

METRIC UNIFORM CROSS SECTION SPIRAL RETAINING RINGS GENERAL SPECIFICATIONS

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1 GENERAL. This standard for general purpose metric series Uniform Cross Section Spiral Retaining Rings represents the application of the ring cross sections for the inch series rings shown in American National Standard, ANSI B27.6, to comparable metric module shaft, housing and groove sizes.

1.1 Ring Types. Retaining rings and recommended grooves are provided for both external and internal application on shafts and in housing bores of respective sizes. Both internal and external rings are available in two types as follows:

1.1.1 External Rings. The external retaining rings covered by this standard are designated Type 2A01 for light duty and Type 2A02 for heavy duty, respectively.

1.1.2 Internal Rings. The internal retaining rings covered by this standard are designated Type 2B01 for light duty and Type 2B02 for heavy duty, respectively.

1.2 Applicability. The rings in this standard are intended primarily for general application with the recommended shaft, housing and groove sizes specified in the dimensional tables. However, in specific cases, it may be desirable to alter these diameters somewhat to best suit the requirements of a particular design. Where such alternatives are considered, care must be exercised to insure that the shaft or housing size is not altered to an extent which will necessitate overstressing the ring during installation nor that the depth of the groove be changed to a point which will allow the ring to fit loosely after assembly.

2 DESIGNATION. Where specifying metric uniform cross section spiral retaining rings, the designation shall include the nominal ring size and the ring type.

3 CRIMP. Unless otherwise designated by the purchaser, rings of sizes tabulated below for the respective ring types and series shall be supplied uncrimped as shown in the general illustrations:

Ring Type	Ring Series	Nominal Ring Size (mm)
2A01	External-Light Duty	13-37
2A02	External-Heavy Duty	13-17
2B01	Internal-Light Duty	13-37
2B02	Internal-Heavy Duty	13-19

All other rings shall be furnished crimped as depicted in the general illustrations.

4 REMOVAL PROVISIONS. Unless otherwise designated by the purchaser, rings shall be supplied with either notches or slots, to facilitate removal, in accordance with the tabulation below for the respective ring types, series and size ranges. See Figures 1A and 1B. The dimensions and contours of slots and notches shall be optional with manufacturer.

Ring Type	Ring Series	Nominal Ring Size Range, mm	Removal Provision
2A01	External - Light Duty	13 thru 70	Notch
		72 thru 235	Slot
2A02	External - Heavy Duty	13 thru 235	Notch
2B01	Internal - Light Duty	13 thru 70	Notch
		72 thru 235	Slot
2B02	Internal - Heavy Duty	13 thru 235	Notch



EXTERNAL RINGS



INTERNAL RINGS



FIGURE 1A - REMOVAL NOTCHES

FIGURE 1B - REMOVAL SLOTS

FIGURE 1 - REMOVAL PROVISIONS

5 MISCELLANEOUS DIMENSIONS. The following requirements shall supplement the data presented in the dimensional tabulations in regard to the respective features:

5.1 Ring Thickness. The overall thickness of rings shall be within the specified limits when measured under a 4.5 kg load, as illustrated in Figure 2 and described in Paragraph 5.2, at a location other than at the ends of the ring leaves or the gap at the overlap.

5.2 Lateral Deformations. Lateral deformations may consist of leaf cutoff distortion as shown in Figure 3A or lateral kink occurring over a short span of the ring circumference, as depicted in Figure 3B. Lateral deformation shall be inspected

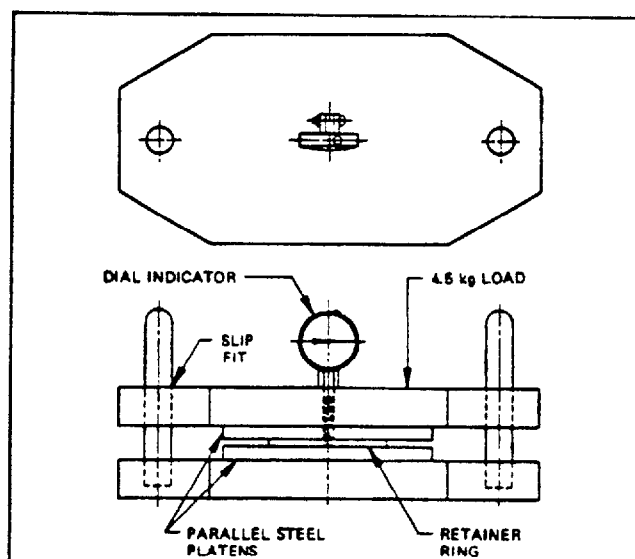


FIGURE 2 - TYPICAL INSPECTION FIXTURE

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by placing the ring between hardened and ground steel platens equipped with a deflection gage graduated in millimeters so located that the readings are obtained at approximately the center of the platens. The ring shall be compressed under a 4.5 kg load and the distance between the platens determined. The ring shall be considered acceptable from a lateral deformation standpoint if this distance does not exceed the specified minimum recommended groove width "F" for the respective ring size. A typical fixture suitable for checking ring thickness and lateral deformation is shown in Figure 2.

5.3 Dish. Dish shall be considered as any height difference occurring between the inner and outer peripheries of the ring as depicted in Figure 4. It shall not exceed the values tabulated below for the respective maximum ring section width (radial wall).

Ring Section Width or Radial Wall, mm	Allowable Dish, mm	Ring Section Width or Radial Wall, mm	Allowable Dish, mm
Max Up to 1.00, Incl	Max 0.03	Max 5.70-6.58	Max 0.20
1.01-1.75	0.05	6.59-7.47	0.23
1.76-2.51	0.08	7.48-8.61	0.25
2.52-3.28	0.10	8.62-10.00	0.28
3.29-4.04	0.13	10.01-12.04	0.30
4.05-4.93	0.15	12.05-16.48	0.33
4.94-5.69	0.18	16.49-25.40	0.36

5.4 Parallelism. The side outer surfaces of rings in free state shall be parallel to each other within one-half the total tolerance on the ring thickness as illustrated in Figure 5.

5.5 Radial Deformations. Radial deformations in the periphery of ring may consist of misalignment between leaves of

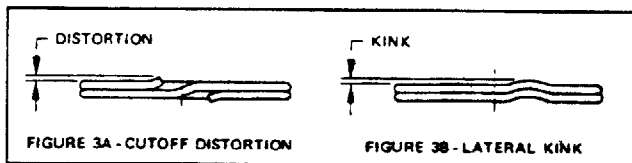


FIGURE 3 - LATERAL DEFORMATIONS

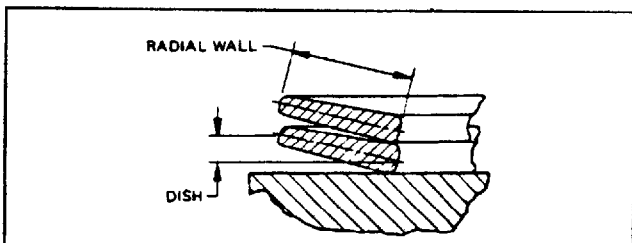


FIGURE 4 - DISH

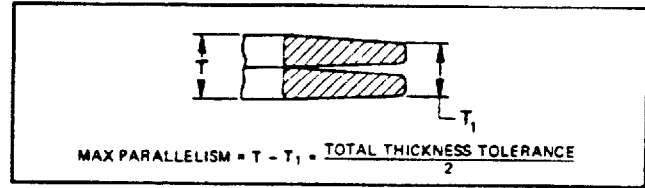


FIGURE 5 - PARALLELISM

ring or radial kink as depicted in Figure 6. Radial deformations shall not exceed the respective limitations tabulated below:

6 MATERIAL AND HARDNESS. As designated by part number, spiral retaining rings shall be made from steel or corrosion resistant steel as specified in the following:

6.1 Steel. Rings shall be fabricated from SAE 1070 to 1090 carbon spring steel, or equivalent, and heat treated to conform to the properties tabulated below for the respective minimum material thicknesses:

Minimum Material Thickness, mm	Rockwell Scale ¹	Hardness	Tensile Strength, MPa
0.17	15N	85-90	1850-2060
0.36	30N	68-73	1760-1960
0.54	A	72-78	1520-1730
1.10	C	43-49	1450-1630

¹ Recommended scale for respective section thickness.

6.2 Corrosion Resistant Steel. Rings shall be fabricated from SAE 30302 corrosion resistant steel, or equivalent, and heat treated to conform to the properties tabulated below for the respective minimum material thicknesses:

Nominal Ring Size Range, mm	Allowable Misalignment, mm	Allowable Radial Kink, mm
	Max	Max
13 thru 25	0.25	0.25
26 thru 50	0.51	0.25
52 thru 150	1.14	0.51
160 thru 235	1.78	0.51

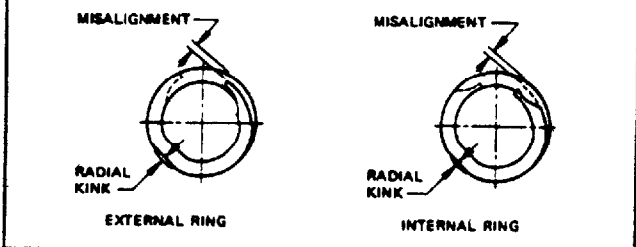


FIGURE 6 - RADIAL DEFORMATIONS

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Minimum Material Thickness, mm	Rockwell Scale ¹	Hardness	Tensile Strength, MPa
0.20	15N	83.0–86.0	1450–1720
0.41	30N	64.0–69.5	1450–1720
0.58	A	72.0–74.9	1380–1590
1.22	C	39.8–48.5	1280–1620
1.57	C	38.0–47.0	1210–1550

¹ Recommended scale for respective section thickness.

6.3 Hardness Test. For hardness tests, both sides of the specimens shall be ground to remove scale and surface decarburization to a surface texture not coarser than that obtained by the use of 180 grit. Prepared specimens shall be sufficiently wide to prevent bulging of the sides by the penetrator. The surfaces to be tested shall be perpendicular within 7° to the load being applied and the checks should be made with the scales recommended for the respective material thicknesses.

7 FINISHES. As designated by part number, rings shall be furnished plain; plated or coated, in accordance with the respective GM specifications.

7.1 Plain Steel. Unless otherwise specified by user, plain finish rings shall be supplied with a light oil film.

7.2 Determinant of Plating Thickness. The thickness of the plating or coating on retaining rings shall be as determined on the flat surface of the ring approximately midway between the inside and outside diameters.

7.3 Relief of Embrittlement. Steel retaining rings plated with metal or otherwise processed as to be subject to hydrogen embrittlement shall be suitably treated to relieve such embrittlement in accordance with the referenced plating specifications.

8 WORKMANSHIP. Rings shall be free from rust, loose scale, burrs, pit marks, cracks and any other defects that might affect their serviceability.

9 PERFORMANCE REQUIREMENTS. As a check on the suitability of the retaining rings with regard to uniformity of temper and section, external rings after having been expanded to pass over the external gage diameter "E" shall not in the free state be entered by the external gage diameter

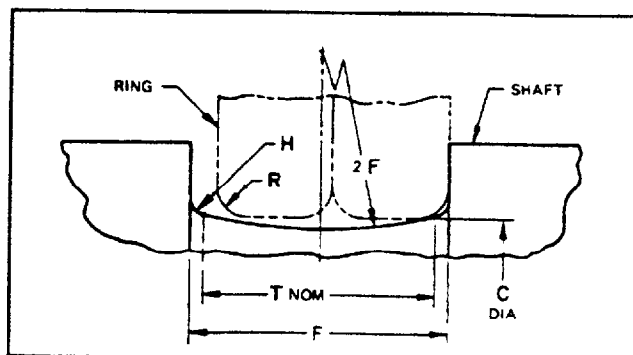


FIGURE 7 – ALTERNATE GROOVE DESIGN

"D" with the axes of the ring and the gage parallel. Likewise, internal rings after having been compressed to fit into internal gage diameter "E" shall not in the free state enter internal gage diameter "D" with the axes of the ring and the gage parallel.

10 ASSEMBLY PRECAUTIONS. Care should be exercised not to overexpand external rings or to overcontract internal rings upon installation inasmuch as this may lead to failure of the assembly. Rings which are radially loose in grooves should not be used. Suitable notes reflecting these points should be placed on assembly instruction drawings.

11 DESIGN CONSIDERATIONS. The following items pertaining to design features should be given due consideration when these rings are specified:

11.1 Groove Width. The groove widths specified in the dimensional tables are absolute minimums which will accept the standard rings. It may be desirable to specify larger minimum widths and tolerances consistent with the design requirements of the application. The important consideration in the dimensioning of the groove is to locate it within the limits required by the design from the side of the groove on which the retainer ring will bear in the assembled state. Where the location of components is extremely critical and the ring is plated, it may be desirable to consider the effects of the plating thickness in establishing the groove location.

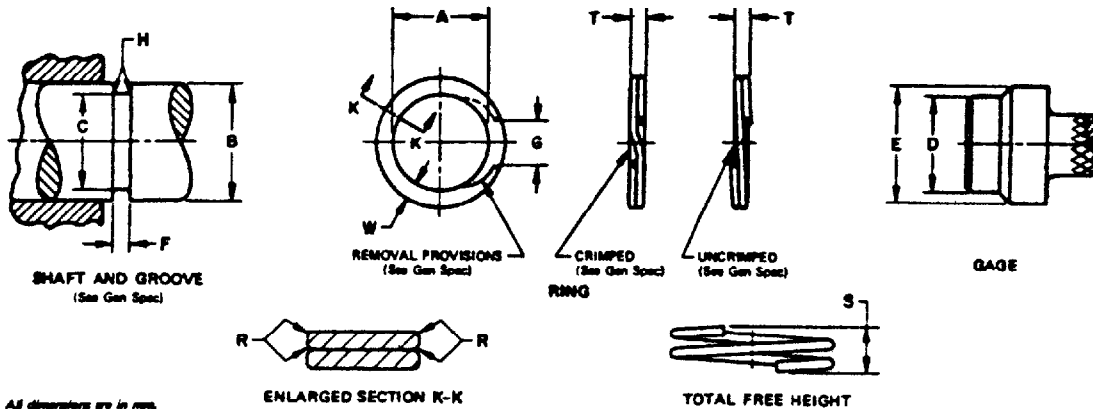
11.2 Alternate Groove Design. In applications where the shaft is subjected to critical bending loads or fatigue, it is recommended the alternate groove design specified in Figure 7 be employed to minimize stress concentration.

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TYPE 2A01



All dimensions are in mm.

SHAFT	GROOVE						RING						GAGE						GM PART NUMBER
	C		F		H	A		T		W		G		R		S	E	D	
	Recom- mended Groove Diameter		Recom- mended Groove Width			Free Inside Diameter		Overall Thick- ness ¹		Section Width		Free Gap Opening		Section Corner Radius			Dia- meter	Dia- meter	
	Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		Max	+0.03 -0.00	
13	12.39	12.29	0.84	0.76	0.13	12.16	11.83	0.69	0.58	1.22	1.02	8.74	3.96	0.15	0.08	0.91	13.00	12.23	11501280
14	13.38	13.28	0.84	0.76	0.13	13.16	12.83	0.69	0.58	1.22	1.02	8.74	3.96	0.15	0.08	0.91	14.00	13.21	11501281
15	14.53	14.38	0.84	0.76	0.13	14.25	13.92	0.69	0.58	1.22	1.02	8.74	3.96	0.15	0.08	0.91	15.00	14.30	11501282
16	15.29	15.14	0.84	0.76	0.13	15.01	14.68	0.69	0.58	1.47	1.02	8.74	3.96	0.15	0.08	0.91	16.00	15.06	11501283
17	16.28	16.13	0.84	0.76	0.13	15.98	15.65	0.69	0.58	1.47	1.02	8.74	3.96	0.15	0.08	0.91	17.00	16.05	11501284
18	17.28	17.12	0.84	0.76	0.13	16.97	16.64	0.69	0.58	1.47	1.02	8.74	3.96	0.15	0.08	0.91	18.00	17.03	11501285
19	18.34	18.19	0.99	0.91	0.13	18.03	17.70	0.84	0.74	1.73	1.52	8.74	3.96	0.20	0.10	1.12	19.00	18.08	11501286
20	19.28	19.12	0.99	0.91	0.13	18.97	18.64	0.84	0.74	1.73	1.52	8.74	3.96	0.20	0.10	1.12	20.00	19.02	11501287
21	20.30	20.14	0.99	0.91	0.13	19.97	19.64	0.84	0.74	1.73	1.52	8.74	3.96	0.20	0.10	1.12	21.00	20.04	11501288
22	21.14	20.98	0.99	0.91	0.13	20.81	20.48	0.84	0.74	1.73	1.52	8.74	3.96	0.20	0.10	1.12	22.00	20.87	11501289
23	22.15	22.00	0.99	0.91	0.13	21.84	21.51	0.84	0.74	1.73	1.52	8.74	3.96	0.20	0.10	1.12	23.00	21.89	11501290
24	23.00	22.84	1.14	1.07	0.13	22.66	22.33	0.99	0.89	1.98	1.78	9.52	4.75	0.23	0.13	1.35	24.00	22.72	11501291
25	23.98	23.82	1.14	1.07	0.13	23.62	23.29	0.99	0.89	1.98	1.78	9.52	4.75	0.23	0.13	1.35	25.00	23.70	11501292
26	24.97	24.82	1.14	1.07	0.25	24.59	24.26	0.99	0.89	1.98	1.78	9.52	4.75	0.23	0.13	1.35	26.00	24.69	11501293
27	26.01	25.81	1.14	1.07	0.25	25.58	25.20	0.99	0.89	1.98	1.78	9.52	4.75	0.23	0.13	1.35	27.00	25.68	11501294
28	27.00	26.80	1.14	1.07	0.25	26.60	26.22	0.99	0.89	1.98	1.78	9.52	4.75	0.23	0.13	1.35	28.00	26.66	11501295
29	28.00	27.80	1.14	1.07	0.25	27.60	27.22	0.99	0.89	1.98	1.78	9.52	4.75	0.23	0.13	1.35	29.00	27.66	11501296
30	28.88	28.68	1.32	1.22	0.25	28.48	28.10	1.14	1.04	2.24	2.03	9.52	4.75	0.28	0.15	1.55	30.00	28.53	11501297
31	29.82	29.62	1.32	1.22	0.25	29.44	29.06	1.14	1.04	2.24	2.03	9.52	4.75	0.28	0.15	1.55	31.00	29.46	11501298
32	30.88	30.68	1.32	1.22	0.25	30.44	30.06	1.14	1.04	2.24	2.03	9.52	4.75	0.28	0.15	1.55	32.00	30.52	11501299
33	32.99	32.79	1.32	1.22	0.25	32.56	32.18	1.14	1.04	2.49	2.29	11.12	6.35	0.28	0.15	1.55	34.00	32.61	11501300
34	33.71	33.50	1.32	1.22	0.25	33.22	32.84	1.14	1.04	2.49	2.29	11.12	6.35	0.28	0.15	1.55	35.00	33.32	11501301
35	34.77	34.57	1.32	1.22	0.25	34.30	33.92	1.14	1.04	2.49	2.29	11.12	6.35	0.28	0.15	1.55	36.00	34.39	11501302
36	35.77	35.57	1.32	1.22	0.25	35.30	34.92	1.14	1.04	2.49	2.29	11.12	6.35	0.28	0.15	1.55	37.00	35.39	11501303
38	36.88	36.68	1.32	1.22	0.25	36.40	36.02	1.14	1.04	2.49	2.29	11.12	6.35	0.28	0.15	1.55	38.00	36.49	11501304
40	38.74	38.48	1.52	1.42	0.25	38.18	37.68	1.32	1.17	2.82	2.62	11.12	6.35	0.30	0.15	1.78	40.00	38.28	11501305
42	40.63	40.37	1.52	1.42	0.25	40.06	39.56	1.32	1.17	2.82	2.62	11.12	6.35	0.30	0.15	1.78	42.00	40.16	11501306
45	43.51	43.26	1.52	1.42	0.25	42.92	42.42	1.32	1.17	3.07	2.87	12.70	7.92	0.30	0.15	1.78	45.00	43.03	11501307
46	44.55	44.30	1.52	1.42	0.25	43.94	43.44	1.32	1.17	3.07	2.87	12.70	7.92	0.30	0.15	1.78	46.00	44.07	11501308
47	45.50	45.24	1.52	1.42	0.25	44.90	44.40	1.32	1.17	3.07	2.87	12.70	7.92	0.30	0.15	1.78	47.00	44.98	11501309
48	46.45	46.19	1.52	1.42	0.25	45.84	45.34	1.32	1.17	3.33	3.07	12.70	7.92	0.30	0.15	1.78	48.00	45.95	11501310
50	48.44	48.18	1.52	1.42	0.25	47.80	47.30	1.32	1.17	3.33	3.07	12.70	7.92	0.30	0.15	1.78	50.00	47.93	11501311
52	50.35	50.09	1.52	1.42	0.25	49.70	49.20	1.32	1.17	3.33	3.07	12.70	7.92	0.30	0.15	1.78	52.00	49.83	11501312
54	52.25	51.94	1.52	1.42	0.25	51.54	50.90	1.32	1.17	3.33	3.07	12.70	7.92	0.30	0.15	1.78	54.00	51.66	11501313
55	53.26	52.96	1.52	1.42	0.25	52.58	51.94	1.32	1.17	3.58	3.38	12.70	7.92	0.30	0.15	1.78	55.00	52.68	11501314
56	54.25	53.95	1.52	1.42	0.25	53.54	52.90	1.32	1.17	3.58	3.38	12.70	7.92	0.30	0.15	1.78	56.00	53.57	11501315
58	56.22	55.92	1.52	1.42	0.25	55.50	54.86	1.32	1.17	3.58	3.38	12.70	7.92	0.30	0.15	1.78	58.00	55.63	11501316
60	58.17	57.86	1.52	1.42	0.25	57.43	56.79	1.32	1.17	3.58	3.38	12.70	7.92	0.30	0.15	1.78	60.00	57.56	11501317
62	59.97	59.66	1.52	1.42	0.25	59.21	58.57	1.32	1.17	3.84	3.63	12.70	7.92	0.30	0.15	1.78	62.00	59.35	11501318
65	62.97	62.66	1.52	1.42	0.25	62.21	61.57	1.32	1.17	3.84	3.63	12.70	7.92	0.30	0.15	1.78	65.00	62.33	11501319
68	65.92	65.62	1.52	1.42	0.25	65.14	64.50	1.32	1.17	4.09	3.89	13.51	8.74	0.30	0.15	1.78	68.00	65.28	11501320
70	67.84	67.54	1.52	1.42	0.25	67.05	66.30	1.32	1.17	4.09	3.89	13.51	8.74	0.30	0.15	1.78	70.00	67.19	11501321

1 Measured with ring compressed flat, see Paragraph 5.1 in General Specifications.

2 Manufacturers should be consulted in regard to availability.

3 Part numbers shown may or may not require additional color identification per GM9093P specification as indicated on the respective detail drawings.

Type 2A01 External Uniform Cross Section Spiral Retaining Rings must conform to General Specifications.