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(B) ENTIRE STANDARD REVISED

P.A.
NAVY - OS
Other Cust
ARMY - AR
AIRFORCE - 99INTERNATIONAL
INTEREST

TITLE

RING, RETAINING, EXTERNAL, BOWED "E"
(REDUCED SECTION TYPE)PROCUREMENT SPECIFICATION
MIL-R-21248

SUPERSEDES:

MILITARY STANDARD

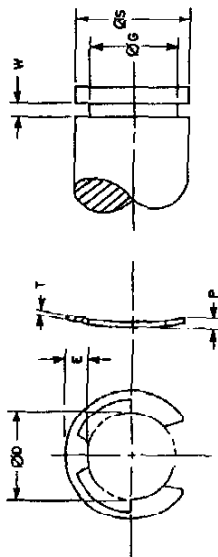
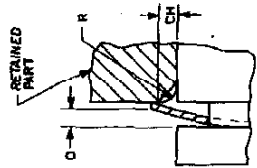
MSI6634

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DD FORM 672-1 (COORDINATED)

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5365 - 0126

GROOVE BOTTOM RADIUS (MAX)
SHAFT DIAMETER .110 TO .250 INCL. - .005
.312 TO .438 INCL. - .010
.500 AND OVER - .015

ENLARGED DETAILS

TABLE 1. DIMENSIONS

Ø S SHAFT (REF)	Ø D FREE	E LARGE SECTION HEIGHT	T THICKNESS	P OVERALL BOW HEIGHT	Ø G RECOMMENDED GROOVE (REF)		W WIDTH GROOVE (REF)	O TAKE UP	R OF RETAINED PART (REF)	
					BASIC	TOL			MAX	MIN
.110	.075	.155	.010	.030	.079	+.002		.013	.080	.060
.125	.084	.073	.010	.030	.096	-.001		.013	.040	.030
.140	.102	.090	.015	.033	.105	FTM 2/		.014	.040	.045
.156	.114	.090	.015	.035	.116			.014	.060	.045
.172	.123	.099	.015	.037	.127	+.003		.016	.060	.045
.188	.145	.101	.015	.038	.147	-.003			.060	.045
.219	.185	.132	.015	.051	.188	FTM 2/		.027	.060	.045
.250	.207	.167	.025	.058	.210			.026	.060	.045
.312	.243	.136	.025	.068	.250			.023	.060	.045
.375	.300	.128	.025		.303			.022	.065	.050
.438	.337	.183	.035	.068	.343			.022	.065	.050
.500	.392	.213	.042	.084	.396	+.004		.030	.080	.060
.625	.480	.240	.042	.089	.485	-.000		.035	.080	.060
.744	.616	.202	.050	.100	.625	.004		.037	.060	.045
.750	.574	.283	.050	.110	.580	FTM 2/		.037	.085	.065
.875	.668	.326	.050							
.984	.822	.349	.050	.100	.775			.037	.085	.065
1.188	1.066	.297	.062	.124	.835	+.005		.037	.085	.065
1.375	1.213	.348	.062	.124	1.079	-.000		.045	.090	.070
					1.230	FTM 2/		.045	.090	.070

1/ = THICKNESS "T" APPLIES TO UNPLATED RINGS. FOR CORROSION RESISTANT STEEL AND PLATED RINGS, +.002 SHOULD BE ADDED TO THE MAXIMUM TOLERANCE, I.E. +.002 SHOULD BE +.004/-.002.

2/ FTM = FULL TOLERANCE MOVEMENT IS THE MAXIMUM ALLOWABLE DEVIATION OF CONCENTRICITY BETWEEN THE GROOVE AND THE SHAFT.

3/ Ø D = END VIEW TAKE-UP (DESIGN REFERENCE DIMENSION).
Ø R AND CH = RADIUS OR CHAMFER ALLOWABLE ON PARTS TO BE RETAINED BY THE RINGS. TOLERANCE LIMITS OF RINGS, RETAINING PARTS WITH CORNER RADIUS OR CHAMFER, SEE NOTE (1) ON PAGE 5.

APPROVED 11 DEC 1958 REVISED (B) 2 MAY 1990

FED SUP CLASS
5365REQUIREMENTS

1. CLASSIFICATION: RETAINING RINGS FURNISHED UNDER THIS STANDARD SHALL BE TYPE II, CLASS 3 OF THE PROCUREMENT SPECIFICATION.
2. MATERIAL:
 - (a) CARBON SPRING STEEL, GRADE 1060 THRU 1095 (UNS G10600 THRU G10950) IN ACCORDANCE WITH ASTM A568 OR ASTM A582.
 - (b) CORROSION RESISTANT STEEL IN ACCORDANCE WITH AISI 5520 (UNS S15700).
 - (c) BERYLLIUM COPPER ALLOY NUMBER 170 (UNS C17000) OR ALLOY NUMBER 172 (UNS C17200) IN ACCORDANCE WITH ASTM B194.
3. HARDNESS:

TABLE II, HARDNESS

Ø SHAFT (INCH)	CARBON STEEL	CORROSION RESISTANT STEEL	BERYLLIUM COPPER
.110 TO .219 INCL	84.5-87HRC	82.5-86HRC	77-82HRC
.220 TO .312 INCL	66.5-71HRC	63-69.5HRC	77-82HRC
.375 TO 1.375 INCL	47-52HRC	44-51HRC	-

4. PROTECTIVE FINISH OR SURFACE TREATMENT:

- (a) CARBON STEEL - SHALL BE AS SPECIFIED (SEE TABLE III OR IV):

- (1) CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3 OR ASTM B696, TYPE II, CLASS 5.
- (2) ZINC COAT IN ACCORDANCE WITH ASTM B633, TYPE II, CLASS Fe/Zn5, OR ASTM B695, TYPE II, CLASS 5.
- (3) PHOSPHATE COAT IN ACCORDANCE WITH DOD-P-16232, TYPE 2, CLASS 2.

- (b) CORROSION RESISTANT STEEL - SHALL BE CLEANED, DESCALED AND PASSIVATED IN ACCORDANCE WITH QQ-P-35.

5. PART NUMBER: THE BASIC NO PART NUMBER IS FOLLOWED BY A DASH NUMBER TAKEN FROM TABLE III OR IV.

EXAMPLE: MS16634-1011 IS THE PART NUMBER FOR A CARBON STEEL CADMIUM PLATE, EXTERNAL, BOWED "E" RETAINING RING FOR USE ON A .110 DIAMETER SHAFT.

NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES.
2. IN THE EVENT OF A CONFLICT BETWEEN THE TEXT OF THIS STANDARD AND THE REFERENCES CITED HEREIN, THE TEXT OF THIS STANDARD SHALL TAKE PRECEDENCE.
3. REFERENCED GOVERNMENT (OR NON-GOVERNMENT) DOCUMENTS OF THE ISSUE LISTED IN THAT ISSUE OF THE DEPARTMENT OF DEFENSE INDEX OF SPECIFICATIONS AND STANDARDS (DDOISS) SPECIFIED IN THE SOLICITATION FORM A PART OF THIS STANDARD TO THE EXTENT SPECIFIED HEREIN.

APPROVED 11 DEC 1958 REVISED 8 FOR CHANGES SEE PAGES 1 THRU 5

PA. NAVY - OS Other Code ARMY - AR AIRFORCE - 99	INTERNATIONAL INTEREST	TITLE RING, RETAINING, EXTERNAL, BOWED "E" (REDUCED SECTION TYPE)	MILITARY STANDARD MS16634
PROCUREMENT SPECIFICATION MIL-R-21248	SUPERSEDES	PAGE 2 OF 6	

DD FORM 672-1 (COORDINATED)

5365 - 0126

USER ACTIVITIES:
ARMY - AL, ER, GL
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5366

TABLE III. DASH NUMBERS FOR MS16634

Ø S SHAFT (REF)	CARBON STEEL 1/ CADMIUM PLATE	CARBON STEEL 1/ ZINC COAT	CARBON STEEL 1/ PHOSPHATE COAT	CORROSION RESISTANT STEEL	BERYLLIUM 1/ COPPER
	DASH NO.	DASH NO.	DASH NO.	DASH NO.	DASH NO.
.110	-1011	-2011	-3011	-4011	-5011
.125	-1012	-2012	-3012	-4012	-5012
.140	-1014	-2014	-3014	-4014	-5014
.156	-1015	-2015	-3015	-4015	-5015
.172	-1017	-2017	-3017	-4017	-5017
.188	-1018	-2018	-3018	-4018	-5018
.219	-1021	-2021	-3021	-4021	-5021
.250	-1025	-2025	-3025	-4025	-5025
.312	-1031	-2031	-3031	-4031	-5031
.375	-1037	-2037	-3037	-4037	-5037
.437	-1043	-2043	-3043	-4043	-5043
.500	-1050	-2050	-3050	-4050	-5050
.625	-1062	-2062	-3062	-4062	-5062
.744	-1074	-2074	-3074	-4074	-5074
.750	-1075	-2075	-3075	-4075	-5075
.875	-1087	-2087	-3087	-4087	-5087
.984	-1098	-2098	-3098	-4098	-5098
1.188	-1118	-2118	-3118	-4118	-5118
1.375	-1137	-2137	-3137	-4137	-5137

1/ SUBSTITUTE CORROSION RESISTANT STEEL WHEN USED IN FOOD PROCESSING MACHINERY, OR IN FUEL OR LUBRICATION SYSTEMS, OR WHEN USED AT TEMPERATURES OVER 450°F (233°C).

TABLE IV. SUBSTITUTION TABLE (CROSS REFERENCE OF PART NUMBERS)

Ø S SHAFT (REF)	INACTIVE	SUBSTITUTE	SUBSTITUTE	SUBSTITUTE
	CARBON STEEL	CARBON 1/ STEEL CADMIUM PLATE	CARBON 1/ STEEL ZINC COAT	CARBON 1/ STEEL PHOSPHATE COAT
	MS16634	MS16634	MS16634	MS16634
.110	-11	-1011	-2011	-3011
.125	-12	-1012	-2012	-3012
.140	-14	-1014	-2014	-3014
.156	-15	-1015	-2015	-3015
.172	-17	-1017	-2017	-3017
.188	-18	-1018	-2018	-3018
.219	-21	-1021	-2021	-3021
.250	-25	-1025	-2025	-3025
.312	-31	-1031	-2031	-3031
.375	-37	-1037	-2037	-3037
.437	-43	-1043	-2043	-3043
.500	-50	-1050	-2050	-3050
.625	-62	-1062	-2062	-3062
.744	-74	-1074	-2074	-3074
.750	-75	-1075	-2075	-3075
.875	-87	-1087	-2087	-3087
.984	-98	-1098	-2098	-3098
1.188	-118	-1118	-2118	-3118
1.375	-137	-1137	-2137	-3137

1/ SUBSTITUTE CORROSION RESISTANT STEEL WHEN USED IN FOOD PROCESSING MACHINERY, OR IN FUEL OR LUBRICATION SYSTEMS, OR WHEN USED AT TEMPERATURES OVER 450°F (233°C).

P.A. NAVY - OS Other Cust ARMY - AR AIRFORCE - 99	INTERNATIONAL INTEREST	TITLE RING, RETAINING, EXTERNAL, BOWED "E" (REDUCED SECTION TYPE)	MILITARY STANDARD MS16634
PROCUREMENT SPECIFICATION MIL-R-21248	SUPERSEDES:	PAGE 3	OF 5

USER ACTIVITIES:
ARMY - AT, ER, GL
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APPROVED 11 DEC 1958
REVISED (B) FOR CHANGES SEE PAGES 1 THRU 5

C-10073

FED SUP CLASS
5365RECOMMENDED DESIGN LIMITATIONS AND USAGE

- (a) INTENDED USE - TO PROVIDE UNUSUALLY LARGE SHOULDERS FOR POSITIONING AND MAINTAINING MACHINE COMPONENTS ON SHAFTS. THEY ARE APPLIED RADially AND WITHSTAND CONSIDERABLE THRUST LOAD. THE RINGS ARE BENT LIKE A BOW OUT OF PLANE. FREE ENDS AND OPPOSITE EDGE ABUT THE MACHINE PART, MID SECTION OF RING ABUTS OUTER GROOVE WALL. RINGS WILL TAKE UP END PLAY RESILIENTLY. THEY ARE OF ADVANTAGE WHERE AXIAL ASSEMBLY OF A BORED RETAINING RING IS NOT POSSIBLE. THE USE OF THE FOLLOWING FORMULAS ARE BASED ON THE FACT THAT THE RING MATERIAL WILL NOT FAIL IN COMPRESSION.

LIMITATION ON USE - THE FOLLOWING FORMULAS ARE NOT TO BE USED FOR BRITTLE MATERIALS SUCH AS CAST IRON, ETC.

WARNING - RINGS SHOULD NOT BE OVER EXPANDED DURING INSTALLATION SINCE THIS WILL LEAD TO RING FAILURES. IF RING HAS PLAY BETWEEN THE GROOVE DIAMETER AND THE INSIDE RING DIAMETER THIS INDICATES THAT THE RING HAS BEEN OVER EXPANDED, (PROVIDING GROOVE HAS BEEN MACHINED TO RECOMMENDED DIMENSIONS).

FOR APPROXIMATE SAFETY RPM LIMITS SEE TABLE V.

TABLE V. APPROXIMATE SAFETY RPM LIMITS

Ø SHAFT (INCHES)		.250	.500	1.000
CARBON STEEL AND CORROSION RESISTANT STEEL	RPM LIMIT	25,000	14,000	6,500
BERYLLIUM COPPER	RPM LIMIT	16,000	9,000	-

- (b) ALLOWABLE THRUST LOAD CAPACITY OF THE RING (ABUTTING COMPONENTS TO HAVE SHARP CORNERS) =

$$P = \frac{157X}{3F}$$

WHERE:

P = ALLOWABLE THRUST LOAD (POUNDS)

S = SHAFT DIAMETER (INCHES)

T = RING THICKNESS (INCHES)

X = ULTIMATE SHEAR STRENGTH OF THE RING MATERIAL (PSI) ^{1/}

F = FACTOR OF SAFETY

A SAFETY FACTOR, F=3, IS RECOMMENDED SINCE THE RING UNDER LOAD IS SUBJECTED NOT ONLY TO PURE SHEAR STRESSES BUT ALSO TO BENDING STRESSES.

- (c) ALLOWABLE LOAD CAPACITY OF GROOVE WALL =

$$P = \frac{WGY}{3F}$$

WHERE:

P = ALLOWABLE COMPRESSION LOAD (POUNDS)

G = GROOVE DIAMETER (INCHES)

d = GROOVE DEPTH (INCHES)

Y = YIELD STRENGTH IN COMPRESSION OF THE GROOVE MATERIAL (PSI)

F = FACTOR OF SAFETY

TO INSURE A SAFE WORKING LOAD, A SAFETY FACTOR, F = 2 IS RECOMMENDED.

- (d) MINIMUM DISTANCE BETWEEN OUTER GROOVE WALL AND END OF SHAFT =

$$Z = 2d$$

WHERE:

Z = MINIMUM DISTANCE BETWEEN OUTER GROOVE WALL AND END OF SHAFT (INCHES)

d = GROOVE DEPTH (INCHES)

- ^{1/} X = 100,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS UP TO AND INCLUDING .219 INCH SHAFT DIAMETER OF CARBON STEEL OR CORROSION RESISTANT STEEL.
 X = 120,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS .250 AND .312 INCH SHAFT DIAMETER OF CARBON STEEL OR CORROSION RESISTANT STEEL.
 X = 150,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS .375 INCH AND OVER SHAFT DIAMETER OF CARBON STEEL OR CORROSION RESISTANT STEEL.
 X = 110,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS OF ALL SHAFT DIAMETERS AND OF BERYLLIUM COPPER.

FOR CHANGES SEE PAGES 1 THRU 5

REVISED

11 DEC 1958

APPROVED

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Other Govt ARMY - AR				MS16634	
AIRFORCE - 99		SUPERSEDES:	PAGE 4 OF 5		
PROCUREMENT SPECIFICATION MIL-R-21248					

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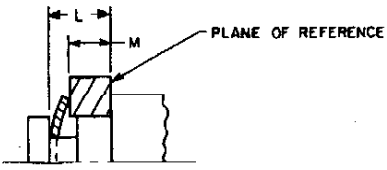
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614920		FED. SUP CLASS 5365	
<p>(e) LOCATION OF GROOVE =</p> $L_{MAX} = M_{MIN} + T_{MIN} + \text{TAKE-UP (AS LISTED)}$ $L_{MIN} = M_{MAX} + T_{MAX} + .005 \frac{1}{2}$ $\text{TAKE-UP} \geq \Delta L + \Delta M + \Delta T + .005$ <p>WHERE:</p> $\Delta L = L_{MAX} - L_{MIN}$ $\Delta M = M_{MAX} - M_{MIN}$ $\Delta T = T_{MAX} - T_{MIN}$			
			
<p>(f) VIBRATION =</p> <p>A RETAINING RING WILL BE SECURE AGAINST VIBRATION IF ITS SHEAR FATIGUE STRENGTH EQUALS OR EXCEEDS THE FORCE CREATED BY THE MASS OF THE PART BEING REPEATEDLY ACCELERATED AGAINST THE RING.</p> <p>(1) SHEAR STRENGTH OF RING (CRITICAL) (ABUTTING COMPONENTS TO HAVE SHARP CORNERS).</p> $.36XTS \geq \frac{W}{g} a$ <p>OR FOR HARMONIC MOTION</p> $.36XTS \geq \frac{W}{g} \delta \omega^2$ <p>WHERE:</p> <p>X = ULTIMATE SHEAR STRENGTH OF RING MATERIAL (PSI) $\frac{1}{2}$</p> <p>T = RING THICKNESS (INCHES)</p> <p>S = SHAFT DIAMETER (INCHES)</p> <p>W = WEIGHT OF ABUTTING PARTS (POUNDS)</p> <p>g = ACCELERATION DUE TO GRAVITY (IN/SEC²)</p> <p>δ = AMPLITUDE OF VIBRATION (INCHES)</p> <p>ω = ANGULAR SPEED (RAD/SEC)</p> <p>a = ACCELERATION (IN/SEC²)</p> <p>(2) COMPRESSION STRENGTH OF GROOVE MATERIAL (CRITICAL).</p> $.55YdG \geq \frac{W}{g} \delta \omega^2$ <p>WHERE:</p> <p>Y = YIELD STRENGTH IN COMPRESSION OF THE GROOVE MATERIAL (PSI)</p> <p>d = GROOVE DEPTH (INCHES)</p> <p>G = GROOVE DIAMETER (INCHES)</p> <p>OTHER SYMBOLS AS SHOWN IN (1)</p>			
<p>(g) IMPACT CAPACITY OF RING OR GROOVE WALL -</p> $I_R = \frac{PT}{2} - \text{FOR THE RING (INCH POUNDS) (ABUTTING COMPONENTS TO HAVE SHARP CORNERS)}$ $I_G = \frac{Pd}{2} - \text{FOR THE GROOVE (INCH POUNDS)}$ <p>WHERE:</p> <p>P = ALLOWABLE THRUST LOAD OF RING OR GROOVE (POUNDS)</p> <p>T = RING THICKNESS (INCHES)</p> <p>I_G = IMPACT CAPACITY OF GROOVE WALL (INCH POUNDS)</p> <p>d = GROOVE DEPTH (INCHES)</p> <p>I_R = IMPACT CAPACITY OF RING (INCH POUNDS)</p>			
<p>(h) LOAD CAPACITY, WITH THE RETAINED PART RADIUSED OR CHAMFERED.</p> <p>THE ALLOWABLE THRUST LOADS, WHEN COMPUTED FROM THE FORMULAS ON PAGE 4, WILL NOT BE AFFECTED WHEN THE (S) RINGS ARE USED AGAINST PARTS HAVING CORNER RADIUS OR CHAMFERS UP TO THE LISTED MAXIMUM DIMENSIONS.</p> <p>1/ IT IS ADVISABLE FOR SAFER RING ASSEMBLY TO CALCULATE L_{MIN} WITH AN ADDITIONAL .005 IN ORDER THAT THE RING IS NOT FLATTENED OUT COMPLETELY IN ADVERSE TOLERANCE CASES.</p> <p>2/ X = 100,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS UP TO AND INCLUDING .219 INCH SHAFT DIAMETER OF CARBON STEEL OR CORROSION RESISTANT STEEL.</p> <p>X = 120,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS .250 AND .312 INCH SHAFT DIAMETER OF CARBON STEEL OR CORROSION RESISTANT STEEL.</p> <p>X = 150,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS .375 INCH AND OVER SHAFT DIAMETER OF CARBON STEEL OR CORROSION RESISTANT STEEL.</p> <p>X = 110,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS OF ALL SHAFT DIAMETERS AND OF BERYLLIUM COPPER.</p>			
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