

**MIL-R-21248B**1 August 1969**SUPERSEDING****MIL-R-21248A****10 December 1963****MILITARY SPECIFICATION****RINGS, RETAINING (TAPERED AND REDUCED SECTION TYPE)**

This specification is mandatory 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 shall be 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)

**FSC 5340**

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## 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

## SPECIFICATIONS

Federal

QQ-C-533	Copper-Beryllium Alloy Strip
QQ-P-35	Passivation Treatment for Austenitic, Ferritic, and Martensitic Corrosion-Resisting Steel (Fastening Devices)
QQ-P-416	Plating, Cadmium (Electrodeposited)
PPP-B-566	Boxes, Folding, Paperboard
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-636	Box, Fiberboard
PPP-B-665	Boxes, Paperboard, Metal Stayed, Including Stay Material
PPP-B-676	Boxes, Set-Up, Paperboard

Military

MIL-P-116	Preservation, Methods of
MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-P-16232	Phosphate Coating, Heavy, Manganese or Zinc Base (for Ferrous Metals)
MIL-B-22205	Bags, Transparent, Flexible, Heat Sealable for Packaging Applications

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**STANDARDS****Federal**

FED-STD-66                      **Steel: Chemical Composition and Hardenability**

**Military**

MIL-STD-105                      **Sampling Procedures and Tables For Inspection  
by Attributes**

MIL-STD-129                      **Marking for Shipment and Storage**

**DRAWINGS****Military Standards (Sheet)**

*	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)

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## DRAWINGS

Military Standards (Sheet) (Continued)

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 specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

Aerospace Material Specifications

- \* AMS 5520 Plate, Sheet and Strip - 15 Cr, 7.1 Ni, 2.5 Mo, 1.1 Al

- \* (Application for copies should be addressed to the Society of Automotive Engineers, Inc., Department A-1, 485 Lexington Avenue, New York, New York 10017.)

## 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).

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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 FED-STD-66, steel numbers 1060 through 1090 inclusive.

\* 3.2.2 Corrosion resisting steel - Corrosion resisting steel shall conform to the composition of AMS 5520 or equivalent.

3.2.3 Copper-beryllium-alloy - Copper-beryllium-alloy shall conform to QQ-C-533.

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

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 QQ-P-416, Type II, Class 3.

\* 3.4.2 Passivation - Corrosion resisting steel rings shall be passivated in accordance with QQ-P-35.

3.4.3 Phosphate coating - Phosphate coating shall be in accordance with MIL-P-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:

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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 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.



Figure 1. Type I, Class 1 retaining rings.

3.5.2.1.2 Type I, Class 2 retaining rings - Type I, Class 2 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.

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TABLE I

## SUPPLEMENTARY DIMENSIONS ALL CLASS 1 RETAINING RINGS

Nominal ring size		K (Free gap)		P		C 1/	V 1/
		(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	.047		.012	.008
.512	13.0	.160	-.025	.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	.062		.024	.010
.938	23.8	.329	-.035	.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	.078	+.015	.035	.012
1.259	32.0	.450	-.065	.078	-.002	.035	.012
1.312	33.3	.480		.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

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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.
1.500	38.1	.560	+.090 -.065	.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	+.125	.078		.046	.012
1.750	44.4	.640	-.085	.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		.051	.012
2.000	50.8	.745		.093		.055	.012
2.047	52.0	.775		.093		.056	.015
2.062	52.4	.775		.093	+.015	.056	.015
2.125	54.0	.780		.093	-.002	.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		.110		.066	.015
2.500	63.5	.930	+.140	.110		.057	.015
2.531	64.3	.930	-.110	.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	+.015 -.002	.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		.090	.015
3.469	88.1	1.355	±.190	.125		.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
3.780	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	±.230	.125	+.020 -.005	.110	.020
4.331	110.0	1.630		.156		.113	.020
4.500	114.3	1.665		.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		.135	.025
5.375	136.5	1.990		.156		.135	.025
5.500	139.7	2.045		.156		.135	.025

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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.
5.750	146.0	2.140	+.230	.156	+.020 -.005	.135	.025
6.000	152.4	2.240		.156		.135	.025
6.250	158.7	2.325	±.280	.187		.140	.025
6.500	165.1	2.430		.187		.145	.025
6.625	168.3	2.470		.187		.150	.025
6.750	171.4	2.450		.187		.152	.025
7.000	177.8	2.550	-.320	.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		.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

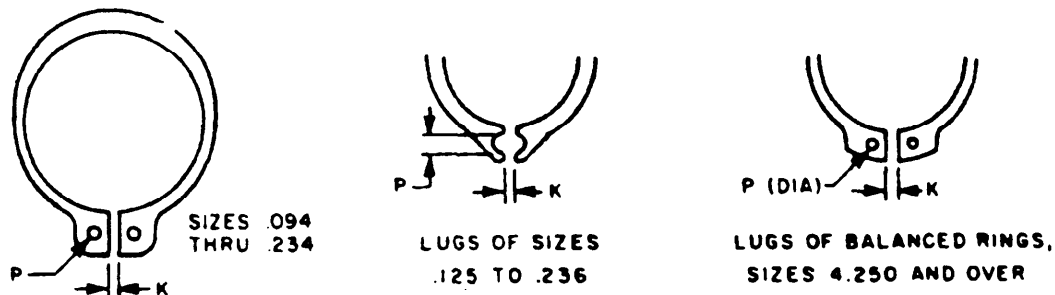
 $\frac{1}{2}$  See Table XI and Figure 12.

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 $\frac{1}{2}$	V $\frac{1}{2}$
		(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	+.015 -.002	.021	.010

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TABLE II (Continued)

Nominal ring size		K (Free gap)	P		C $\frac{1}{2}$	V $\frac{1}{2}$
		(Inch)	(Inch)		(Inch)	(Inch)
Inch	mm	Max.	Basic	Tol.	Max.	Max.
.984	25.0	.060	.078		.022	.010
1.000	25.4	.060	.078		.022	.010
1.023	26.0	.060	.078		.023	.010
1.062	27.0	.080	.078		.023	.012
1.125	28.6	.080	.078		.025	.012
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	+.015	.038	.012
1.750	44.4	.102	.125	-.002	.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		.049	.015
2.250	57.1	.123	.125		.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

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TABLE II (Continued)

Nominal ring size		K (Free gap)	P		C $\frac{1}{2}$	V $\frac{1}{2}$
		(Inch)	(Inch)		(Inch)	(Inch)
Inch	mm	Max.	Basic	Tol.	Max.	Max.
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
3.438	87.3	.153	.125	+.015 -.002	.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		.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	+.020 -.005	.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

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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.
6.750	171.4	.216	.187		.142	.025
7.000	177.8	.216	.187		.147	.025
7.500	190.5	.250	.187		.160	.025
8.000	203.2	.250	.187	+.020	.170	.025
8.500	215.9	.250	.187	-.005	.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.

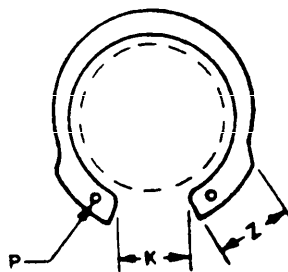


Figure 3. Type I, Class 3 retaining rings.

TABLE III

## SUPPLEMENTARY DIMENSIONS, TYPE I CLASS 3 RETAINING RINGS

Nominal ring size		K (Free gap)		Z		P		C $\frac{1}{2}$	V $\frac{1}{2}$
		Inch		Inch		Inch		Inch	Inch
Inch	mm	Basic	Tol.	Basic	Tol.	Basic	Tol.	Max.	Max.
.750	19.0	.229		9/32		.042		.020	.008
.812	20.6	.249		5/16		.042		.022	.010
.875	22.2	.267	+.040	11/32	$\pm 1/16$	.042		.023	.010
.938	23.8	.285	-.025	23/64		.042		.025	.010
1.000	25.4	.309		3/8		.042		.027	.010
1.063	27.0	.327		13/32		.050	+.010	.028	.010
1.125	28.6	.347		7/16		.050	-.002	.030	.012
1.888	30.2	.367		29/64		.050		.031	.012
1.250	31.7	.387	+.060	31/64	$\pm 3/32$	.050		.035	.012
1.312	33.3	.407	-.045	1/2		.050		.036	.012
1.375	34.9	.428		17/32		.050		.037	.012
1.438	36.5	.443		9/16		.076		.039	.012
1.500	38.1	.463		19/32		.076		.040	.012
1.562	39.7	.478		19/32		.076		.042	.012
1.625	41.3	.498		5/8		.076		.045	.012
1.688	42.9	.517	+.075	21/32	$\pm 1/8$	.076		.046	.012
1.750	44.4	.548	-.055	11/16		.076		.047	.012
1.875	47.6	.584		23/32		.076		.050	.012
2.000	50.8	.615		3/4		.076		.055	.012
2.062	52.4	.637		25/32		.094		.056	.015
2.125	54.0	.658	+.090	13/16		.094	+.015	.057	.015
2.375	60.3	.741	-.060	57/64		.094	-.002	.065	.015
2.438	61.9	.760		59/64	$\pm 5/32$	.094		.066	.015
2.500	63.5	.778		31/32		.094		.067	.015
2.625	66.7	.815		1-1/32		.109		.070	.015
2.750	69.8	.851	+.105	1-1/16		.109		.075	.015
2.812	71.4	.884	-.075	1-3/32		.109		.076	.015
2.834	72.0	.884		1-3/32		.109		.076	.015
3.000	76.2	.936		1-11/64		.109		.082	.015
3.156	80.2	.984	+.110 -.080	1-3/16		.125		.086	.015

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TABLE III (Continued)

Nominal ring size		K (Free gap)		Z		P		C $\frac{1}{2}$	V $\frac{1}{2}$
		Inch		Inch		Inch		Inch	Inch
Inch	mm	Basic	Tol.	Basic	Tol.	Basic	Tol.	Max.	Max.
3.346	85.0	1.049		1-5/16		.125		.090	.015
3.500	88.9	1.100	+.110	1-3/8	13/16	.125	+.015	.095	.020
3.562	90.5	1.121	-.080	1-13/32		.125	-.002	.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.

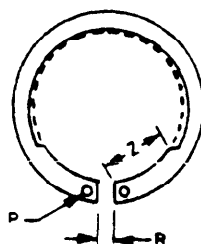


Figure 4. Type I, Class 4 retaining rings.

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.

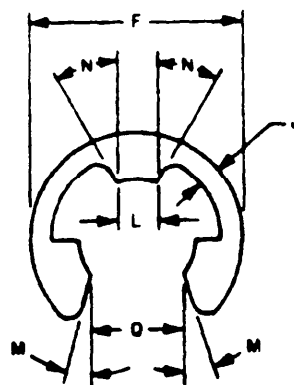


Figure 5. Type I, Class 5 retaining rings.



TABLE IV

## SUPPLEMENTARY DIMENSIONS, TYPE I, CLASS 4 RETAINING RINGS

Nominal ring size		R (Free gap)	Z		P dia.		C $\frac{1}{2}$	V $\frac{1}{2}$
		(Inch)	(Inch)		(Inch)		(Inch)	(Inch)
(Inch)	mm	Max.	Basic	Tol.	Basic	Tol.	(Max.)	(Max.)
.500	12.7	.050	3/16		.042		.0130	.008
.562	14.3	.050	3/16		.042		.0140	.008
.594	15.1	.050	7/32	$\pm 1/32$	.042		.0145	.008
.625	15.9	.050	7/32		.042		.0145	.008
.672	17.1	.050	15/64		.042		.0155	.008
.688	17.5	.060	15/64		.042	+.010	.0160	.010
.750	19.0	.060	1/4		.042	-.002	.0175	.010
.781	19.8	.060	1/4		.042		.0180	.010
.812	20.6	.060	9/32	$\pm 1/16$	.050		.0180	.010
.875	22.2	.060	5/16		.050		.0210	.010
.938	23.8	.060	11/32		.050		.0210	.010
.984	25.0	.060	3/8		.050		.0225	.010
1.000	25.4	.060	3/8		.050		.0225	.010
1.062	27.0	.080	3/8		.078		.0235	.012
1.125	28.6	.080	13/32		.078		.0250	.012
1.188	30.2	.080	7/16		.078		.0260	.012
1.250	31.7	.080	15/32		.078		.0275	.012
1.312	33.3	.080	15/32	$\pm 3/32$	.078		.0310	.012
1.375	34.9	.080	1/2		.078		.0325	.012
1.438	36.5	.080	17/32		.078		.0340	.012
1.500	38.1	.080	9/16		.078	+.015	.0350	.012
1.562	39.7	.102	19/32		.078	-.002	.0365	.012
1.750	44.4	.102	11/16		.078		.0410	.012
1.772	45.0	.102	11/16		.078		.0410	.012
1.812	46.0	.102	11/16	$\pm 1/8$	.078		.0415	.012
1.969	50.0	.102	3/4		.078		.0450	.015
2.000	50.8	.102	3/4		.078		.0450	.015
2.125	54.0	.123	13/16		.120		.0495	.015
2.156	54.8	.123	13/16	$\pm 5/32$	.120		.0495	.015
2.500	63.5	.123	15/16		.120		.0575	.015

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TABLE IV (Continued)

Nominal ring size		R (Free gap)	Z		P dia.		C $\frac{1}{2}$	V $\frac{1}{2}$
		(Inch)	(Inch)		(Inch)		(Inch)	(Inch)
(Inch)	mm	Max.	Basic	Tol.	Basic	Tol.	(Max.)	(Max.)
2.875	73.0	.153	1-1/8	$\pm 5/32$	.120	+.015	.0660	.015
3.156	80.1	.153	1-3/16		.120		.0730	.015
3.500	88.8	.170	1-3/8	$\pm 3/16$	.125	-.002	.0800	.020
3.938	100.0	.170	1-9/16		.125		.0905	.020

 $\frac{1}{2}$  See Table XI and Figure 12.

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.

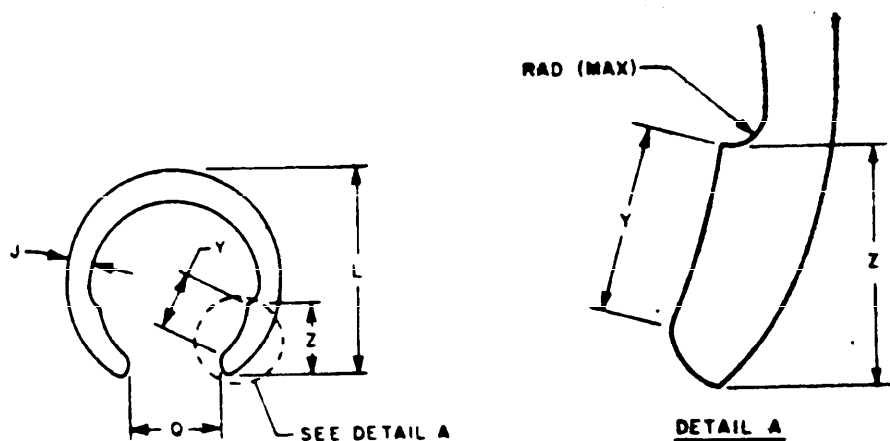


Figure 6. Type I, Class 6 retaining rings

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TABLE V  
SUPPLEMENTARY DIMENSIONS, TYPE I, CLASS 5 AND TYPE II, CLASS 3 RETAINING RINGS

Nominal ring size		Q (Free gap)		F (Free dia)	J		L		M (ref)	N (ref)	C 1/ (Inch)	V 1/ (Inch)	
Inch	mm	(Inch)		(Inch)	(Inch)		(Inch)		Degree	Degree	(Inch)	(Inch)	
		Basic	Tol.	Max.	Basic	Tol.	Basic	Tol.	Nom.	Nom.	Max.	Max.	
.040	1.0	.022	+.002	.082	.012	±.002	.015	±.003	10°	0°	.005	.003	
.062	1.55	.046	-.004	.159	.022	±.002	.016	±.003			.009	.005	
.094	2.4	.066		.192	.022		.019				.013		
.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				30°-36°	.008	
.156	4.0	.098		.287	.033		.035						
.172	4.3	.109	+.005	.317	.040		.038	±.010					
.188	4.8	.125	-.010	.340	.042		.038						
.219	5.6	.159		.442	.045		.057						
.250	6.4	.179		.534	.055		.064				.025		
.312	7.9	.210		.607	.057	±.004	.075						
.375	9.5	.259	+.007	.667	.060		.093	±.015					
.438	11.1	.291	-.014	.694	.062		.104				.034		
.500	12.7	.339		.810	.080		.121						
.625	15.9	.416		.950	.090	±.005	.148	±.020	10°	30°-36°	.048	.012	
.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	±.030					
.984	25.0	.712		1.510	.130	±.006	.254				.054		
1.188	30.2	.923	+.020	1.640	.130		.329						
1.375	34.9	1.050	-.030	1.889	.140		.375						

1/ See Table XII and Figure 12.

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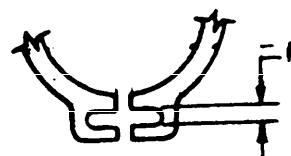
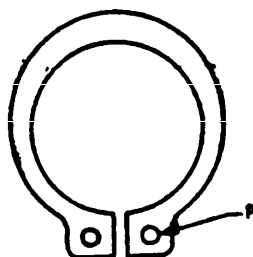
TABLE VI  
SUPPLEMENTARY DIMENSIONS, TYPE I, CLASS 6 RETAINING RINGS

Nominal ring size		Q (free gap)		I		Y		I	CI/ VI	
		(Inch)		(Inch)		(Inch)		(Inch)	(Inch)	(Inch)
Inch	mm	Basic	Tol.	Basic	Tol.	Basic	Tol.	Basic	Max.	Max.
.125	3.2	.096	+.004	.021	.047	.010	+.006	.129	.009	.005
.156	4.0	.122	-.004	.024	.061	.015	-.010	.163		
.188	4.8	.148		.028	.075	.019		.197		
.219	5.6	.175		.031	.079	.019		.216		
.236	6.0	.190		.033	.085	.022		.232		
.250	6.4	.198		.035	.089	.022		.245		
.281	7.1	.229	+.004	.035	.099	.026	+.008	.272	.013	.005
.312	7.9	.256	-.012	.035	.108	.026	-.013	.295		
.375	9.5	.306		.047	.129	.034		.353		
.406	10.3	.338		.037	.140	.038		.382		
.436	11.1	.361		.040	.148	.044		.407		
.500	12.7	.412	+.010	.050	.167	.050	+.010	.457	.025	.008
.582	14.3	.464	-.015	.050	.187	.057	-.015	.514		
.625	15.9	.510		.052	.205	.071		.563		
.688	17.5	.564		.054	.225	.079		.613		
.750	19.0	.612		.057	.242	.079		.665		
.812	20.6	.666		.060	.262	.079	+.012	.720	.034	.010
.875	22.2	.720	+.015	.062	.284	.080	-.017	.780		
.938	23.8	.770	-.020	.066	.304	.092		.833		
1.000	25.4	.820		.075	.324	.100		.889		
1.125	28.6	.922		.080	.364	.109		.998		
1.250	31.7	1.026	+.020	.093	.405	.125	+.015	1.113	.048	.012
1.375	34.9	1.130	-.025	.098	.446	.136	-.020	1.224		
1.500	38.1	1.230		.106	.485	.148		1.331		
1.750	44.4	1.436	+.025	.123	.567	.170	+.017	1.554	.054	
2.000	50.8	1.640	-.030	.143	.647	.196	-.024	1.776		

1/ See Table XII and Figure 12.

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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.



Alternate design

Figure 7 Type I, Class 7 retaining rings.

TABLE VII

SUPPLEMENTARY DIMENSIONS, TYPE I, CLASS 7 RETAINING RINGS

Nominal ring size (Inch) mm			P (Inches)		C $\frac{1}{2}$ / (Inch)	V $\frac{1}{2}$ / (Inch)
Basic	Tol.		Basic	Tol.	Max.	Max.
.094	$\pm .002$	2.4	.034	$\pm .004$	.013	.005
.125		3.2	.042			
.156		4.0	.042	$+.015$ $-.002$	.025	.008
.187		4.8	.051			
.250		6.3	.051			
.313	$\pm .003$	7.9	.078	$+.015$ $-.002$	.034	.010
.376		9.5	.078		.048	.012
.437		11.1	.078			
.500		12.7	.078		.054	.012
.625		15.9	.078			
.750	$\pm .005$	19.0	.120			

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 dimensions and hardness requirements of MS90708 and the supplementary dimensions of Table VIII.

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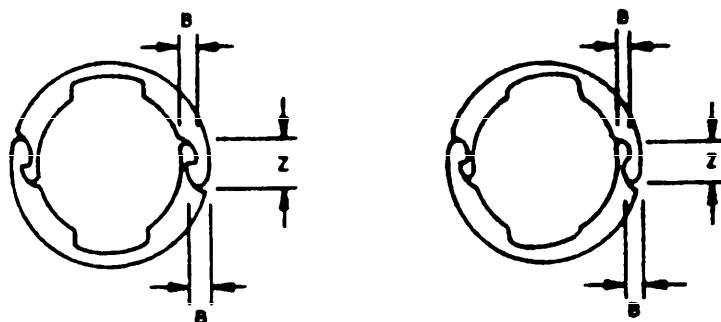
Alternate design

Figure 8. Type I, Class 8 retaining rings

TABLE VIII

SUPPLEMENTARY DIMENSIONS, TYPE I, CLASS 8 RETAINING RINGS

Nominal ring size		B		Z		C 1/	V 1/
		(Inches)		(Inches)		(Inch)	(Inch)
Inch	mm	Basic	Tol.	Basic	Tol.	Max.	Max.
.469	11.9	.067		.152			
.500	12.7	.067		.152			
.594	15.1	.067		.152		.025	.008
.625	15.9	.067		.152			
.669	17.0	.087		.204			
.750	19.0	.087		.204			
.781	19.8	.087		.204		.034	.010
.875	22.2	.087		.204			
.984	25.0	.122		.280			
1.000	25.4	.122	±.010	.280	±.020		
1.125	28.6	.122		.280			
1.188	30.2	.122		.280		.048	.012
1.250	31.7	.122		.280			
1.375	34.9	.122		.280			
1.500	38.1	.122		.280			

TABLE VIII (Continued)

Nominal ring size		B		Z		C 1/	V 1/	
		(Inches)		(Inches)		(Inch)	(Inch)	
Inch	mm	Basic	Tol.	Basic	Tol.	Max.	Max.	
1.562	39.7	.145	±.010	.324	±.020	.054	.012	
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				

1/ See Table XI and Figure 12.

- \* 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 dimensions and hardness requirements of MS3215 and the supplementary dimensions of Table IX.

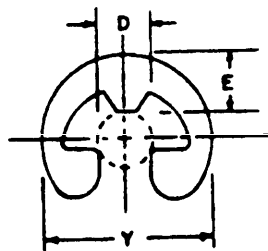


Figure 9. Type I, Class 9 retaining rings

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TABLE IX

SUPPLEMENTARY DIMENSIONS, TYPE I,  
CLASS 9 RETAINING RINGS

Nominal Ring Size		D Free Diameter		E (Inches)	Y Free Outside Diameter (Ref)	C <u>1/</u>	V <u>1/</u>
Inch	mm	Basic	Tol.	Max.			
.094	2.4	.072	$\pm .001$	.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	$\pm .003$	.122	.375	.015	
.219	5.6	.182		.138	.446	.015	
.250	6.4	.204	$\pm .004$	.163	.515	.015	.012
.312	7.9	.242		.181	.588	.025	
.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	

1/ 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 dimensions and hardness requirements of MS3217 and the supplementary dimensions of Table X.

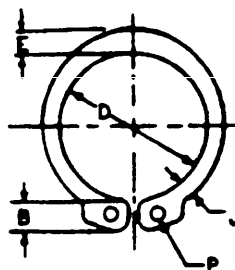


Figure 10. Type I, Class 10 retaining rings



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TABLE X  
DIMENSIONS, TYPE I, CLASS 10 RETAINING RINGS

Nominal Ring Size		D Free Diameter		R		E		J		P Hole Diameter		C I/	V I/
Inch	mm	Basic	Tol.	Basic	Tol.	Basic	Tol.	Basic	Tol.	Basic	Tol.		
.394	10	.362	+ .003 - .004	.101		.068		.039		.042		.013	.010
.437	11.1	.435		.101		.088	+ .004	.053	± .004	.042	+ .010	.015	
.500	12.7	.460		.120		.090		.050		.050		.016	.012
.591	15.0	.543		.130	+ .004	.102		.057		.050	- .002	.018	
.625	15.9	.575		.130		.106	+ .005	.059	± .005	.050		.019	
.669	17.0	.616		.130		.112		.062		.050		.020	
.750	19.0	.669	+ .005	.140		.127		.077		.078		.024	.015
.787	19.9	.689	- .010	.160		.127		.077		.078		.024	
.875	22.2	.804		.180		.146		.083		.078		.027	
.984	23.8	.906		.180		.151	+ .006	.084	± .006	.078		.031	
1.000	25.4	.906		.180		.151		.084		.078	+ .015	.031	
1.062	27.0	.978		.220		.161		.090		.093		.031	.020
1.125	28.6	1.036		.220		.169		.095		.093		.032	
1.181	30.0	1.087		.220		.176		.098		.093	- .002	.033	
1.186	30.2	1.087		.220		.176		.098		.093		.036	
1.250	31.7	1.150		.220		.185		.103		.093		.038	
1.312	33.3	1.208	+ .010	.220		.192		.106		.093		.039	
1.375	34.9	1.268	- .015	.220	+ .005	.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	.025
1.562	39.7	1.437		.280		.228		.127		.109		.048	
1.575	40.0	1.437		.280		.228		.127		.109		.048	
1.750	44.4	1.608	+ .013	.290		.254	± .008	.140	± .008	.109		.052	
1.772	45.0	1.608	- .020	.290		.254		.140		.109		.052	
1.938	49.2	1.782		.314		.280		.154		.125		.056	.030
1.969		1.782		.314	+ .006	.280		.154		.125		.060	
2.000	50.8	1.840		.314		.290		.160		.125		.060	

1/ See Table XII 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 MS3210.

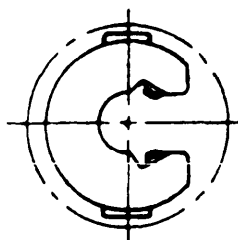


Figure 11. Type II, Class 4 retaining rings.

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.

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### 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.

TABLE XI

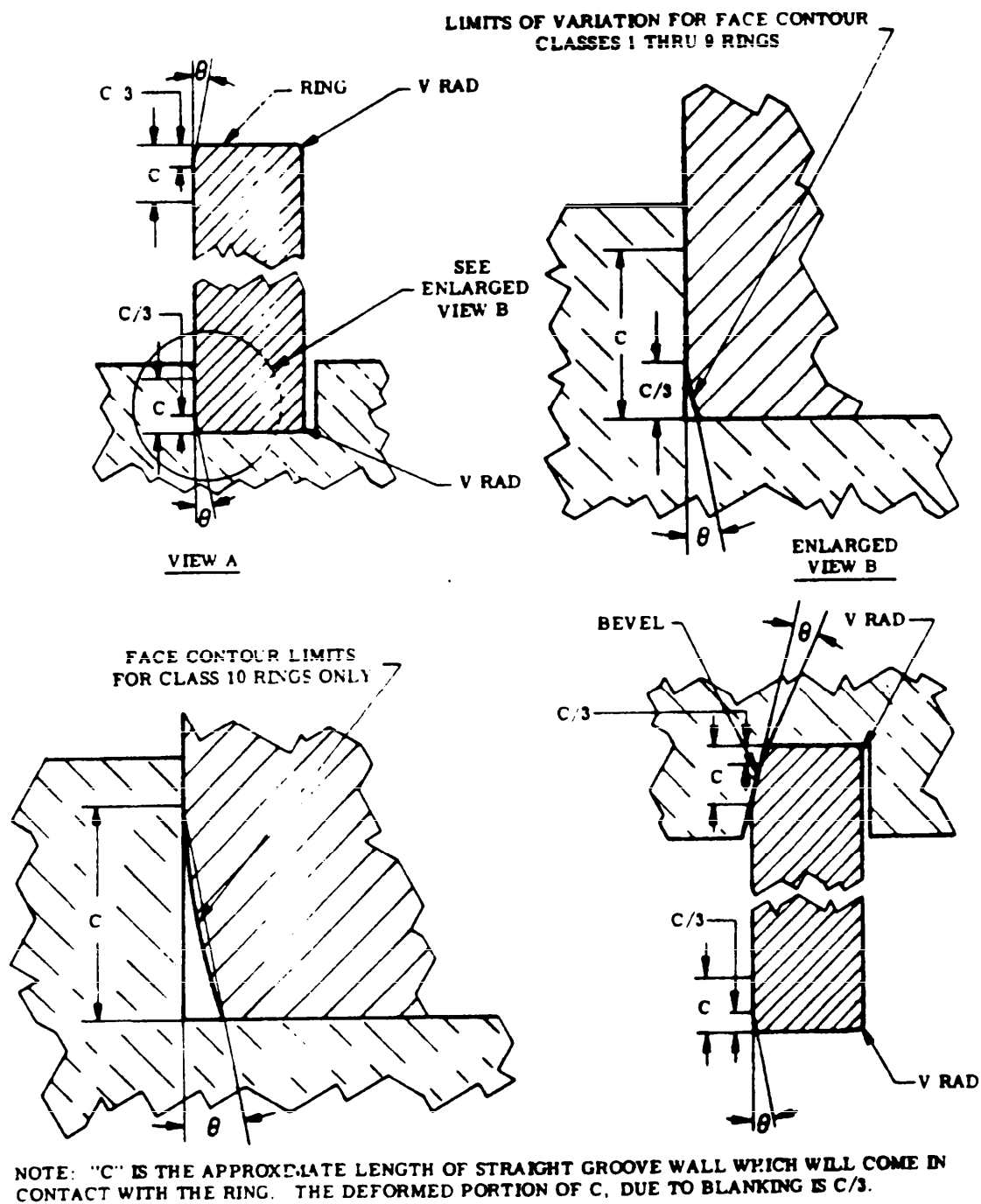
#### CORRELATION OF CROSS-SECTIONAL DETAILS IN FIGURE 12 TO RELATED RING DESIGN AND TABLES IN TEXT

Applicable Ring Type & Class		Table In MIL-R-21248B	
Type	Class	"C" Dimension Defined	
I	1	I	(pg 7)
I	2	II	(pg 11)
I	3	III	(pg 15)
I	4	IV	(pg 17)
I	5	V	(pg 19)
I	6	VI	(pg 20)
I	7	VII	(pg 21)
I	8	VIII	(pg 22)
I	9	IX	(pg 24)
I	10	X	(pg 25)
II	1	I	(pg 7)
II	2	II	(pg 11)
II	3	V	(pg 19)
I	1 (3.062" to 10")	I	(pg 7)
III	1	I	(pg 7)
III	2	II	(pg 11)
III	1 (3.062" to 10")	I	(pg 7)

### 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 12. FACE CONTOUR LIMITATIONS**  
(SECTIONAL VII V OF RING TAKEN AT LARGEST SECTION OF FIGURES 1 THROUGH 10)

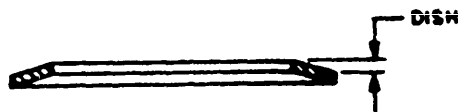


Figure 13. Dish.

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), shall not exceed the maximum thickness ( $T + \text{Tolerance}$ ) as specified in the applicable MS.

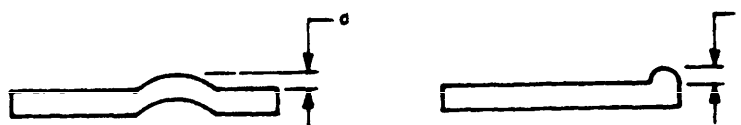


Figure 14. Axial kink and protrusion

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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.

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 III, Class 1 retaining rings - Dimension "V" (see Figure 15) shall not exceed the limitations specified in Table XIV for the applicable size ring.

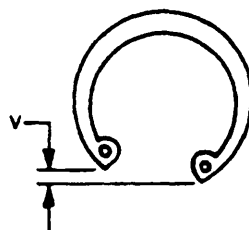


Figure 15. Radial kink, internal rings.

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TABLE XIV

RADIAL KINK LIMITATIONS FOR TYPE I, CLASSES 1 AND 3;  
TYPE II, CLASS 1; AND TYPE III, CLASS 1 RINGS

Ring size (inches)	Dimension V (max.) (inch)
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.

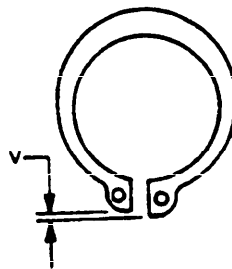


Figure 16. Radial kink, external rings.

TABLE XV

RADIAL KINK LIMITATIONS FOR TYPE I, CLASSES 2, 4, AND 10;  
TYPE II, CLASS 2; AND TYPE III, CLASS 2 RINGS

Ring size (inches)	Dimension V (max.) (inch)
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

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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.

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.

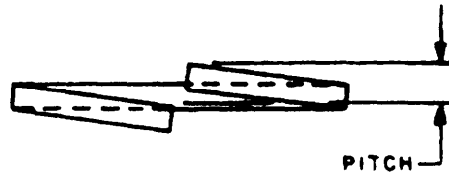


Figure 17. Helix.

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  $1/2$  "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  $1/2$  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.

3.5.4.6.2 Type I, 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 XVI

## PERMANENT SET LIMITS FOR CLASS 1 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

TABLE XVII

PERMANENT SET LIMITATIONS FOR TYPE I, CLASSES 2, 4, AND 10;  
TYPE II, CLASS 2; AND TYPE III, CLASS 2 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.

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.

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TABLE XVIII

## PERMANENT SET LIMITATIONS FOR TYPE I, CLASS 3 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

3.5.4.6.5 Type I, Class 7 retaining rings - The free diameter of the rings before expansion test shall be within the specified tolerances on MB90707. 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.

#### 4. QUALITY ASSURANCE PROVISIONS

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 MIL-STD-105 Inspection Level II for examination in accordance with 4.3.1.

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4.2.3 For quality conformance tests - Sample retaining rings shall be selected from each lot in accordance with MIL-STD-105, 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 MIL-STD-105, Acceptable Quality Level (AQL) 4.0 percent defective, except that the free diameter of retaining rings shall be judged in accordance with Acceptable Quality Level (AQL) 1.5 percent defective.

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 MIL-STD-105, AQL 1.0 percent defective. 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, Class 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 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 MIL-STD-105, AQL 4.0 percent defective.

## 5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging - Preservation and packaging of retaining rings shall be Level A or C as specified (see 6.2).

### 5.1.1 Level A -

5.1.1.1 Cleaning - Prior to preservation, all uncoated retaining rings and unplated retaining rings shall be cleaned in accordance with Method C-1 of MIL-P-116. Retaining rings which do not require application of a preservative compound shall be cleaned so they are free of dirt, grease and foreign matter.

5.1.1.2 Preservation - Bare ferrous metal retaining rings subject to corrosion shall be preserved, Method I of MIL-P-116, with a Type P-2 preservative compound. Preserved rings shall be wrapped with barrier material conforming to MIL-B-121, Grade A. Ferrous metal retaining rings plated or coated with corrosion

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resistant finishes and retaining rings made of materials which are inherently corrosion resistant shall be preserved in accordance with Method III of MIL-P-116.

5.1.1.3 Unit packaging - Unless otherwise specified in the contract or order, retaining rings, in the quantities specified in Table XIX, shall be packaged in accordance with MIL-P-116 and as follows:

Rings shall be packaged in sealed envelopes. The envelopes shall be closed by means of tape, staples, heat-sealed or fastened in a manner to prevent accidental opening. Alternatively, rings may be packaged in heat-sealed transparent envelopes conforming to MIL-B-22205 using Type II material. Individual unit packages shall contain retaining rings of only one type, class, size, material and protective finish.

TABLE XIX

LEVEL A UNIT PACKAGING, QUANTITY - THICKNESS TABLE

Ring thickness (inches)	Unit package quantity
0.010 through 0.035	50
0.042	20
0.050 through 0.062	10
0.078 through 0.093	4
0.109 through 0.187	2

5.1.1.4 Intermediate packaging - Unless otherwise specified in the contract or order, unit packages shall be enclosed in intermediate containers in quantities specified in Table XX and conforming to PPP-B-566, PPP-B-636, PPP-B-665 and PPP-B-676. Intermediate containers shall contain retaining rings of only one type, class, size, material and protective finish.

TABLE XX

LEVEL A INTERMEDIATE PACKAGING, QUANTITY - THICKNESS TABLE

Ring thickness (inches)	Intermediate package (quantity unit packages)
0.010 through 0.035	40
0.042	10
0.050 through 0.062	10
0.078 through 0.093	5
0.109 through 0.187	5

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5.1.2 Level C -

5.1.2.1 Preservation - Unless otherwise specified in the contract or order, preservation shall be such as to afford the minimum degree of protection necessary to prevent deterioration during shipment under normal environmental conditions and commercial modes of transportation.

5.1.2.2 Unit packaging - Unless otherwise specified in the contract or order, retaining rings shall be packaged in a manner which affords the minimum degree of protection necessary to prevent deterioration or damage during shipment under normal environmental conditions and commercial modes of transportation; except that packaging material in direct contact with the retaining rings or the preservative film, shall meet the acidity and pH requirements of MIL-B-121 and if in contact with the preservative film it shall be greaseproof. Individual unit packages shall contain retaining rings of only one type, class, size, material and protective finish.

5.1.2.3 Intermediate packaging - Unless otherwise specified in the contract or order intermediate packaging shall afford the minimum degree of protection necessary to prevent deterioration or damage during shipment under normal environmental conditions and commercial modes of transportation.

5.2 Packing - Packing shall be Level A, B or C as specified (see 5.2).

5.2.1 Level A - Unless otherwise specified in the contract or order, retaining rings preserved and packaged as specified in 5.1.1 shall be packed in wood-cleated, plywood shipping containers conforming to PPP-B-601, overseas type. Insofar as practical, containers shall be of a minimum weight and cube consistent with the protection required, be uniform in shape and size and contain identical quantities. Gross weight of the container shall not exceed 200 pounds. Container closure and strapping shall be in accordance with the appendix to PPP-B-601.

5.2.2 Level B - Unless otherwise specified in the contract or order, retaining rings preserved and packaged as specified in 5.1.1 shall be packed in fiberboard shipping containers conforming to PPP-B-636, Class-Domestic. Insofar as practical, containers shall be uniform in shape and size and contain identical quantities. Container closure shall be in accordance with the appendix to PPP-B-636.

5.2.3 Level C - Unless otherwise specified in the contract or order, retaining ring packages that require overpacking for acceptance by the carrier shall be packed in exterior type shipping containers in a manner that will insure safe transportation at the lowest rate to the point of delivery, and shall meet, as a minimum, the requirements of the following rules and regulations, as applicable to the mode of transportation selected:

- (a) Postal Regulations
- (b) Interstate Commerce Commission Regulations
- (c) Civil Air Regulations
- (d) Consolidated Freight Classification Rules
- (e) Truckers Association Rules
- (f) Other applicable carrier's rules

5.3 Marking - In addition to any special marking that may be required by the contract or order (see 6.2), all unit intermediate and shipping containers shall be marked in accordance with MIL-STD-129.

## 6. NOTES

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 Ordering data - Procurement documents should specify the following:

- (a) Title, date, and number of this specification.
- (b) Military standard part number required (see 3.5).
- (c) Special marking if required (see 5.3).
- (d) Selection of applicable levels of preservation, packaging and packing required (see 5.1 and 5.2).

6.3 Patents - The Government has a royalty free license under Waldes Kohinoor Inc's. Copyrights pertinent to portions of the information contained herein and under the following listed patents for the benefit of manufacturers of the item for the Government or for use in equipment to be delivered to the Government:

### U. S. Patent Numbers

2,411,761	2,509,081
2,416,852	2,547,263
2,420,921	2,574,034
2,487,803	2,861,824
2,491,306	

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6.4 Changes to previous issue - The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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Navy - OS

Air Force - 82

**Preparing Activity:**

Navy - OS

(DoD Project No. 5340-0505)

**Review interest:**

Army - MI, WC, GL, AV, MU

Navy - OS

Air Force - 82, 85, 11

DSA - SC

**User Interest:**

Army - AT, MU, ME, EL

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