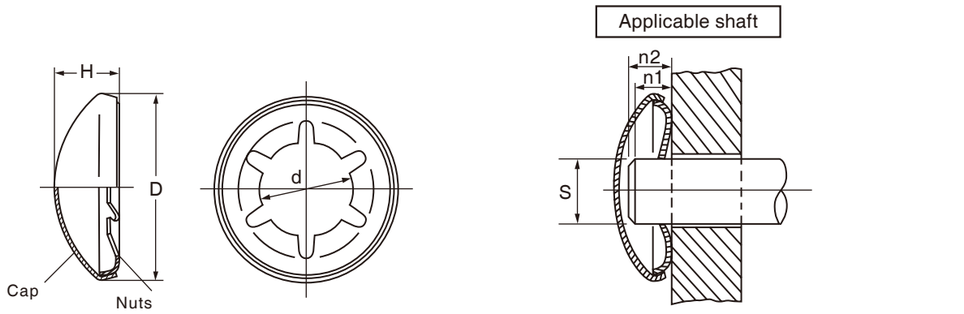
Size No.	Nuts						Applicable shaft			
	D1		D2	H		t	S		n1 (Min.)	n2 (Max.)
	Basic	Tol.	Basic	Basic	Tol.		Basic	Tol.		
WS-5	11.5	±0.2	6	5	±0.3	0.4	5	±0.05	3	4
6	12		7.1	5		0.45	6		3	4
8	14.3		9.3	7.3		0.5	8		3	6

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Nickel plating

Notes

1. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Cap Nut D-Type



Unit: mm

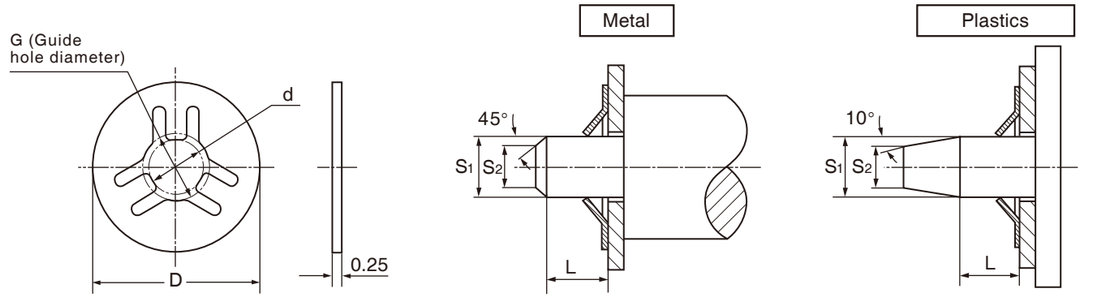
Size No.	Nuts								Applicable shaft			
	d		D		H		Plate hickness of cap	Plate thicknes of nut	S		n1 (Min.)	n2 (Max.)
	Basic	Tol.	Basic	Tol.	Basic	Tol.			Basic	Tol.		
DS-5	4.9	0 -0.15	13	±0.3	5.5	±0.3	0.3	0.3	5	+0.05 -0.03	2.5	4
6	5.9		15		5.5		0.3	0.3	6		2.5	4
8	7.9		15.6		5.5		0.3	0.3	8		2.5	4

Raw material of cap = Stainless steel (SUS304-CS)
Raw material of nut = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

1. Please note that it may not be usable when the hardness of the mating shaft is high or when a hard coating such as nickel plating or chrome plating has been applied to the surface.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Flat Push Nut



Unit: mm

Size No.	Flat Push Nut							Applicable stud Note 2			
	d		D		G		Number of teeth	Metal & Plastics			
	Basic	Tol.	Basic	Tol.	Basic	Tol.		S1		S2	L
FSPN-2	1.6	±0.05	7	±0.2	2.2	±0.05	3	2	+0.1 -0.03 (+0.1 0) Note 3	1.5	Approx.3
3	2.6		8		3.2		3	3		2	
4	3.6		9		4.2		4	4		3	
5	4.6		10		5.2		5	5		4	

Material = Carbon spring steel

Notes

1. Type of packing: Stack (500 pieces per stack)
2. A preferable hardness for metal shafts is 200HV or lower. When rigid shafts are to be applied, consult with us.
3. The tolerance value in parentheses is for plastic material.
4. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

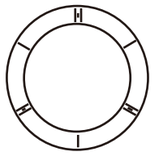
OCHIAI OF INDUSTRIAL FASTENERS

Types of Compressed Spring Washers (Characteristics and Instructions for Use)

Common Characteristics

- Provide for load capacity requirements in smaller space than coiled spring types.
- Provide locking of screws and can suppress abnormal sound, looseness and unsteadiness by pressurizing retained parts at specific levels.
- Absorption of vibrations where dynamic load is applied.
- For Wave Washers and Dish Springs, different spring characteristics can be obtained by combining (stacking) them in the same direction and/or in the face-to-face direction.

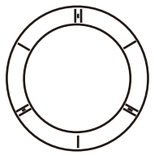
TYPE 1 Wave Washer



Characteristics

- Load is introduced by bending and flexing a flat washer on a waved shape. The waves are available from 2.
- This type provides higher load than the Curved Washer.

TYPE 2 Wave Washer for Bearing



Characteristics

- Provide for load capacity requirements in smaller space than coiled spring types.
- Provide locking of screws and can suppress abnormal sound, looseness and unsteadiness by pressurizing retained parts at specific levels.
- Absorption of vibrations where dynamic load is applied.
- For Curved and Dish Springs, different spring characteristics can be obtained by combining (stacking) them in the same direction and/or in the face-to-face direction.

TYPE 3 Curved Washer

Characteristics

- Load is introduced by bending and flexing a flat washer on a circular (arched) shape.

TYPE 4 Dish Spring

Characteristics

- Load is introduced by bending and flexing a flat washer on a conical (dish) shape.
- Higher load can be acquired by smaller deflection.
- Although this type provides higher load than the Curved and Wave Washers, the resultant load has larger variations because of larger load rate.

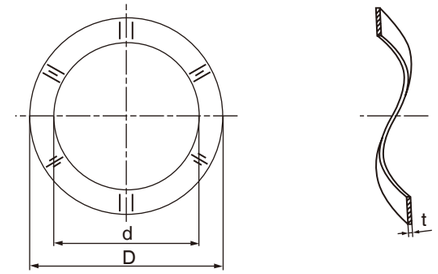
Instructions for Use

Where total compression is accomplished in the assembly process, settling may occur causing a difference between the initial load and the load after compression. The method for preventing this requires prior setting to remove settling (See page 36).

Calculations for Compressed Spring Washers (Reference)

1 Load and Stress Calculations of Wave Washer

Fig. 1 Wave Washer



Load

$$P = \frac{16Ebt^3N^4\delta}{\pi^3 D_m^3} \quad (1)$$

Stress

$$S = \frac{0.75\pi P D_m}{bt^2N^2} \quad (2)$$

P: Load (N)
S: Stress (N/mm²)
D: Diameter of outer periphery (mm)
d: Diameter of inner periphery (mm)
D_m: Average diameter (mm) [= (D + d)/2]
b: Rim width (mm) [= (D - d)/2]
t: Plate thickness (mm)
N: Wave number
δ: Amount of deflection (mm)
E: Longitudinal elastic modulus (N/mm²) (Table 1)
π: Circumference ratio

Table 1 Longitudinal elastic modulus of main materials (E)

Material	Longitudinal elastic modulus (N/mm²)
Carbon spring steel	206000
Stainless steel for spring	181000

Reference for design

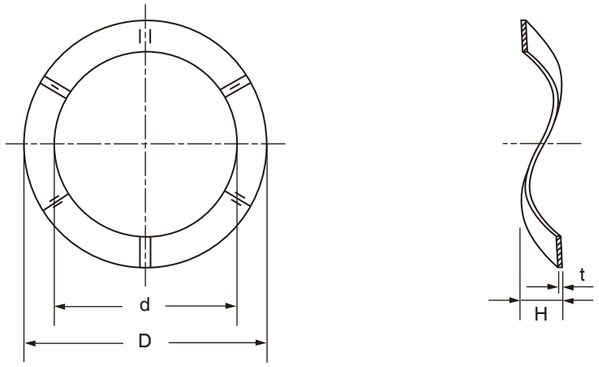
To change the load by a large amount
Please adjust the plate thickness and wave number. The load is proportional to the cube when adjusting the plate thickness, and to the fourth power when adjusting the wave number. (However, as the number of waves increases, it becomes easier to settle, so please consider the basic three waves.)

To change the load by a small amount
Adjust the diameters of inner and outer peripheries (rim width). The load is proportional to the rim width.

Notes

There are differences between the calculated and measured values for the formula of deflection and load. Substitution of conditions such as diameters of outer and inner peripheries gives a first-order equation of deflection and load which is plotted as a straight line. However, the actual load curve will not be a simple straight line but a curve.

Wave Washer



Unit: mm

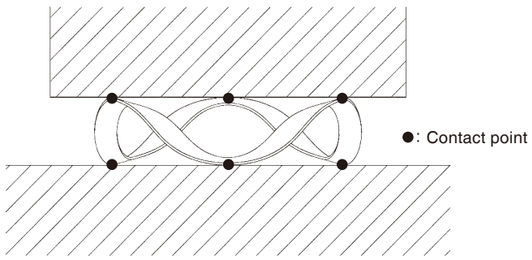
Size No.	d		D		H		t	
	Basic	Tol.	Basic	Tol.	Basic	Tol.	Basic	Tol.
WW- 4	4.3		8		1.5		0.2	±0.02
5	5.4		9		1.5	+0.5 0	0.3	
6	6.4		11		1.5		0.3	
8	8.5		12.5		2		0.3	
10	10.5	+0.3 -0.15	14.5	0 -0.5	2		0.3	
12	12.5		17		2.5		0.3	
14	14.5		20		2.5	+0.7 0	0.3	
16	16.7		22.5		2.5		0.3	
18	18.7		26		3		0.3	±0.025
20	20.7		29.1		3		0.3	
23	23.5		31		3.5	+1 0	0.3	
26	26.4	+0.5 -0.3	34.2	0 -0.8	3.5		0.3	
30	30.4		39.3		3.5		0.3	
32	33.9		46		4.5		0.3	
38	39		51		5	+1 -0.5	0.3	
40	40.6		53.5		5		0.3	
46	47.5	+0.7 -0.5	61	0 -1.2	5.5		0.4	
50	51.4		67.5		5.5		0.4	±0.03
53	54		69.8		6		0.45	
60	61.9		79		6.5		0.45	

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

1. The value d is the diameter of inscribed circle. The value D is the diameter of circumscribed circle.
2. The value H is a dimension when three threads are flush with each other with parallel two planes compressed (see Fig. 1).
3. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Fig. 1



Wave Washer for Bearing

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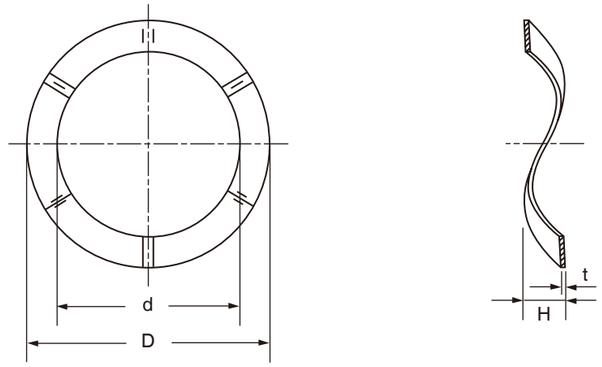


Unit: mm

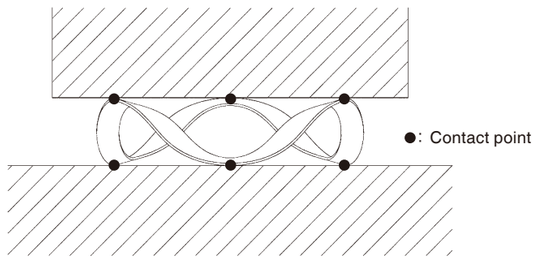
Size No.	Bearing outer diameter	d	D	H	t	Applicable bearing No.				
BWW- 624	13	8.8	12.8	1.5	0.15	695		624	633	
625	16	12	15	2	0.15			625	634	
626	19	12.7	18.1	2.5	0.2	698	607	626	635	
608	22	14.5	21	2.4	0.2	6900	608	627	636	
629	26	19.5	24.8	3.2	0.2		6000	629	637	
6001	28	20.9	26.9	3	0.25	6902	6001		638	
6200	30	22	28.5	4.1	0.25	6903		6200	639	
6201	32	23.5	30.5	4	0.25		6002	6201		
6202	35	26.4	33.9	3.5	0.3		6003	6202	6300	
6203	40	29.8	38.3	5	0.3			6203		
6302	42	30.1	40.6	4.5	0.3	6905	6004		6302	
6303	47	33.7	45.5	5	0.3	6906	6005	6204	6303	
6304	52	38.5	50	7.2	0.3			6205	6304	
6305	62	47.2	60.2	6.5	0.4	6908	6007	6206	6305	6403
6306	72	55	70.5	7	0.45	6910		6207	6306	6404
6307	80	61.3	77.8	8.5	0.45	6911	6010	6208	6307	6405
6308	90	69	88.5	7	0.6	6913	6011	6210	6308	6406
6309	100	79.3	98.8	6.5	0.7	6914	6013	6211	6309	6407
6310	110	88.9	108.9	8	0.8	6916	6014	6212	6310	6408
6311	120	95.8	118.9	8.5	0.8	6917		6213	6311	6409
6312	130	108.3	128.3	11	0.8	6919	6017	6215	6312	6410
6313	140	112.4	138.4	11	0.8	6920	6018	6216	6313	6411

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

1. The value d is the diameter of inscribed circle. The value D is the diameter of circumscribed circle.
2. The value H is a dimension when three threads are flush with each other with parallel two planes compressed (see Fig. 1).
3. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

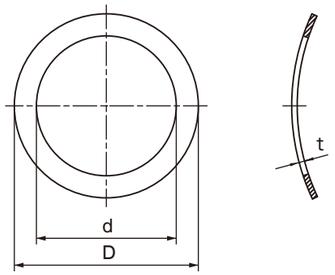
Fig. 1



Calculations for Compressed Spring Washers (Reference)

2 Load and Stress Calculations of Curved Washer

Fig. 1 Curved Washer



Load

$$P = \frac{4K_1Et^3\delta}{D^2} \quad (1)$$

Stress

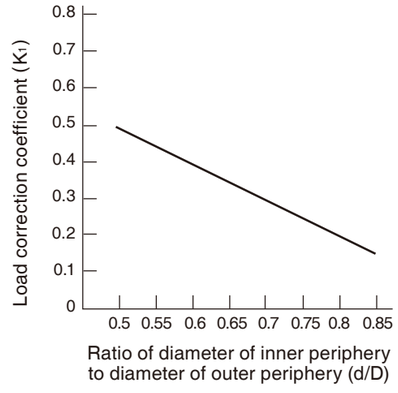
$$S = \frac{1.5P}{K_1t^2} \quad (2)$$

P: Load (N)
S: Stress (N/mm²)
D: Diameter of outer periphery (mm)
d: Diameter of inner periphery (mm)
t: Plate thickness (mm)
δ: Amount of deflection (mm)
E: Longitudinal elastic modulus (N/mm²) (Table 1)
K_1: Load correction coefficient [= 1 - d/D] (Table 2)

Table 1 Longitudinal elastic modulus of main materials (E)

Material	Longitudinal elastic modulus (N/mm²)
Carbon spring steel	206000
Stainless steel for spring	181000

Table 2



Notes

There are differences between the calculated and measured values for the formula of deflection and load. Substitution of conditions such as diameters of outer and inner peripheries gives a first-order equation of deflection and load which is plotted as a straight line. However, the actual load curve will not be a simple straight line but a curve.

3 Load and Stress Calculations of Dish Spring (Reference data: JIS B 2706)

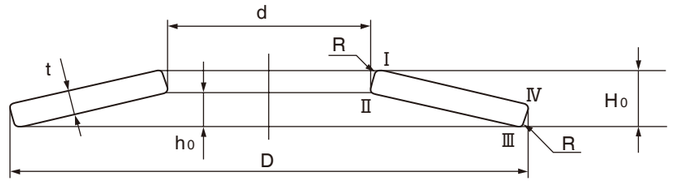


Fig. 3 Dish Spring

D: Diameter of outer periphery (mm)
d: Diameter of inner periphery (mm)
t: Plate thickness (mm)
H_0: Free height (mm)
h_0: Total amount of deflection (H_0 - t) (mm)
E: Longitudinal elastic modulus (N/mm²) (Table 1)
ν: Poisson's ratio of material (0.3)
P: Load (N)
δ: Amount of deflection (mm)
k: Load rate (N/mm)
R: Chamfer radius of corner (mm)
σⅠ: Stress on position Ⅰ (N/mm²)
σⅡ: Stress on position Ⅱ (N/mm²)
σⅢ: Stress on position Ⅲ (N/mm²)
σⅣ: Stress on position Ⅳ (N/mm²)

The coefficients used for calculation are as follows:

$$\alpha = \frac{D}{d}$$

$$C_1 = \frac{1}{\pi} \cdot \frac{\left(\frac{\alpha - 1}{\alpha}\right)^2}{\frac{\alpha + 1}{\alpha - 1} - \frac{2}{\ln \alpha}}$$

$$C_2 = \frac{1}{\pi} \cdot \frac{6}{\ln \alpha} \cdot \left(\frac{\alpha - 1}{\ln \alpha} - 1\right)$$

$$C_3 = \frac{3}{\pi} \cdot \frac{\alpha - 1}{\ln \alpha}$$

Including the correction item $\left(\frac{D - d}{(D - d) - 3R}\right)$ that allows for round chamfering of the corner presents the load P by the following formula:

$$P = \frac{D - d}{(D - d) - 3R} \cdot \frac{4E}{1 - \nu^2} \cdot \frac{t^3}{C_1D^2} \cdot \delta \cdot \left[\left(\frac{h_0}{t} - \frac{\delta}{t}\right) \cdot \left(\frac{h_0}{t} - \frac{\delta}{2t}\right) + 1\right]$$

The stresses on the positions Ⅰ, Ⅱ, Ⅲ and Ⅳ can be calculated according to the formulas given below. A positive value indicates tensile stress while a negative value indicates compression stress.

$$\sigma_{Ⅰ} = \frac{4E}{1 - \nu^2} \cdot \frac{t}{C_1D^2} \cdot \delta \cdot \left[-C_2 \cdot \left(\frac{h_0}{t} - \frac{\delta}{2t}\right) - C_3\right]$$

$$\sigma_{Ⅱ} = \frac{4E}{1 - \nu^2} \cdot \frac{t}{C_1D^2} \cdot \delta \cdot \left[-C_2 \cdot \left(\frac{h_0}{t} - \frac{\delta}{2t}\right) - C_3\right]$$

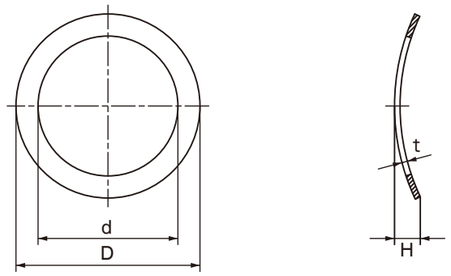
$$\sigma_{Ⅲ} = \frac{4E}{1 - \nu^2} \cdot \frac{t}{\alpha C_1D^2} \cdot \delta \cdot \left[(2C_3 - C_2) \cdot \left(\frac{h_0}{t} - \frac{\delta}{2t}\right) + C_3\right]$$

$$\sigma_{Ⅳ} = \frac{4E}{1 - \nu^2} \cdot \frac{t}{\alpha C_1D^2} \cdot \delta \cdot \left[(2C_3 - C_2) \cdot \left(\frac{h_0}{t} - \frac{\delta}{2t}\right) - C_3\right]$$

The load rate of the spring is non-linear and can be calculated according to the following equation.

$$k = \frac{dP}{d\delta} = \frac{D - d}{(D - d) - 3R} \cdot \frac{4E}{1 - \nu^2} \cdot \frac{t^3}{C_1D^2} \cdot \left[\left(\frac{h_0}{t}\right)^2 - 3\frac{h_0}{t} \cdot \frac{\delta}{t} + \frac{3}{2}\left(\frac{\delta}{t}\right)^2 + 1\right]$$

Curved Washer



Unit: mm

Size No.	d		D		H		t
	Basic	Tol.	Basic	Tol.	Basic	Tol.	
MB-4301	4.3	$^{+0.2}_{0}$	6.8	–	1	±0.2	0.15
4302	4.3	$^{+0.3}_{0}$	8	±0.2	1.2		0.3
5011	5	±0.2	7.9	$^{+0.05}_{-0.15}$	1.2	±0.15	0.15
5301	5.3		10	±0.2	1.4	±0.2	0.3
6203	6.2		11		1.4		0.15
6301	6.3		11		1.5		0.4

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

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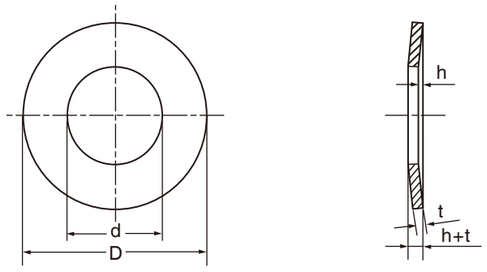
Dish Spring



Unit: mm

Size No.	d		D		H (For heavy duty)				L (For light duty)			
					t		h (Approx.)	h+t (Approx.)	t		h (Approx.)	h+t (Approx.)
	Basic	Tol.	Basic	Tol.	Basic	Tol.			Basic	Tol.		
DB- 4	4.2	+0.3 -0.1	8	±0.3	0.4	±0.03	0.2	0.6	0.3	±0.025	0.25	0.55
5	5.2		10		0.5		0.25	0.75	0.4	±0.03	0.3	0.7
6	6.2		12.5		0.7	±0.04	0.3	1	0.5		0.35	0.85
7	7.2		14		0.8		0.3	1.1	0.5		0.4	0.9
8	8.2		16		0.9	±0.05	0.35	1.25	0.6	±0.04	0.45	1.05
9	9.2		18		1		0.4	1.4	0.7		0.5	1.2
10	10.2	+0.4 -0.1	20	±0.4	1		0.45	1.45	0.8		0.55	1.35
11	11.2		22.5		1.2	±0.06	0.5	1.7	0.8		0.65	1.45
12	12.2		25		1.5		0.55	2.05	0.9	±0.05	0.7	1.6
14	14.2		28		1.5		0.65	2.15	1		0.8	1.8
16	16.3	+0.5 -0.2	31.5	±0.5	1.75	±0.07	0.7	2.45	1.2	±0.06	0.9	2.1
18	18.3		35.5		2		0.8	2.8	1.2		1	2.2
20	20.4		40		2		0.9	2.9	1.5		1.15	2.65
22	22.4		45		2.5	±0.08	1	3.5	1.75	±0.07	1.3	3.05
25	25.4		50		3	±0.09	1.1	4.1	2		1.4	3.4
28	28.5		56		3		1.3	4.3	2		1.6	3.6
30	31	+0.6 -0.4	63	±0.6	3.5		1.4	4.9	2.5	±0.08	1.75	4.25
35	36		71		4		1.6	5.6	2.5		2	4.5
40	41		80		5	±0.15	1.7	6.7	3	±0.09	2.3	5.3
45	46		91		5		2	7	3.5		2.5	6
50	51	±0.7	100	±0.7	6		2.2	8.2	3.5		2.8	6.3

Material = Carbon spring steel Hardness = 40 through 50HRC, Finish = Phosphate coating (ACP)

Notes

Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Prevention of Settling and Combined Use

1 Prevention of Settling

When wave washers, bending washers, and Dish Springs are used under the conditions shown in (1)-(3), the height becomes lower than the initial free height due to the effect of settling, and the load changes (See Fig. 1). Compressing before using wave washers or disc springs can remove this sagging (See Fig. 2).

(1) When a repetitive load is applied
(2) When using in a creep condition
(3) When the wave washer gets compressed during installation

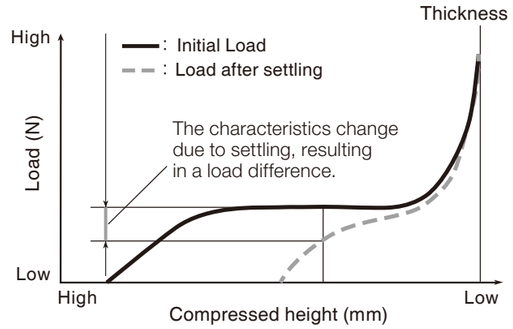


Fig. 1

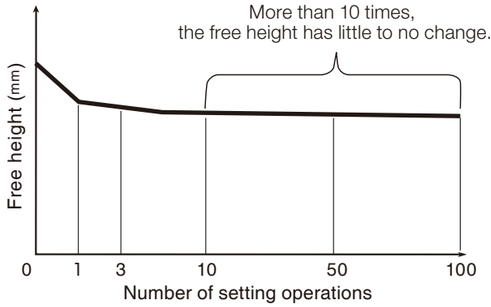


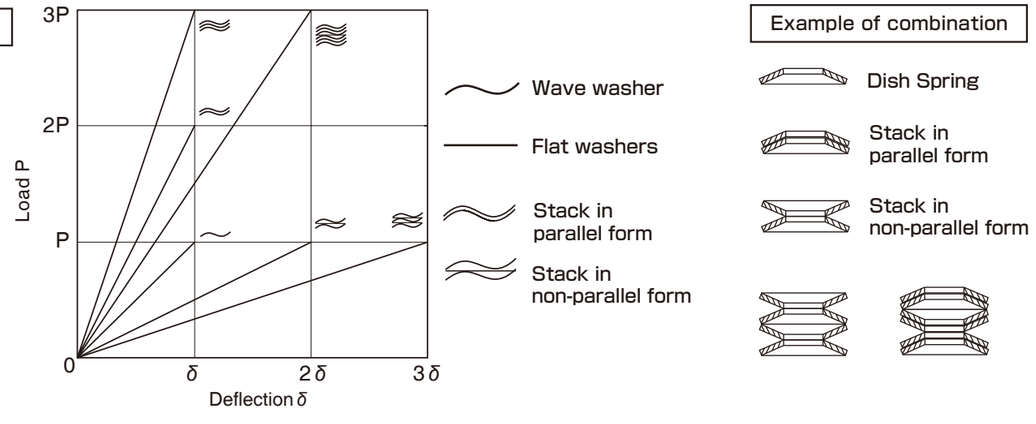
Fig. 2

2 Combined Use

For the Wave and Dish Springs, the load and the deflection can be changed according to the combination (stacking) methods as shown below (see Fig. 3).
However, the Wave Washer needs to be combined with flat washers.

- **To make the load larger with a certain deflection, combine the washers in the same direction.**
- **To make the deflection larger at a certain load, combine them in the face-to-face directions.**
- **To make both the deflection and load larger, combine them using both the methods.**

Fig. 3

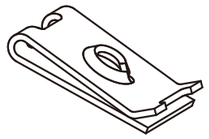


Types of Screw Type Plate Nuts (Characteristics and Instructions for Use)

Common Characteristics

- The Screw Type Plate Nut is a thin plate spring nut that has a mount and a threaded portion.
- The spring action of the mount prevents dropping off of the nut from the retained part (Except for the F-Type Plate Nut).
- These nuts are lighter than welded and swaged nuts. Thus they allow simplification to address comparatively light tightening requirements.
- These nuts can be used in locations where the nut cannot be supported by hand or with a tool because of mounting space.
- Certain nuts have a float on the panel supporting side. This float functions to prevent dropping off the nut and for positioning (Except for the F-Type Plate Nut).

TYPE 1 U-Type Plate Nut



Characteristics

- The U-Type Plate Nut is installed to the end of panel initially and therefore dropping off of nut is prevented to provide excellent workability.

TYPE 2 U-Type Wide Plate Nut

Characteristics

- This product allows for a wider range in application of the plate thickness of the applicable panel.

TYPE 3 F-Type Plate Nut

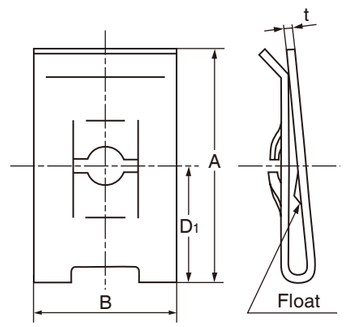
Characteristics

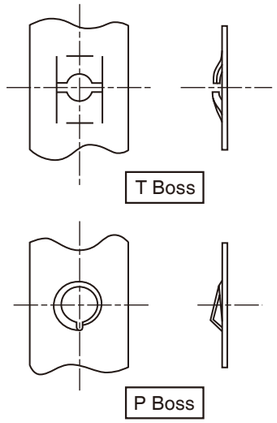
- Can be used in locations other than the end face of the panel.
- Like the P-Type Plate Nut, the spring action is introduced by curving the whole nut on an arched line. When installed, the Nut can prevent looseness of the panel.

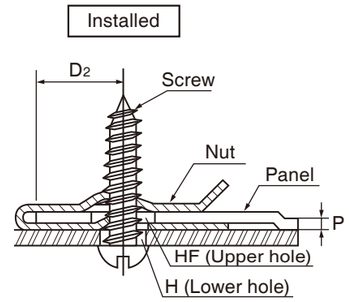
Instructions for Use

(1) Be sure to use the designated thread and panel. Use of an undesignated thread or panel disallows tightening of the screw.

(2) The Plate Nuts have two sides, front and back. Take care of the orientation of the nut for insertion of the screw.







Unit: mm

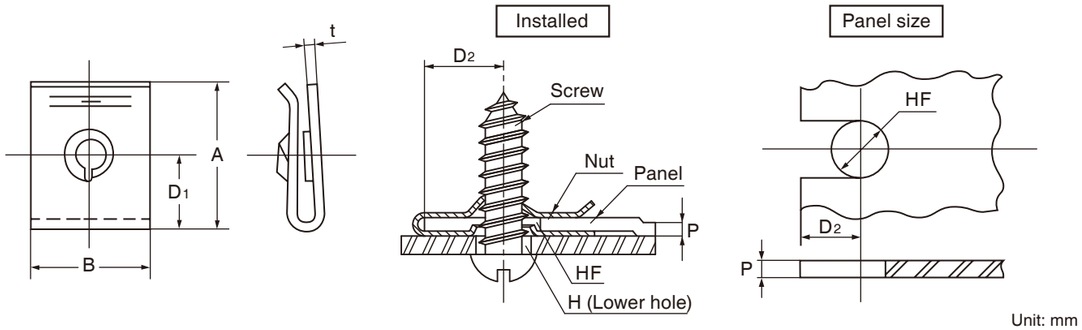
Size No.	Applicable screw (Note 1)	Nuts A	B	D1	t	Remarks Boss	Float	Material	Panel size P Min.	P Max.	D2 Max.	H	HF
USN-3001	M3 × 0.5	18	11.2	9	0.3	T	With	Carbon spring steel	0.6	1	7.5	4	5.5
3006	M3 × 0.5	11.5	8	6	0.3	P	Without	SUS	0.6	1.2	4.5	4	4
3012	3 - 24-thread	11.5	8	6	0.45	P	Without	SUS	0.6	1.2	4.5	4	4
4001	M4 × 0.7	20	12.7	10	0.4	T	With	Carbon spring steel	0.7	1.2	8	5	7
4003	M4 × 0.7	16.5	9	10	0.4	P	Without	SUS	0.8	1.2	8	5	5
4004	4 - 16-thread	20	12.7	10	0.8	T	With	Carbon spring steel	0.8	1.5	8	5	7
4005	4 - 16-thread	20	12.7	10	0.8	P	Without	Carbon spring steel	1	1.6	8	5	6
4006	4 - 16-thread	16.3	11	8.3	0.6	T	With	Carbon spring steel	1	1.6	6.5	5	7
4007	4 - 16-thread	20	12.7	13	0.45	T	Without	Carbon spring steel	2	2.7	10	5	6
4024	4 - 16-thread	17	11	9.1	0.6	T	Without	Carbon spring steel	0.7	1.6	7	5	7
4026	4 - 16-thread	16	11	8	0.5	P	With	SUS	2	2.5	6	5	6
4031	4 - 18-thread	19	9	13	0.45	P	Without	Carbon spring steel	2	3	10	5	5
4037	M4 × 0.7	18	9	12	0.4	P	Without	SUS	1	1.2	10	5	6
4048	4 - 16-thread	24	11	17	0.6	T	With	Carbon spring steel	0.7	1.6	14.5	5	7
5001	M5 × 0.8	20	12.7	10	0.45	T	With	Carbon spring steel	0.7	1.2	8	6.5	8
5003	5 - 12-thread	20	13	11.5	0.7	T	Without	Carbon spring steel	1	2.3	9	6.5	7
5004	5 - 16-thread	19.6	13	11.6	0.6	P	With	Carbon spring steel	0.7	1.5	10	6.5	7.5
5008	5 - 16-thread	32.2	12.7	22.2	0.7	P	With	Carbon spring steel	1	2.6	19	6.5	8
5016	5 - 16-thread	16.2	12.7	8.7	0.7	P	Without	Carbon spring steel	0.8	1.6	7	6.5	6.5
5017	M5 × 0.8	21	12.7	11.5	0.4	T	Without	Carbon spring steel	1.3	2	9	6.5	8
6001	M6 × 1	20	12.7	10	0.5	T	With	Carbon spring steel	0.7	1.2	8	7.5	9.5
6002	6 - 10-thread	21.8	12.7	11.3	0.8	P	Without	Carbon spring steel	0.6	1.2	9.5	7.5	7.5

Material = Carbon spring steel Hardness = 40 through 50HRC (38-45HRC only for USN-4024)
Material = Stainless steel for spring

Notes

1. Refer to the JIS standard for the thread size.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

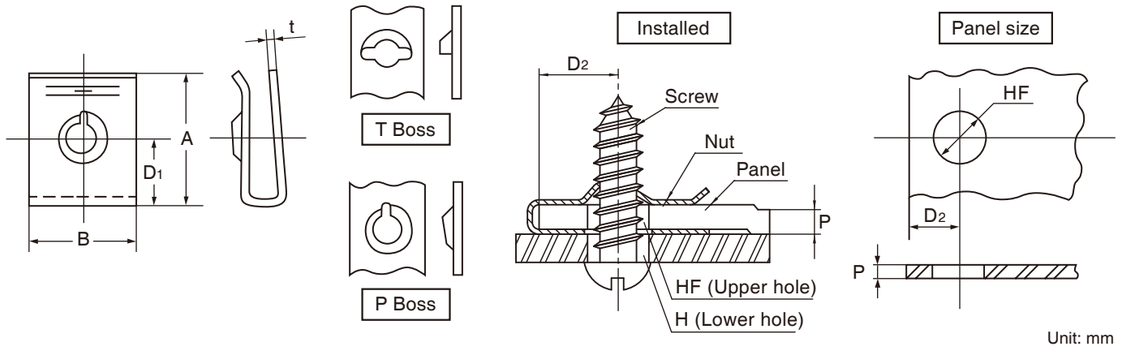
U-Type Wide Plate Nut



Unit: mm

Size No.	Applicable screw	Nuts				Remarks			Panel size				
		A	B	D1	t	Boss	Float	Material	P		D2	H	HF
									Min.	Max.	Max.		
USN-4009	M4 × 0.7	11.4	11	5.9	0.4	P	With	SUS	0.7	0.9	5	4.5	6
4015	M4 × 0.7	12.4	11	5.9	0.4	P	With	SUS	2.5	2.8	4	4.5	6
4035	4 - 16-thread	12.4	11	5.9	0.4	P	With	SUS	0.7	0.9	5	4.5	6
4036	4 - 16-thread	12.4	11	5.9	0.4	P	With	SUS	2.5	2.8	4	4.5	6

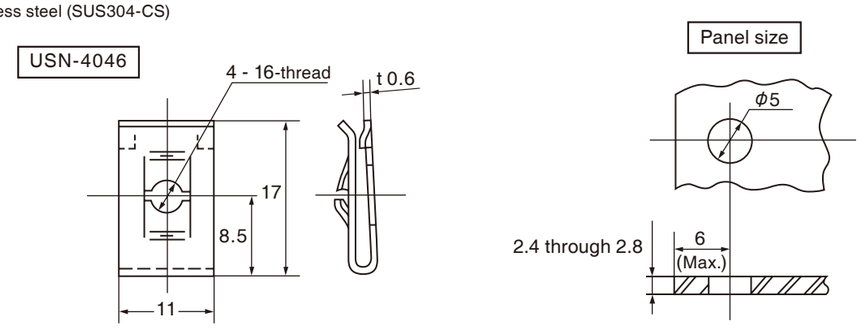
Material = Stainless steel for spring



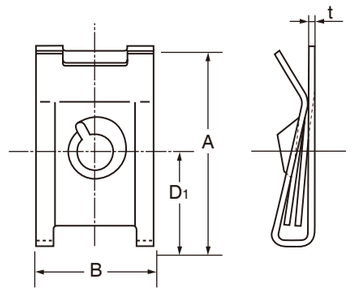
Unit: mm

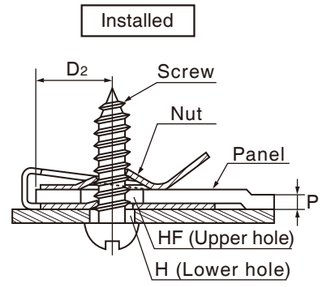
Size No.	Applicable screw	Nuts				Remarks			Panel size				
		A	B	D1	t	Boss	Float	Material	P		D2	H	HF
									Min.	Max.	Max.		
USN-4043	4 - 18-thread	10	10	5.5	0.5	T	Without	Carbon spring steel	2.6	2.7	4.5	5	5
5021	5 - 12-thread	20.5	17	9	0.7	P	Without	SUS	6	7	7.5	6	7
5023	5 - 16-thread	14.5	11	8.6	0.6	P	Without	Carbon spring steel	2	3.5	7	6	6
5026	5 - 16-thread	11	10	6	0.5	T	Without	Carbon spring steel	2.6	2.7	5	6	6

Material = Carbon spring steel
Material = Stainless steel (SUS304-CS)



Notes
1. Refer to the JIS standard for the thread size.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.





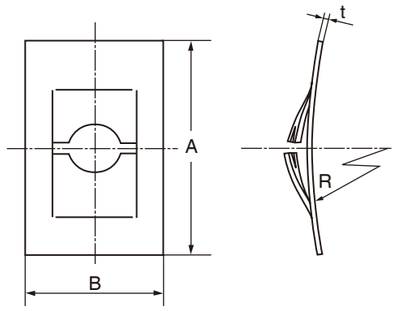
Unit: mm

Size No.	Applicable screw (Note 1)	Nuts				Remarks	Panel size				
		A	B	D1	t	Float	P		D2	H	HF
							Min.	Max.	Max.		
WUSN-4039	4 - 18-thread	21.6	12.7	10.1	0.6	With	0.7	2.5	8	5	7
4044	4 - 18-thread	16.6	13.5	8.6	0.6	Without	0.6	2	7	5	6
5022	5 - 16-thread	21.7	12.7	10.2	0.7	With	0.7	3.1	8	6	8
5025	5 - 16-thread	20.6	13.5	9.5	0.6	Without	0.6	3.8	8	6	7
5029	5 - 16-thread	21.7	12.7	10.2	0.7	Without	2	3	8	6	7

Material = Carbon spring steel

Notes
1. Refer to the JIS standard for the thread size.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

F-Type Plate Nut



Unit: mm

Size No.	Applicable screw (Note 1)	Nuts				Panel size	
		A	B	R	t	H	HF
FSN-3001	M3 × 0.5	16	10	40	0.3	3.2	4
4001	M4 × 0.7	20	13	50	0.4	4.3	5
5001	M5 × 0.8	20	13	50	0.45	5.3	6
6001	M6 × 1	20	13	50	0.5	6.4	7

Material = Carbon spring steel

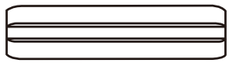
Notes
1. Refer to the JIS standard for the thread size.
2. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Types of Spring Pins (Characteristics and Instructions for Use)

Common Characteristics

- The Spring Pin is a thin sheet rolled in a cylindrical shape and provided with a slit. Inserting (press fitting) the pin into a hole having a slightly smaller diameter than the diameter of its outer periphery causes the inner pressure (pin spreading force) to act on the inner circumference of the hole. This prevents dropping off of the pin.
- As compared to sold pins, the hollow Spring Pin allows lighter weight.
- Used for positioning, prevention of rotation and prevention of dropping off.

TYPE 1 Spring Pin (For General Purpose)



Characteristics

- Used for easy tightening, and positioning.
- It prevents falling out the maiting hole with gripping force.
- The Pin should be doubled if you want to increase the shear load. (The resultant load is given by adding the shear load of inner pin and that of outer pin.)

TYPE 2 Spring Pin (For Light Duty)

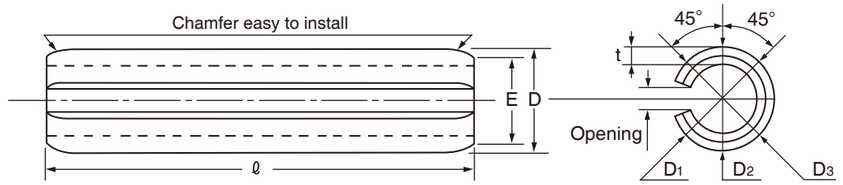
Characteristics

- The insertion force is smaller than the Spring Pin (For General Purpose).
- The slit is waved to prevent entanglement of the product.
- Mainly used for hinges from resin (retained parts will be broken by general-purpose pins) as well as in applications where the shear load is lower.

Instructions for Use

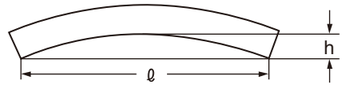
With the Pin inserted into the hole, rotating the retained part repeatedly may cause the pin to drop off.

OCHIAI OF INDUSTRIAL FASTENERS



The clearance C must have dimensions that do not allow contact of the sides of the Pin as inserted into the applicable hole.

Camber



ℓ	1-10	11-30	31-50	51-70	71 or over
h	0.2 or under	0.3 or under	0.4 or under	0.5 or under	0.6 or under

Unit: mm

Nominal dia.			1	1.2	1.5	1.6	2	2.5	3	3.5	4	4.5	5	6	8	10	12	13
Dimension	D	Max.	1.2	1.4	1.7	1.8	2.25	2.75	3.25	3.84	4.4	4.84	5.4	6.4	8.6	10.6	12.5	13.7
		Min.	1.1	1.3	1.6	1.7	2.15	2.65	3.15	3.7	4.2	4.7	5.2	6.2	8.3	10.3	12.3	13.4
	t	Basic	0.2	0.25	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.2	1.6	2	2	2.5
	E	Max.	0.9	1.1	1.4	1.5	1.9	2.4	2.9	3.4	3.9	4.3	4.8	5.8	7.8	9.8	11.7	12.7
Groove dimention		Diameter	1	1.2	1.5	1.6	2	2.5	3	3.5	4	4.5	5	6	8	10	12	13
		Tol.	+0.08 0				+0.09 0			+0.12 0					+0.15 0		+0.2 0	

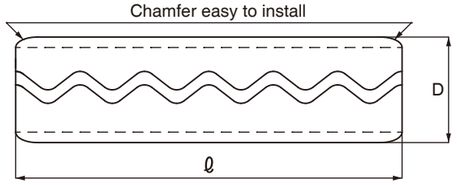
Length(ℓ)		Nominal dia.															
Basic	Tol.	1	1.2	1.5	1.6	2	2.5	3	3.5	4	4.5	5	6	8	10	12	13
4	+0.5 0	○	○	○	○	○	○										
5		○	○	○	○	○	○	○		○							
6		○	○	○	○	○	○	○	○	○							
8		○	○	○	○	○	○	○	○	○	○	○	○				
10		○	○	○	○	○	○	○	○	○	○	○	○	○			
12		○	○	○	○	○	○	○	○	○	○	○	○	○			
14			○	○	○	○	○	○	○	○	○	○	○	○			
15			○	○	○	○	○	○	○	○	○		○	○	○		
16				○	○	○	○	○	○	○	○	○	○	○	○	○	
18				○		○	○	○	○	○	○	○	○	○	○		
20					○	○	○	○	○	○	○	○	○	○	○	○	
22						○	○	○	○	○	○	○	○	○	○	○	○
24						○	○	○	○	○	○	○	○	○	○	○	
25	+1 0					○	○	○	○	○	○	○	○	○	○	○	○
26						○	○	○	○	○	○	○	○		○		
28						○	○	○	○	○		○	○	○	○	○	
30						○	○	○	○	○	○	○	○	○	○	○	
32						○	○	○	○	○	○	○	○	○	○	○	○
35							○	○	○	○		○	○	○	○	○	
36						○	○	○	○	○	○	○	○	○	○	○	○
38								○		○		○	○	○			
40						○	○	○	○	○	○	○	○	○	○	○	○
45							○	○	○	○		○		○	○	○	
50							○	○	○	○	○	○	○	○	○	○	○
55	+1.5 0									○		○		○	○	○	
56												○	○	○	○		
60								○		○	○	○	○	○	○	○	○
63												○	○	○	○		○
65												○	○	○	○	○	
70										○		○	○	○	○	○	○
75												○	○	○	○	○	
80												○	○	○	○	○	
85													○	○	○	○	○
90													○	○	○	○	○
95														○	○		
100														○	○	○	○
110														○	○	○	
120														○	○	○	
130															○	○	
140															○	○	

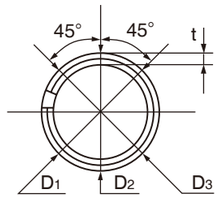
Material = Carbon spring steel Finish = Phosphate coating (ACP) Hardness = 40 through 50HRC (40 through 50HRC only for Nominal dia. 13mm)
Material = Stainless steel for spring (SUS304-CS) Finish = N/A

Notes

1. Max. D shall be the maximum value on the circumference of the pin. Min. D shall be the average of the D1, D2, and D3 diameter values.
2. Contact us for products having lengths other than the ○ marked dimensions.
3. ○ marks stand for the dimensions of products of carbon spring steel. The dimensions of products of stainless steel may not be manufactured. Contact us.
4. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Spring Pin (For Light Duty)





Unit: mm

Nominal dia.			1.6	2	2.5	3	4
Spring Pin	D	Max.	1.8	2.25	2.75	3.25	4.4
		Min.	1.7	2.15	2.65	3.15	4.2
	t		0.15	0.2	0.25	0.3	0.4
Groove dimention			1.6 +0.08 0	2 +0.09 0	2.5 +0.09 0	3 +0.09 0	4 +0.12 0
Length (ℓ)	5	+0.5 0	○	○			
	6			○	○	○	
	8		○	○	○	○	○
	10		○	○	○	○	○
	12	+1 0	○	○	○	○	○
	14			○		○	
	16			○	○	○	
	18			○	○	○	
	20			○		○	
	22				○	○	
	25				○	○	○
	28					○	○
	30					○	
	32					○	
	36					○	

Material = Stainless steel for spring

Notes

1. Max. D shall be the maximum value on the circumference of the pin. Min. D shall be the average of the D1, D2, and D3 diameter values.
2. Contact us for products having lengths other than the ○ marked dimensions.
3. Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Types of Snap Pins (Characteristics and Instructions for Use)

Common Characteristics

- These products are made by coiling of wire rods.
- It is used to avoid dropping off of the mating object from dropping off from the counterpart shaft by inserting the straight part into a hole opened radially on the mating shaft and securing the pin with the spring action of the semicircular part.
- Used to avoid dropping off of retained parts.
- Can be used in place of split pins.

TYPE 1 Snap Pin

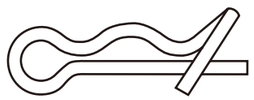
Characteristics

- Can be inserted by a single operation and easily removed.

Notes

- Inserting the pin with excessive force may cause deformation and falling off from the retained part.
- It is necessary to pay attention to falling off by external interference.

TYPE 2 Retaining Pin



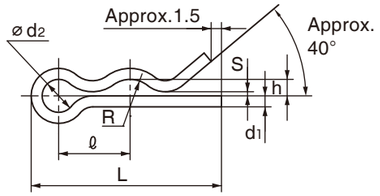
Characteristics

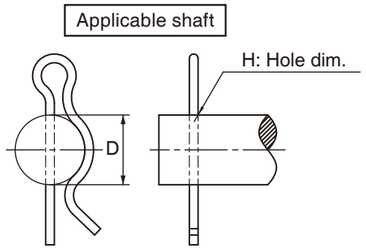
- This is a snap pin attached with a mechanism to prevent falling off.
- Can be inserted by a single operation.
- The product itself is designed for disallowing easy falling off.

Notes

- Insertion method:
  Pinch between the opening and the arch portion on the other side and insert the point of pin (straight-line part) into the hole in the retained shaft. Rotate the pin approximately 90 degrees counterclockwise to insert it. Inserting the pin by any other method may result in deformation disabling it to function normally.
- Removal method:
  Rotate the pin in the same manner as the insertion method to pull it out.

Snap Pin





Unit: mm

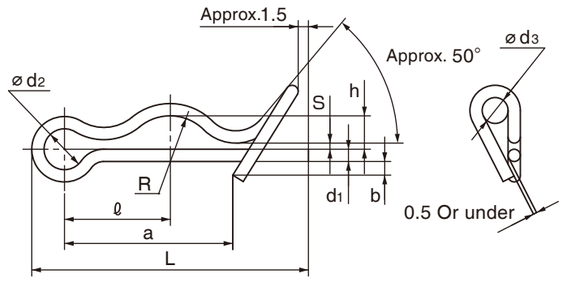
Size No.	Snap Pin								Applicable shaft	
	d_1		d_2	ℓ	R	h	S	L	D	H
	Basic	Tol.	Approx.	Approx.	Approx.	Approx.	Max.	Approx.	Ref.	Ref.
SSP- 4	1	±0.02	3	6	2	1	0.5	16.3	4	1.2
5	1		3	6.5	2.5	1.5	0.5	17.9	5	1.2
6	1.2	±0.03	3.6	7.8	3	1.8	0.6	21.2	6	1.5
8	1.6		4.8	10.4	4	2.4	0.8	27.7	8	1.9
10	1.8		5.4	12.2	5	3.2	0.9	32.6	10	2.2
12	1.8		5.4	13.2	6	4.2	0.9	35.8	12	2.2
14	2		6	15	7	5	1	40.6	14	2.4
16	2		6	16	8	6	1	43.8	16	2.4

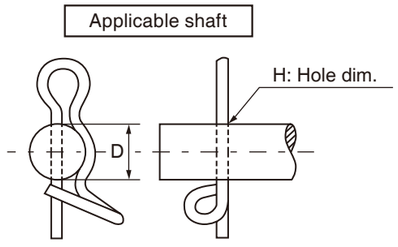
Material = SW-B Finish = Zinc Plate plus Chromate
The value d_1 is the diameter of wire rod as material.

Notes

Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Retaining Pin





Unit: mm

Size No.	Retaining Pin														Applicable shaft	
	d_1		d_2		ℓ	R	h		S	a	b	L		d_3	D	H
	Basic	Tol.	Basic	Tol.	Approx.	Approx.	Basic	Tol.	Max.	Approx.	Approx.	Basic	Tol.	Approx.	Ref.	Ref.
SSP- 5012	1	±0.02	3		6.5	2.5	1.5		0.5	9.5	1	17.9		2.2	5	1.2
6013	1.2		3.6	±0.4	7.8	3	1.8	±0.3	0.6	11.4	1.2	21.2	±1	2.4	6	1.5
8012	1.6	±0.03	4.8		10.4	4	2.4		0.8	15.2	1.6	27.7		3.4	8	1.9
10011	1.8		5.4	±0.6	12.2	5	3.2	±0.4	0.9	18.1	1.8	32.6	±1.5	3.6	10	2.2
12012	1.8		5.4		13.2	6	4.2		0.9	20.8	2	35.8		3.8	12	2.2

Material = SW-B Finish = Zinc Plate plus Chromate
The value d_1 is the diameter of wire rod as material.

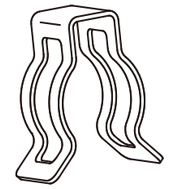
Notes

Our products with little marketability may not be in stock. When employing our products, consult with us for their availability.

Types of Joint Clips (Characteristics and Instructions for Use)

Characteristics

- It is mainly used to join flanged pipes around water.
- It can be easily combined with one touch, which improves workability.
- Since it does not require tools and can be attached and detached by hand, it can be installed even in narrow places where there is no space to handle tools.



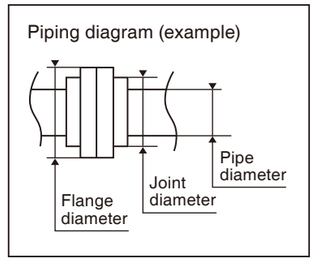
Instructions for Use

(1) Conditions such as water pressure and operating environment vary from customer to customer, so check the specifications of water hammer, thrust load, etc.

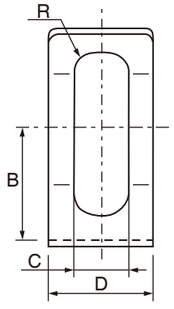
(2) After installing the Joint Clip, be sure to rotate it left and right to make sure that the flange of the pipe is inserted in the correct position in the window of the quick fastener. Incorrect installation may cause the piping to come off.

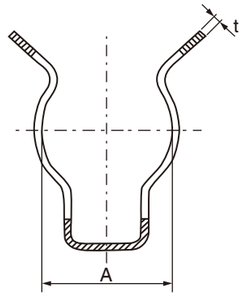
(3) Since the nominal diameter of the product and the joint diameter do not necessarily match, check the dimension table / catalog and use the product that matches the fitting diameter (using a product with a mismatched flange diameter may cause the Joint Clip to fall off or be damaged).

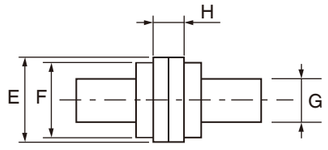
(4) Repeated use (reuse of the product once inserted into the flange) is not recommended.



Joint Clip [General Type]







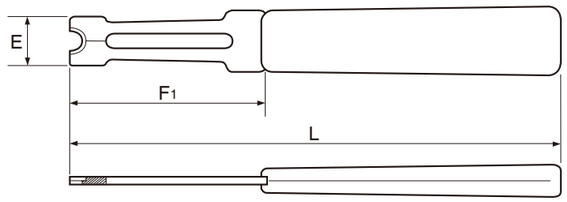
Applicable mating parts

Unit: mm

Size No.	A		B	C	D		R	t		Applicable mating parts			
	Basic	Tol.			Basic	Tol.		Basic	Tol.	E	F	G	H
Quick-4	9		11	5.5	11.5		R1	0.5		13	11	4	5
6	11		13	6	12		R1	0.8	±0.04	15	13	6	5.5
8 -R3	13		14	6	12		R3	0.8		17	15	8	5.5
10 -R2.5	15		14	6	12		R2.5	0.8		20	17	10	5.5
12.7-R3	20	±1	18	6	14	±0.15	R3	1		26	22	12.7	5.5
16A-R3	23		19	6	14		R3	1		30	25	16	5.5
16B-R3	26		23	6	14		R3	1	±0.05	34	28	16	5.5
22.2-R3	29		25	6	14		R3	1		-	32	22.2	5.5
25.4-R3	35		27	6	16		R3	1		44	38	25.4	5.5

Material = Stainless steel for spring (SUS304-CSP-3/4H) Hardness = 31HRC or over (310HV or over)

ET Holder



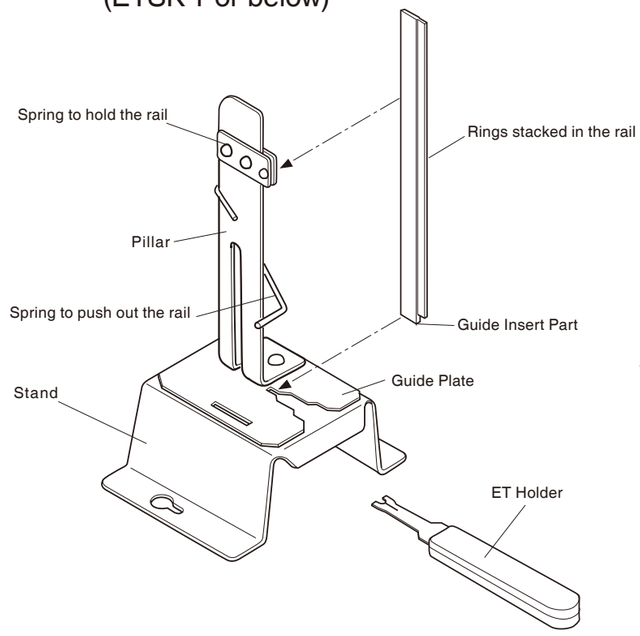
Unit:mm

Applicable Size of E-Ring				ET Holder Size No.	Dimension				
Size No.	Diameter of inner periphery	Diameter of outer periphery	Plate thickness		L	F1	E	G	H
ETW- 0.6	0.6	1.5	0.2	ETH- 0.6	123	39	3.6	12	5
0.7	0.67	2	0.2	0.7, 0.8					
0.8	0.8	2	0.2	0.7, 0.8			5		
1	0.98	2.8	0.2	1					
1.2	1.2	3	0.3	1.2	122	38	7	9	8
1.5	1.5	4	0.4	1.5					
1.9	1.9	4.5	0.4	1.9					
2	2	5	0.4	2	124	40	10	10	
2.3	2.3	6	0.4	2.3, 2.5					
2.5	2.5	6	0.4	2.3, 2.5					
3	3	7	0.6	3, 3.2	123	43	12	12	
3.2	3.2	7	0.6	3, 3.2					
4	4	9	0.6	4	129	49	18	16	10
5	5	11	0.6	5					
6	6	12	0.8	6	154	54	21	18	12
7	7	14	0.8	7					
8	8	16	0.8	8	160	60	24	20	14
9	9	18	0.8	9					
10	10	20	1	10	163	63	26	23	
12	12	23	1	12	165	65	29	26	

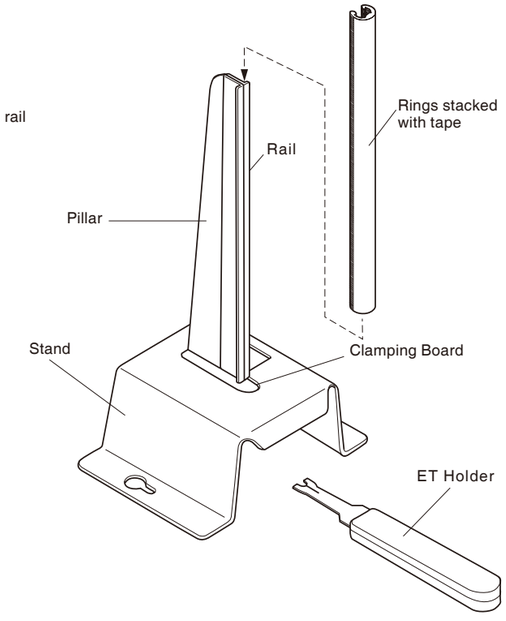
Dispenser (ET Stand)

OCHIAI OF INDUSTRIAL FASTENERS

●For E-Rings stacked on rail
(ETSK-1 or below)



●For E-Rings stacked with tape
(ETSK-1.2 or above)

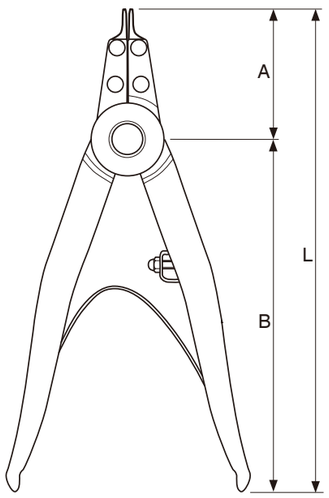


Size chart of Stacked E-Ring and ET Holder used in Dispenser (ET Stand)

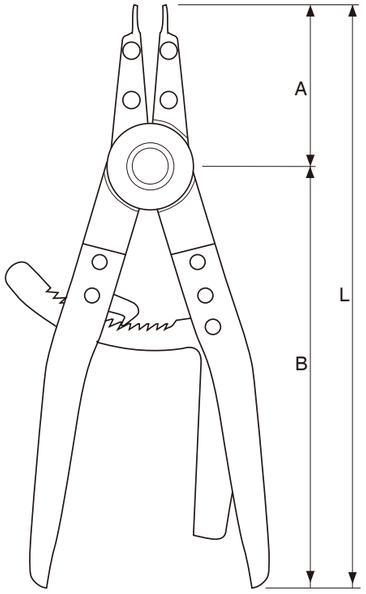
Unit:mm

Applicable Size of E-Ring				ET Stack Size No.	ET Holder Size No.	Dispenser (ET Stand) Size No.
Size No.	Diameter of inner periphery	Diameter of outer periphery	Plate thickness			
ETW- 0.6	0.6	1.5	0.2	ES- 0.6	ETH- 0.6	ETSK- 00
0.7	0.67	2	0.2	0.7	0.8	00
0.8	0.8	2	0.2	0.8	0.8	00
1	0.98	2.8	0.2	1	1	1
1.2	1.2	3	0.3	1.2	1.2	1.2
1.5	1.5	4	0.4	1.5	1.5	1.5
1.9	1.9	4.5	0.4	1.9	1.9	1.9
2	2	5	0.4	2	2	2
2.3	2.3	6	0.4	2.3	2.5	2.5
2.5	2.5	6	0.4	2.5	2.5	2.5
3	3	7	0.6	3	3	3
3.2	3.2	7	0.6	3.2	3	3
4	4	9	0.6	4	4	4
5	5	11	0.6	5	5	5
6	6	12	0.8	6	6	6
7	7	14	0.8	7	7	7
8	8	16	0.8	8	8	8
9	9	18	0.8	9	9	9
10	10	20	1	10	10	10
12	12	23	1	12	12	12

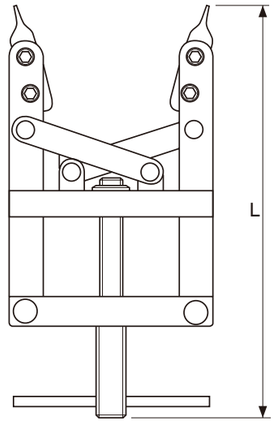
Pliers (A Tool to install C-Type Retaining Ring)



Model: No.1,2

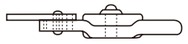


Model: No.3,4



Model: No.5

Tip Shape



Standard

ST Plier (For Shafts)

Size No.	Applicable Size of Retaining Ring	A	B	L	Model
ST-0	4 - 9	50	150	Approx. 200	No.1
ST-1	10 - 18	50	150	Approx. 200	No.1
ST-2	19 - 30	50	150	Approx. 200	No.1
ST-2N	32 - 58	65	180	Approx. 245	No.2
ST-3	60 - 80	75	210	Approx. 285	No.3
ST-4	82 - 165	90	330	Approx. 420	No.4
ST-5	170 - 300	–	–	Approx. 240	No.5

RT Plier (For Groove)

Size No.	Applicable Size of Retaining Ring	A	B	L	Model
RT-0	6 - 9	50	150	Approx. 200	No.1
RT-1	10 - 8	50	150	Approx. 200	No.1
RT-2	19 - 30	50	150	Approx. 200	No.1
RT-2N	32 - 58	65	180	Approx. 245	No.2
RT-3	60 - 80	75	210	Approx. 285	No.3
RT-4N	82 - 175	98	365	Approx. 465	No.4
RT-5	180 - 300	–	–	Approx. 240	No.5

memo

memo