

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
DEPARTMENT OF DEFENSE

Form Approved
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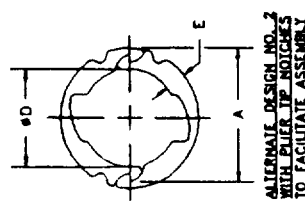
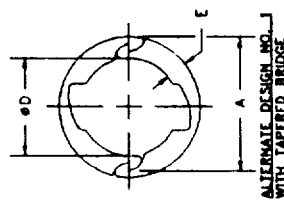
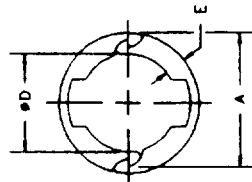
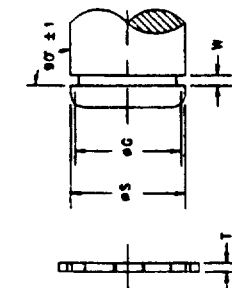
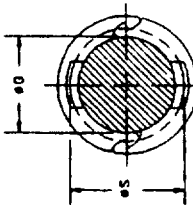
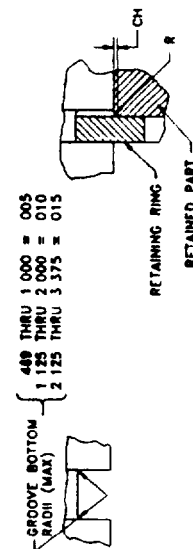


TABLE 1 DIMENSIONS
ENLARGED DETAILS

ØS SHAFT (REF)	ØD1/ 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
INCH	MM												
469	11.9	414	± .003	105	± .005	035		419	± .0015	040		052	040
500	12.7	459		105		035		464	± .004	040		052	040
594	15.1	538	± .004	105		035		544	FIM 3/	040	+ .003	052	040
625	15.9	569		105		035		575		040	- .000	052	040
669	17.0	593		135		042		599	± .002	047		065	050
750	19.0	673	± .005	135		042	± .002	680	± .004	047		065	050
781	19.8	703		135		042		711	FIM 3/	047		065	050
875	22.2	796		135		042		805	± .003	047		065	050
984	25.0	863	± .006	188	± .006	050		872	± .004	056		086	062
1 000	25.4	863		188		050		872	FIM 3/	056		081	062
1 125	28.6	1 002		188		050		1 013		056		086	066
1 188	30.2	1 084		188		050		1 075	± .003	056		086	066
1 250	31.7	1 126	± .007	188		050		1 138	± .005	056	+ .004	086	066
1 375	34.9	1 250		188		050		1 263	FIM 3/	056	- .000	086	066
1 500	38.1	1 374		188		050		1 388		056		086	066
1 562	39.7	1 412		222		062		1 427		068		100	077
1 625	41.3	1 474		222		062		1 489		068		100	077
1 750	44.4	1 597	± .008	222		062		1 614	± .005	068		100	077
1 772	45.0	1 597		222		062		1 614	FIM 3/	068		100	077
1 875	47.6	1 721		222		062		1 739		068		100	077
1 969	50.0	1 779		262		078		1 797		086		114	088
2 000	50.8	1 809		262	± .007	078		1 828		086		114	088
2 125	54.0	1 933		262		078		1 953		086		114	088
2 156	54.8	1 933		262		078	± .003	1 953		086		104	080
2 250	57.1	2 057		262		078		2 078		086		114	088
2 375	60.3	2 180	± .010	262		078		2 203	± .005	086	+ .005	114	088
2 500	63.5	2 304		262		078		2 328	FIM 3/	086	- .000	114	088
2 625	66.7	2 428		262		078		2 453		086		114	088
2 750	69.8	2 518		323		093		2 544		103		143	110
2 875	73.0	2 642	± .012	323		093		2 669	± .006	103		143	110
3 000	76.2	2 754		329	± .008	093		2 794	FIM 3/	103		143	110
3 250	82.5	3 013	± .015	325		109		3 044		103		144	111
3 375	85.7	3 114		395		109		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

DISTRIBUTION STATEMENT

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

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DD Form 672, MAY 88

PREVIOUS EDITIONS ARE OBSOLETE

FOR FOOTNOTES SEE PAGE 2

- 1/ ØD = 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, ± 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

ØSHAFT (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 AY, ER, MC, ME, SH, YD, B2

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TABLE III DASH NUMBERS FOR MS90708					
#S SHAFT (REF)	CARBON STEEL 1/ Cadmium Plate OR 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/ Cadmium Plate OR 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 PROJECT NUMBER 5365-0200 DISTRIBUTION STATEMENT	MILITARY SPECIFICATION SHEET TITLE RING RETAINING EXTERNAL INTERLOCKING	SPECIFICATION SHEET NUMBER MS90708 28 JUNE 95 REV C SUPERSEDING MS90708B 25 AUG 89 AMSC- N/A FSC -5385
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THE REQUIREMENTS FOR ACQUIRING THE PRODUCT(S) DESCRIBED HEREIN SHALL CONSIST OF "H-S SPECIFICATION" ON SHEET AND THE ISSUE OF THE FOLLOWING SPECIFICATION LISTED IN THAT ISSUE OF THE DODDS SPECIFIED IN THE SOLICITATION MIL-R-21248

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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) ^{1/}

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

C_f = CONVERSION FACTOR, C_f = 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_f = CONVERSION FACTOR, C_f = 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_f = CONVERSION FACTOR, SEE FORMULA (c) ABOVE

- ^{1/} 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-	TITLE	MS90708	28 JUNE 95 REV C
AIR FORCE-99	DLA-	RING RETAINING EXTERNAL INTERLOCKING		SUPERSEDING	25 AUG 89
REVIEW AS AT AV ER, MC ME SH YD B2				AMSC- N/A	FSC 5365
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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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