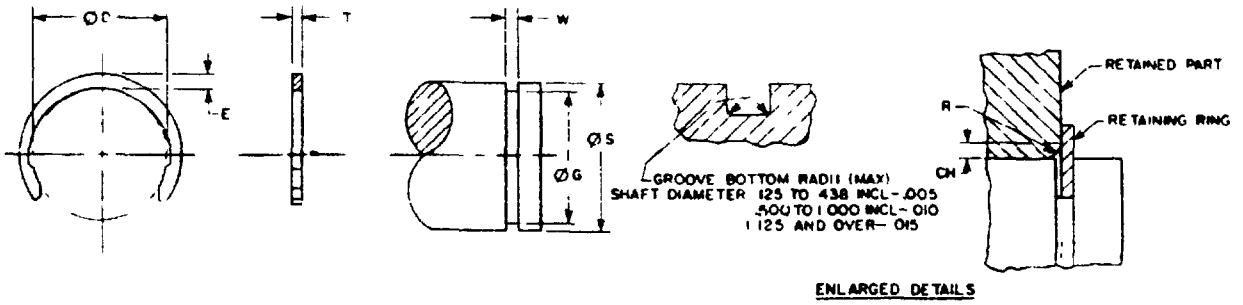
FED SUP CLASS
5365



ENLARGED DETAILS

TABLE I. DIMENSIONS

Ø S SHAFT (REF)		Ø D FREE		E LARGE SECTION HEIGHT		T 1/ THICKNESS		Ø G RECOMMENDED GROOVE (REF)		W WIDTH (REF)		R 3/ CH 3/ OF RETAINED PART (REF)	
INCH	MM	BASIC	TOL	BASIC	TOL	BASIC	TOL	BASIC	TOL	BASIC	TOL	MAX	MAX
.125	3.2	.102	+.002 -.004	.031	±.003	.015		106	± 0015 .0015 FIM 2/	020	+ 002 - 000	014	011
.156	4.0	.131		.037		.015		.135		020		018	.014
.188	4.8	.161		.042		.015		.165		.020		.021	016
.219	5.6	.187		.044		.025		193		.030		021	016
.236	6 0	.203		.046		.025		208		.030		.022	017
.250	6 4	211		.050		.025		220		030		.023	.018
.281	7 1	.242		.052		.025		.247	±.002 .002 FIM 2/	.030		.021	016
.312	7.9	.270	+.003 -.005	.053	±.004	.025		.276		.030		.024	018
.375	9.5	.328		.060		.025		335		030		.026	020
.406	10.3	.359		.063		.025		.364		.030		.027	021
.438	11 1	.386		.065		.025	± 002	393		030		.029	.022
.500	12.7	.441		.070		.035		450		.040	+.003 -.000	.030	023
.562	14.3	.497	±.006	.078		.035		507		040		.033	.025
.625	15.9	.553		.081		.035		563		040		.033	025
.688	17.5	.608		.086	± 005	042		619		047		.034	.026
.750	19.0	.665		.090		042		676	±.003 .004 FIM 2/	.047		.036	.027
.812	20.6	.721	±.007	.097		.042		732		047		038	.029
.875	22.2	.777		.105		.042		789		047		.040	.031
.938	23 8	.830		.112		042		843		047		.043	.033
1.000	25 4	887		.120		.042		.900		.047		.046	.035
1.125	28.6	.997		.135		.050		1 013		.056		.052	.040
1.250	31.7	1.110	±.008	.150		.050		1.126	± 004 .005 FIM 2/	.056	+.004 - 000	.057	.044
1.375	34 9	1.220		165	±.007	.050		1.237		056		.062	.048
1.500	38.1	1.331		180		.050		1 350		.056		.069	053
1 750	44 4	1 555	±.010	210		.062	± 003	1 576	±.005 .005 FIM 2/	.068		.081	062
2.000	50 8	1 777		.240		.062		1.800		068		091	.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/ FIM = (FULL INDICATOR MOVEMENT) IS THE MAXIMUM ALLOWABLE DEVIATION OF CONCENTRICITY BETWEEN THE GROOVE AND THE SHAFT

3/ R AND CH = RADII OR CHAMFERS ALLOWABLE ON PARTS TO BE RETAINED BY THE RING THRUST LOADS OF RINGS, RETAINING PARTS WITH CORNER RADII OR CHAMFERS AS LISTED ABOVE ARE TABULATED ON PAGE 6

Ⓑ ENTIRE STANDARD REVISED

APPROVED 11 DEC 1958 REVISED Ⓑ 30 APRIL 1990

USER ACTIVITIES
ARMY-ER, GL
NAVY-MC, SH, YD

REVIEWER ACTI
ARMY-MI
NAVY-AS
AIR FORCE-82
DLA-IS

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PA
NAVY-OS
Other Cust
ARMY-AR
AIR FORCE-99

INTERNATIONAL INTEREST

TITLE
RING, RETAINING, EXTERNAL, CRESCENT (REDUCED SECTION TYPE)

MILITARY STANDARD
MS16632

PROCUREMENT SPECIFICATION
MIL-R-21248

SUPERSEDES

PAGE 1 OF 6

AMSC N/A

DD 672-1 (OBSOLETE)

5365-0127

REQUIREMENTS

1. CLASSIFICATION. RETAINING RINGS FURNISHED UNDER THIS STANDARD SHALL BE TYPE I, CLASS 6 OF THE PROCUREMENT SPECIFICATION

2 MATERIAL:

(a) CARBON SPRING STEEL, GRADE 1060 THRU 1095 (UNS G10600 THRU G10950) IN ACCORDANCE WITH ASTM A566 OR ASTM A682.

(b) CORROSION RESISTANT STEEL IN ACCORDANCE WITH AMS 5520 (UNS S15700)

(c) BERYLLIUM COPPER ALLOY NUMBER 170 (UNS C17000) OR ALLOY NUMBER 172 (UNS C17200) IN ACCORDANCE WITH ASTM B196

3 HARDNESS

TABLE II HARDNESS

Ø SHAFT (REF)	CARBON STEEL	CORROSION RESISTANT STEEL	BERYLLIUM COPPER
.125 TO .438 INCL	84 5-87.0 HR15N 1/	82 5-86 HR15N 1/	77-82 HR.5N 1/
.500 TO .625 INCL	66 5-71 5 HR30N 1/	67-69 5 HR30N 1/	54-62 HR30N 1/
688 TO 1 000 INCL	52 5-58 5 HR45N 1/	48-56 HR45N 1/	36-47 HR45N 1/
1.125 TO 2.000 INCL	48-53 HRC	44-51 HRC	34-43 HRC

1/ USE HIGHEST SCALE TO PROVIDE SECTION WIDTH EQUAL TO OR GREATER THAN 5 TIMES THE BRALE IMPRESSION DIAMETER

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 I., CLASS 3 OR ASTM B696, TYPE II, CLASS 5

(2) ZINC COAT IN ACCORDANCE WITH ASTM B633, TYPE I., CLASS Fe/Zn5, OR ASTM B695, TYPE II, CLASS 5

(3) PHOSPHATE COAT IN ACCORDANCE WITH DOD-P-16232, TYPE Z, CLASS 2

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

5 PART NUMBER THE BASIC MS PART NUMBER IS FOLLOWED BY A DASH NUMBER TAKEN FROM TABLE III OR IV

EXAMPLE MS16632-1100 IS THE PART NUMBER FOR A CARBON STEEL CADMIUM PLATE, EXTERNAL, CRESCENT RETAINING RING FOR USE ON A 1.000 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 (DODISS) SPECIFIED IN THE SOLICITATION FORM A PART OF THIS STANDARD TO THE EXTENT SPECIFIED HEREIN

USER ACTIVITIES
ARMY-ER,GL
NAVY-MC,SH,YD

REVIEWER ACTIVITIES
ARMY-MI
NAVY-AS
AIR FORCE-82
DLA-IS

REVISED (B) FOR CHANGES SEE PAGES 1 THRU 6

APPROVED 11 DEC 1958

TABLE III DASH NUMBERS FOR MS16632

Ø S SHAFT (REF)	CARBON STEEL 1/ CADMIUM PLATE	CARBON STEEL 1/ ZINC COAT	CARBON STEEL 1/ PHOSPHATE COAT	STEEL CORROSION RESISTANT	BERYLLIUM 1/ COPPER
	DASH NO	DASH NO	DASH NO	DASH NO	DASH NO
.125	-1012	-2012	-3012	-4012	-5012
156	-1015	-2015	-3015	-4015	-5015
188	-1018	-2018	-3018	-4018	-5018
.219	-1021	-2021	-3021	-4021	-5021
.236	-1023	-2023	-3023	-4023	-5023
.250	-1025	-2025	-3025	-4025	-5025
281	-1028	-2028	-3028	-4028	-5028
.312	-1031	-2031	-3031	-4031	-5031
375	-1037	-2037	-3037	-4037	-5037
406	-1040	-2040	-3040	-4040	-5040
438	-1043	-2043	-3043	-4043	-5043
.500	-1050	-2050	-3050	-4050	-5050
.562	-1056	-2056	-3056	-4056	-5056
.625	-1062	-2062	-3062	-4062	-5062
.688	-1068	-2068	-3068	-4068	-5068
750	-1075	-2075	-3075	-4075	-5075
.812	-1081	-2081	-3081	-4081	-5081
.875	-1087	-2087	-3087	-4087	-5087
938	-1093	-2093	-3093	-4093	-5093
1.000	-1100	-2100	-3100	-4100	-5100
1 125	-1112	-2112	-3112	-4112	-5112
1 250	-1125	-2125	-3125	-4125	-5125
1 375	-1137	-2137	-3137	-4137	-5137
1 500	-1150	-2150	-3150	-4150	-5150
1 750	-1175	-2175	-3175	-4175	-5175
2 000	-1200	-2200	-3200	-4200	-5200

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).

USER ACTIVITIES
ARMY-ER,GL
NAVY-MC,SH,YD

REVIEWER ACTI
ARMY-MI
NAVY-AS
AIR FORCE-82
DLA-IS

APPROVED 11 DEC 1958 REVISED (B) FOR CHANGES SEE PAGES 1 THRU 6

AMSC N/A

P A	INTERNATIONAL INTEREST	TITLE	MILITARY STANDARD
NAVY-OS ARMY-AR AIR FORCE-99		RING, RETAINING, EXTERNAL, CRESCENT (REDUCED SECTION TYPE)	MS16632
PROCUREMENT SPECIFICATION MIL-R-21248	SUPERSEDES		PAGE 3 OF 6

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

Ø S SHAFT (REF)	INACTIVE	SUBSTITUTE	SUBSTITUTE	SUBSTITUTE
	CARBON STEEL	CARBON STEEL 1/ CADMIUM PLATE	CARBON STEEL 1/ ZINC COAT	CARBON STEEL 1/ PHOSPHATE COAT
	MS16632	MS16632	MS16632	MS16632
.125	-12	-1012	-2012	-3012
156	-15	-1015	-2015	-3015
188	-18	-1018	-2018	-3018
219	-21	-1021	-2021	-3021
236	-23	-1023	-2023	-3023
.250	-25	-1025	-2025	-3025
281	-28	-1028	-2028	-3028
.312	-31	-1031	-2031	-3031
375	-37	-1037	-2037	-3037
406	-40	-1040	-2040	-3040
.438	-43	-1043	-2043	-3043
500	-50	-1050	-2050	-3050
562	-56	-1056	-2056	-3056
625	-62	-1062	-2062	-3062
688	-68	-1068	-2068	-3068
750	-75	-1075	-2075	-3075
812	-81	-1081	-2081	-3081
875	-87	-1087	-2087	-3087
938	-93	-1093	-2093	-3093
1 000	-100	-1100	-2100	-3100
1 125	-112	-1112	-2112	-3112
1 250	-125	-1125	-2125	-3125
1 375	-137	-1137	-2137	-3137
1 500	-150	-1150	-2150	-3150
1 750	-175	-1175	-2175	-3175
2.000	-200	-1200	-2200	-3200

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)

USER ACTIVITIES
ARMY-ER, GL
NAVY-MC, SH, YD

REVIEWER ACTIVITIES
ARMY-MI
NAVY-AS
AIR FORCE-82
DLA-IS

APPROVED 11 DEC 1958 REVISED (8) FOR CHANGES SEE PAGES 1 THRU 6

RECOMMENDED DESIGN LIMITATIONS AND USAGE

(a) INTENDED USE - TO PROVIDE SHOULDERS FOR POSITIONING AND MAINTAINING MACHINE PARTS ON SHAFTS WHICH ARE AXIALLY INACCESSIBLE IN ASSEMBLY. THEY ARE APPLIED RADIALLY AND BECAUSE OF DEEP GROOVES, HAVE HIGH THRUST CAPACITY. THEY ARE OF ADVANTAGE WHERE FAST ASSEMBLY FOR MASS PRODUCTION LINES IS ESSENTIAL AND WHERE COMPARATIVELY SMALL CLEARANCE DIAMETERS ARE DESIRABLE. 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 SHALL NOT BE OVER EXPANDED DURING INSTALLATION SINCE THIS WILL LEAD TO RING FAILURE. 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	2 000
CARBON STEEL AND CORROSION RESISTANT STEEL	RPM LIMIT	60,000	25,000	12,500	6,000
BERYLLIUM COPPER	RPM LIMIT	38,000	16,000		

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

$$P = \frac{\pi STX}{2F}$$

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 = 4, 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 =

$$P = \frac{\pi GdY}{2F}$$

WHERE
P = ALLOWABLE COMPRESSION LOAD (POUNDS)
G = GROOVE DIAMETER (INCHES)
d = GROOVE DEPTH (INCHES)
Y = YIELD STRENGTH OF COMPRESSION IN 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)

(e) DIFFERENTIAL ROTATION =

THE CONDITIONS UNDER WHICH A RETAINING RING MAY BE USED WHEN ADJACENT PARTS ROTATE RELATIVE TO IT FALL INTO TWO CATEGORIES

(1) WHERE NO THRUST IS EXERTED BY ADJACENT PART, IN THIS CASE, DIFFERENTIAL ROTATION OF RING AND ADJACENT PART CREATES NO ELEMENT OF RISK IN THE APPLICATION OF THE RINGS BECAUSE NO FUNCTIONAL TORQUE IS EXERTED BY THE MACHINE PART ON THE RING.

(2) CONSIDERATION MUST BE GIVEN TO THE MAGNITUDE OF THE THRUST INVOLVED. THE FRICTION MOMENT MAY NOT EXCEED THE BENDING MOMENT, WHICH THE RING CAN TOLERATE WITHOUT RELEASING ITS PRESSURE AGAINST THE BOTTOM OF THE GROOVE, FORMULATED AS FOLLOWS

$$RPM \leq \frac{sT^2}{.8N} \text{ OR } P \leq \frac{sbT^2}{f18N}$$

WHERE
P = ALLOWABLE THRUST LOAD EXERTED BY ADJACENT PART (POUNDS)
f = COEFFICIENT OF FRICTION
s = WORKING STRESS OF RING UNDER MAXIMUM EXPANSION (PSI) 2/
T = RING THICKNESS (INCHES)
b = LARGEST WIDTH SECTION OF RING (INCHES)
N = NEUTRAL RING DIAMETER (INCHES) = FREE DIAMETER PLUS T+1/2 b DIMENSION

THE CASE WITH DIFFERENTIAL ROTATION OCCURS, THE CALCULATION SHOULD BE BASED ON THE MAXIMUM POSSIBLE VALUE OF THE COEFFICIENT OF FRICTION

1/ X = 120,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS UP TO AND INCLUDING .625 INCH SHAFT DIAMETER OF CARBON STEEL OR CORROSION RESISTANT STEEL.
X = 150,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS .688 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
2/ s = 250,000 PSI WORKING STRESS FOR RINGS OF CARBON STEEL OR CORROSION RESISTANT STEEL
s = 180,000 PSI WORKING STRESS FOR RINGS OF BERYLLIUM COPPER

APPROVED 11 DEC 1958 REVISED (8) FOR CHANGES SEE PAGES 1 THRU 6

(f) IMPACT CAPACITY OF RING OR GROOVE WALL =

$I_R = \frac{PT}{2}$ - FOR THE RING (INCH POUNDS) (ABUTTING COMPONENTS TO HAVE SHARP CORNERS)

$I_G = \frac{Pd}{2}$ - FOR THE GROOVE (INCH POUNDS)

WHERE
- P = ALLOWABLE THRUST LOAD OF RING OR GROOVE (POUNDS)
- T = RING THICKNESS (INCHES)
- I_G = IMPACT CAPACITY OF GROOVE WALL (INCH POUNDS)
- d = GROOVE DEPTH (INCHES)
- I_R = IMPACT CAPACITY OF RING (INCH POUNDS)

(g) LOAD CAPACITY WITH THE RETAINED PART RADIUSED OR CHAMFERED -
WHEN THE RADIUS OR CHAMFER OF THE RETAINED PART DOES NOT EXCEED THE MAXIMUM RADIUS ALLOWED FOR THE BOTTOM OF THE RING GROOVE, THE LESSER LOAD CAPACITY COMPUTED FROM THE FORMULA ON PAGE 5 WILL APPLY. THE CORNER RADII AND CHAMFERS LISTED ON PAGE 1 WERE CHOSEN AS LARGE AS POSSIBLE FOR THE RING SIZES INVOLVED AND ARE RELATED TO THE MAXIMUM THRUST LOADS LISTED IN TABLE VI
IF THE CORNER RADII OR CHAMFERS ARE SMALLER THAN THOSE LISTED, THEN THE THRUST LOADS INCREASE PROPORTIONALLY IN ACCORDANCE WITH THE FOLLOWING FORMULAS

$P^1 = \frac{P\ CH}{CH^1}$ OR

$P^1 = \frac{PR}{R^1}$

WHERE
- P^1 = NEW ALLOWABLE THRUST LOAD
- P = LISTED ALLOWABLE THRUST LOAD
- CH^1 = NEW (SMALLER) CHAMFER
- CH = LISTED CHAMFER
- R^1 = NEW (SMALLER) CORNER RADIUS
- R = LISTED CORNER RADIUS

LIMIT LOADS LISTED IN TABLE VI ARE BASED ON RINGS OF CARBON STEEL OR CORROSION RESISTANT STEEL (WORKING STRESS 250,000 PSI). IF THE ALLOWABLE GROOVE CAPACITY LOADS AS CALCULATED BY USING THE FORMULA ON PAGE 5 ARE LESS, THEN THEY SHOULD BE USED.

TABLE VI LIMIT LOADS

NOMINAL RING SIZE		ALLOWABLE THRUST LOAD FOR RING ASSEMBLIES WITH PARTS HAVING MAXIMUM CORNER RADII OR CHAMFERS	
FROM	TO	CARBON STEEL OR CORROSION RESISTANT STEEL	BERYLLIUM COPPER
125		90 LB	65 LB
156		105 LB	75 LB
.188		110 LB	80 LB
.219		260 LB	185 LB
.236		275 LB	200 LB
.250		290 LB	210 LB
.281	438	310 LB	220 LB
500	625	610 LB	440 LB
688	1 000	880 LB	
1 125	1 500	1250 LB	
1 750	2 000	1920 LB	