

INCH-POUND

MIL-DTL-21248C

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SUPERSEDING

MIL-R-21248B

1 August 1969

## DETAIL SPECIFICATION

## RING, RETAINING (TAPERED AND REDUCED SECTION TYPE)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers the procurement requirements for tapered and reduced section type retaining rings of rectangular and beveled cross - section.

1.2 Classification. Retaining rings are of the following types and classes as specified (see 6.2):

Type	Class	Description
I – Flat	1	Internal, Basic (see 3.5.2.1.1)
	2	External, Basic (see 3.5.2.1.2)
	3	Internal, Inverted (see 3.5.2.1.3)
	4	External, Inverted (see 3.5.2.1.4)
	5	External, “E” (see 3.5.2.1.5)
	6	External, Crescent (see 3.5.2.1.6)
	7	External, Grip (see 3.5.2.1.7)
	8	External, Interlock (see 3.5.2.1.8)
	9	External, Reinforced “E” (see 3.5.2.1.9)
	10	External, Heavy Duty (see 3.5.2.1.10)
II – Bowed	1	Internal (see 3.5.2.2.1)
	2	External (see 3.5.2.2.2)
	3	External, “E” (see 3.5.2.2.3)
	4	External, Prong Lock (see 3.5.2.2.4)
III – Beveled	1	Internal (see 3.5.3.1)
	2	External (see 3.5.3.2)

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Philadelphia (DSCP), ATTN: DSCP-NASA, 700 Robbins Avenue, Philadelphia, PA 19111-5096 or e-mail to [dscpg&ispeccomments@dla.mil](mailto:dscpg&ispeccomments@dla.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard or recommend for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this standard, whether or not they are listed.

## 2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

## DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-16232 Phosphate Coating, Heavy, Manganese or Zinc Base

## DEPARTMENT OF DEFENSE STANDARDS

MS3215	Ring, Retaining, External, "E", Reinforced (Reduced Section Type)
MS3216	Ring, Retaining, External, Prong-Lock (Reduced Section Type)
MS3217	Ring, Retaining, External, Heavy Duty (Tapered Section Type)
MS16624	Ring, Retaining, External, Basic (Tapered Section Type)
MS16625	Ring, Retaining, Internal, Basic (Tapered Section Type)
MS16626	Ring, Retaining, External, Inverted (Tapered Section Type)
MS16627	Ring, Retaining, Internal, Inverted (Tapered Section Type)
MS16628	Ring, Retaining, External, Bowed (Tapered Section Type)
MS16629	Ring, Retaining, Internal, Bowed (Tapered Section Type)
MS16630	Ring, Retaining, External, Beveled (Tapered Section Type)
MS16631	Ring, Retaining, Internal, Beveled (Tapered Section Type)
MS16632	Ring, Retaining, External, Crescent (Reduced Section Type)
MS16633	Ring, Retaining, External, "E" (Reduced Section Type)
MS16634	Ring, Retaining, External, Bowed "E" (Reduced Section Type)
MS90707	Ring, Retaining, External, Grip
MS90708	Ring, Retaining, Interlocking

(Copies of these documents are available online at <http://quicksearch.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

## AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes.

(Copies of this document are available from [www.asq.org](http://www.asq.org) American Society for Quality Control, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B194 Copper-Beryllium Alloy Plate, Sheet, Strip and Rolled Bar

(Copies of these documents are available from [www.astm.org](http://www.astm.org) or the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

## SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AIR4127	Steel: Chemical Composition and Hardenability
SAE AMS2700	Passivation of Corrosion Resistant Steels
SAE AMS5520	Steel, Corrosion and Heat-Resistant, Sheet, Strip, Foil, and Plate 15Cr - 7.1Ni - 2.5Mo - 1.1Al Solution Heat Treated, Precipitation Hardenable
SAE AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)

(Copies of these documents are available from [www.sae.org](http://www.sae.org) or the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 All requirements specified herein apply to all types, classes, materials and sizes of retaining rings listed herein or as otherwise specified in the contract or order (see 3.5 and 6.2).

3.2 Materials. Material used in the manufacture of retaining rings shall be either carbon steel, corrosion resisting steel or copper-beryllium-alloy conforming to 3.2.1, 3.2.2 or 3.2.3 as applicable (see 6.2).

3.2.1 Carbon steel. Carbon steel shall conform to the chemical composition of SAE AIR4127, steel numbers 1060 through 1090 inclusive.

3.2.2 Corrosion resisting steel. Corrosion resisting steel shall conform to the composition of SAE AMS5520 or equivalent.

3.2.3 Copper-beryllium-alloy. Copper-beryllium-alloy shall conform to ASTM B194.

3.3 Physical properties. Retaining rings shall conform to the physical requirements as specified in 3.3.1 and 3.3.2.

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3.3.1 Hardness. The hardness of retaining rings shall be as specified on the applicable MS drawing for the type, class, material and size of ring required (see 3.5).

3.3.2 Stress relief. Corrosion resisting steel retaining rings shall be stress relieved as required to meet the physical requirements specified for the respective type, class, material and size of ring required (see 3.5).

3.4 Protective finish. When specified in the contract or order (see 6.2) retaining rings shall be plated, treated or coated in accordance with 3.4.1, 3.4.2 or 3.4.3 as applicable.

3.4.1 Cadmium plating. Cadmium plating shall be in accordance with SAE AMS-QQ-P-416, Type II, Class 3.

3.4.2 Passivation. Corrosion resisting steel rings shall be passivated in accordance with SAE AMS2700.

3.4.3 Phosphate coating. Phosphate coating shall be in accordance with MIL-DTL-16232, Type Z, Class 2.

3.5 Design and dimensions. Unless otherwise specified in the contract or order, retaining rings furnished under this specification shall conform to the design, shape, dimensions and other requirements, specified on the applicable MS drawing type, class, material, protective finish and size of retaining ring specified in the contract or order (see 6.2).

3.5.1 Additional thickness tolerance. For plated rings and corrosion resisting steel rings, the plus thickness tolerance specified in the applicable tables shall be increased as follows:

- (a) The additional plus tolerance for Type I, Classes 1, 2, 3, 4, 5, 6, 8, 9 and 10 plated rings and corrosion resisting steel rings shall be:

Ring thickness (inch)	Additional thickness tolerance (inch)
0.010 and 0.015	0.0008
0.025 through 0.042	0.0018
Over 0.042	0.002

- (b) The additional plus tolerance for Type I, class 7 and all classes of Type II and Type III plated rings and corrosion resisting steel rings shall be 0.002 inch.

3.5.2 Type I and Type II retaining rings. Type I and Type II retaining rings shall have a regular rectangular cross section conforming to the limitations specified in 3.5.4.1 and shall otherwise conform to the requirements of 3.5.2.1 or 3.5.2.2 as applicable.

3.5.2.1 Type I retaining rings. Type I retaining rings shall be flat (not bowed) in the same plane within limits of 3.5.4.5 and shall conform to the requirements of 3.5.2.1.1 through 3.5.2.1.10 and 3.5.4 as applicable.

3.5.2.1.1 Type I, Class 1 retaining rings. Type I, Class 1 retaining rings shall be similar to Figure 1 and shall conform to the hardness requirements and the dimensions of MS16625 and the supplementary dimensions of Table I.

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FIGURE 1. Type I, Class 1 Retaining Rings.

TABLE I. Supplementary Dimensions All Class 1 Retaining Rings.

Nominal Ring Size		K (Free gap)		P		C $\frac{1}{2}$	V $\frac{1}{2}$
		(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Max	Max
.250	6.4	.080		.031		.009	.005
.312	7.9	.100		.031		.009	.005
.375	9.5	.120		.041		.011	.005
.438	11.1	.145		.041		.012	.005
.453	11.5	.145		.047		.012	.005
.500	12.7	.155	+.040 -.025	.047		.012	.008
.512	13.0	.160		.047		.012	.008
.562	14.3	.175		.047		.015	.008
.625	15.9	.205		.062		.017	.008
.688	17.5	.230		.062	+.010 -.002	.018	.008
.750	19.0	.250		.062		.020	.008
.777	19.7	.260		.062		.021	.010
.812	20.6	.273		.062		.022	.010
.866	22.0	.297		.062		.023	.010
.875	22.2	.301		.062		.023	.010
.901	22.9	.312	+.050 -.035	.062		.024	.010
.938	23.8	.329		.062		.025	.010
1.000	25.4	.355		.062		.027	.010
1.023	26.0	.365		.062		.028	.010
1.062	27.0	.370		.078		.028	.010
1.125	28.6	.400		.078		.030	.012
1.181	30.0	.425		.078		.031	.012
1.188	30.2	.425		.078		.031	.012
1.250	31.7	.450	+.090 -.065	.078	+.015 -.002	.035	.012
1.259	32.0	.450		.078		.035	.012

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TABLE I. (Continued)

Nominal Ring Size		K (Free gap)		P		C $\frac{1}{2}$	V $\frac{1}{2}$
		(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Max	Max
1.312	33.3	.480	+.090 -.065	.078		.036	.012
1.375	34.9	.505		.078		.037	.012
1.378	35.0	.505		.078		.037	.012
1.438	36.5	.535		.078		.039	.012
1.456	37.0	.540		.078		.039	.012
1.500	38.1	.560	+.125 -.085	.078		.040	.012
1.562	39.7	.580		.078		.042	.012
1.575	40.0	.580		.078		.042	.012
1.625	41.3	.590		.078		.045	.012
1.653	42.0	.605		.078		.046	.012
1.688	42.9	.620		.078		.046	.012
1.750	44.4	.640		.078		.047	.012
1.812	46.0	.670		.093		.049	.012
1.850	47.0	.685		.093		.049	.012
1.875	47.6	.695		.093		.050	.012
1.938	49.2	.720		.093	+.015 -.002	.051	.012
2.000	50.8	.745		.093		.055	.012
2.047	52.0	.775		.093		.056	.015
2.062	52.4	.775		.093		.056	.015
2.125	54.0	.780		.093		.057	.015
2.165	55.0	.815		.093		.059	.015
2.188	55.6	.815		.093		.059	.015
2.250	57.1	.825		.093		.060	.015
2.312	58.7	.855		.093		.063	.015
2.375	60.3	.880		.093		.065	.015
2.440	62.0	.900	+.140 -.110	.110		.066	.015
2.500	63.5	.930		.110		.067	.015
2.531	64.3	.930		.110		.068	.015
2.562	65.1	.960		.110		.068	.015
2.625	66.7	.985		.110		.070	.015
2.677	68.0	1.000		.110		.072	.015
2.688	68.3	1.000		.110		.072	.015
2.750	69.8	1.030		.110		.075	.015
2.812	71.4	1.070		.110		.076	.015
2.835	72.0	1.070		.110		.076	.015

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TABLE I. (Continued)

Nominal Ring Size		K (Free gap)		P		C $\frac{1}{2}$	V $\frac{1}{2}$
		(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Max	Max
2.875	73.0	1.095	+.140	.110		.077	.015
2.953	75.0	1.215	-.110	.110		.082	.015
3.000	76.2	1.215		.110		.082	.015
3.062	77.8	1.225		.125		.083	.015
3.125	79.4	1.230		.125		.085	.015
3.149	80.0	1.240		.125		.086	.015
3.156	80.2	1.240		.125		.086	.015
3.250	82.5	1.270		.125		.088	.015
3.346	85.0	1.310		.125	+.015	.090	.015
3.469	88.1	1.355	±.190	.125	-.002	.094	.015
3.500	88.9	1.370		.125		.095	.020
3.543	90.0	1.390		.125		.096	.020
3.562	90.5	1.390		.125		.097	.020
3.625	92.1	1.415		.125		.098	.020
3.740	95.0	1.465		.125		.102	.020
3.750	95.2	1.465		.125		.102	.020
3.875	98.4	1.505		.125		.106	.020
3.938	100.0	1.525		.125		.106	.020
4.000	101.6	1.525		.125		.110	.020
4.125	104.8	1.575		.125		.107	.020
4.250	108.0	1.620		.125		.110	.020
4.331	110.0	1.630		.156		.113	.020
4.500	114.3	1.665	±.230	.156		.117	.020
4.625	117.5	1.710		.156		.120	.020
4.724	120.0	1.760		.156		.122	.020
4.750	120.6	1.760		.156		.122	.020
5.000	127.0	1.730		.156		.130	.020
5.250	133.3	1.940		.156	+.020	.135	.025
5.375	136.5	1.990		.156	-.005	.135	.025
5.500	139.7	2.045		.156		.135	.025
5.750	146.0	2.140		.156		.135	.025
6.000	152.4	2.240		.156		.135	.025
6.250	158.7	2.325		.187		.140	.025
6.500	165.1	2.430	±.280	.187		.145	.025
6.625	168.3	2.470		.187		.150	.025

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TABLE I. (Continued)

Nominal Ring Size		K (Free gap)		P		C <u>1/</u>	V <u>1/</u>
		(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Max	Max
6.750	171.4	2.450	±.280	.187	+.020 -.005	.152	.025
7.000	177.8	2.550		.187		.157	.025
7.250	184.1	2.635		.187		.162	.025
7.500	190.5	2.710		.187		.170	.025
7.750	196.8	2.820		.187			.025
8.000	203.2	2.910	±.320	.187		.180	.025
8.250	209.5	3.000		.187		.185	.025
8.500	215.9	3.050		.187		.190	.025
8.750	222.2	3.140		.187		.197	.025
9.000	228.6	3.230		.187		.202	.025
9.250	235.0	3.310		.187			.025
9.500	241.3	3.380		.187		.215	.025
9.750	247.7	3.510		.187			.025
10.000	254.0	3.580		.187		.225	.025

1/ See Table XI and Figure 12.

3.5.2.1.2 Type I, Class 2 retaining rings. Type I, Class 2 retaining rings shall be similar to Figure 2 and shall conform to the hardness requirements and the dimensions of MS16624 and the supplementary dimensions of Table II.

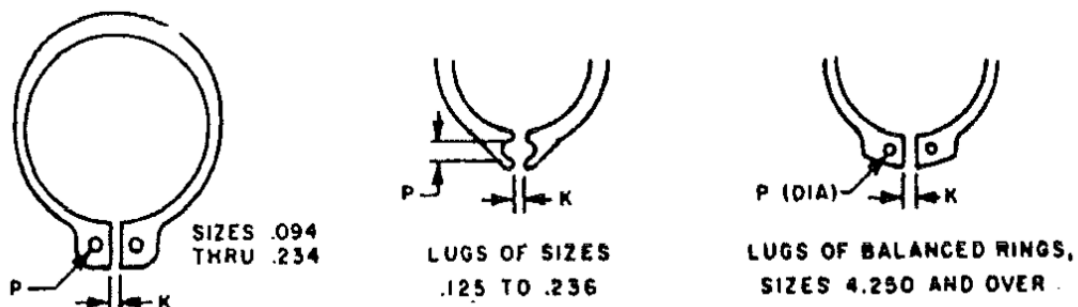


FIGURE 2. Type I, Class 2 retaining rings.



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TABLE II. Supplementary Dimensions All Class 2 Retaining Rings.

Nominal Ring Size		K (Free gap)	P		C <u>1</u> /	V <u>1</u> /
		(Inch)	(Inch)		(Inch)	(Inch)
Inch	mm	Max	Basic	Tol	Max	Max
.125	3.2	.013	.026		.004	.003
.156	4.0	.013	.026		.005	.003
.188	4.8	.015	.026		.006	.005
.197	5.0	.015	.026		.006	.005
.219	5.6	.015	.026		.007	.005
.236	6.0	.015	.026		.007	.005
.250	6.4	.031	.041		.010	.005
.276	7.0	.031	.041		.010	.005
.281	7.1	.031	.041		.010	.005
.312	7.9	.031	.041		.011	.005
.344	8.7	.031	.041		.011	.005
.354	9.0	.031	.041		.012	.005
.375	9.5	.031	.041		.012	.005
.394	10.0	.031	.041	+.010	.012	.005
.406	10.3	.031	.041	-.002	.012	.005
.438	11.1	.031	.041		.013	.005
.469	11.9	.031	.041		.013	.005
.500	12.7	.050	.047		.013	.008
.551	14.0	.050	.047		.013	.008
.562	14.3	.050	.047		.014	.008
.594	15.1	.050	.047		.014	.008
.625	15.9	.050	.047		.014	.008
.669	17.0	.050	.047		.015	.008
.672	17.1	.050	.047		.015	.010
.688	17.5	.060	.052		.016	.010
.750	19.0	.060	.052		.017	.010
.781	19.8	.060	.052		.018	.010
.812	20.6	.060	.052		.018	.010
.875	22.2	.060	.052		.021	.010
.938	23.8	.060	.078		.021	.010
.984	25.0	.060	.078		.022	.010
1.000	25.4	.060	.078	+.015	.022	.010
1.023	26.0	.060	.078	-.002	.023	.010
1.062	27.0	.080	.078		.023	.012
1.125	28.6	.080	.078		.025	.012

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TABLE II. (Continued)

Nominal Ring Size		K (Free gap)	P		C 1/	V 1/
		(Inch)	(Inch)		(Inch)	(Inch)
Inch	mm	Max	Basic	Tol	Max	Max
1.188	30.2	.080	.078		.026	.012
1.250	31.7	.080	.078		.027	.012
1.312	33.3	.080	.078		.031	.012
1.375	34.9	.080	.078		.032	.012
1.438	36.5	.080	.078		.034	.012
1.500	38.1	.080	.120		.035	.012
1.562	39.7	.102	.125		.036	.012
1.625	41.3	.102	.125		.037	.012
1.688	42.9	.102	.125		.038	.012
1.750	44.4	.102	.125		.040	.012
1.772	45.0	.102	.125		.041	.012
1.812	46.0	.102	.125		.041	.012
1.875	47.6	.102	.125		.042	.012
1.969	50.0	.102	.125		.045	.012
2.000	50.8	.102	.125		.045	.012
2.062	52.4	.123	.125		.046	.015
2.125	54.0	.123	.125		.049	.015
2.156	54.8	.123	.125	+ .015	.049	.015
2.250	57.1	.123	.125	- .002	.052	.015
2.312	58.7	.123	.125		.054	.015
2.375	60.3	.123	.125		.055	.015
2.438	61.9	.123	.125		.056	.015
2.500	63.5	.123	.125		.057	.015
2.559	65.0	.138	.125		.054	.015
2.625	66.7	.138	.125		.060	.015
2.688	68.3	.138	.125		.061	.015
2.750	69.8	.153	.125		.062	.015
2.875	73.0	.153	.125		.066	.015
2.938	74.6	.153	.125		.068	.015
3.000	76.2	.153	.125		.070	.015
3.062	77.8	.153	.125		.071	.015
3.125	79.4	.153	.125		.072	.015
3.156	80.2	.153	.125		.073	.015
3.250	82.5	.153	.125		.075	.015
3.346	85.0	.153	.125		.077	.015

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TABLE II. (Continued)

Nominal Ring Size		K (Free gap)	P		C <u>1/</u>	V <u>1/</u>
		(Inch)	(Inch)		(Inch)	(Inch)
Inch	mm	Max	Basic	Tol	Max	Max
3.438	87.3	.153	.125		.078	.015
3.500	88.9	.170	.125		.080	.020
3.543	90.0	.170	.125		.081	.020
3.625	92.0	.170	.125		.083	.020
3.688	93.7	.170	.125		.085	.020
3.750	95.2	.170	.125	+.015 -.002	.086	.020
3.875	98.4	.170	.125		.089	.020
3.938	100.0	.170	.125		.090	.020
4.000	101.6	.170	.125		.092	.020
4.250	108.0	.170	.125		.092	.020
4.375	111.1	.170	.125		.092	.020
4.500	114.3	.170	.125		.095	.020
4.750	120.6	.170	.125		.100	.020
5.000	127.0	.170	.156		.105	.020
5.250	133.3	.185	.156		.110	.025
5.500	139.7	.185	.156		.117	.025
5.750	146.0	.185	.156		.122	.025
6.000	152.4	.185	.156		.127	.025
6.250	158.7	.216	.156		.132	.025
6.500	165.1	.216	.156		.137	.025
6.750	171.4	.216	.187	+.020 -.005	.142	.025
7.000	177.8	.216	.187		.147	.025
7.500	190.5	.250	.187		.160	.025
8.000	203.2	.250	.187		.170	.025
8.500	215.9	.250	.187		.180	.025
9.000	228.6	.250	.187		.190	.025
9.500	241.3	.250	.187		.200	.025
10.000	254.0	.250	.187		.212	.025

1/ See Table XI and Figure 12.

3.5.2.1.3 Type I, Class 3 retaining rings. Type I, Class 3 retaining rings shall be similar to Figure 3 and shall conform to the hardness requirements and the dimensions of MS16627 and the supplementary dimensions of Table III.

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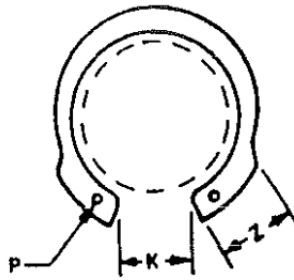


FIGURE 3. Type I, Class 3 Retaining Rings.

TABLE III. Supplementary Dimensions, Type I, Class 3 Retaining Rings.

Nominal Ring Size		K (Free gap)		Z		P		C 1/	V 1/
		(Inch)		(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Basic	Tol	Max	Max
.750	19.0	.229		.281		.042		.020	.008
.812	20.6	.249		.312		.042		.022	.010
.875	22.2	.267	+.040	.343	±.062	.042		.023	.010
.938	23.8	.285	-.025	.359		.042		.025	.010
1.000	25.4	.309		.375		.042		.027	.010
1.063	27.0	.327		.406		.050	+.010	.028	.010
1.125	28.6	.347		.437		.050	-.002	.030	.012
1.888	30.2	.367		.453		.050		.031	.012
1.250	31.7	.387	+.060	.484	±.093	.050		.035	.012
1.312	33.3	.407	-.045	.500		.050		.036	.012
1.375	34.9	.428		.531		.050		.037	.012
1.438	36.5	.443		.562		.076		.039	.012
1.500	38.1	.463		.593		.076		.040	.012
1.562	39.7	.478		.593		.076		.042	.012
1.625	41.3	.498		.625		.076		.045	.012
1.688	42.9	.517	+.075	.656	±.125	.076		.046	.012
1.750	44.4	.548	-.055	.687		.076		.047	.012
1.875	47.6	.584		.718		.076	+.015	.050	.012
2.000	50.8	.615		.750		.076	-.002	.055	.012
2.062	52.4	.637		.781		.094		.056	.015
2.125	54.0	.658	+.090	.812		.094		.057	.015
2.375	60.3	.741	-.060	.890	±.156	.094		.065	.015
2.438	61.9	.760		.921		.094		.066	.015
2.500	63.5	.778		.968		.094		.067	.015
2.625	66.7	.815	+.105 -.075	1.031		.109		.070	.015

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TABLE III. (Continued)

Nominal Ring Size		K (Free gap)		Z		P		C 1/	V 1/
		(Inch)		(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Basic	Tol	Max	Max
2.750	69.8	.851		1.062		.109		.075	.015
2.812	71.4	.884	+.105	1.093	±.156	.109		.076	.015
2.834	72.0	.884	.075	1.093		.109		.076	.015
3.000	76.2	.936		1.171		.109	+.015	.082	.015
3.156	80.2	.984		1.187		.125	-.002	.086	.015
3.346	85.0	1.049	+.110	1.312		.125		.090	.015
3.500	88.9	1.100	-.080	1.375	±.187	.125		.095	.020
3.562	90.5	1.121		1.406		.125		.097	.020

1/ See Table XI and Figure 12.

3.5.2.1.4 Type I, Class 4 retaining rings. Type I, Class 4 retaining rings shall be similar to Figure 4 and shall conform to the hardness requirements and the dimensions of MS16626 and the supplementary dimensions of Table IV.

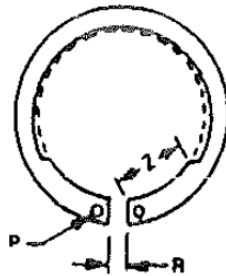


FIGURE 4. Type I, Class 4 Retaining Rings.

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TABLE IV. Supplementary Dimensions, Type I, Class 4 Retaining Rings.

Nominal Ring Size		R (Free gap)	Z		P dia		C <u>1/</u>	V <u>1/</u>
		(Inch)	(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Max	Basic	Tol	Basic	Tol	Max	Max
.500	12.7	.050	.187	±.031	.042	+.010 -.002	.0130	.008
.562	14.3	.050	.187		.042		.0140	.008
.594	15.1	.050	.218		.042		.0145	.008
.625	15.9	.050	.218		.042		.0145	.008
.672	17.1	.050	.234		.042		.0155	.008
.688	17.5	.060	.234	±.062	.042	+.010 -.002	.0160	.010
.750	19.0	.060	.250		.042		.0175	.010
.781	19.8	.060	.250		.042		.0180	.010
.812	20.6	.060	.281		.050		.0180	.010
.875	22.2	.060	.312		.050		.0210	.010
.938	23.8	.060	.343	±.093	.050	+.015 -.002	.0210	.010
.984	25.0	.060	.375		.050		.0225	.010
1.000	25.4	.060	.375		.050		.0225	.010
1.062	27.0	.080	.375		.078		.0235	.012
1.125	28.6	.080	.406		.078		.0250	.012
1.188	30.2	.080	.437	±.125	.078	+.015 -.002	.0260	.012
1.250	31.7	.080	.468		.078		.0275	.012
1.312	33.3	.080	.468		.078		.0310	.012
1.375	34.9	.080	.500		.078		.0325	.012
1.438	36.5	.080	.531		.078		.0340	.012
1.500	38.1	.080	.562	±.156	.078	+.015 -.002	.0350	.012
1.562	39.7	.102	.593		.078		.0365	.012
1.750	44.4	.102	.687		.078		.0410	.012
1.772	45.0	.102	.687		.078		.0410	.012
1.812	46.0	.102	.687		.078		.0415	.012
1.969	50.0	.102	.750	±.187	.078	+.015 -.002	.0450	.015
2.000	50.8	.102	.750		.078		.0450	.015
2.125	54.0	.123	.812		.120		.0495	.015
2.156	54.8	.123	.812		.120		.0495	.015
2.500	63.5	.123	.812		.120		.0575	.015
2.875	73.0	.153	1.125	±.187	.120	+.015 -.002	.0660	.015
3.156	80.1	.153	1.187		.120		.0730	.015
3.500	88.8	.170	1.375		.125		.0800	.020
3.938	100.0	.170	1.562		.125		.0905	.020

1/ See Table XI and Figure 12.

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3.5.2.1.5 Type I, Class 5 retaining rings. Type I, Class 5 retaining rings shall be similar to Figure 5 and shall conform to the hardness requirements and the dimensions of MS16633 and the supplementary dimensions of Table V.

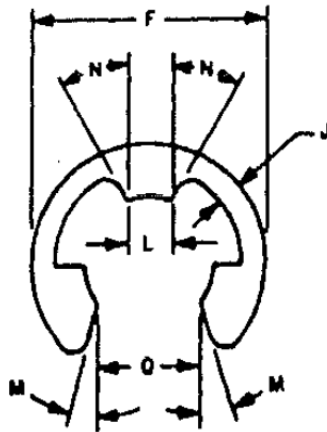


FIGURE 5. Type I, Class 5 Retaining Rings.

TABLE V. Supplementary Dimensions, Type I, Class 5 and Type II, Class 3 Retaining Rings.

Nominal Ring Size		Q		F	J		L		M	N	C <u>1</u> /	V <u>1</u> /	
		(Free gap)		(Free dia)					(ref)	(ref)			
		(Inch)		(Inch)	(Inch)		(Inch)		Degree	Degree	(Inch)	(Inch)	
Inch	mm	Basic	Tol	Max	Basic	Tol	Basic	Tol	Nom	Nom	Max	Max	
.040	1.0	.022	+.002	.082	.012		.015		10°	0°	.005	.003	
.062	1.55	.046	-.004	.159	.022	±.002	.016	±.003		30°-36°	.009		
.094	2.4	.066		.192	.022		.019						
.110	2.8	.066	+.003	.213	.026		.040						
.125	3.2	.085	-.007	.235	.030		.029	±005					
.140	3.6	.092		.275	.038	±.003	.032				.013	.005	
.156	4.0	.098		.287	.033		.035						
.172	4.3	.109	+.005	.317	.040		.038						
.188	4.8	.125	-.010	.340	.042		.038	±.010					
.219	5.6	.159		.442	.045		.057						
.250	6.4	.179		.534	.055		.064				.025	.008	
.312	7.9	.210		.607	.057	±.004	.075						
.375	9.5	.259	+.007	.667	.060		.093						
.438	11.1	.291	-.014	.694	.062		.104	±.015					
.500	12.7	.339		.810	.080		.121				.034	.048	.012
.625	15.9	.416		.950	.090	±.005	.148	±.020					
.744	18.9	.497		1.010	.100		.160						
.750	19.0	.497	+.010	1.130	.110		.177						
.875	22.2	.578	-.017	1.310	.120		.206						
.984	25.0	.712		1.510	.130	±.006	.254	±.030					
1.188	30.2	.923	+.020	1.640	.130		.329			.054			
1.375	34.9	1.050	-.030	1.889	.140		.375						

1/ See Table XI and Figure 12.

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3.5.2.1.6 Type I, Class 6 retaining rings. Type I, Class 6 retaining rings shall be similar to Figure 6 and shall conform to the hardness requirements and the dimensions of MS16632 and the supplementary dimensions of Table VI.

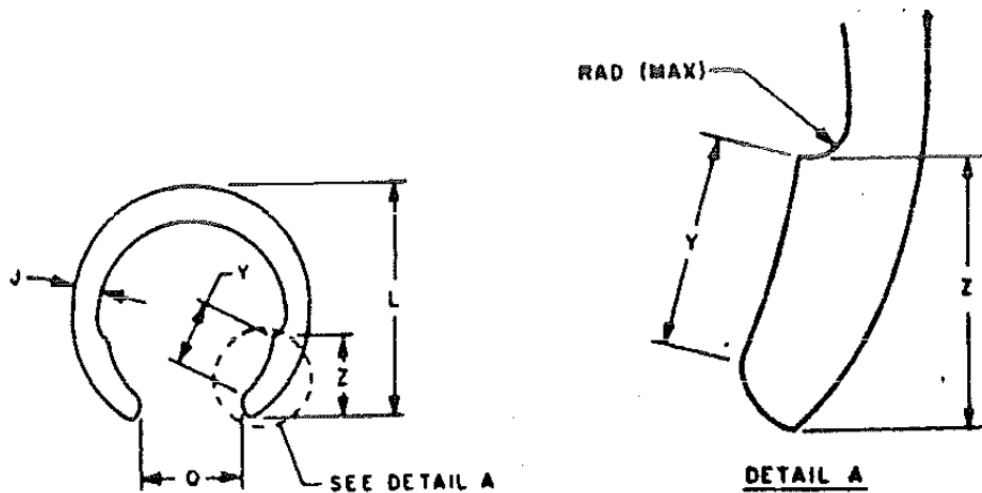


FIGURE 6. Type I, Class 6 Retaining Rings.

TABLE VI. Supplementary Dimensions, Type I, Class 6 Retaining Rings.

Nominal Ring Size		Q (Free gap)		J		Z		Y		L	C 1/	V 1/
		(Inch)		(Inch)		(Inch)		(Inch)		(Inch)	(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Basic	Tol	Basic	Tol	Ref	Max	Max
.125	3.2	.096	+.004	.021		.047	+.006	.010		.129		
.156	4.0	.122	-.008	.024	±.003	.061	-.010	.015		.163	.009	.005
.188	4.8	.148		.028		.075		.019		.197		
.219	5.6	.175		.031		.079		.019	±.005	.216		
.236	6.0	.190		.033		.085		.022		.232		
.250	6.4	.198		.035		.089		.022		.245		
.281	7.1	.229	+.008	.035	±.004	.099	+.008	.026		.272	.013	.005
.312	7.9	.256	-.012	.035		.108	-.013	.026		.295		
.375	9.5	.306		.037		.129		.038		.353		
.406	10.3	.338		.037		.140		.038		.382		
.438	11.1	.361		.040		.148		.044	±.010	.407		
.500	12.7	.412		.050		.167		.050		.457		
.562	14.3	.464	+.010	.050		.187	+.010	.057		.514	.025	.008
.625	15.9	.510	-.015	.052		.205	-.015	.071		.563		
.688	17.5	.564		.054		.225		.079		.613		
.750	19.0	.612	+.015	.057	±.005	.242	+.012	.079	±.015	.665		
.812	20.6	.666	-.020	.060		.262	-.017	.079		.720	.034	.010
.875	22.2	.720		.062		.284		.080		.780		
.938	23.8	.770		.066		.304		.092		.833		
1.000	25.4	.820		.075		.324		.100	±.020	.889	.048	.012



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TABLE VI. (Continued)

Nominal Ring Size		Q (Free gap)		J		Z		Y		L	C 1/	V 1/
		(Inch)		(Inch)		(Inch)		(Inch)		(Inch)	(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Basic	Tol	Basic	Tol	Ref	Max	Max
1.125	28.6	.922		.080		.364		.108		.998		
1.250	31.7	1.026	+.020	.093		.405	+.015	.125	±.020	1.113		
1.375	34.9	1.130	-.025	.098	±.007	.446	-.020	.136		1.224	.048	.012
1.500	38.1	1.230		.106		.485		.148		1.331		
1.750	44.4	1.436		.123		.567		.170	±.030	1.554	.054	
			+.025				+.017					
2.000	50.8	1.640	-.030	.143		.647	-.024	.196		1.776		

1/ See Table XI and Figure 12.

3.5.2.1.7 Type I, Class 7 retaining rings. Type I, Class 7 retaining rings shall be similar to Figure 7 and shall conform to the hardness requirements and the dimensions of MS90707 and the supplementary dimensions of Table VII.

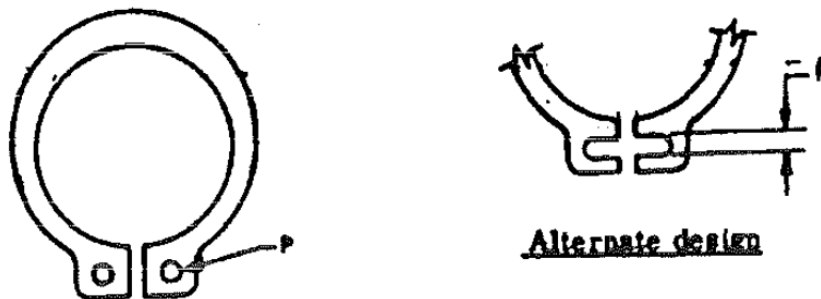


FIGURE 7. Type I, Class 7 Retaining Rings.

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TABLE VII. Supplementary Dimensions, Type I, Class 7 Retaining Rings.

Nominal Ring Size			P		C <u>1/</u>	V <u>1/</u>
(Inch)		mm	(Inch)		(Inch)	(Inch)
Basic	Tol		Basic	Tol	Max	Max
.094	±.002	2.4	.034	±.004	.013	.005
.125		3.2	.042	+.010 -.002		
.156		4.0	.042		.025	.008
.187		4.8	.051			
.250		6.3	.051			
.313	±.003	7.9	.078	+.015 -.002	.034	.010
.376		9.5	.078			
.437		11.1	.078		.048	.012
.500		12.7	.078			
.625		15.9	.078			
.750	±.005	19.0	.120		.054	

1/ See Table XI and Figure 12.

3.5.2.1.8 Type I, Class 8 retaining rings. Type I, Class 8 retaining rings shall be similar to Figure 8 and shall conform to the hardness requirements and the dimensions of MS90708 and the supplementary dimensions of Table VIII.

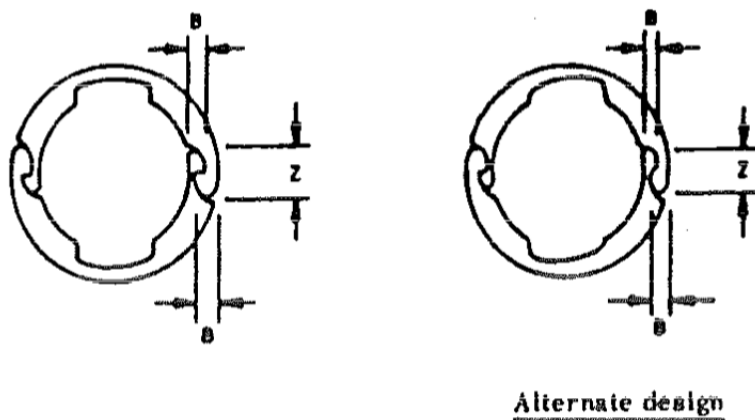


FIGURE 8. Type I, Class 8 Retaining Rings.

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TABLE VIII. Supplementary Dimensions, Type I, Class 8 Retaining Rings.

Nominal Ring Size		B		Z		C <sup>1/</sup>	V <sup>1/</sup>	
		(Inch)		(Inch)		(Inch)	(Inch)	
Inch	mm	Basic	Tol	Basic	Tol	Max	Max	
.469	11.9	.067	±.010	.152	±.020	.025	.008	
.500	12.7	.067		.152				
.594	15.1	.067		.152				
.625	15.9	.067		.152				
.669	17.0	.087		.204				
.750	19.0	.087		.204		.034	.010	
.781	19.8	.087		.204				
.875	22.2	.087		.204				
.984	25.0	.122		.280				
1.000	25.4	.122		.280				
1.125	28.6	.122	.280	.048	.012			
1.188	30.2	.122	.280					
1.250	31.7	.122	.280					
1.375	34.9	.122	.280					
1.500	38.1	.122	.280					
1.562	39.7	.145	.324	.054		.015		
1.625	41.3	.145	.324					
1.750	44.4	.145	.324					
1.772	45.0	.145	.324					
1.875	47.6	.145	.324					
1.969	50.0	.170	±.015	.388	±.030		.068	.015
2.000	50.8	.170		.388				
2.125	54.0	.170		.388				
2.156	54.8	.170		.388				
2.250	57.1	.170		.388				
2.375	60.3	.170		.388		.082		
2.500	63.5	.170		.388				
2.625	66.7	.170		.388				
2.750	69.8	.210		.480				
2.875	73.0	.210		.480				
3.000	76.2	.210		.480	.095			
3.250	82.5	.210		.480				
3.375	85.7	.258		.604				

<sup>1/</sup> See Table XI and Figure 12.

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3.5.2.1.9 Type I, Class 9 retaining rings. Type I, Class 9 retaining rings shall be similar to Figure 9 and shall conform to the hardness requirements and the dimensions of MS3215 and the supplementary dimensions of Table IX.

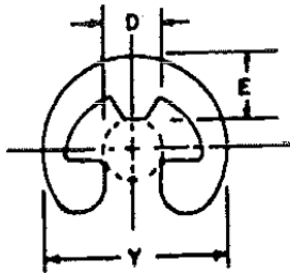


FIGURE 9. Type I, Class 9 Retaining Rings.

TABLE IX. Supplementary Dimensions, Type I, Class 9 Retaining Rings.

Nominal Ring Size		D Free Diameter		E	Y Free Outside Diameter	C <sup>1/</sup>	V <sup>1/</sup>
		(Inch)		(Inch)	(Ref)	(Inch)	(Inch)
		Basic	Tol	Max		Max	Max
.094	2.4	.072	+.001	.073	.206	.009	.005
.125	3.2	.093	-.003	.099	.270	.009	
.156	4.0	.113	+.002 -.003	.117	.335	.015	.008
.188	4.8	.143	±.003	.122	.375	.015	
.219	5.6	.182		.138	.446	.015	
.250	6.4	.204	±.004	.163	.515	.015	
.312	7.9	.242		.181	.588	.025	.012
.375	9.5	.292		.192	.660	.025	
.438	11.1	.332		.219	.746	.025	
.500	12.7	.385		.222	.810	.043	
.562	14.3	.430		.231	.870	.043	

<sup>1/</sup> See Table XI and Figure 12.

3.5.2.1.10 Type I, Class 10 retaining rings. Type I, Class 10 retaining rings shall be similar to Figure 10 and shall conform to the hardness requirements and the dimensions of MS3217 and the supplementary dimensions of Table X.

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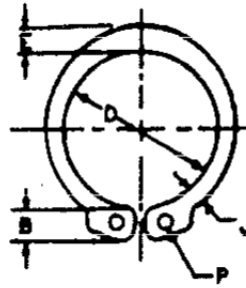


FIGURE 10. Type I, Class 10 Retaining Rings.

TABLE X. Supplementary Dimensions, Type I, Class 10.

Nominal Ring Size		D Free Diameter		B		E		J		P Hole Diameter		C <sup>1/</sup>	V <sup>1/</sup>
		(Inch)		(Inch)		(Inch)		(Inch)		(Inch)		(Inch)	(Inch)
Inch	mm	Basic	Tol	Basic	Tol	Basic	Tol	Basic	Tol	Basic	Tol	Max	Max
.394	10	.362	+0.003 -.008	.101	±.004	.068	±.004	.039	±.004	.042	+0.010 -.002	.013	.010
.437	11.1	.435		.101		.068		.053		.042		.015	
.500	12.7	.460		.120		.090	±.005	.050	±.005	.050		.016	.012
.591	15.0	.543		.130		.102		.057		.050		.018	
.625	15.9	.575	+0.005 -.010	.130		.106	±.006	.059	±.006	.050		.019	.015
.669	17.0	.616		.130		.112		.062		.050		.020	
.750	19.0	.689		.180		.127		.077		.078		.024	
.787	19.9	.689		.180		.127		.077		.078		.024	
.875	22.2	.804	+0.010 -.015	.180	±.005	.148	±.007	.083	±.007	.078		.027	.020
.984	23.8	.906		.180		.151		.084		.078		.031	
1.000	25.4	.906		.180		.151		.084		.078		.031	
1.062	27.0	.978		.220		.161		.090		.093		.031	
1.125	28.5	1.036	+0.013 -.020	.220	±.006	.169	±.008	.095	±.008	.093	+0.015 -.002	.032	.025
1.181	30.0	1.087		.220		.176		.098		.093		.033	
1.188	30.2	1.087		.220		.176		.098		.093		.038	
1.250	31.7	1.150		.220		.185		.103		.093		.038	
1.312	33.3	1.208	+0.013 -.020	.220	±.006	.192	±.008	.106	±.008	.093		.039	.030
1.375	34.9	1.268		.220		.200		.110		.093		.044	
1.378	35.0	1.268		.220		.200		.110		.093		.044	
1.500	38.1	1.380		.280		.218		.123		.109		.047	
1.562	39.7	1.437	+0.013 -.020	.280	±.006	.228	±.008	.127	±.008	.109	+0.015 -.002	.048	.025
1.575	40.0	1.437		.280		.228		.127		.109		.048	
1.750	44.4	1.608		.290		.254		.140		.109		.052	
1.772	45.0	1.608		.290		.254		.140		.109		.052	
1.938	49.2	1.782		.314	±.006	.280		.154		.125		.056	.030
1.969	50.0	1.782		.314		.280		.154		.125		.060	
2.000	50.8	1.840		.314		.290		.160		.125		.060	

<sup>1/</sup> See Table XI and Figure 12.

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3.5.2.2 Type II retaining rings. Type II retaining rings shall be bowed (not flat) and shall conform to the requirements of 3.5.2.2.1 through 3.5.2.2.4 and 3.5.4 as applicable.

3.5.2.2.1 Type II, Class 1 retaining rings. Type II, Class 1 retaining rings shall be similar to Figure 1 and shall conform to the hardness requirements and the dimensions of MS16629 and the supplementary dimensions of Table I.

3.5.2.2.2 Type II, Class 2 retaining rings. Type II, Class 2 retaining rings shall be similar to Figure 2 and shall conform to the hardness requirements and the dimensions of MS16628 and the supplementary dimensions of Table II.

3.5.2.2.3 Type II, Class 3 retaining rings. Type II, Class 3 retaining rings shall be similar to Figure 5 and shall conform to the hardness requirements and the dimensions of MS16634 and the supplementary dimensions of Table V.

3.5.2.2.4 Type II, Class 4 retaining rings. Type II, Class 4 retaining rings shall be similar to Figure 11 and shall conform to the hardness requirements and the dimensions of MS3216.

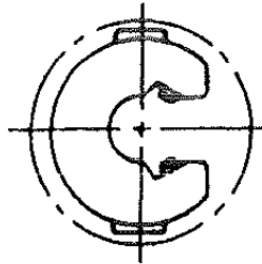


FIGURE 11. Type II, Class 4 Retaining Rings.

3.5.3 Type III retaining rings. Type III retaining rings shall be flat (not bowed) in the same plane within limits of 3.5.4.5 and shall conform to the requirements of 3.5.3.1, 3.5.3.2 and 3.5.4 as applicable.

3.5.3.1 Type III, Class 1 retaining rings. Type III, Class 1 retaining rings shall be similar to Figure 1 and shall conform to the hardness requirements and the dimensions of MS16631 and the supplementary dimensions of Table I.

3.5.3.2 Type III, Class 2 retaining rings. Type III, Class 2 retaining rings shall be similar to Figure 2 and shall conform to the hardness requirements and the dimensions of MS16630 and the supplementary dimensions of Table II.

3.5.4 Design and irregularity limitations.

3.5.4.1 Face contour design parameters. Figure 12 shows the cross section details and Table XI relates these details to the various retaining ring designs with their corresponding dimensional tables in the text. The "C" dimension shown in Figure 12 appears in the various ring dimensional tables in the text. The angle "θ" shown in Figure 12 shall not exceed 10° maximum.

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TABLE XI. Correlation of Cross-Sectional Details in Figure 12 to Related Ring Design and Tables in Text.

Applicable Ring Type & Class		Table in MIL-DTL-21248 "C" Dimension Defined
Type	Class	
I	1	I (page 5)
I	2	II (page 9)
I	3	III (page 12)
I	4	IV (page 14)
I	5	V (page 15)
I	6	VI (page 16)
I	7	VII (page 18)
I	8	VIII (page 19)
I	9	IX (page 20)
I	10	X (page 21)
II	1	I (page 5)
II	2	II (page 9)
II	3	V (page 15)
I	1(3.062" to 10")	I (page 5)
III	1	I (page 5)
III	2	II (page 9)
III	1(3.062" to 10")	I (page 5)

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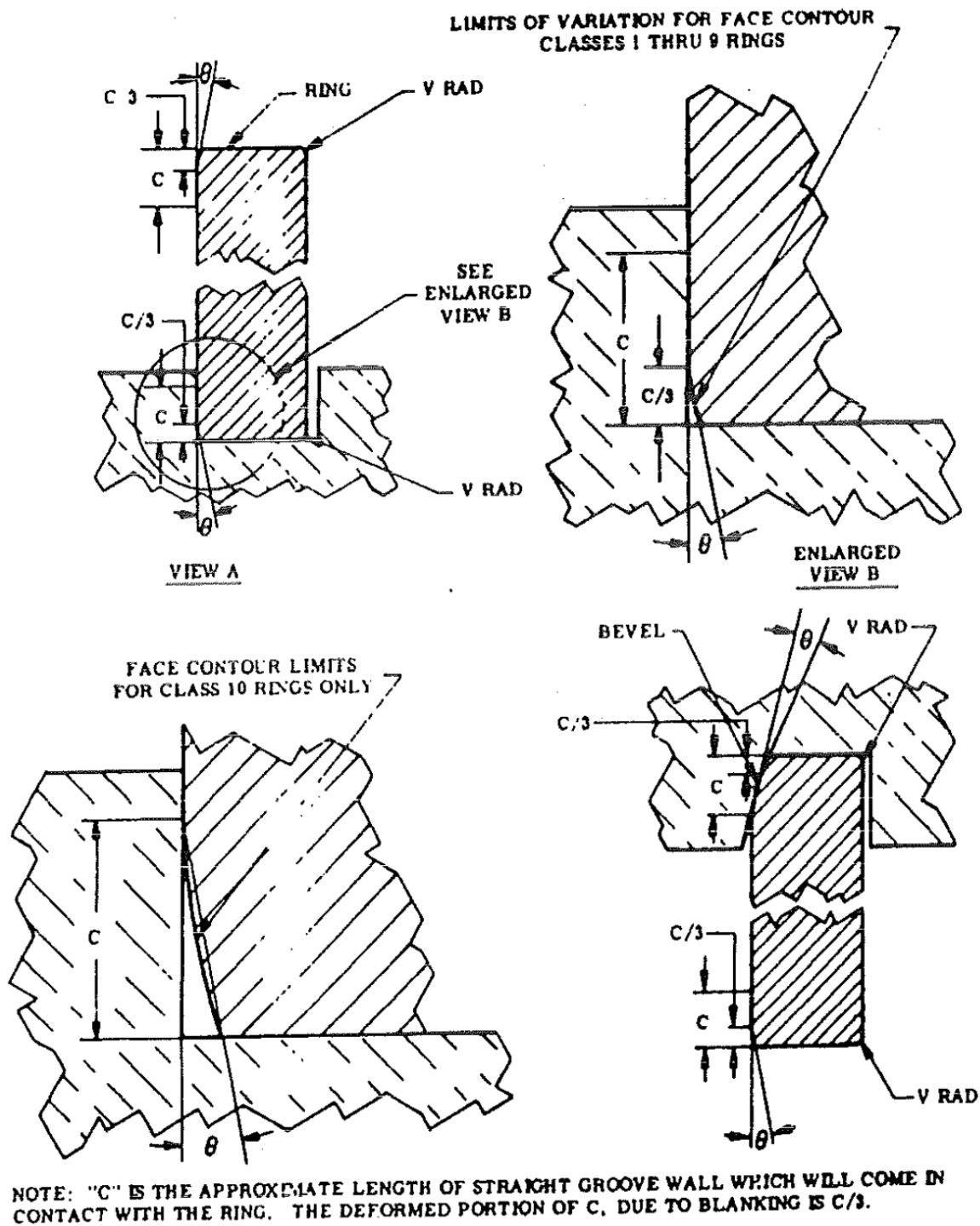


FIGURE 12. FACE CONTOUR LIMITATIONS  
(SECTIONAL VIEW OF RING TAKEN AT LARGEST SECTION OF FIGURES 1 THROUGH 10)

#### 3.5.4.2 Dish.

3.5.4.2.1 Type I and Type III rings. The dish (see Figure 13) of Type I and Type III rings shall not exceed the dimensions specified in Table XII for the applicable ring thickness.



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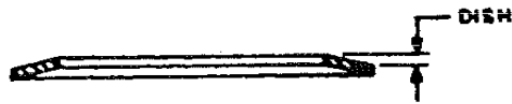


FIGURE 13. Dish.

TABLE XII. Dish Limitations for Type I and Type III Rings.

Ring Thickness (inches)	Dish (max) (inches)
.010-.015	.002
.025-.035	.003
.042-.093	.005
.109-.125	.010
.156-.187	.015

3.5.4.3 Axial kink and solid protrusion. The thickness of retaining rings with axial kink or solid protrusion “d” (see Figure 14 and Table XIII), shall not exceed the maximum thickness (T+ Tolerance) as specified in the applicable MS.

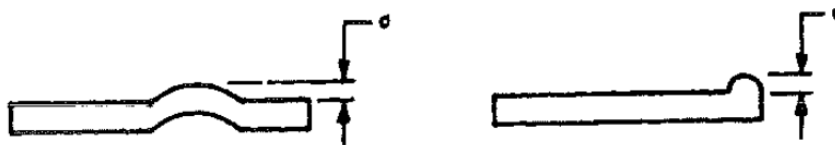


FIGURE 14. Axial kink and protrusion.

TABLE XIII. Axial Kink and Protrusion Limitation.

Ring Thickness (inches)	d (max) (inches)
0.010 through 0.025	0.001
0.035 through 0.109	0.002
0.125 and over	0.003

3.5.4.3.1 Type I rings. The overall thickness of Type I rings, including dimension “d”, shall not exceed the thickness limitations specified on the MS Drawing for the applicable class and size of ring.

3.5.4.3.2 Type II rings. Dimension “Y”, plus dimension “d” shall not exceed the limitations of dimension “Y” as specified on the MS Drawing for the applicable class and size of ring.

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3.5.4.3.3 Type III rings. Bevel edge dimension "U" plus dimension "d", and thickness dimension "T" plus dimension "d" shall not exceed the limitations of dimensions "U" or "T" respectively, as specified on the MS Drawing for the applicable class and size of ring.

3.5.4.4 Radial kink. The radial kink of retaining rings shall not exceed the limitations specified in 3.5.4.4.1 through 3.5.4.4.4 for the applicable type and class of ring.

3.5.4.4.1 Type I, Classes 1 and 3; Type II, Class 1; and Type II, Class 1 retaining rings. Dimension "V" (see Figure 15) shall not exceed the limitations specified in Table XIV for the applicable size ring.

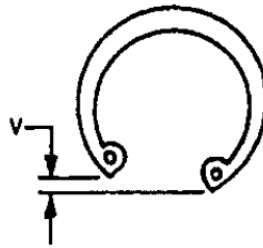


FIGURE 15. Radial Kink, Internal Rings.

TABLE XIV. Radial Kink Limitations for Type I, Classes 1 and 3; Type II, Class 1; and Type III, Class 1 Retaining Rings.

Ring Size (inches)	Dimension V (max) (inches)
0.250 through 0.750	0.020
0.777 through 1.500	0.031
1.562 through 2.500	0.062
2.531 through 5.000	0.094
Over 5.000	0.124

3.5.4.4.2 Type I, Classes 2, 4 and 10; Type II, Class 2; and Type III, Class 2 retaining rings. Dimension "V" (see Figure 16) shall not exceed the limitations specified in Table XV for the applicable size ring.

3.5.4.4.3 Type I, Classes 5, 6, 8 and 9; and Type II, Classes 3 and 4 retaining rings. Radial kink (dimension V, Figure 16) readily visible to the normal eye will not be acceptable.

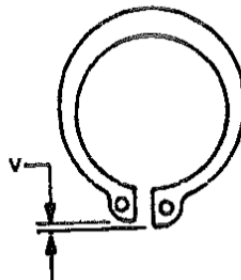


FIGURE 16. Radial Kink, External Rings.

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TABLE XV. Radial Kink Limitations for Type I, Classes 2, 4 and 10; Type II, Class 2; and Type III, Class 2 Retaining Rings.

Ring Size (inches)	Dimension V (max) (inches)
0.125 through 0.750	0.016
0.781 through 1.500	0.031
1.562 through 2.500	0.047
2.562 through 5.000	0.078
Over 5.000	0.125

3.5.4.4.4 Type I, Class 7 retaining rings. Radial kink (dimension V) shall not exceed 3 percent of the nominal free diameter of the applicable size ring.

3.5.4.5 Pitch. The pitch of retaining rings (see Figure 17) shall not exceed the limitations specified in 3.5.4.5.1 through 3.5.4.5.3 for the applicable type and class of ring.

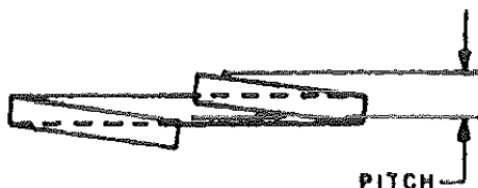


FIGURE 17. Helix.

3.5.4.5.1 Type I, Classes 1, 2, 3, 4 and 10; Type II, Classes 1 and 2; and Type III, Classes 1 and 2. The pitch of the ring shall not exceed 2 T, Where "T" equals thickness.

3.5.4.5.2 Type I, Classes 5, 6 and 9; Type II, Classes 3 and 4. The pitch of the ring shall not exceed  $\frac{1}{2}$  "T" for ring sizes up to and including 0.500 inch and "T" for ring sizes over 0.500 inch.

3.5.4.5.3 Type I, Classes 7 and 8. The pitch of the ring shall not exceed  $\frac{1}{2}$  T.

3.5.4.6 Permanent set. All retaining rings shall be capable of undergoing the tests of 4.3.2 without showing any evidence of cracking and without taking a permanent set in excess of the limitations specified in 3.5.4.6.1 through 3.5.4.6.5 for the applicable type and class of ring.

3.5.4.6.1 Type I, Class 1; Type II, Class 1; and Type III, Class 1 retaining rings. The rings shall not crack and the permanent set shall not exceed the limitations specified in Table XVI.

TABLE XVI. Permanent Set Limits for Class 1 Retaining Rings.

Ring Size (inches)	Permanent Set (max) (Percent of Free Diameter)	
	Carbon Steel and Beryllium-Copper	Corrosion Resistant Steel
0.250 through 0.453	3.5	3.8
0.500 through 3.500	3.0	3.0
3.543 and over	2.5	2.5

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3.5.4.6.2 Type 1, Class 2, 4 and 10; Type II, Class 2; and Type III, Class 2 retaining rings. The rings shall not crack and the permanent set shall not exceed the limitations specified in Table XVII.

TABLE XVII. Permanent Set Limitations for Type I, Classes 2, 4 and 10; Type II, Class 2; and Type III, Class 2 Retaining Rings.

Ring Size (inches)	Permanent Set (max) (Percent of Free Diameter)		
	Carbon Steel and Beryllium-Copper	Corrosion Resistant Steel	
	Type I, Class 2, 4 and 10 Type II, Class 2 Type III, Class 2	Type I, Class 2 Type II, Class 2 Type III, Class 2	Type I, Class 4
0.250 to 0.469	1.0	2.5	
0.500 and over	1.0	1.5	1.5

3.5.4.6.3 Type I, Class 3 retaining rings. The rings shall not crack and the permanent set shall not exceed the limitations specified in Table XVIII.

TABLE XVIII. Permanent Set Limitations for Type I, Class 3 Retaining Rings.

Ring Size (inches)	Permanent Set (max) (Percent of Free Diameter)	
	Carbon Steel	Corrosion Resistant Steel
0.750 through 1.000	1.5	1.5
1.062 and over	1.3	1.4

3.5.4.6.4 Type I, Classes 5, 6, 8 and 9; and Type II, Classes 3 and 4 retaining rings. The rings shall grip the minimum groove diameter and shall have no less than 3 point contact.

3.5.4.6.5 Type I, Class 7 retaining rings. The free diameter of the rings before expansion test shall be within the specified tolerances on MS90707. The rings after expansion over shaft (see 4.3.2.1.1.5) shall not show any evidence of cracking.

3.6 Workmanship. Workmanship shall be in accordance with high grade commercial practice governing this type of material. Each retaining ring shall be uniform in quality and temper and shall be free from hanging burrs, slivers, gouges, porosity, cracks, objectionable scale or any other defects which may adversely affect the serviceability of the rings.

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## 4. VERIFICATION

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Sampling.

4.2.1 Lot. A lot shall consist of all the retaining rings of the same type, class, size, material and finish, manufactured under essentially the same conditions and presented for examination and inspection.

4.2.2 For quality conformance examination. Sample retaining rings, packages and shipping containers shall be selected from each lot in accordance with ASQ Z1.4 Inspection Level II for examination in accordance with 4.3.1.

4.2.3 For quality conformance tests. Sample retaining rings shall be selected from each lot in accordance with ASQ Z1.4, Inspection Level S-3 for testing in accordance with 4.3.2. If the lot consists of less than 26 rings, 10 percent of the lot shall be selected at random for testing.

4.3 Inspection.4.3.1 Examination.

4.3.1.1 Quality conformance examination. Sample retaining rings selected in accordance with 4.2.2 shall be visually and dimensionally examined to verify compliance with the requirements of the contract or order and this specification. The rings shall be accepted or rejected in accordance with the requirements of ASQ Z1.4.

4.3.2 Tests.

4.3.2.1 Quality conformance tests. Sample retaining rings selected in accordance with 4.2.3 shall be tested as specified in 4.3.2.1.1 and 4.3.2.1.2 in accordance with the requirements of ASQ Z1.4. Any retaining ring containing one or more defects shall be rejected. If the quantity of defective rings in the sample exceeds the acceptance quantity for that sample, the lot represented shall be rejected.

4.3.2.1.1 Performance and crack tests. Prior to the hardness test of 4.3.2.1.2 the sample retaining rings selected in accordance with 4.2.3 shall be subjected to the tests of 4.3.2.1.1.1 through 4.3.2.1.1.5 as applicable.

4.3.2.1.1.1 Class 1 retaining rings (all types). Class 1 rings (all types) shall be compressed so that the open ends of the ring touch but do not overlap. After compressing and releasing the ring 5 times, the ring shall be visually and dimensionally inspected for compliance with the requirements of 3.5.4.6.1.

4.3.2.1.1.2 Type I, Classes 2, 4 and 10; Type II, Class 2; and Type III, Class 2 retaining rings. Type I, Classes 2, 4 and 10; Type II, Class 2; and Type III, Class 2 retaining rings shall be expanded over and removed from a shaft 1 percent larger in diameter than the nominal size shaft for which the rings are intended. After repeating this test 5 times the free diameter of the rings shall be checked for compliance with the permanent set limitations specified in 3.5.4.6.2. Each sample ring shall then be expanded over a shaft 15 percent larger in diameter than the applicable free ring diameter. After this test the rings shall be inspected for conformance to the cracking requirements of 3.5.4.6.2.

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4.3.2.1.1.3 Type I, Class 3 retaining rings. Type I, Class 3 rings shall be compressed so that the open ends of the ring touch but do not overlap. After compressing and releasing the ring 5 times, the ring shall be inspected for compliance with the requirements of 3.5.4.6.3.

4.3.2.1.1.4 Type I, Classes 5, 6, 8 and 9; and Type II, Classes 3 and 4 retaining rings. Type I, Classes 5, 6, 8 and 9; and Type II, Classes 3 and 4 rings shall be radially assembled into a groove or over a pin having the minimum groove diameter specified for the applicable size ring and inspected for compliance with the requirements of 3.5.4.6.4.

4.3.2.1.1.5 Type I, Class 7 retaining rings. Type I, Class 7 rings shall be expanded over a shaft having the maximum diameter (see Table VII) of the shaft on which the ring is intended for use. After removal from the shaft, the ring shall be inspected for compliance with the requirements of 3.5.4.6.5.

4.3.2.1.2 Hardness test. After the tests of 4.3.2.1.1 each sample retaining ring selected in accordance with 4.2.3 shall be tested for conformance to the hardness requirements specified herein for the applicable type, class, material and size of retaining ring. The surfaces of both sides of each sample ring shall be prepared for hardness testing by removal of all plating and other surface conditions which may affect the hardness reading. Hardness readings shall be taken as close as practicable to the center of the widest surface of the ring.

4.3.2.1.3 Packaging, packing and marking. Samples of packaging and packing containers selected in accordance with 4.2.2 shall be examined for compliance with the contract or order and this specification, in accordance with the requirements of ASQ Z1.4.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Retaining rings covered by this specification are for internal and external retaining applications, such as positioning and retaining bearings and springs in housings and on shafts, and for retaining shafts in housings. This specification covers the procurement requirements for Military Standards MS3215, MS3216, MS3217, MS16624 through MS16634, MS90707 and MS90708.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Title, number and date of applicable Military standard(s) (see 3.5).
- c. Applicable MS part number (see 3.5).
- d. Copies and distribution of test certifications.
- e. Packaging requirements (see 5.1).

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6.3 Subject term (key word) listing.

Beveled  
Bowed  
External  
Flat  
Internal

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodian:

Army - AR  
Navy - OS  
Air Force - 99  
DLA - IS

Preparing Activity:

DLA - IS

(Project 5325-2013-004)

Review Activity:

Army – AV, MI  
Navy - MC, SH

NOTE: The activities listed above were interested in this document as of the date of document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.