

REQUIREMENTS FOR ACQUIRING THE PRODUCT(S) DESCRIBED HEREIN SHALL CONSIST OF THE  
SHEET AND THE ISSUE OF THE FOLLOWING SPECIFICATION LISTED IN THAT ISSUE OF THE DODDS - CIFIED IN  
THE SOLICITATION MIL-R-21248

THIS SPECIFICATION IS APPROVED FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE  
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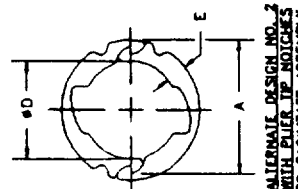
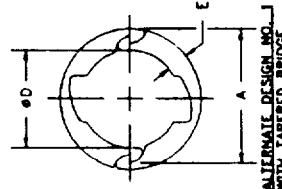
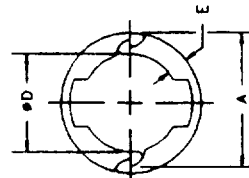
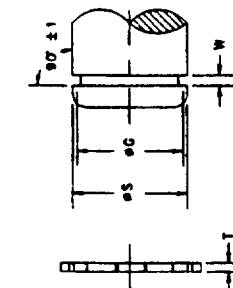
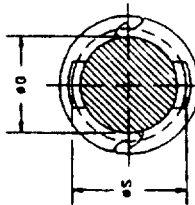
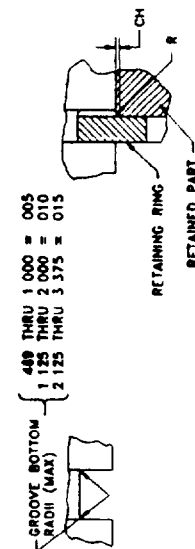


TABLE 1 DIMENSIONS

ØS SHAFT (REF)	ØD FREE (REF)	WIDTH ACROSS LUGS		E		T2/ THICKNESS		ØG RECOMMENDED GROOVE (REF)		W WIDTH		R4/ OF RETAINED PART (REF)	
		BASIC	TOL	BASIC	TOL	BASIC	TOL	BASIC	TOL	BASIC	TOL	MAX	MAX
11.9	414	585	± .003	105	± .005	.035		419	± .0015	.040		.052	.040
469	459	625		105		.035		464	FIM 3/	.040	+ .003	.052	.040
500	538	710	± .004	105		.035		544		.040	- .000	.052	.040
594	569	740		105		.042		575		.040		.052	.040
625	593	815		135				599	± .002	.047		.065	.050
669			± .005										
750	673	894		135		.042	± .002	680	FIM 3/	.047		.065	.050
781	703	925		135		.042		711		.047		.065	.050
875	796	1 017		135		.042		805	± .003	.047		.065	.050
984	863	1 172		188	± .006	.050		872	FIM 3/	.056		.086	.062
1 000	863	1 172	± .006	188				872		.056		.081	.062
1 125	1 002	1 311		188		.050		1 013		.056		.086	.066
1 188	1 084	1 373		188		.050		1 075	± .003	.056		.086	.066
1 250	1 126	1 435		188		.050		1 138	FIM 3/	.056	+ .004	.086	.066
1 375	1 250	1 559	± .007	188		.050		1 263		.056	- .000	.086	.066
1 500	1 374	1 683		188				1 388		.056		.086	.066
1 562	1 412	1 778		222		.062		1 427		.068		.100	.077
1 625	1 474	1 840		222		.062		1 489		.068		.100	.077
1 750	1 597	1 963	± .008	222		.062		1 614	± .005	.068		.100	.077
1 772	1 597	1 963		222		.062		1 614	FIM 3/	.068		.100	.077
1 875	1 721	2 090		222				1 739		.068		.100	.077
1 969	1 779	2 209		262		.078		1 797		.086		.114	.088
2 000	1 809	2 242		262	± .007	.078		1 828		.086		.114	.088
2 125	1 933	2 364		262		.078		1 953		.086		.114	.088
2 156	1 933	2 364		262		.078	± .003	1 953		.086		.104	.080
2 250	2 057	2 488		262		.078		2 078		.086		.114	.088
2 375	2 180	2 610	± .010	262		.078			± .005	.086	+ .005	.114	.088
2 500	2 304	2 734		262		.078		2 203	FIM 3/	.086	- .000	.114	.088
2 625	2 428	2 858		262		.078		2 328		.086		.114	.088
2 750	2 518	3 049		323		.093		2 453		.103		.143	.110
2 875	2 642	3 172	± .012	323		.093		2 544		.103		.143	.110
3 000	2 754	3 294		323	± .008	.093		2 669	± .006	.103		.143	.110
3 250	3 013	3 542	± .015	395		.109		2 794	FIM 3/	.103		.143	.110
3 375	3 114	3 761		395				3 145		.120		.182	.140

© DENOTES CHANGES

INCH-POUND

PREPARING ACTMITY DLA-IS  
CUSTODIANS ARMY-AR NAVY-  
AIR FORCE- 99 DLA  
REVIEW AS,AT,AV,ER,MC,ME,SH YD 82  
USER  
PROJECT NUMBER 5365-0200

MILITARY SPECIFICATION SHEET  
TITLE  
RING, RETAINING, EXTERNAL INTERLOCKING

SPECIFICATION SHEET NUMBER  
MS90708 28 JUNE 85  
REV C  
SUPERSEDING  
MS907088 25 AUG 89  
AMSC-N/A FSC-5365

DISTRIBUTION STATEMENT

A Approved for public release distribution is unlimited

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DD Form 672, MAY 88

PREVIOUS EDITIONS ARE OBSOLETE

FOR FOOTNOTES SEE PAGE 2

- 1/  $\phi D$  = DIMENSION "D" SHOULD NOT BE USED AS PART OF AN INSPECTION PROCEDURE USE DIMENSION "A"
- 2/ T = THICKNESS "T" APPLIES TO UNPLATED RINGS FOR CORROSION RESISTANT STEEL AND PLATED RINGS + 002 SHOULD BE ADDED TO THE MAXIMUM TOLERANCE,  $\pm 002$  SHOULD BE  $\pm 004/-002$
- 3/ FIM = (FULL INDICATOR MOVEMENT) IS THE MAXIMUM ALLOWABLE DEVIATION OF CONCENTRICITY BETWEEN THE GROOVE AND THE SHAFT
- 4/ R AND CH = RADII OR CHAMFERS ALLOWABLE ON PARTS TO BE RETAINED BY THE RINGS THRUST LOADS FOR RINGS RETAINING PARTS WITH CORNER RADII OR CHAMFERS, ARE TABULATED ON PAGE 4

**REQUIREMENTS**

- 1 **CLASSIFICATION** RETAINING RINGS FURNISHED UNDER THIS STANDARD SHALL BE TYPE I CLASS 8 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 AMS 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

$\phi$ SHAFT (REF)	CARBON STEEL	CORROSION RESISTANT STEEL	BERYLLIUM COPPER
469 TO 625 INCL	66 5-71 SHR30N	44-51HRC	56 5-62HR30N
669 TO 1 500 INCL	52 5-59 OHR45N	44-51HRC	-
1 562 TO 3 375 INCL	48 0-53 OHRC	44-51HRC	-
669 TO 1 875 INCL	-	-	37-43HRC

- 4 **PROTECTIVE FINISH OR SURFACE TREATMENT**
- (a) CARBON STEEL - SHALL BE AS SPECIFIED (SEE TABLE III OR IV)
- (c) (1) CADMIUM PLATE IN ACCORDANCE WITH QQ-P-416, TYPE II, CLASS 3 OR ASTM B696, TYPE II, CLASS 5 OR ZINC-NICKEL PLATE IN ACCORDANCE WITH AMS 2417, TYPE 2
- (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 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 MS90708-1200 IS THE PART NUMBER FOR A CARBON STEEL CADMIUM PLATE EXTERNAL INTERLOCKING RETAINING RING FOR USE ON A 2 000 DIAMETER SHAFT

**NOTES**

- 1 UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES
- (c) 2 IN THE EVENT OF A CONFLICT BETWEEN THE TEXT OF THIS DOCUMENT AND THE REFERENCES CITED HEREIN, THE TEXT OF THIS DOCUMENT SHALL TAKE PRECEDENCE
- (c) 3 UNLESS OTHERWISE SPECIFIED, ISSUES OF REFERENCED DOCUMENTS ARE THOSE IN EFFECT AT THE TIME OF SOLICITATION

PREPARING ACTIVITY DLA-IS

CUSTODIANS ARMY-AR NAVY-

AIR FORCE-99 DLA-

REVIEW AS AT AV, ER, MC, ME, SH, YD, B2

USER

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TABLE III DASH NUMBERS FOR MS90708					
#S SHAFT (REF)	CARBON STEEL 1/ ZINC-NICKEL PLATE (C)	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
469	-1046	-2046	-3046	-4046	-5046
500	-1050	-2050	-3050	-4050	-5050
584	-1058	-2058	-3058	-4058	-5058
625	-1062	-2062	-3062	-4062	-5062
669	-1066	-2066	-3066	-4066	-5066
750	-1075	-2075	-3075	-4075	-5075
781	-1078	-2078	-3078	-4078	-5078
875	-1087	-2087	-3087	-4087	-5087
884	-1088	-2088	-3088	-4088	-5088
1 000	-1098	-2098	-3098	-4098	-5098
1 125	-1112	-2112	-3112	-4112	-5112
1 188	-1118	-2118	-3118	-4118	-5118
1 250	-1125	-2125	-3125	-4125	-5125
1 375	-1137	-2137	-3137	-4137	-5137
1 500	-1150	-2150	-3150	-4150	-5150
1 562	-1156	-2156	-3156	-4156	-5156
1 625	-1162	-2162	-3162	-4162	-5162
1 750	-1175	-2175	-3175	-4175	-5175
1 772	-1175	-2175	-3175	-4175	-5175
1 875	-1187	-2187	-3187	-4187	-5187
1 888	-1188	-2188	-3188	-4188	-5188
2 000	-1200	-2200	-3200	-4200	-5200
2 125	-1212	-2212	-3212	-4212	-5212
2 156	-1212	-2212	-3212	-4212	-5212
2 250	-1225	-2225	-3225	-4225	-5225
2 375	-1237	-2237	-3237	-4237	-5237
2 500	-1250	-2250	-3250	-4250	-5250
2 625	-1262	-2262	-3262	-4262	-5262
2 750	-1275	-2275	-3275	-4275	-5275
2 875	-1287	-2287	-3287	-4287	-5287
3 000	-1300	-2300	-3300	-4300	-5300
3 250	-1325	-2325	-3325	-4325	-5325
3 375	-1337	-2337	-3337	-4337	-5337

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)				
#S SHAFT (REF)	INACTIVE CARBON STEEL	SUBSTITUTE CARBON STEEL 1/ ZINC-NICKEL PLATE (C)	SUBSTITUTE CARBON STEEL 1/ ZINC COAT	SUBSTITUTE CARBON STEEL 1/ PHOSPHATE COAT
	MS90708	MS90708	MS90708	MS90708
469	-46	-1046	-2046	-3046
500	-50	-1050	-2050	-3050
584	-58	-1058	-2058	-3058
625	-62	-1062	-2062	-3062
669	-66	-1066	-2066	-3066
750	-75	-1075	-2075	-3075
781	-78	-1078	-2078	-3078
875	-87	-1087	-2087	-3087
884	-88	-1088	-2088	-3088
1 000	-98	-1098	-2098	-3098
1 125	-112	-1112	-2112	-3112
1 188	-118	-1118	-2118	-3118
1 250	-125	-1125	-2125	-3125
1 375	-137	-1137	-2137	-3137
1 500	-150	-1150	-2150	-3150
1 562	-156	-1156	-2156	-3156
1 625	-162	-1162	-2162	-3162
1 750	-175	-1175	-2175	-3175
1 772	-175	-1175	-2175	-3175
1 875	-187	-1187	-2187	-3187
1 888	-188	-1188	-2188	-3188
2 000	-200	-1200	-2200	-3200
2 125	-212	-1212	-2212	-3212
2 156	-212	-1212	-2212	-3212
2 250	-225	-1225	-2225	-3225
2 375	-237	-1237	-2237	-3237
2 500	-250	-1250	-2250	-3250
2 625	-262	-1262	-2262	-3262
2 750	-275	-1275	-2275	-3275
2 875	-287	-1287	-2287	-3287
3 000	-300	-1300	-2300	-3300
3 250	-325	-1325	-2325	-3325
3 375	-337	-1337	-2337	-3337

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)

PREPARING ACTIVITY DLA-IS

CUSTODIANS ARMY-AR NAVY-

AIR FORCE-99 DLA-

 REVIEW AS AT,AV,ER,MC,ME,SH,YD,B2  
 USER

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DISTRIBUTION STATEMENT

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RING RETAINING EXTERNAL INTERLOCKING

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25 AUG 89

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"H-S SPECIFICATION IS APPROVED FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

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# RECOMMENDED DESIGN LIMITATIONS AND USAGE

- (a) INTENDED USE - TO PROVIDE HIGH CIRCULAR SHOULDERS FOR POSITIONING AND RETAINING MACHINE COMPONENTS ON SHAFTS. THE IDENTICAL SEMI-CIRCULAR HALVES HELD TOGETHER BY THE INTERLOCKING PRONGS FORM A BALANCED RING CONCENTRIC WITH THE SHAFT, WHICH WILL WITHSTAND HIGH ROTATIONAL SPEEDS. THE USE OF THE FOLLOWING FORMULAS IS 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 - RING HALVES SHOULD 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)		500	1 000	1 500	2 000	2 500	3 000	3 375
CARBON STEEL AND CORROSION RESISTANT STEEL	RPM LIMIT	50,000	30 000	22 000	15,000	12,000	9,000	6,800
BERYLLIUM COPPER	RPM LIMIT	32,000	19,000	14,000				

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

$$P = \frac{C_f \pi S T X}{F}$$

WHERE

P = ALLOWABLE THRUST LOAD (POUNDS)

S = SHAFT DIAMETER (INCHES)

T = THICKNESS (INCHES)

X = ULTIMATE SHEAR STRENGTH OF THE RING MATERIAL (PSI) <sup>1/</sup>

F = FACTOR OF SAFETY, F = 3 IS RECOMMENDED TO INSURE A SAFE WORKING LOAD

C<sub>f</sub> = CONVERSION FACTOR, C<sub>f</sub> = 3/4 IS RECOMMENDED SINCE SHEAR AREA IS REDUCED AT THE CUTOUTS IN THE RING

- (c) ALLOWABLE LOAD CAPACITY OF GROOVE WALL =

$$P = \frac{C_f \pi S d X}{F}$$

WHERE

P = ALLOWABLE COMPRESSION LOAD (POUNDS)

S = SHAFT DIAMETER (INCHES)

d = GROOVE DEPTH (INCHES)

X = YIELD STRENGTH IN COMPRESSION OF THE GROOVE MATERIAL

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

C<sub>f</sub> = CONVERSION FACTOR, C<sub>f</sub> = 3/4 IS RECOMMENDED SINCE CONTACT AREA IN THE GROOVE WALL IS REDUCED AT THE CUTOUTS IN THE RING

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

$$Z = 3d$$

WHERE

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

d = GROOVE DEPTH (INCHES)

- (e) ALLOWABLE SHAFT DIAMETER =

$$S = \sqrt{G^2 + \frac{4 F P}{Y \pi C_f}}$$

WHERE

S = ALLOWABLE SHAFT DIAMETER

G = GROOVE DIAMETER

F = FACTOR OF SAFETY - SEE FORMULA (c) ABOVE

P = DESIGN LOAD

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

C<sub>f</sub> = CONVERSION FACTOR, SEE FORMULA (c) ABOVE

- <sup>1/</sup> X = 150,000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS OF CARBON STEEL OR CORROSION RESISTANT STEEL  
X = 110 000 PSI ULTIMATE SHEAR STRENGTH FOR RINGS OF BERYLLIUM COPPER

PREPARING ACTIVITY DLA-IS		MILITARY SPECIFICATION SHEET		SPECIFICATION SHEET NUMBER	
CUSTODIANS	ARMY-AR	NAVY-	MS90708	28 JUNE 95 REV C	
AIR FORCE-99		DLA-		SUPERSEDING	
REVIEW AS AT AV ER, MC ME SH YD B2		RING RETAINING EXTERNAL INTERLOCKING		MS907088	25 AUG 89
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## (f) DIFFERENTIAL ROTATION =

DIFFERENTIAL ROTATION OF RING AND ADJACENT PART CREATES NO ELEMENT OF RISK IN THE APPLICATION OF THE RING UP TO THE ALLOWABLE LOAD CALCULATED TO THE ABOVE FORMULA (b)

## (g) IMPACT CAPACITY OF RING OR GROOVE WALL =

$$I_R = \frac{P \cdot T}{2} = \text{FOR THE RING (INCH POUNDS) ABUTTING COMPONENTS TO HAVE SHARP CORNERS}$$

$$I_G = \frac{P \cdot d}{2} = \text{FOR THE GROOVE (INCH POUNDS)}$$

WHERE

$P$  = ALLOWABLE THRUST LOAD OF RING OR GROOVES (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)

## (h) LOAD CAPACITY, WITH THE RETAINED PART RADIUS 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 FORMULAS ON PAGE 4 WILL APPLY. THE CORNER RADIUS 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 RADIUS OR CHAMFERS ARE SMALLER THAN THOSE LISTED, THEN THE THRUST LOADS INCREASE PROPORTIONALLY IN ACCORDANCE WITH THE FOLLOWING FORMULAS

$$P^1 = \frac{P \cdot CH}{CH^1} \text{ or}$$

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

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

LIMIT LOADS LISTED BELOW ARE BASED ON RINGS OF STEEL (WORKING STRESS 250,000 PSI) AND OF BERYLLIUM COPPER (WORKING STRESS 180,000 PSI). IF THE ALLOWABLE GROOVE CAPACITY LOADS AS CALCULATED BY USING THE FORMULA GIVEN ABOVE 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 RADIUS OR CHAMFERS	
FROM	TO	CARBON STEEL OR CORROSION RESISTANT STEEL	BERYLLIUM COPPER
469	625	610 LB	440 LB
669	875	880 LB	630 LB
984	1,500	1,250 LB	900 LB
1,562	1,875	1,900 LB	1,370 LB
1,969	2,625	3,050 LB	-
2,750	3,250	4,300 LB	-
3,375	-	5,950 LB	-

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