MIL-STD-1756
15 January 1979

MILITARY STANDARD

RINGS, RETAINING, PREFERRED FOR DESIGN, LISTING OF

FSC 5365

DEPARTMENT OF DEFENSE
Washington, DC 20301

Rings, Retaining, Preferred For Design, Listing of:

MIL-STD-1756

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Aeronautical Systems Division (AFSC), ATTN: ASD/ENESS, Wright-Patterson Air Force Base, Ohio 45433 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FOREWORD

1. The purpose of this bookform standard is to provide a commodity type parts document on retaining rings to aid military equipment designers and engineers in the selection of preferred retaining rings.

2. This document consists of an index of preferred standardization documents and a listing of preferred parts within these documents that have been selected with respect to configuration, sizes, materials, and finishes for retaining rings.

3. The selection of preferred documents listed in this standard and the selection of part numbers within the preferred documents were made as follows:

a. Selection of Documents

(1) Documents listed or scheduled for listing in the Department of Defense Index of Specifications and Standards (DODISS).

(2) Documents which are active for design.

(3) Documents specifying part numbers (dash numbers) which designate specific sizes, materials and finishes.

b. Selection of Part Numbers

(1) By conducting a thorough search and evaluation of existing DoD procurement information.

(2) By evaluation of preferred parts listed in recent weapon system contracts.

(3) By evaluation of preferred parts lists obtained from industry.

4. To increase the scope and versatility of this retaining ring standard, periodic revisions will be developed. Results from Standardization studies, MILITARY PARTS CONTROL ADVISORY GROUP (MPCAG) evaluations, evaluation of a new family of retaining rings and recommendations from interested activities will form the basis for these revisions.

CONTENTS

SECTIONS

SECTIONS - Continued

1. SCOPE

1.1 Scope. This standard provides a listing of preferred retaining rings encompassing the following characteristics:

a. Configuration

b. Size

c. Materials

d. Protective Coatings and Finishes

1.2 Purpose. The purpose of this standard is as follows:

a. Provide the designer with a listing of preferred retaining rings to promote their use in design of weapon systems and equipments.

b. Control and minimize the variety of retaining rings used in military equipment thereby facilitating logistic support of the equipment during its life cycle.

1.3 Application. To minimize the proliferation of retaining rings, only the preferred part numbers listed herein are authorized for use in new design. All other part numbers, even though shown on current Military Specification Sheets, Military Standards (MS), National Aerospace Standards (NAS), Aeronautical Standards (AS), and Air Force/Navy Aeronautical Standards (AN), are not approved for use in new design unless approved by the cognizant Government procuring activity.

1.4 Intended use. Implement this standard by including one of the following options in the contract:

a. Require this standard as a supplement to an end use type standard such as MIL-STD-1471 or MIL-STD-1515. When thus required, only the retaining rings listed in both the end use type and this standard are acceptable. Use of other retaining rings require approval of the Government procuring activity.

b. Require this standard as a guide to be used with an end use type standard such as MIL-STD-1471 or MIL-STD-1515. When thus required, the retaining rings listed in the end use type standard and this standard are acceptable. The designer must assure himself the retaining rings listed in both the end use type standard and this standard are not adequate for his requirement before using retaining rings not listed herein. Use of retaining rings not listed in the end use type standard requires approval of the Government procuring activity.

c. Require this standard and indicate exceptions to it. When thus required, only the retaining rings listed in this standard and not excluded by the exceptions are acceptable. Use of other retaining rings require approval of the Government procuring activity.

d. Require this standard as a guide. When thus required, the designer must assure himself the retaining rings listed in this standard are not adequate for the requirement before using other retaining rings.

2. REFERENCED DOCUMENTS

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

SPECIFICATIONS

MILITARY

MIL-R-27426 - Rings, Retaining, Spiral (uniform Cross Section).

STANDARDS

MILITARY

MS3211 - Ring, Retaining, External.

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).

STANDARDS

MILITARY - Continued

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, External Interlocking.

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

3. DEFINITIONS

3.1 Adopted Industry Standards. Any Industry Specification or Standard which is listed in the Department of Defense Index of Specifications and Standards (DODISS).

3.2 Commodity Type Document. A document which lists preferred parts within a Federal Supply Classification class or Item Name. This document is to be used for selecting preferred parts for a new design when the document is invoked as a contractual requirement in conjunction with a parts control requirement.

3.3 End Use Type Document. A document that lists preferred documents and establishes parts requirements which are contractually binding for the design and construction/manufacture of a weapon system or an established equipment category such as MIL-STD-1515.

3.4 Military Parts Control Advisory Group (MPCAG). A Department of Defense organization which provides advice to the Military Departments and military contractors on the selection of parts in assigned commodity classes, and collects data on nonstandard parts for developing or updating military specifications and standards.

3.5 Definition of the approved item name used in this standard is as follows:

a. Ring, Retaining. A resilient metal item, circular or nearly circular, which is designed to be inserted into an internal or external groove and retained by its own spring action, or it may have external prongs or projections designed to be inserted into a hole and retained by spring action of the prongs which grip by imbedding into the material. It is used to keep and/or lock a part(s) in position, as a ball bearing on a shaft or in a housing.

4. GENERAL STATEMENTS

4.1 Selection procedure.

4.1.1 Document selection. The applicable section shall be selected after reviewing the table of contents.

4.1.2 Part number selection (preliminary). A preliminary selection of the applicable part number shall be made after reviewing the nominal parameters (sizes, materials, finishes and hardness) listed in the sections.

4.1.3 Part number selection (final). A final selection of the applicable part number shall be made after reviewing the detailed requirements specified in the referenced retaining ring documents for suitability in the particular military equipment being designed (considering the application and environmental conditions).

5. DETAILED REQUIREMENTS

5.1 The detailed requirements for preferred retaining rings are contained in the applicable retaining ring document and associated procurement specification. If there is disagreement between the nominal parameters listed in this standard and the parameters specified in the applicable retaining ring document or associated procurement specification, the parameters specified in the applicable retaining ring document or associated procurement specification shall prevail.

6. NOTES

6.1 Dimensions. Dimensions shown in the sections contained herein are in inches.

6.2 Beryllium copper rings are considered acceptable for new design and will be included during the next revision of this document.

Custodians:
Army - AR
Navy - OS
Air Force - 11

Review activities:
Army - ER
Navy - AS, SH
Air Force - 99
DLA - IS

User activities:
Army -
Navy - MC

Preparing Activity:
Air Force - 11

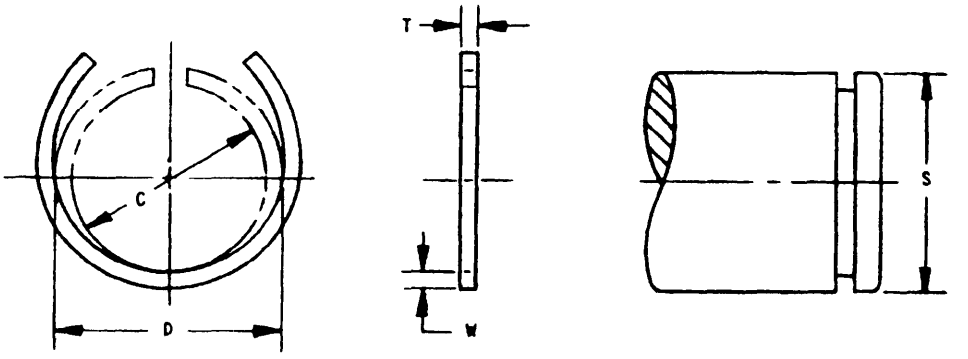
Agent:
DLA - IS

(Project 5365-0020)

SECTION 101

RING, RETAINING, EXTERNAL

APPLICABLE DOCUMENT: MS3211

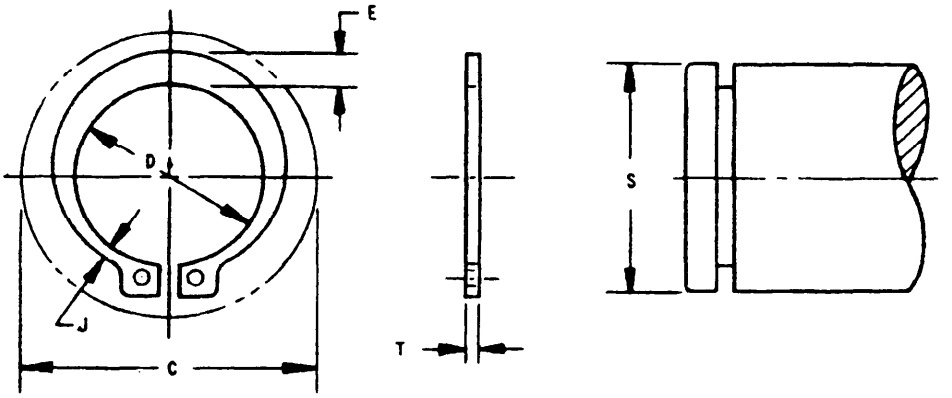


MATERIAL	TENSILE STRENGTH(PSI) MIN	PROTECTIVE FINISH
STEEL, CARBON	NOT SPECIFIED	ZINC PLATE
CRES	NOT SPECIFIED	PASSIVATE
PHOSPHOR BRONZE	NOT SPECIFIED	NOT SPECIFIED

S SHAFT DIAMETER	D FREE DIAMETER	W	T	C INSTALLED	MS3211 DASH NUMBER
.188	.197	.062	.031	.125	- 1
.219	.230	.046	.031	.173	- 2
.250	.266	.062	.031	.188	- 3
.312	.328	.079	.039	.250	- 4
.375	.394	.094	.047	.313	- 5
.438	.459	.109	.055	.376	- 6
.500	.525	.125	.063	.438	- 7
.562	.591	.141	.070	.493	- 8
.625	.656	.156	.078	.547	- 9
.688	.722	.172	.086	.602	-10
.750	.788	.188	.094	.656	-11
.812	.853	.203	.102	.711	-12
.875	.919	.219	.109	.765	-13
.938	.984	.234	.117	.820	-14
1.000	1.050	.250	.125	.874	-15

SECTION 102

RING, RETAINING, EXTERNAL, BASIC
APPLICABLE DOCUMENT: MS16624



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.250 TO .469 INCL .500 TO .812 INCL .875 TO 1.000 INCL 1.062 TO 3.250 INCL 3.500 AND OVER	ROCKWELL 30N-69.5-73 ROCKWELL 30N-66-71 ROCKWELL C-47-53 ROCKWELL C-47-52 ROCKWELL C-45-50	CADMIUM PLATE
CRES	.250 TO .812 INCL .875 AND OVER	ROCKWELL 30N-63-69.5 ROCKWELL C-44-51	PASSIVATE

NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL OR CRES
.250	.469	470 LB
.500	.625	910 LB
.688	1.000	1340 LB
1.062	1.500	1950 LB
1.562	2.000	3000 LB
2.062	2.687	5000 LB
2.750	3.250	7350 LB
3.500	5.000	10500 LB

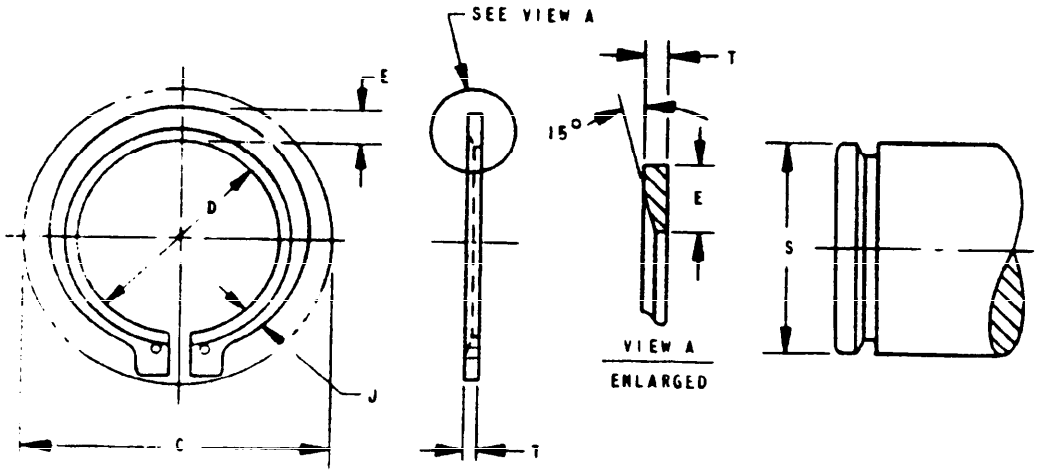
S SHAFT DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16624 DASH NUMBERS	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.250	.225	.035	.025	.025	.450	-1025	-4025
.281	.256	.038	.025	.025	.490	-1028	-4028
.312	.281	.040	.026	.025	.540	-1031	-4031
.344	.309	.042	.026	.025	.570	-1034	-4034
.375	.338	.050	.030	.025	.610	-1037	-4037
.406	.366	.054	.033	.025	.630	-1040	-4040
.438	.395	.055	.033	.025	.660	-1043	-4043
.469	.428	.060	.035	.025	.680	-1046	-4046
.500	.461	.065	.040	.035	.770	-1050	-4050
.562	.521	.072	.041	.035	.820	-1056	-4056
.625	.579	.080	.045	.035	.900	-1062	-4062
.688	.635	.084	.048	.042	1.010	-1068	-4068
.750	.693	.092	.051	.042	1.090	-1075	-4075
.812	.751	.096	.054	.042	1.150	-1081	-4081
.875	.810	.104	.057	.042	1.210	-1087	-4087
.938	.867	.110	.063	.042	1.340	-1093	-4093
1.000	.925	.116	.065	.042	1.410	-1100	-4100
1.062	.982	.122	.069	.050	1.500	-1106	-4106
1.125	1.041	.128	.071	.050	1.550	-1112	-4112
1.188	1.098	.132	.072	.050	1.610	-1118	-4118
1.250	1.156	.140	.076	.050	1.690	-1125	-4125
1.312	1.214	.146	.076	.050	1.750	-1131	-4131
1.375	1.272	.152	.082	.050	1.800	-1137	-4137
1.438	1.333	.160	.086	.050	1.870	-1143	-4143
1.500	1.387	.168	.091	.050	1.990	-1150	-4150
1.562	1.446	.172	.093	.062	2.100	-1156	-4156
1.625	1.503	.180	.097	.062	2.170	-1162	-4162
1.688	1.560	.184	.099	.062	2.240	-1168	-4168
1.750	1.618	.188	.101	.062	2.310	-1175	-4175
1.812	1.675	.192	.102	.062	2.380	-1181	-4181
1.875	1.735	.196	.104	.062	2.440	-1187	-4187

S SHAFT DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16624 DASH NUMBERS	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
2.000	1.850	.204	.108	.062	2.550	-1200	-4200
2.062	1.906	.208	.111	.078	2.680	-1206	-4206
2.125	1.964	.212	.113	.078	2.750	-1212	-4212
2.250	2.081	.220	.116	.078	2.870	-1225	-4225
2.312	2.139	.222	.118	.078	2.940	-1231	-4231
2.375	2.197	.224	.119	.078	3.010	-1237	-4237
2.438	2.255	.228	.120	.078	3.070	-1243	-4243
2.500	2.313	.232	.122	.078	3.120	-1250	-4250
2.625	2.428	.242	.127	.078	3.250	-1262	-4262
2.688	2.485	.246	.129	.078	3.320	-1268	-4268
2.750	2.543	.248	.131	.093	3.450	-1275	-4275
2.875	2.650	.256	.133	.093	3.570	-1287	-4287
2.938	2.717	.260	.136	.093	3.640	-1293	-4293
3.000	2.775	.264	.138	.093	3.690	-1300	-4300
3.125	2.892	.272	.141	.093	3.820	-1312	-4312
3.250	3.006	.280	.145	.093	3.950	-1325	-4325
3.500	3.237	.285	.148	.109	4.250	-1350	-4350
3.625	3.352	.296	.153	.109	4.370	-1362	-4362
3.750	3.468	.310	.160	.109	4.500	-1375	-4375
3.875	3.584	.318	.163	.109	4.600	-1387	-4387
4.000	3.700	.318	.163	.109	4.780	-1400	-4400
4.250	3.989	.318	.176	.109	5.000	-1425	-4425
4.500	4.223	.285	.128	.109	5.370	-1450	-4450
4.750	4.458	.303	.136	.109	5.670	-1475	-4475
5.000	4.692	.360	.194	.109	5.960	-1500	-4500

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG OVER THE SHAFT PRIOR TO INSTALLATION INTO THE GROOVE.

SECTION 103

RING, RETAINING, EXTERNAL, BEVELED
APPLICABLE DOCUMENT: MS16630



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	1.000 1.062 TO 3.250 INCL 3.500 AND OVER	ROCKWELL C 47-53 ROCKWELL C-47-52 ROCKWELL C-45-50	CADMIUM PLATE
CRES	——	ROCKWELL C-44-51 (ALL RINGS)	PASSIVATE

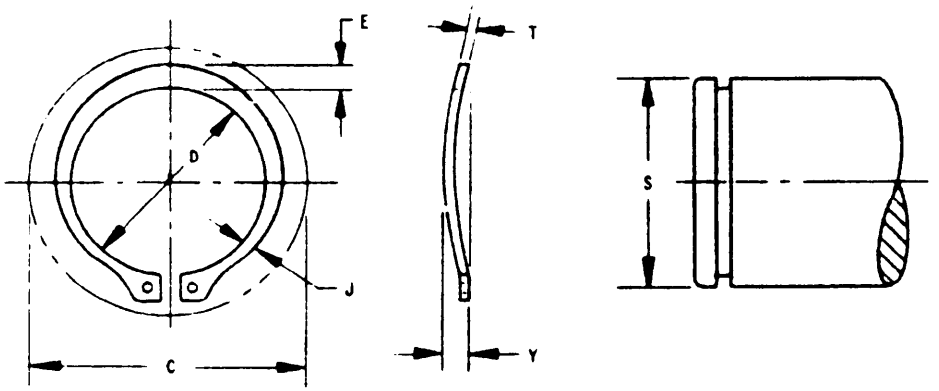
NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFER
FROM	TO	STEEL AND CRES
1.000	——	1340 LB
1.062	1.500	1950 LB
1.562	2.000	3000 LB
2.062	2.687	5000 LB
2.750	3.250	7350 LB
3.500	4.000	10500 LB

S SHAFT DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16630 DASH NUMBER	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
1.000	.925	.116	.065	.062	1.410	-1100	-4100
1.062	.982	.122	.069	.050	1.500	-1106	-4106
1.125	1.041	.128	.071	.050	1.550	-1112	-4112
1.188	1.098	.132	.072	.050	1.610	-1118	-4118
1.250	1.156	.140	.076	.050	1.690	-1125	-4125
1.312	1.214	.146	.076	.050	1.750	-1131	-4131
1.375	1.272	.152	.082	.050	1.800	-1137	-4137
1.438	1.333	.160	.086	.050	1.870	-1143	-4143
1.500	1.387	.168	.091	.050	1.990	-1150	-4150
1.562	1.446	.172	.093	.062	2.100	-1156	-4156
1.625	1.503	.180	.097	.062	2.170	-1162	-4162
1.687	1.560	.184	.099	.062	2.240	-1168	-4168
1.750	1.618	.188	.101	.062	2.310	-1175	-4175
1.812	1.675	.192	.102	.062	2.380	-1181	-4181
1.875	1.735	.196	.104	.062	2.440	-1187	-4187
2.000	1.850	.204	.108	.062	2.550	-1200	-4200
2.062	1.906	.208	.111	.078	2.680	-1206	-4206
2.125	1.964	.212	.113	.078	2.750	-1212	-4212
2.250	2.081	.220	.116	.078	2.870	-1225	-4225
2.312	2.139	.222	.118	.078	2.940	-1231	-4231
2.375	2.197	.224	.119	.078	3.010	-1237	-4237
2.437	2.255	.228	.120	.078	3.070	-1243	-4243
2.500	2.313	.232	.122	.078	3.120	-1250	-4250
2.625	2.428	.282	.127	.078	3.230	-1262	-4262
2.687	2.485	.246	.129	.078	3.320	-1268	-4268
2.750	2.543	.248	.131	.093	3.440	-1275	-4275
2.875	2.659	.256	.133	.093	3.570	-1287	-4287
2.937	2.717	.260	.136	.093	3.640	-1293	-4293
3.000	2.775	.264	.138	.093	3.690	-1300	-4300
3.125	2.892	.272	.141	.093	3.820	-1312	-4312
3.250	3.006	.280	.145	.093	3.940	-1325	-4325
3.500	3.237	.285	.148	.109	4.250	-1350	-4350
3.625	3.352	.296	.153	.109	4.370	-1362	-4362
3.750	3.468	.310	.160	.109	4.500	-1375	-4375
3.875	3.584	.318	.163	.109	4.600	-1387	-4387
4.000	3.700	.318	.163	.109	4.780	-1400	-4400

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG OVER THE SHAFT PRIOR TO INSTALLATION INTO GROOVE

SECTION :04

RING, RETAINING, EXTERNAL, BOWED
APPLICABLE DOCUMENTS: MS16628



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.250 TO .469 INCL	ROCKWELL 30N-69.5-73	CADMIUM PLATE
	.500 TO .812 INCL	ROCKWELL 30N-66-71	
	.875 TO 1.000 INCL	ROCKWELL C-47-53	
	1.062 TO 1.500 INCL	ROCKWELL C-47-52	
CRES	.250 TO .812 INCL	ROCKWELL 30N-63-69.5	PASSIVATE
	.875 TO 1.500 INCL	ROCKWELL C-44-51	

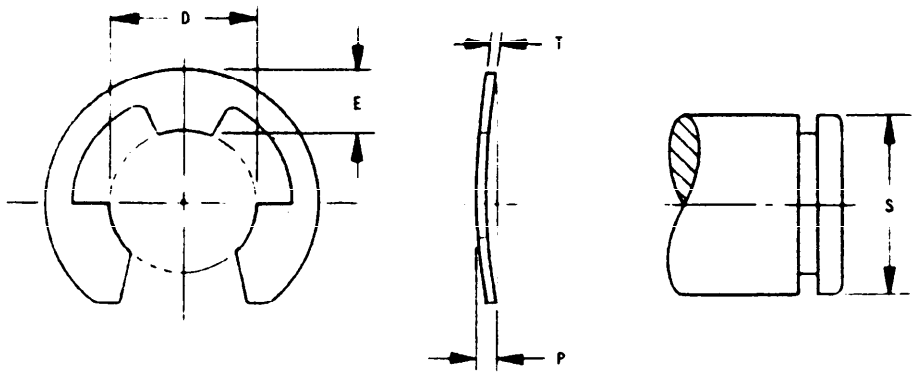
NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL OR CRES
.250	.469	470 LB
.500	.625	910 LB
.688	1.000	1340 LB
1.062	1.500	1950 LB

S SHAFT DIAMETER	D FREE DIAMETER	E	J	T	Y	C 1/	MS16625 DASH NUMBERS	
							STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.250	.225	.035	.025	.025	.047	.450	-1025	-4025
.281	.256	.038	.025	.025	.047	.490	-1028	-4028
.312	.281	.040	.026	.025	.047	.540	-1031	-4031
.344	.309	.042	.026	.025	.047	.570	-1034	-4034
.375	.338	.050	.030	.025	.047	.610	-1037	-4037
.406	.366	.054	.033	.025	.047	.630	-1040	-4040
.438	.395	.055	.033	.025	.047	.660	-1043	-4043
.469	.428	.060	.035	.025	.047	.680	-1046	-4046
.500	.461	.065	.040	.035	.063	.770	-1050	-4050
.562	.521	.072	.041	.035	.063	.820	-1056	-4056
.625	.579	.080	.045	.035	.063	.900	-1062	-4062
.688	.635	.084	.048	.042	.073	1.010	-1068	-4068
.750	.693	.092	.051	.042	.073	1.090	-1075	-4075
.812	.751	.096	.054	.042	.073	1.150	-1081	-4081
.875	.810	.104	.057	.042	.073	1.210	-1087	-4087
.938	.867	.110	.063	.042	.073	1.340	-1093	-4093
1.000	.925	.116	.065	.042	.073	1.410	-1100	-4100
1.062	.982	.122	.069	.050	.085	1.500	-1106	-4106
1.125	1.041	.128	.071	.050	.085	1.550	-1112	-4112
1.188	1.098	.132	.072	.050	.085	1.610	-1118	-4118
1.250	1.156	.140	.076	.050	.085	1.690	-1125	-4125
1.312	1.214	.146	.076	.050	.085	1.750	-1131	-4131
1.375	1.272	.152	.082	.050	.085	1.800	-1137	-4137
1.438	1.333	.160	.086	.050	.085	1.870	-1143	-4143
1.500	1.387	.168	.091	.050	.085	1.990	-1150	-4150

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG OVER THE SHAFT PRIOR TO INSTALLATION IN THE GROOVE.

SECTION 105

RING, RETAINING, EXTERNAL, BOWED "E"
APPLICABLE DOCUMENT: MS16634



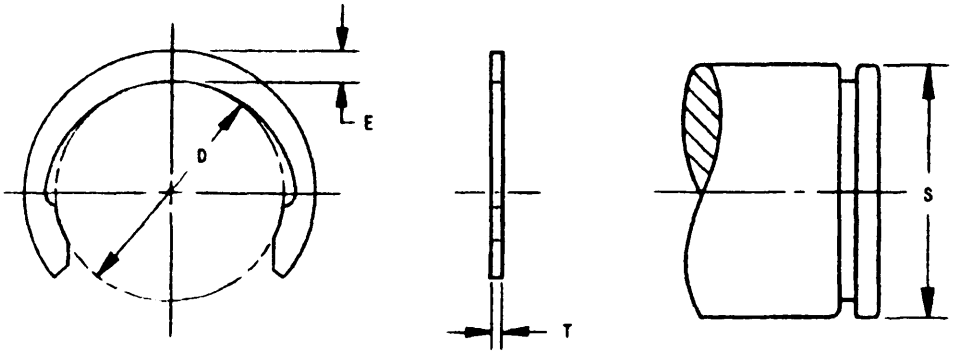
MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.125 TO .219 INCL .250 TO .312 INCL .375 TO 1.375 INCL	ROCKWELL 15N-84.5-87 ROCKWELL 30N-66.5-71 ROCKWELL C-47-52	CADMIUM PLATE
CRES	.125 TO .219 INCL .250 TO .312 INCL .375 TO 1.375 INCL	ROCKWELL 15N.82.5-86 ROCKWELL 30N-63-69.5 ROCKWELL C-44-51	PASSIVATE

S NOMINAL SHAFT DIAMETER	D FREE DIAMETER	E	T	P	MS16634 DASH NUMBER	
					STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.125	.094	.073	.010	.029	-1012	-4012
.156	.114	.090	.015	.035	-1015	-4015
.188	.145	.101	.015	.038	-1018	-4018
.219	.185	.132	.015	.051	-1021	-4021
.250	.207	.167	.025	.060	-1025	-4025
.312	.243	.136	.025	.058	-1031	-4031
.375	.300	.188	.035	.068	-1037	-4037
.438	.337	.183	.035	.068	-1043	-4043
.500	.392	.213	.042	.084	-1050	-4050
.625	.480	.240	.042	.089	-1062	-4062
.750	.574	.283	.050	.100	-1075	-4075
.875	.668	.326	.050	.100	-1087	-4087
1.000	1.066	.297	.062	.124	-1118	-4118
1.375	1.213	.348	.062	.124	-1137	-4137

SECTION 106

RING, RETAINING, EXTERNAL, CRESCENT

APPLICABLE DOCUMENT: MS16632



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.125 TO .188 INCL	ROCKWELL 15N-86-88.5	CADMIUM PLATE
	.219 TO .438 INCL	ROCKWELL 30N-67.5-72	
	.500 TO .812 INCL	ROCKWELL 30N-66-71	
	.875 TO 2.000 INCL	ROCKWELL C-47-52	
CRES	.125 TO .188 INCL	ROCKWELL 15N-82.5-86	PASSIVATE
	.219 TO .812 INCL	ROCKWELL 30N-63-69.5	
	.875 TO 2.000 INCL	ROCKWELL C-44-51	

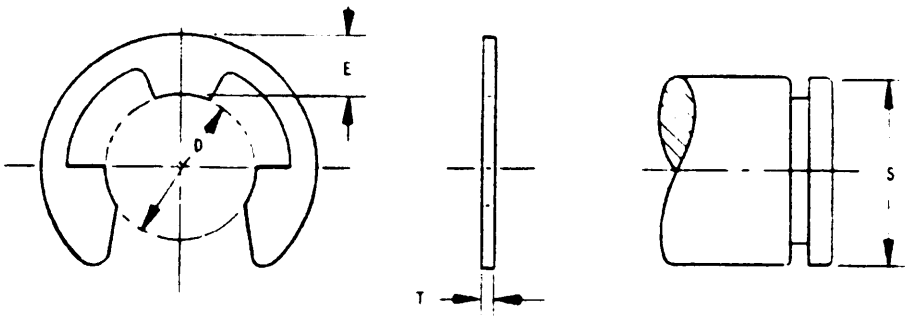
NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	RINGS OF STEEL OR CRES
.125	—	90 LB
.156	—	105 LB
.188	—	110 LB
.219	—	260 LB
.250	—	290 LB
.281	.437	310 LB
.500	.625	610 LB
.688	1.000	880 LB
1.125	1.500	1250 LB
1.750	2.000	1920 LB

S NOMINAL SHAFT DIAMETER	D FREE DIAMETER	E	T	MS16632 DASH NUMBERS	
				STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.125	.102	.031	.015	-1012	-4012
.156	.131	.037	.015	-1015	-4015
.188	.161	.042	.015	-1018	-4018
.219	.187	.044	.025	-1021	-4021
.250	.211	.050	.025	-1025	-4025
.281	.242	.049	.025	-1028	-4028
.312	.270	.053	.025	-1031	-4031
.375	.328	.060	.025	-1037	-4037
.406	.359	.063	.025	-1040	-4040
.438	.386	.065	.025	-1043	-4043
.500	.441	.070	.035	-1050	-4050
.562	.497	.078	.035	-1056	-4056
.625	.553	.081	.035	-1062	-4062
.688	.608	.086	.042	-1068	-4068
.750	.665	.090	.042	-1075	-4075
.812	.721	.097	.042	-1081	-4081
.875	.777	.105	.042	-1087	-4087
.938	.830	.112	.042	-1093	-4093
1.000	.887	.120	.042	-1100	-4100
1.125	.997	.135	.050	-1112	-4112
1.250	1.110	.150	.050	-1125	-4125
1.375	1.220	.165	.050	-1137	-4137
1.500	1.331	.180	.050	-1150	-4150
1.750	1.555	.210	.062	-1175	-4175
2.000	1.777	.240	.062	-1200	-4200

SECTION 107

RING, RETAINING, EXTERNAL "E"

APPLICABLE DOCUMENT: MS16633

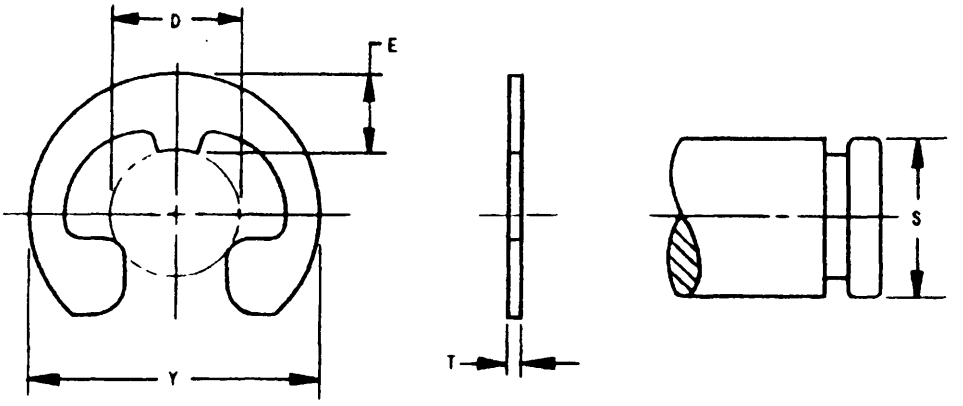


MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.062 TO .125 INCL .156 TO .312 INCL .375 TO 1.375 INCL	ROCKWELL 15N-84.5-87 ROCKWELL 30N-66.5-71 ROCKWELL C-47-52	CADMIUM PLATE
CRES	.062 TO .125 INCL .156 TO .312 INCL .375 TO 1.375 INCL	ROCKWELL 15N-82.5-86 ROCKWELL 30N-63-69.5 ROCKWELL C-44-51	PASSIVATE

S SHAFT DIAMETER	D FREE DIAMETER	E MAX	T	MS16633 DASH NUMBERS	
				STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.062	.051	.057	.010	-1006	-4006
.094	.073	.063	.015	-1009	-4009
.125	.094	.073	.015	-1012	-4012
.156	.114	.090	.025	-1015	-4015
.188	.145	.101	.025	-1018	-4018
.219	.185	.132	.025	-1021	-4021
.250	.207	.167	.025	-1025	-4025
.312	.243	.136	.025	-1031	-4031
.375	.300	.188	.035	-1037	-4037
.438	.337	.183	.035	-1043	-4043
.500	.392	.213	.042	-1050	-4050
.625	.480	.240	.042	-1062	-4062
.750	.574	.283	.050	-1075	-4075
.875	.668	.326	.050	-1087	-4087
1.188	1.066	.297	.062	-1118	-4118
1.375	1.213	.348	.062	-1137	-4137

SECTION 108

RING, RETAINING, EXTERNAL, "E," REINFORCED
APPLICABLE DOCUMENT: MS3215

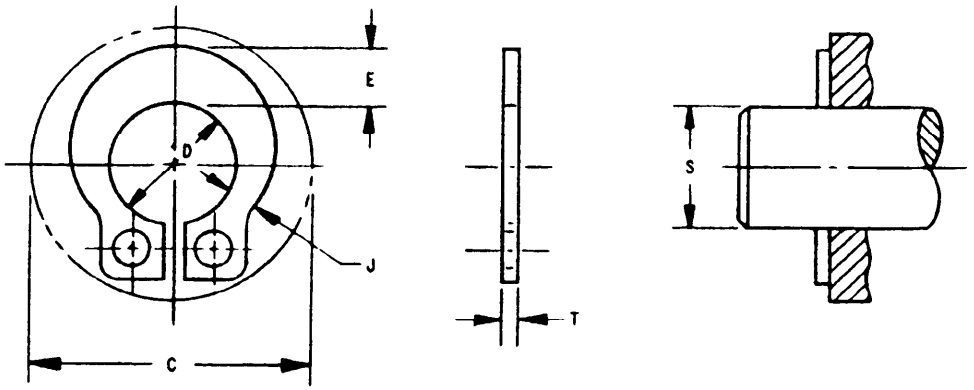


MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.094 AND .125	ROCKWELL 15N-84.5-87	CADMIUM PLATE
	.156 TO .312 INCL	ROCKWELL 30N-66.5-71	
	.375 TO .562 INCL	ROCKWELL C-47-52	
CRES	.094 AND .125	ROCKWELL 15N-82.5-86	PASSIVATE
	.156 TO .312 INCL	ROCKWELL 30N-63-69.5	
	.375 TO .562 INCL	ROCKWELL C-44-51	

S SHAFT DIAMETER	D FREE DIAMETER	E	T	Y FREE OUTSIDE DIAMETER	MS3215 DASH NUMBER	
					STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.094	.072	.073	.015	.206	-1009	-4009
.125	.093	.099	.015	.270	-1012	-4012
.156	.113	.117	.025	.335	-1015	-4015
.188	.143	.122	.025	.375	-1018	-4018
.219	.182	.138	.025	.446	-1021	-4021
.250	.204	.163	.025	.515	-1025	-4025
.312	.242	.181	.035	.588	-1031	-4031
.375	.292	.192	.035	.660	-1037	-4037
.438	.332	.219	.035	.746	-1043	-4043
.500	.385	.222	.042	.810	-1050	-4050
.562	.430	.231	.042	.870	-1056	-4056

SECTION 109

RING, RETAINING, EXTERNAL GRIP
APPLICABLE DOCUMENT: MS90707



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.093 .125 TO .187 INCL .250 TO .750 INCL	ROCKWELL 15N-83.5-86 ROCKWELL 30N-65-69.5 ROCKWELL C-46-51	CADMIUM PLATE
CRES	.093 .125 TO .187 INCL .250 TO .750 INCL	ROCKWELL 15N-82.5-86 ROCKWELL 30N-63-69.5 ROCKWELL C-44-51	PASSIVATE

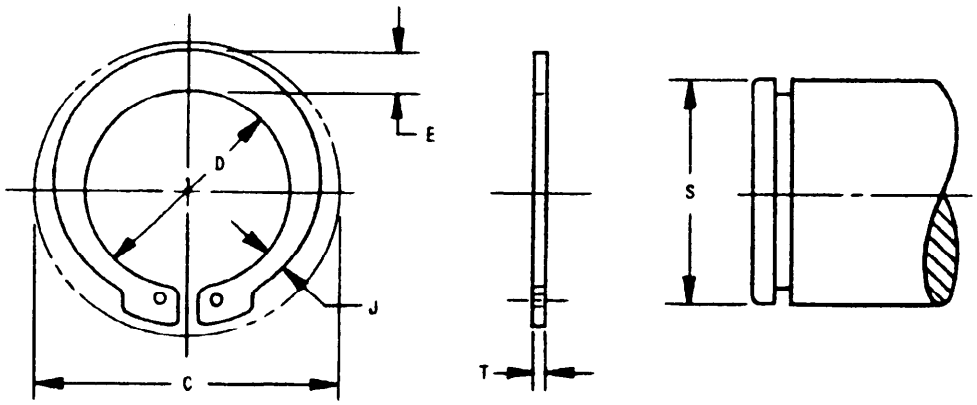
NOMINAL SHAFT DIAMETER	ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITHOUT GROOVE. RETAINED PART SHARP CORNERED RADIUSED OR CHAMFERED
	STEEL OR CRES
.093	10 LB
.125	20 LB
.156	22 LB
.187	25 LB
.250	35 LB
.312	45 LB
.375	60 LB
.437	60 LB
.500	65 LB
.625	85 LB
.750	90 LB

S SHAFT DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS90707 DASH NUMBER	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.094	.089	.045	.028	.025	.26	-1009	-4009
.125	.120	.070	.048	.025	.33	-1012	-4012
.156	.150	.079	.051	.025	.36	-1015	-4015
.187	.181	.086	.052	.035	.44	-1018	-4018
.250	.238	.101	.057	.035	.49	-1025	-4025
.313	.298	.114	.073	.042	.68	-1031	-4031
.376	.354	.125	.075	.042	.74	-1037	-4037
.437	.412	.138	.083	.050	.81	-1043	-4043
.500	.470	.140	.082	.050	.90	-1050	-4050
.625	.593	.175	.100	.062	1.06	-1062	-4062
.750	.706	.176	.104	.062	1.32	-1075	-4075

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG OVER THE SHAFT

SECTION 110

RING, RETAINING, EXTERNAL, HEAVY-DUTY
APPLICABLE DOCUMENT: MS3217



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.500 AND .625 .750 TO 2.000 INCL	ROCKWELL 30N-67.5-72 ROCKWELL C-47-52	CADMIUM PLATE
CRES	.500 AND .625 .750 TO 2.000 INCL	ROCKWELL 30N-63-69.5 ROCKWELL C-44-51	PASSIVATE

NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL OR CRES
——	.500	650 LB
——	.625	750 LB
.750	1.000	2500 LB
1.062	1.375	4000 LB
1.500	1.750	5000 LB
1.938	2.000	6000 LB

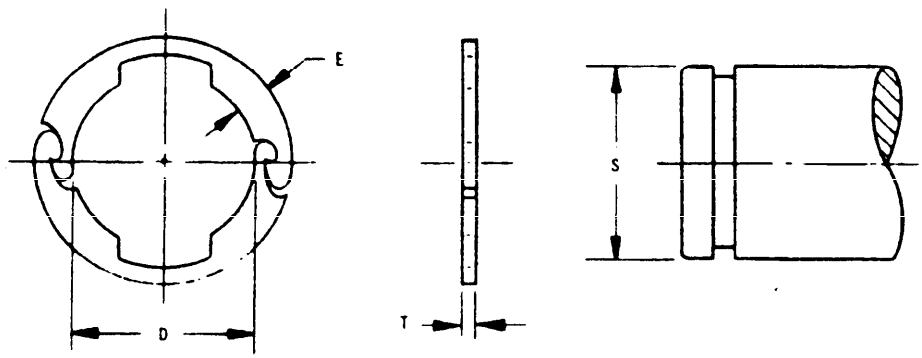
S SHAFT DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS3217 DASH NUMBER	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.500	.460	.090	.050	.050	.75	-1050	-4050
.625	.575	.106	.059	.050	.90	-1062	-4062
.750	.689	.127	.077	.078	1.12	-1075	-4075
.875	.804	.148	.083	.078	1.25	-1087	-4087
1.000	.906	.151	.084	.078	1.37	-1098	-4098
1.062	.978	.161	.090	.093	1.52	-1106	-4106
1.125	1.036	.169	.095	.093	1.58	-1112	-4112
1.188	1.087	.176	.098	.093	1.64	-1118	-4118
1.250	1.150	.185	.103	.093	1.70	-1125	-4125
1.312	1.208	.192	.106	.093	1.77	-1131	-4131
1.375	1.268	.200	.110	.093	1.83	-1137	-4137
1.500	1.380	.218	.123	.109	2.08	-1150	-4150
1.562	1.437	.225	.127	.109	2.14	-1156	-4156
1.750	1.608	.254	.140	.109	2.34	-1175	-4175
1.938	1.782	.280	.154	.125	2.58	-1193	-4193
2.000	1.840	.290	.160	.125	2.64	-1200	-4200

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG OVER THE SHAFT PRIOR TO INSTALLATION INTO THE GROOVE.

SECTION III

RING, RETAINING, EXTERNAL INTERLOCKING

APPLICABLE DOCUMENT: MS90708



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.469 TO .625 INCL .750 TO 3.375 INCL	ROCKWELL 30N-65.5-70.5 ROCKWELL C-47-52	CADMIUM PLATE
CRES	.469 TO 3.375 INCL	ROCKWELL C-44-51	PASSIVATE

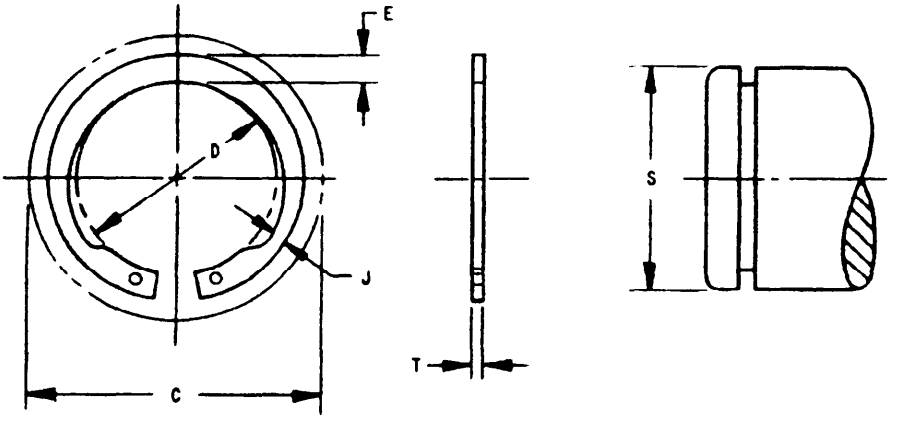
NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL OR CRES
.469	.625	610 LB
.750	.875	880 LB
1.000	1.500	1250 LB
1.562	1.875	1900 LB
2.000	2.625	3050 LB
2.750	3.250	4300 LB
3.375	—	5350 LB

S SHAFT DIAMETER	D FREE DIAMETER	E	T	MS90708 DASH NUMBER	
				STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.469	.414	.105	.035	-1046	-4046
.500	.459	.098	.035	-1050	-4050
.625	.569	.105	.035	-1062	-4062
.750	.673	.135	.042	-1075	-4075
.875	.796	.135	.042	-1087	-4087
1.000	.863	.188	.050	-1098	-4098
1.125	1.002	.188	.050	-1112	-4112
1.188	1.064	.188	.050	-1118	-4118
1.250	1.126	.188	.050	-1125	-4125
1.375	1.250	.188	.050	-1137	-4137
1.500	1.374	.188	.050	-1150	-4150
1.562	1.412	.222	.062	-1156	-4156
1.625	1.474	.222	.062	-1162	-4162
1.750	1.597	.222	.062	-1175	-4175
1.875	1.721	.222	.062	-1187	-4187
2.000	1.809	.262	.078	-1200	-4200
2.125	1.933	.262	.078	-1212	-4212
2.250	2.057	.262	.078	-1225	-4225
2.375	2.180	.262	.078	-1237	-4237
2.500	2.304	.262	.078	-1250	-4250
2.625	2.428	.262	.078	-1262	-4262
2.750	2.518	.323	.093	-1275	-4275
2.875	2.642	.323	.093	-1287	-4287
3.000	2.754	.329	.093	-1300	-4300
3.250	3.013	.325	.093	-1325	-4325
3.375	3.114	.395	.109	-1337	-4337

SECTION 112

RING, RETAINING, EXTERNAL, INVERTED

APPLICABLE DOCUMENT: MS16626



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.500 TO .812 INCL .875 TO 1.000 INCL 1.062 TO 2.875 INCL 3.500	ROCKWELL 30N-66-71 ROCKWELL C-47-53 ROCKWELL C-47-52 ROCKWELL C-45-50	CADMIUM PLATE
CRES	.500 TO .812 INCL .875 TO 1.000 INCL ABOVE 1.000	ROCKWELL 30N-63-69.5 ROCKWELL C-44-51 NONE SPECIFIED	PASSIVATE

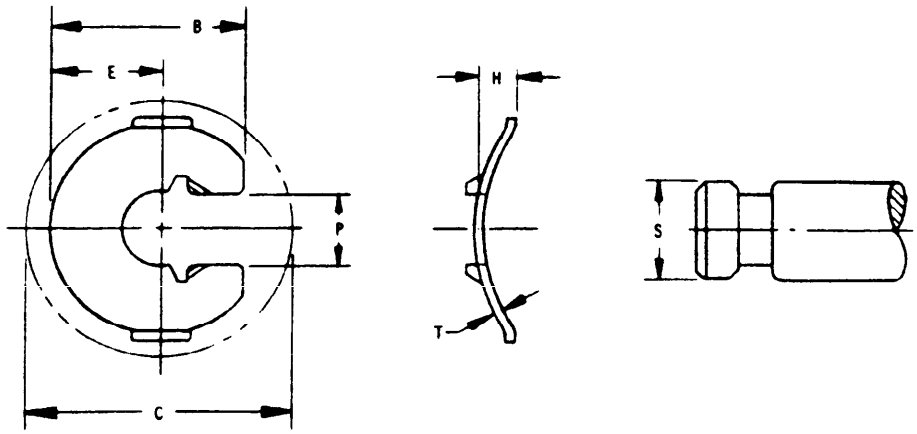
NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	RINGS OF STEEL OR CRES
.500	.625	680 LB
.688	1.000	1000 LB
1.062	1.500	1460 LB
1.563	2.000	2250 LB
2.125	2.500	3750 LB
2.875	—	5500 LB
3.500	—	7850 LB

S SHAFT DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16626 DASH NUMBERS	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.500	.461	.080	.041	.035	.670	-1050	-4050
.562	.521	.088	.043	.035	.750	-1056	-4056
.625	.579	.096	.048	.035	.830	-1062	-4062
.688	.635	.104	.052	.042	.910	-1068	-4068
.750	.693	.112	.056	.042	.990	-1075	-4075
.812	.751	.120	.060	.042	1.080	-1081	-4081
.875	.810	.128	.064	.042	1.150	-1087	-4087
.938	.867	.136	.068	.042	1.230	-1093	-4093
1.000	.925	.144	.072	.042	1.310	-1100	-4100
1.062	.982	.147	.073	.050	1.380	-1106	-4106
1.125	1.041	.150	.075	.050	1.450	-1112	-4112
1.188	1.098	.153	.076	.050	1.520	-1118	-4118
1.250	1.156	.157	.079	.050	1.590	-1125	-4125
1.312	1.214	.161	.080	.050	1.660	-1131	-4131
1.375	1.272	.165	.082	.050	1.730	-1137	-4137
1.438	1.333	.169	.085	.050	1.800	-1143	-4143
1.500	1.387	.173	.086	.050	1.870	-1150	-4150
1.562	1.446	.178	.089	.062	1.950	-1156	-4156
1.750	1.637	.196	.098	.062	2.180	-1175	-4175
1.812	1.675	.199	.100	.062	2.240	-1181	-4181
2.000	1.850	.216	.108	.062	2.470	-1200	-4200
2.125	1.993	.229	.117	.078	2.620	-1212	-4212
2.500	2.313	.259	.130	.078	3.050	-1250	-4250
2.875	2.659	.290	.145	.093	3.490	-1287	-4287
3.500	3.237	.345	.173	.109	4.220	-1350	-4350

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG OVER THE SHAFT, PRIOR TO INSTALLATION INTO THE GROOVE.

SECTION 113

RING, RETAINING, EXTERNAL, PRONG LOCK
APPLICABLE DOCUMENT: MS3216



MATERIAL	SHAFT DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.094 TO .250 INCL .312 TO .438 INCL	ROCKWELL 15N-83.5-86 ROCKWELL 30N-65-69.5	CADMIUM PLATE
CRES	.094 TO .312 INCL .375 TO .438 INCL	ROCKWELL 15N-82.5-86 ROCKWELL 30N-63-69.5	PASSIVATE

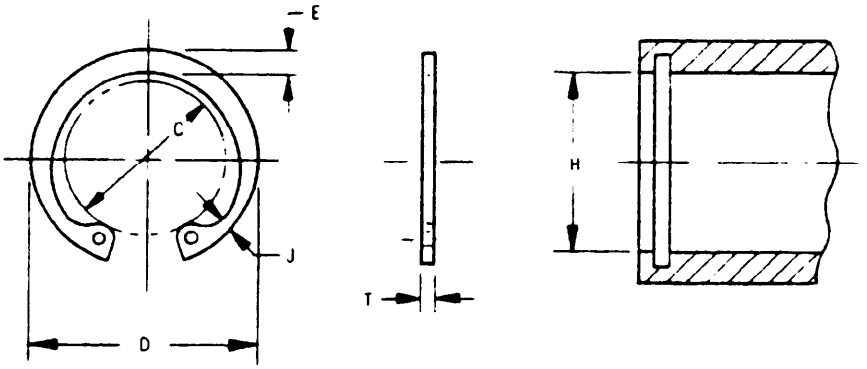
NOMINAL SHAFT DIAMETER	APPROXIMATE AVERAGE RESISTANCE (LB) RINGS OF STEEL AND CORROSION RESISTING STEEL		APPROXIMATE FORCE (LB) TO FLATTEN RINGS OF STEEL AND CORROSION RESISTING STEEL
	1/	2/	
.094	9	3.5	30
.125	8	3	30
.156	8	4	30
.188	20	5.5	60
.250	15	7	60
.312	6	4	60
.375	19	7	80
.438	12	6	80

1/ - AS INSTALLED
2/ - AFTER FLATTENING

S SHAFT DIAMETER	P FREE GAP WIDTH	B	E	H	T	C CLEARANCE DIAMETER	MS3216 DASH NUMBER	
							STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.094	.063	.307	.166	.050	.010	.370	-1009	-4009
.125	.086	.307	.166	.050	.010	.370	-1012	-4012
.156	.108	.330	.184	.055	.010	.410	-1015	-4015
.188	.130	.390	.213	.060	.015	.480	-1018	-4018
.250	.172	.500	.280	.070	.015	.620	-1025	-4025
.312	.234	.620	.360	.095	.015	.790	-1031	-4031
.375	.280	.740	.427	.130	.020	.940	-1037	-4037
.438	.340	.820	.475	.130	.020	1.050	-1043	-4043

SECTION 114

RING, RETAINING, INTERNAL, BASIC
APPLICABLE DOCUMENT: MS16625



MATERIAL	HOUSING DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.250 AND .312 .375 TO .500 INCL .562 TO .750 INCL .812 TO 1.000 INCL 1.062 TO 3.000 INCL 3.125 AND OVER	ROCKWELL 15N-86-88 ROCKWELL 30N-69.5-73 ROCKWELL 30N-67.5-72 ROCKWELL 30N-66-71 ROCKWELL C-47-52 ROCKWELL C-45-52	CADMIUM PLATE
CRES	.250 AND .312 .375 TO 1.000 INCL 1.062 AND OVER	ROCKWELL 15N-82.5-86 ROCKWELL 30N-63-69.5 ROCKWELL C-44-51	PASSIVATE

NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL OR CRES
.250	.312	190 LB
.375	.438	530 LB
.500	.750	1100 LB
.812	.938	1650 LB
1.000	1.500	2400 LB
1.562	2.000	3900 LB
2.062	2.500	6200 LB
2.562	3.000	9000 LB
3.125	5.000	12000 LB

H HOUSING DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16625 DASH NUMBER	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.250	.280	.025	.015	.015	.115	-1025	-4025
.312	.346	.033	.018	.015	.173	-1031	-4031
.375	.415	.040	.028	.025	.204	-1037	-4037
.438	.482	.049	.029	.025	.23	-1043	-4034
.500	.548	.053	.035	.035	.26	-1050	-4050
.562	.620	.053	.035	.035	.275	-1056	-4056
.625	.694	.060	.035	.035	.34	-1062	-4062
.688	.763	.063	.036	.035	.40	-1068	-4068
.750	.831	.070	.040	.035	.45	-1075	-4075
.812	.901	.077	.044	.042	.49	-1081	-4081
.875	.971	.084	.045	.042	.545	-1087	-4087
.938	1.041	.091	.050	.042	.61	-1093	-4093
1.000	1.111	.104	.052	.042	.665	-1100	-4100
1.062	1.180	.110	.055	.050	.685	-1106	-4106
1.125	1.249	.116	.057	.050	.745	-1112	-4112
1.188	1.319	.120	.058	.050	.80	-1118	-4118
1.250	1.388	.124	.062	.050	.875	-1125	-4125
1.312	1.456	.130	.062	.050	.93	-1131	-4131
1.375	1.526	.130	.063	.050	.99	-1137	-4137
1.438	1.596	.133	.065	.050	1.06	-1143	-4143
1.500	1.660	.133	.066	.050	1.12	-1150	-4150
1.562	1.734	.157	.078	.062	1.14	-1156	-4156
1.625	1.804	.164	.082	.062	1.15	-1162	-4162
1.688	1.874	.170	.085	.062	1.21	-1168	-4168
1.750	1.942	.171	.083	.062	1.26	-1175	-4175
1.812	2.012	.170	.084	.062	1.32	-1181	-4181
1.875	2.072	.170	.085	.062	1.39	-1187	-4187
1.938	2.141	.170	.085	.062	1.45	-1193	-4193

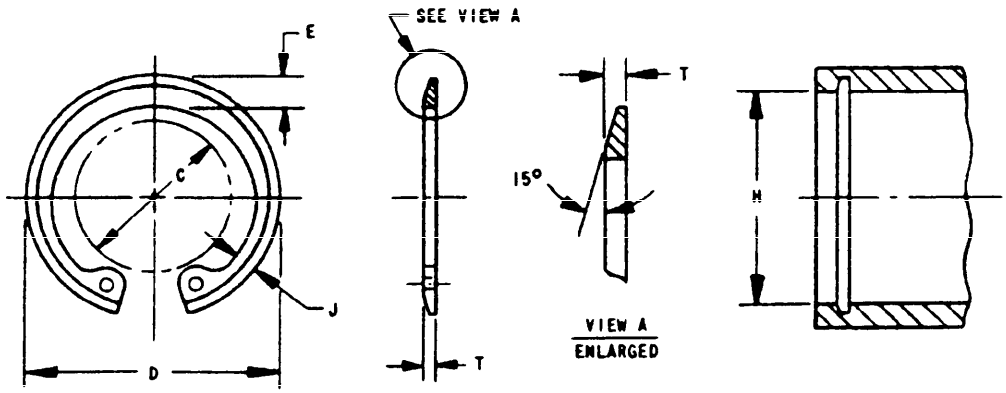
H HOUSING DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16625 DASH NUMBER	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
2.000	2.210	.170	.085	.062	1.50	-1200	-4200
2.062	2.280	.186	.091	.078	1.54	-1206	-4206
2.125	2.350	.195	.096	.078	1.58	-1212	-4212
2.188	2.415	.199	.098	.078	1.64	-1218	-4218
2.250	2.490	.203	.099	.078	1.69	-1225	-4225
2.312	2.560	.206	.100	.078	1.75	-1231	-4231
2.375	2.630	.207	.102	.078	1.81	-1237	-4237
2.500	2.775	.210	.103	.078	1.91	-1250	-4250
2.562	2.844	.222	.109	.093	1.95	-1256	-4256
2.625	2.910	.226	.111	.093	2.02	-1262	-4262
2.688	2.980	.230	.113	.093	2.06	-1268	-4268
2.750	3.050	.234	.115	.093	2.12	-1275	-4275
2.812	3.121	.230	.115	.093	2.18	-1281	-4281
2.875	3.191	.240	.120	.093	2.22	-1287	-4287
3.000	3.325	.250	.122	.093	2.35	-1300	-4300
3.125	3.488	.259	.129	.109	2.47	-1312	-4312
3.250	3.623	.269	.135	.109	2.54	-1325	-4325
3.500	3.890	.289	.142	.109	2.79	-1350	-4350
3.625	4.024	.299	.150	.109	2.91	-1362	-4362
3.750	4.157	.309	.155	.109	3.03	-1375	-4375
3.875	4.291	.319	.160	.109	3.11	-1387	-4387
4.000	4.424	.330	.166	.109	3.23	-1400	-4400
4.250	4.691	.335	.180	.109	3.48	-1425	-4425
4.500	4.940	.351	.181	.109	3.66	-1450	-4450
4.750	5.213	.370	.183	.109	3.90	-1475	-4475
5.000	5.485	.390	.186	.109	4.08	-1500	-4500

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG INTO THE HOUSING. PRIOR TO INSTALLATION INTO THE GROOVE.

SECTION 115

RING, RETAINING, INTERNAL, BEVELED

APPLICABLE DOCUMENT: MS16631



MATERIAL	HOUSING DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	1.000	ROCKWELL 30N-66-71	CADMIUM PLATE
	1.062 TO 3.000 INCL	ROCKWELL C-47-52	
	3.125 AND OVER	ROCKWELL C-45-52	
CRES	1.000	ROCKWELL 30N-63-69.5	PASSIVATE
	1.062 AND OVER	ROCKWELL C-44-51	

NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD, FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL OR CRES
1.000	1.500	2400 LB
1.562	2.000	3900 LB
2.062	2.500	6200 LB
2.562	3.000	9000 LB
3.125	5.000	12000 LB

H HOUSING DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS3320 PART NUMBERS STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
1.000	1.111	.104	.052	.042	.665	-1100	-4100
1.062	1.180	.110	.055	.050	.685	-1106	-4106
1.125	1.249	.116	.057	.050	.745	-1112	-4112
1.188	1.319	.120	.058	.050	.80	-1118	-4118
1.250	1.388	.124	.062	.050	.875	-1125	-4125
1.312	1.456	.130	.062	.050	.93	-1131	-4131
1.375	1.526	.130	.063	.050	.99	-1137	-4137
1.438	1.596	.133	.065	.050	1.06	-1143	-4143
1.500	1.660	.133	.066	.050	1.12	-1150	-4150
1.562	1.734	.157	.078	.062	1.14	-1156	-4156
1.625	1.804	.164	.082	.062	1.15	-1162	-4162
1.688	1.874	.170	.085	.062	1.21	-1168	-4168
1.750	1.942	.171	.083	.062	1.26	-1175	-4175
1.812	2.012	.170	.084	.062	1.32	-1181	-4181
1.875	2.072	.170	.085	.062	1.39	-1187	-4187
1.938	2.141	.170	.085	.062	1.45	-1193	-4193
2.000	2.210	.170	.085	.062	1.50	-1200	-4200
2.062	2.280	.186	.091	.078	1.54	-1206	-4206
2.125	2.350	.195	.096	.078	1.58	-1212	-4212
2.188	2.415	.199	.098	.078	1.64	-1218	-4218
2.250	2.490	.203	.099	.078	1.69	-1225	-4225
2.312	2.560	.206	.100	.078	1.75	-1231	-4231
2.375	2.630	.207	.102	.078	1.81	-1237	-4237
2.500	2.775	.210	.103	.078	1.91	-1250	-4250

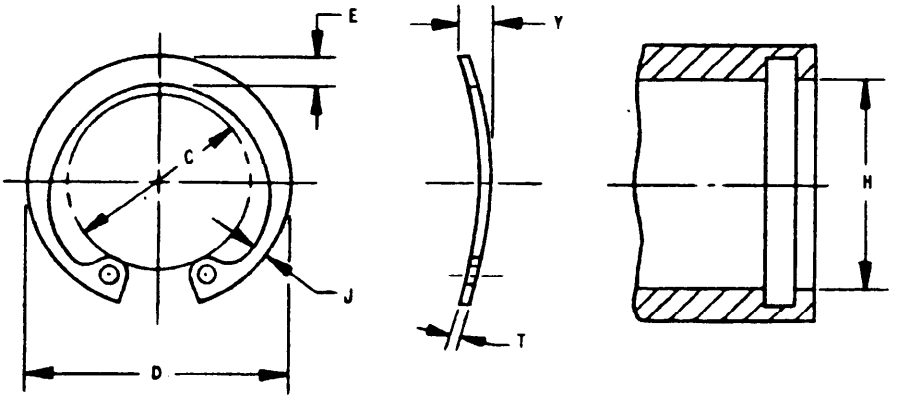
H HOUSING DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16631 PART NUMBERS	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
2.562	2.844	.222	.109	.093	1.95	-1256	-4256
2.625	2.910	.226	.111	.093	2.02	-1262	-4262
2.688	2.980	.230	.113	.093	2.06	-1268	-4268
2.750	3.050	.234	.115	.093	2.12	-1275	-4275
2.812	3.121	.230	.115	.093	2.18	-1281	-4281
2.875	3.191	.240	.120	.093	2.22	-1287	-4287
3.000	3.325	.250	.122	.093	2.35	-1300	-4300
3.125	3.488	.259	.129	.109	2.47	-1312	-4312
3.250	3.623	.269	.135	.109	2.54	-1325	-4325
3.500	3.890	.289	.142	.109	2.79	-1350	-4350
3.625	4.024	.299	.150	.109	2.91	-1362	-4362
3.750	4.157	.309	.155	.109	3.03	-1375	-4375
3.875	4.291	.319	.160	.109	3.11	-1387	-4387
4.000	4.424	.330	.166	.109	3.23	-1400	-4400
4.250	4.691	.335	.180	.109	3.48	-1425	-4425
4.500	4.940	.351	.181	.109	3.66	-1450	-4450
4.750	5.213	.370	.183	.109	3.90	-1475	-4475
5.000	5.485	.390	.186	.109	4.08	-1500	-4500

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG INTO THE HOUSING. PRIOR TO INSTALLATION INTO THE GROOVE.

SECTION 116

RING, RETAINING, INTERNAL, BOWED

APPLICABLE DOCUMENT: MS16629



MATERIAL	HOUSING DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.250 AND .312 .375 TO .500 INCL .562 TO .750 INCL .812 TO 1.000 INCL 1.062 TO 1.500 INCL	ROCKWELL 15N-86-88 ROCKWELL 30N-69.5-73 ROCKWELL 30N-67.5-72 ROCKWELL 30N-66-71 ROCKWELL C-47-52	CADMIUM PLATE
CRES	.250 AND .312 .375 TO 1.000 INCL 1.062 TO 1.500 INCL	ROCKWELL 15N-82.5-86 ROCKWELL 30N-63-69.5 ROCKWELL C-44-51	PASSIVATE

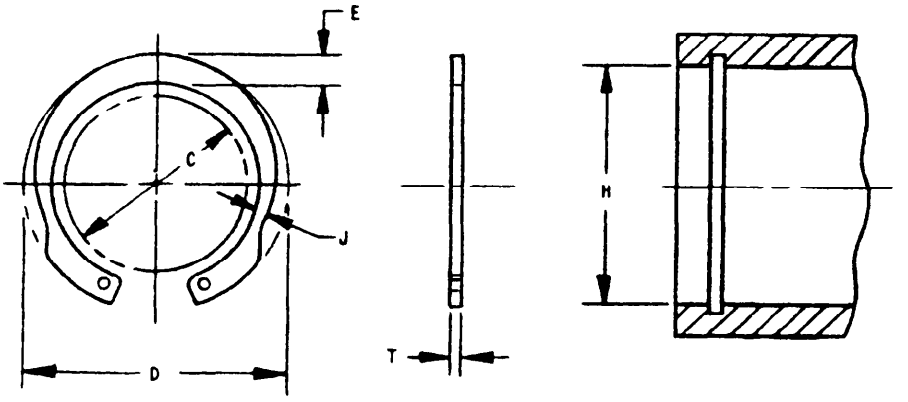
NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL AND CRES
.250	.312	190 LB
.375	.438	530 LB
.500	.750	1100 LB
.812	.938	1650 LB
1.000	1.500	2400 LB

H HOUSING DIAMETER	D FREE DIAMETER	E	J	T	Y	C 1/	MS16629 DASH NUMBERS	
							STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.250	.280	.025	.015	.015	.036	.115	-1025	-4025
.312	.346	.033	.018	.015	.036	.173	-1031	-4031
.375	.415	.040	.028	.025	.047	.204	-1037	-4037
.438	.482	.049	.029	.025	.047	.23	-1043	-4043
.500	.548	.053	.035	.035	.063	.26	-1050	-4050
.562	.620	.053	.035	.035	.063	.275	-1056	-4056
.625	.694	.060	.035	.035	.063	.34	-1062	-4062
.688	.763	.063	.036	.035	.063	.40	-1068	-4068
.750	.831	.070	.040	.035	.063	.45	-1075	-4075
.812	.901	.077	.044	.042	.073	.49	-1081	-4081
.875	.971	.084	.045	.042	.073	.545	-1087	-4087
.938	1.041	.091	.050	.042	.073	.61	-1093	-4093
1.000	1.111	.104	.052	.042	.073	.665	-1100	-4100
1.062	1.180	.110	.055	.050	.085	.685	-1106	-4106
1.125	1.249	.116	.057	.050	.085	.745	-1112	-4112
1.188	1.319	.120	.058	.050	.085	.80	-1118	-4118
1.250	1.388	.124	.062	.050	.085	.875	-1125	-4125
1.312	1.456	.124	.062	.050	.085	.93	-1131	-4131
1.375	1.526	.130	.063	.050	.085	.99	-1137	-4137
1.438	1.596	.133	.065	.050	.085	1.06	-1143	-4143
1.500	1.660	.133	.066	.050	.085	1.12	-1150	-4150

1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG INTO THE HOUSING. PRIOR TO INSTALLATION INTO GROOVE.

SECTION 117

RING, RETAINING, INTERNAL, INVERTED
APPLICABLE DOCUMENT: MS16627



MATERIAL	HOUSING DIAMETER	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.750	ROCKWELL 30N-67.5-72	CADMIUM PLATE
	.813 TO 1.000 INCL	ROCKWELL 30N-66-71	
	1.062 TO 3.000 INCL	ROCKWELL C-47-52	
	3.500	ROCKWELL C-45-50	
	4.000	NONE SPECIFIED	
CRES	.750 TO 1.000 INCL	ROCKWELL 30N-63-69.5	PASSIVATE
	1.062 TO 3.500 INCL	ROCKWELL C-44-51	
	4.000	NONE SPECIFIED	

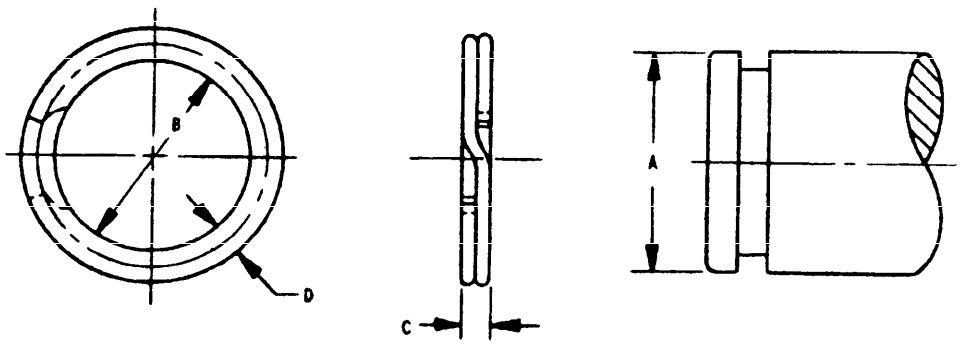
NOMINAL SHAFT DIAMETER		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS
FROM	TO	STEEL OR CRES
.750	——	850 LB
.812	1.000	1250 LB
1.063	1.500	1800 LB
1.562	2.000	2900 LB
2.062	2.500	4600 LB
2.625	3.000	6700 LB
3.500	——	9000 LB
4.000	——	NONE SPECIFIED

H HOUSING DIAMETER	D FREE DIAMETER	E	J	T	C 1/	MS16627 DASH NUMBERS	
						STEEL CADMIUM PLATED	STEEL CORROSION RESISTING
.750	.808	.085	.042	.035	.560	-1075	-4075
.812	.877	.092	.044	.042	.620	-1081	-4081
.875	.944	.099	.047	.042	.650	-1087	-4087
.938	1.015	.106	.051	.042	.700	-1093	-4093
1.000	1.081	.113	.054	.042	.750	-1100	-4100
1.063	1.150	.120	.057	.050	.800	-1106	-4106
1.125	1.217	.123	.059	.050	.860	-1112	-4112
1.188	1.283	.126	.060	.050	.910	-1118	-4118
1.250	1.351	.129	.061	.050	.970	-1125	-4125
1.312	1.418	.132	.063	.050	1.020	-1131	-4131
1.375	1.486	.135	.065	.050	1.080	-1137	-4137
1.438	1.552	.144	.069	.050	1.130	-1143	-4143
1.500	1.622	.148	.070	.050	1.180	-1150	-4150
1.562	1.688	.158	.074	.062	1.210	-1156	-4156
1.625	1.756	.162	.077	.062	1.270	-1162	-4162
1.688	1.823	.166	.079	.062	1.320	-1168	-4168
1.750	1.891	.170	.082	.062	1.380	-1175	-4175
1.875	2.025	.188	.090	.062	1.470	-1187	-4187
2.000	2.160	.208	.100	.062	1.550	-1200	-4200
2.062	2.224	.21	.106	.078	1.590	-1206	-4206
2.125	2.295	.223	.108	.078	1.650	-1212	-4212
2.375	2.567	.243	.115	.078	1.860	-1237	-4237
2.438	2.634	.248	.117	.078	1.910	-1243	-4243
2.500	2.700	.254	.120	.078	1.960	-1250	-4250
2.625	2.840	.266	.128	.093	2.060	-1262	-4262
2.750	2.975	.278	.134	.093	2.160	-1275	-4275
2.812	3.063	.286	.139	.093	2.210	-1281	-4281
3.000	3.245	.302	.143	.093	2.360	-1300	-4300
3.500	3.780	.324	.154	.109	2.820	-1350	-4350
4.000	4.350	.338	.161	.109	3.290	-1400	-4400

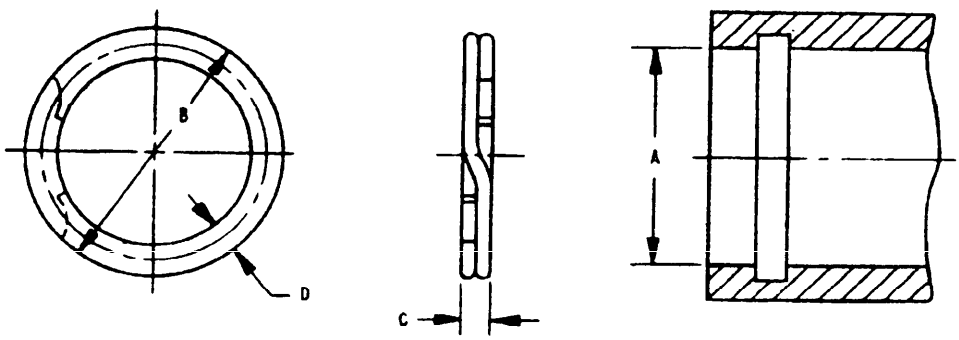
1/ ACTUAL CLEARANCE DIAMETER WHEN THE RING IS SPRUNG INTO THE HOUSING, PRIOR TO INSTALLATION INTO THE GROOVE.

SECTION 118

RING, RETAINING, SPIRAL
APPLICABLE DOCUMENT: MIL-R 27426



TYPE A, (EXTERNAL RING)



TYPE B, (INTERNAL RING)

MATERIAL	MATERIAL THICKNESS	HARDNESS	PROTECTIVE FINISH
STEEL, CARBON	.0068 THRU .0141 .0142 THRU .0212 .0213 THRU .0432 .0433 AND OVER	ROCKWELL 15N-80-87.3 ROCKWELL 30N-60-71 ROCKWELL A-71-77.5 ROCKWELL C-40-51.5	CADMIUM PLATE OR PLAIN
CRES	.008 THRU .015 .016 THRU .022 .023 THRU .047 .048 THRU .062	ROCKWELL 15N-83-86 ROCKWELL 30N-64-69.5 ROCKWELL A-72-74.9 ROCKWELL C-39.8-48.5	PASSIVATE

TABLE I. TYPE A [illegible] RETAINING RING

CLASS 1 (LIGHT)				
A SHAFT DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER
.500	.467	.025	.045	-100
.562	.529	.025	.045	-103
.625	.585	.025	.055	-105
.687	.647	.025	.055	-108
.750	.710	.031	.065	-110
.812	.771	.031	.065	-112
.875	.829	.031	.065	-114
.938	.889	.031	.065	-116
1.000	.946	.037	.075	-119
1.062	1.007	.037	.075	-122
1.125	1.070	.037	.075	-124
1.188	1.127	.043	.085	-126
1.250	1.188	.043	.085	-128
1.312	1.251	.043	.095	-130
1.375	1.308	.043	.095	-132
1.438	1.370	.043	.095	-134
1.500	1.433	.043	.095	-136
1.562	1.490	.049	.108	-137
1.625	1.549	.049	.108	-139
1.687	1.610	.049	.118	-140
1.750	1.673	.049	.118	-141
1.813	1.730	.049	.118	-142
1.875	1.789	.049	.128	-144
1.938	1.844	.049	.128	-145
2.000	1.909	.049	.128	-147
2.062	1.971	.049	.128	-148
2.125	2.029	.049	.128	-149

CLASS 2 (HEAVY)				
A SHAFT DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER
.500	.464	.035	.050	-101
.562	.525	.035	.050	-103
.625	.583	.035	.055	-105
.688	.641	.042	.065	-107
.750	.698	.042	.065	-108
.812	.756	.042	.065	-110
.875	.814	.042	.075	-111
.938	.875	.042	.075	-112
1.000	.932	.042	.085	-114
1.062	.986	.050	.103	-116
1.125	1.047	.050	.103	-117
1.188	1.105	.050	.103	-118
1.250	1.163	.050	.103	-119
1.312	1.218	.050	.113	-120
1.375	1.277	.050	.118	-121
1.438	1.336	.050	.118	-122
1.500	1.385	.050	.118	-123
1.562	1.453	.062	.128	-124
1.625	1.513	.062	.128	-125
1.687	1.573	.062	.128	-126
1.750	1.633	.062	.128	-127
1.813	1.690	.062	.128	-129
1.875	1.751	.062	.158	-130
2.000	1.867	.062	.158	-132
2.062	1.932	.078	.168	-133
2.125	1.989	.078	.168	-134

TABLE I TYPE A (EXTERNAL) RETAINING RING - CONTINUED.

CLASS 1 (LIGHT)					CLASS 2 (HEAVY)				
A SHAFT DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER	A SHAFT DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER
2.188	2.092	.049	.138	-152					
2.250	2.153	.049	.138	-153	2.250	2.105	.078	.168	-136
2.312	2.211	.049	.138	-154	2.312	2.163	.078	.168	-137
2.375	2.273	.049	.138	-156	2.375	2.223	.078	.200	-138
2.437	2.331	.049	.148	-157	2.437	2.283	.078	.200	-139
2.500	2.394	.049	.148	-158	2.500	2.343	.078	.200	-140
2.562	2.452	.049	.148	-160					
2.625	2.514	.049	.148	-161	2.625	2.464	.078	.200	-142
2.688	2.572	.049	.158	-162	2.688	2.523	.078	.200	-143
2.750	2.635	.049	.158	-163	2.750	2.584	.093	.225	-144
2.813	2.696	.049	.168	-164					
2.875	2.755	.049	.168	-165	2.875	2.702	.093	.225	-145
2.937	2.817	.049	.168	-166	2.937	2.760	.093	.225	-146
3.000	2.877	.061	.168	-168	3.000	2.818	.093	.225	-147
3.125	3.000	.061	.178	-170	3.125	2.936	.093	.225	-149
3.250	3.121	.061	.178	-173	3.250	3.054	.093	.225	-151
3.375	3.242	.061	.188	-176					
3.500	3.363	.061	.188	-178	3.500	3.293	.111	.270	-154
3.625	3.483	.061	.198	-181	3.625	3.411	.111	.270	-156
3.750	3.606	.061	.198	-184	3.750	3.527	.111	.270	-158
3.875	3.724	.061	.208	-186	3.875	3.647	.111	.270	-159
4.000	3.842	.061	.218	-188	4.000	3.765	.111	.270	-161
4.250	4.084	.061	.228	-193	4.250	4.037	.111	.270	-162
4.500	4.326	.061	.239	-198	4.500	4.280	.111	.270	-164
4.750	4.571	.072	.250	-203	4.750	4.518	.111	.270	-165
5.000	4.820	.072	.250	-207	5.000	4.756	.111	.270	-166

TABLE II. TYPE B (INTERNAL) RETAINING RING.

CLASS 1 (LIGHT)				
A HOUSING DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER
.500	.532	.025	.045	-100
.562	.594	.025	.045	-103
.625	.658	.025	.045	-105
.687	.720	.025	.045	-107
.750	.790	.031	.065	-109
.812	.853	.031	.065	-112
.875	.922	.031	.065	-115
.938	.986	.031	.065	-117
1.000	1.054	.037	.075	-120
1.062	1.117	.037	.075	-123
1.125	1.180	.037	.075	-125
1.188	1.249	.043	.085	-127
1.250	1.312	.043	.085	-129
1.312	1.374	.043	.085	-131
1.375	1.442	.043	.095	-133
1.437	1.504	.043	.095	-135
1.500	1.567	.043	.095	-138
1.562	1.634	.049	.108	-139
1.625	1.701	.049	.108	-141
1.688	1.768	.049	.118	-143
1.750	1.834	.049	.118	-144
1.813	1.894	.049	.118	-145
1.875	1.960	.049	.118	-147
1.938	2.025	.049	.118	-148
2.000	2.091	.049	.128	-149
2.062	2.154	.049	.128	-151
2.125	2.217	.049	.128	-152
2.188	2.284	.049	.138	-154
2.250	2.347	.049	.138	-155

CLASS 2 (HEAVY)				
A HOUSING DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER
.500	.538	.035	.045	-100
.562	.605	.035	.055	-102
.625	.675	.035	.055	-103
.688	.743	.035	.065	-104
.750	.807	.035	.065	-105
.812	.873	.042	.075	-107
.875	.943	.042	.085	-109
.938	1.013	.042	.085	-111
1.000	1.080	.042	.085	-112
1.062	1.138	.050	.103	-114
1.125	1.205	.050	.103	-115
1.188	1.271	.050	.103	-116
1.250	1.339	.050	.103	-117
1.312	1.406	.050	.118	-118
1.375	1.471	.050	.118	-119
1.500	1.605	.050	.118	-122
1.562	1.675	.062	.128	-123
1.625	1.742	.062	.128	-124
1.688	1.810	.062	.128	-126
1.750	1.876	.062	.128	-127
1.812	1.940	.062	.128	-128
1.875	2.008	.062	.158	-130
1.938	2.075	.062	.158	-131
2.000	2.142	.062	.158	-132
2.062	2.201	.078	.168	-133
2.125	2.267	.078	.168	-134
2.188	2.334	.078	.168	-135
2.250	2.399	.078	.168	-136

TABLE II. TYPE B (INTERNAL) RETAINING RING. CONTINUED

CLASS 1 (LIGHT)					CLASS 2 (HEAVY)				
A HOUSING DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER	A HOUSING DIAMETER	B FREE DIAMETER	C THICKNESS	D RADIAL WALL	DASH NUMBER
2.312	2.403	.049	.138	-156	2.312	2.467	.078	.200	-137
2.375	2.476	.049	.138	-157	2.375	2.535	.078	.200	-138
2.437	2.543	.049	.148	-158					
2.500	2.606	.049	.148	-160	2.500	2.667	.078	.200	-140
2.562	2.673	.049	.148	-162	2.562	2.733	.093	.225	-142
2.625	2.736	.049	.148	-163	2.625	2.801	.093	.225	-143
2.688	2.803	.049	.158	-165	2.688	2.868	.093	.225	-144
2.750	2.865	.049	.158	-166	2.750	2.934	.093	.225	-145
2.813	2.929	.049	.158	-167	2.813	3.001	.093	.225	-146
2.875	2.995	.049	.168	-169	2.875	3.072	.093	.225	-148
2.937	3.058	.049	.168	-170					
3.000	3.122	.061	.168	-172	3.000	3.204	.093	.225	-149
3.125	3.251	.061	.178	-174	3.125	3.333	.111	.281	-151
3.250	3.379	.061	.178	-177	3.250	3.470	.111	.281	-153
3.375	3.509	.061	.188	-180					
3.500	3.636	.061	.188	-182	3.500	3.736	.111	.281	-156
3.625	3.769	.061	.198	-185	3.625	3.868	.111	.281	-159
3.750	3.894	.061	.198	-188	3.750	4.002	.111	.312	-160
3.875	4.025	.061	.208	-190	3.875	4.136	.111	.312	-161
4.000	4.157	.061	.218	-192	4.000	4.270	.111	.312	-163
4.250	4.416	.061	.228	-196	4.250	4.501	.111	.312	-165
4.500	4.674	.061	.238	-201	4.500	4.768	.111	.312	-167
4.750	4.930	.072	.250	-207	4.750	5.030	.111	.312	-169
5.000	5.185	.072	.250	-212	5.000	5.297	.111	.312	-170

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