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Retaining rings

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Foreword

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

Consequently **JIS B 2804 : 2001** has been replaced with this Standard.

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Retaining rings

1 Scope

This Japanese Industrial Standard specifies characteristics of C-type eccentric retaining rings, C-type concentric retaining rings, E-type retaining rings and grip retaining rings.

2 Normative references

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

- JIS B 0103 *Glossary of terms used in springs*
- JIS B 0601 *Geometrical Product Specifications (GPS) — Surface texture : Profile method — Terms, definitions and surface texture parameters*
- JIS B 1091 *Fasteners — Acceptance inspection*
- JIS B 7184 *Profile projectors*
- JIS B 7502 *Micrometer callipers*
- JIS B 7507 *Vernier, dial and digital callipers*
- JIS B 7513 *Precision surface plates*
- JIS B 7517 *Vernier, dial and digital height gauges*
- JIS B 7533 *Dial test indicators (Lever type)*
- JIS B 7738 *Verification of helical compression and extension springs testing machines*
- JIS G 3311 *Cold rolled special steel strip*
- JIS G 3506 *High carbon steel wire rods*
- JIS G 3521 *Hard drawn steel wires*
- JIS G 4313 *Cold rolled stainless steel strip for springs*
- JIS G 4401 *Carbon tool steels*
- JIS G 4802 *Cold-rolled steel strips for springs*
- JIS Z 2244 *Vickers hardness test — Test method*
- JIS Z 2245 *Rockwell hardness test — Test method*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS B 0103 apply.

4 Quantity symbols

For the purposes of this Standard, the main quantity symbols given in table 1 apply.

Table 1 Quantity symbols

Quantity symbol	Meaning of quantity symbol	Unit
d_0	Diameter of hole for pliers or diameter of aperture	mm
d_1	Applicable shaft diameter or applicable bore diameter	mm
d_2	Groove bottom diameter of applicable shaft or groove bottom diameter of applicable bore	mm
d_3	Inside diameter or outside diameter	mm
d_4	Outside diameter of a retaining ring part or inside diameter of a retaining ring part	mm
d_5	Minimum dimension of an interference object in the outside diameter side or maximum dimension of an interference object in the inside diameter side	mm
a	Width of a hole section for pliers for attachment	mm
b	Width of retaining ring, width of retaining ring part or maximum width of retaining ring part	mm
t	Thickness	mm
m	Width of a groove section of applicable shaft or width of a groove section of applicable bore	mm
n	Length from the edge to the groove of applicable shaft or length from the groove edge to the groove of applicable bore	mm
r	Chamfer amount of retaining ring	mm
d	Inside diameter of E-type retaining ring	mm
D	Outside diameter of E-type retaining ring	mm
H	Width of cut ends of E-type retaining ring	mm
α	Amount of fins	mm
β	Amount of pan-like deformation	mm
γ	Amount of cut-ends discrepancy	mm
δ	Amount of sectional deformation	mm
A	Dimension at the time of attachment to testing device or diameter of test bar	mm
B	Dimension of maximum outside diameter of test bar, dimension of minimum inside diameter of test cylinder or inside diameter of fixture	mm
C	Shaft diameter or bore diameter for confirming inside diameter after scragging test and outside diameter after scragging test	mm
P	Maximum amount of load until grip retaining ring and test bar begin to slip	N

5 Types

Retaining rings shall be classified according to the shape and use into the types as given in table 2.

Table 2 Classification of retaining rings

Type	Shape	Application	Symbol of type
C-type on-shaft-use eccentric retaining ring	Shaft centre of inside diameter differs from shaft centre of outside diameter.	For use on grooved shaft	CE-EX
C-type in-bore-use eccentric retaining ring	Shaft centre of inside diameter differs from shaft centre of outside diameter.	For use in grooved bore	CE-IN
C-type on-shaft-use concentric retaining ring	Shaft centre of inside diameter agrees with shaft centre of outside diameter.	For use on grooved shaft	CC-EX
C-type in-bore-use concentric retaining ring	Shaft centre of inside diameter agrees with shaft centre of outside diameter	For use in grooved bore	CC-IN
E-type retaining ring	E-type	For use on grooved shaft	ER
Grip retaining ring	Shaft centre of inside diameter differs from shaft centre of outside diameter	For use on grooveless shaft	GR

6 Material

The material of retaining rings shall be as given in table 3. The applied material of each type of the retaining ring is shown by ○ mark. Where other materials than in table 3 are to be used, it shall be subjected to the agreement between the parties concerned with delivery.

Table 3 Material of retaining ring

Materials to be used for retaining rings (symbol)	C-type eccentric retaining ring	C-type concentric retaining ring	E-type retaining ring	Grip retaining ring
JIS G 3311 S60CM	○	○	○	○
JIS G 3311 S65CM	○	○	○	○
JIS G 3311 S70CM	○	○	○	○
JIS G 3311 SK85M	○	○	○	○
JIS G 3506 SWRH62 (A·B)	○	○	—	—
JIS G 3506 SWRH67 (A·B)	○	○	—	—
JIS G 3506 SWRH72 (A·B)	○	○	—	—
JIS G 3506 SWRH77 (A·B)	○	○	—	—
JIS G 3506 SWRH82 (A·B)	○	○	—	—
JIS G 3521 SW-B	—	○	—	—
JIS G 3521 SW-C	—	○	—	—
JIS G 4313 SUS301-CSP	—	—	○	—
JIS G 4313 SUS304-CSP	—	—	○	—
JIS G 4401 SK85	○	—	—	—
JIS G 4802 S60C-CSP	○	○	○	○
JIS G 4802 S65C-CSP	○	○	○	○
JIS G 4802 S70C-CSP	○	○	○	○
JIS G 4802 SK85-CSP	○	○	○	○

7 Shape and dimensions

The shape and dimensions of the retaining rings, when measured in accordance with 12.2, shall conform to table 4.

Table 4 Shape and dimensions of retaining ring

Type	Relevant table
C-type on-shaft-use eccentric retaining ring	Table 16
C-type in-bore-use eccentric retaining ring	Table 17
C-type on-shaft-use concentric retaining ring	Table 18
C-type in-bore-use concentric retaining ring	Table 19
E-type retaining ring	Table 20
Grip retaining ring	Table 21

8 Permitted range of amount of fins and deformation

The permitted range of amount of fins and deformation shall be in accordance with Annex A.

9 Hardness

The hardness of carbon steel retaining rings, when tested in accordance with 12.4, shall conform to table 5. The hardness of stainless steel retaining ring shall be subjected to the agreement between the parties concerned with delivery.

Table 5 Hardness of retaining ring

Type	Hardness
C-type eccentric retaining ring	44HRC to 53HRC or 434HV to 560HV
C-type concentric retaining ring	40HRC to 50HRC or 392HV to 513HV
E-type retaining ring	44HRC to 53HRC or 434HV to 560HV
Grip retaining ring	46HRC to 51HRC or 458HV to 528HV

10 Spring function

The spring function of the retaining rings, when tested in accordance with 12.5, shall conform to the requirement shown in table 6.

Table 6 Requirement

Type	Name of test	Requirement
C-type on-shaft-use eccentric retaining ring	Scrapping test	When it is attached to an applicable shaft, there shall be no play to the opposite groove.
C-type in-bore-use eccentric retaining ring		When it is attached to an applicable hole, there shall be no play to the opposite groove.
C-type on-shaft-use concentric retaining ring		When it is attached to an applicable shaft, there shall be no play to the opposite groove.
C-type in-bore-use concentric retaining ring		When it is attached to an applicable hole, there shall be no play to the opposite groove.
E-type retaining ring ^{a)}		When it is attached to an applicable shaft, there shall be no play to the opposite groove.
Grip retaining ring	Axial loading test	When tested in accordance with 12.5.4, the axial loading requirement shown in table 21 shall be satisfied.
Note ^{a)} The requirement of stainless steel E-type retaining rings shall be as agreed between the parties concerned with delivery.		

11 Appearance

The appearance of retaining rings, when tested in accordance with 12.6, shall be smooth on the surface without cracks, and free from rust or the like.

12 Tests

12.1 Test equipment and tool

The test equipment and tool shall be as follows :

- a) **Retaining ring pliers** The retaining ring pliers are a tool used for attachment and detachment of a retaining ring, having a narrow cylindrical section at the tip which is inserted into the hole for pliers of the retaining ring.
- b) **Load tester** A tester specified in JIS B 7738.
- c) **Vernier callipers** Vernier callipers of which the scale interval is 0.05 mm specified in JIS B 7507.
- d) **Spherical micrometer** Micrometer of which the measuring surface of the anvil and spindle is spherical and the scale interval is 0.01 mm
- e) **Pin gauge** The pin gauge shall be as follows :
 - 1) Length of effective part, 5 mm or more
 - 2) Tolerance on diameter, $\pm 2 \mu\text{m}$ or less
 - 3) Tolerance on roundness, $2 \mu\text{m}$ or less
 - 4) Tolerance on cylindricity, $2 \mu\text{m}$ or less
 - 5) Surface roughness, not more than $R_z 0.8 \mu\text{m}$

- 6) Hardness and shape, round bar of not less than 650HV
- f) **Profile projector** A profile projector specified in JIS B 7184, with a projection lens of $\times 10$ magnifications.

12.2 Measurement of shape and dimensions

12.2.1 C-type on-shaft-use eccentric retaining ring, C-type in-bore-use eccentric retaining ring and grip retaining ring

The measured positions and measuring instrument of a C-type on-shaft-use eccentric retaining ring, a C-type in-bore-use eccentric retaining ring and a grip retaining ring shall be as given in table 7.

The number of measured positions and the evaluation method of measured values shall be as agreed between the parties concerned with delivery.

**Table 7 Measured positions and measuring instrument of
C-type on-shaft-use eccentric retaining ring,
C-type in-bore-use eccentric retaining ring and
grip retaining ring**

Measured position	Quantity symbol	Measuring instrument
Inside diameter or outside diameter	d_3	Vernier callipers specified in 12.1 c)
Thickness	t	Spherical micrometer specified in 12.1 d)
Maximum width of retaining ring part	b	Vernier callipers specified in 12.1 c)
Width of hole for pliers for attachment	a	Vernier callipers specified in 12.1 c)
Diameter of hole for pliers	d_0	Vernier callipers specified in 12.1 c) or pin gauge specified in 12.1 e)

12.2.2 C-type on-shaft-use concentric retaining ring and C-type in-bore-use concentric retaining ring

The measured positions and measuring instrument of a C-type on-shaft-use concentric retaining ring and C-type in-bore-use concentric retaining ring shall be as given in table 8.

The number of measured positions and the evaluation method of measured values shall be as agreed between the parties concerned with delivery.

**Table 8 Measured positions and measuring instrument of
C-type on-shaft-use concentric retaining ring and
C-type in-bore-use concentric retaining ring**

Measured position	Quantity symbol	Measuring instrument
Inside diameter or outside diameter	d_3	Vernier callipers specified in 12.1 c)
Thickness	t	Spherical micrometer specified in 12.1 d)
Width	b	Vernier callipers specified in 12.1 c)

12.2.3 E-type retaining ring

The measured positions and measuring instrument of E-type retaining ring shall be as given in table 9.

The number of measured positions and the evaluation method of measured values shall be as agreed between the parties concerned with delivery.

Table 9 Measured positions and measuring instrument of E-type retaining ring

Measured position	Quantity symbol	Measuring instrument
Inside diameter	d	Pin gauge specified in 12.1 e) or profile projector specified in 12.1 f)
Outside diameter	D	Vernier callipers specified in 12.1 c)
Width of cut ends	H	Vernier callipers specified in 12.1 c)
Thickness	t	Spherical micrometer specified 12.1 d)
Width of a retaining ring	b	Vernier callipers specified in 12.1 c)

12.3 Measurement of amount of fins and deformation

The measurement of amount of fins and deformation shall be in accordance with Annex A.

12.4 Hardness test

The hardness shall be measured in accordance with JIS Z 2244 or JIS Z 2245. The number of measured positions and the evaluation method of measured values shall be as agreed between the parties concerned with delivery.

In addition, the hardness shall be measured after lightly grinding the surface of a product. When measuring the hardness of retaining rings which have been given surface treatment, the surface treatment shall be removed prior to measurement.

12.5 Spring function test

12.5.1 C-type on-shaft-use eccentric retaining ring and C-type on-shaft-use concentric retaining ring

The scragging test of a C-type on-shaft-use eccentric retaining ring and a C-type on-shaft-use concentric retaining ring shall be as follows :

- a) **Testing device** The testing device consists of the test bar composed of two-step cylinder portion and the extruding tool as shown in tables 10 and 11. The circular cone portion of the test bar is used for expanding the inside diameter of a retaining ring to the maximum inside diameter, and the minor diameter cylinder portion (portion shown by ϕC in tables 10 and 11) is used for confirming the minimum re-stored inside diameter after the retaining ring is extruded. The dimensions of each part of the testing device shall be as given in tables 10 and 11.

In addition, for the C-type on-shaft-use eccentric retaining ring, instead of the extruding tool, the pliers for retaining rings specified in 12.1 a) may be used.

- b) **Test method** Attach the retaining ring to the circular cone portion of the test bar, expand the inside diameter of the retaining ring along the outside diameter of the test bar by means of the extruding tool, and after passing the retaining ring through the ϕB portion in which the maximum inside diameter is attained, attach the it to the ϕC portion.

In the case of using the pliers for retaining rings specified in 12.1 a), this may be done by passing the retaining ring through the maximum diameter location in such a way that it is not expanded too much or slanted, and then attaching it to the ϕC portion.

After attaching the retaining ring according to the above-mentioned method, examine if there is any play between the test bar and the retaining ring.

12.5.2 C-type in-bore-use eccentric retaining ring and C-type in-bore-use concentric retaining ring

The scragging test of a C-type in-bore-use eccentric retaining ring and a C-type in-bore-use concentric retaining ring shall be as follows :

- a) **Testing device** The testing device consists of the test cylinder composed of two-step cylinder portion and the extruding tool as shown in tables 12 and 13. The circular cone portion of the test bar is used for compressing the retaining ring to the minimum outside diameter, and the large diameter cylinder portion (portion shown by ϕC in tables 12 and 13) is used for confirming the maximum restored outside diameter after the retaining ring is extruded. The dimensions of each part of the testing device shall be as given in tables 12 and 13.

In addition, for the C-type on-shaft-use eccentric retaining ring, instead of the extruding tool, the pliers for retaining rings specified in 12.1 a) may be used.

- b) **Test method** Attach the retaining ring to the circular cone portion of the test cylinder, compress the outside diameter of the retaining ring along the inside diameter of the test cylinder by means of the extruding tool, and after passing the retaining ring through the ϕB portion in which the minimum outside diameter is attained, attach it to the ϕC portion.

In the case of using the pliers for retaining rings specified in 12.1 a), this may be done by passing the retaining ring through the minimum diameter location in such a way that it is not compressed too much or slanted, and then attaching it to the ϕC portion.

After attaching the retaining ring according to the above-mentioned method, examine if there is any play between the test bar and the retaining ring.