FEDERAL SUPPLY CLASS
5365

RATIONALE

THIS DOCUMENT HAS BEEN REAFFIRMED TO COMPLY WITH THE SAE 5-YEAR REVIEW POLICY.

NOTICE

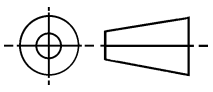
THIS DOCUMENT HAS BEEN TAKEN DIRECTLY FROM U.S. MILITARY SPECIFICATION MS90708C AND CONTAINS ONLY MINOR EDITORIAL AND FORMAT CHANGES REQUIRED TO BRING IT INTO CONFORMANCE WITH THE PUBLISHING REQUIREMENTS OF SAE TECHNICAL STANDARDS. THE INITIAL RELEASE OF THIS DOCUMENT IS INTENDED TO REPLACE MS90708C. ANY PART NUMBERS ESTABLISHED BY THE ORIGINAL SPECIFICATION REMAIN UNCHANGED.

THE ORIGINAL MILITARY SPECIFICATION WAS ADOPTED AS AN SAE STANDARD UNDER THE PROVISIONS OF THE SAE TECHNICAL STANDARDS BOARD (TSB) RULES AND REGULATIONS (TSB 001) PERTAINING TO ACCELERATED ADOPTION OF GOVERNMENT SPECIFICATIONS AND STANDARDS. TSB RULES PROVIDE FOR (A) THE PUBLICATION OF PORTIONS OF UNREVISED GOVERNMENT SPECIFICATIONS AND STANDARDS WITHOUT CONSENSUS VOTING AT THE SAE COMMITTEE LEVEL, AND (B) THE USE OF THE EXISTING GOVERNMENT SPECIFICATION OR STANDARD FORMAT.

UNDER DEPARTMENT OF DEFENSE POLICIES AND PROCEDURES, ANY QUALIFICATION REQUIREMENTS AND ASSOCIATED QUALIFIED PRODUCTS LISTS ARE MANDATORY FOR DOD CONTRACTS. ANY REQUIREMENT RELATING TO QUALIFIED PRODUCTS LISTS (QPL'S) HAS NOT BEEN ADOPTED BY SAE AND IS NOT PART OF THIS SAE TECHNICAL DOCUMENT.

ISSUED 2001-10 REAFFIRMED 2006-05

THIRD ANGLE PROJECTION



CUSTODIAN: SAE E-25

SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

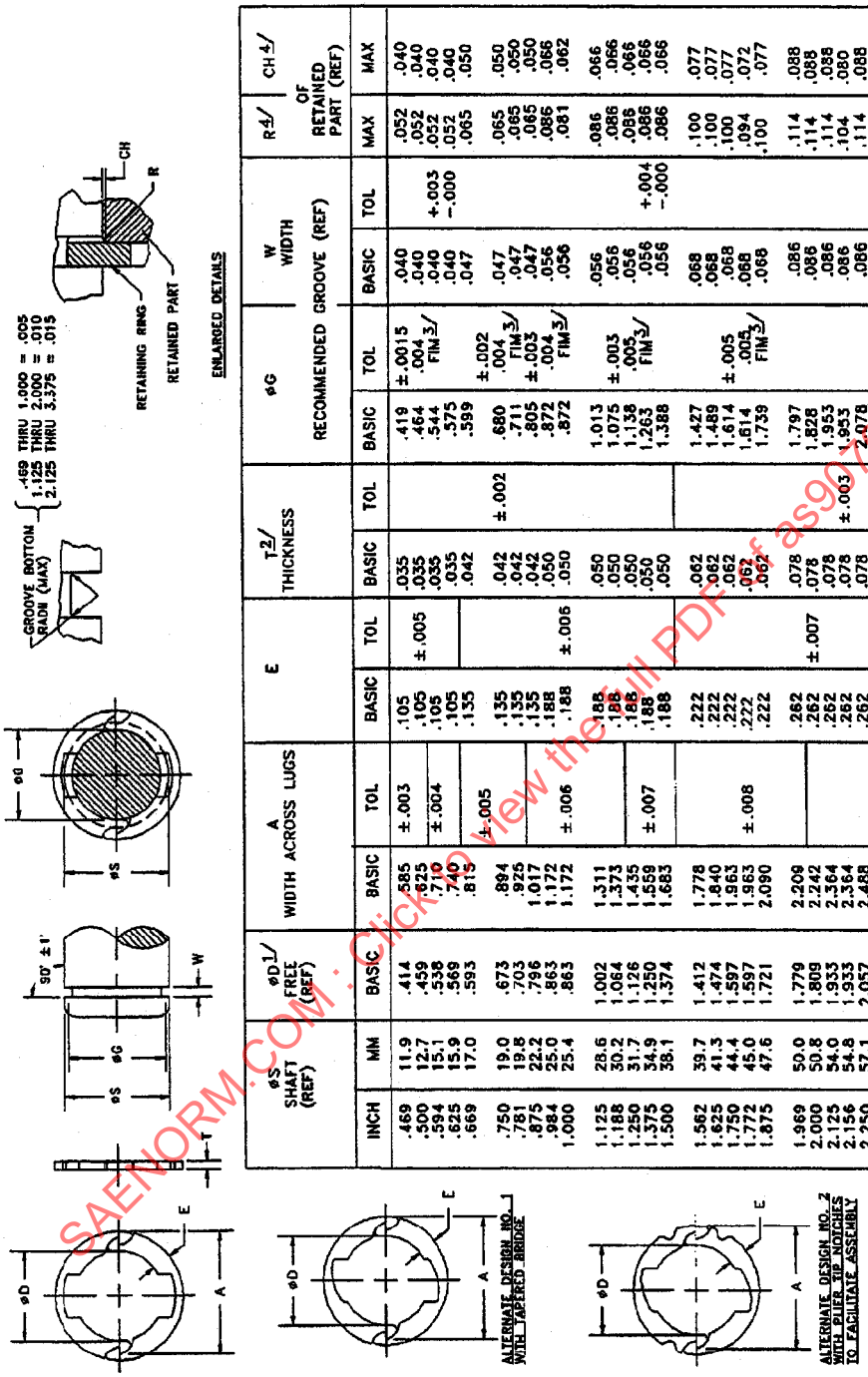
RING, RETAINING, EXTERNAL, INTERLOCKING

AS90708
SHEET 1 OF 7

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

TABLE I. DIMENSIONS

SHAFT ØS (REF) INCH	SHAFT ØS (REF) MM	ØD1/ FREE (REF) BASIC	A WIDTH ACROSS LUGS BASIC	A WIDTH ACROSS LUGS TOL	E BASIC	E TOL	T2/ THICKNESS BASIC	T2/ THICKNESS TOL	ØG RECOMMENDED GROOVE (REF) BASIC	ØG TOL	W WIDTH BASIC	W WIDTH TOL	R4/ OF RETAINED PART (REF) MAX	CH4/ MAX
.469	11.9	.414	.585	±.003	.105	±.005	.035	±.002	.419	±.0015 .004 FIM3/	.040	+.003 -.000	.052	.040
.500	12.7	.459	.625	±.004	.105		.035		.464		.040		.052	.040
.594	15.1	.538	.710		.105		.035		.544		.040		.052	.040
.625	15.9	.569	.740	±.005	.135		.042		.575		.047		.065	.050
.669	17.0	.593	.815		.135		.042		.599	±.002 .004 FIM3/	.047		.065	.050
.750	19.0	.673	.894		.135		.042		.680		.047		.065	.050
.781	19.8	.703	.926		.135		.042		.711		.047		.065	.050
.875	22.2	.796	1.017	±.006	.188	±.006	.050		.805	±.003 .004 FIM3/	.056		.085	.066
.984	25.0	.863	1.172		.188		.050		.872		.056		.086	.066
1.000	25.4	.863	1.172		.188		.050		.872		.056		.081	.062
1.125	28.6	1.002	1.311		.188		.050		1.013		.056		.086	.066
1.188	30.2	1.064	1.373		.188		.050		1.075	±.003 .005 FIM3/	.056		.086	.066
1.250	31.7	1.126	1.435	±.007	.188		.050		1.138		.056		.086	.066
1.375	34.9	1.250	1.559		.188		.050		1.263		.056		.086	.066
1.500	38.1	1.374	1.683		.188		.050		1.388		.056		.086	.066
1.562	39.7	1.412	1.778	±.008	.222	±.007	.062	±.003	1.427	±.005 .003 FIM3/	.068	+.004 -.000	.100	.077
1.625	41.3	1.474	1.840		.222		.062		1.489		.068		.100	.077
1.750	44.4	1.597	1.963		.222		.062		1.614		.068		.100	.077
1.772	45.0	1.597	1.963		.222		.062		1.614		.068		.094	.072
1.875	47.6	1.721	2.090		.222		.062		1.739		.068		.100	.077
1.969	50.0	1.779	2.209	±.010	.262	±.007	.078	±.003	1.797	±.005 .006 FIM3/	.086	+.005 -.000	.114	.088
2.000	50.8	1.809	2.242		.262		.078		1.828		.086		.114	.088
2.125	54.0	1.933	2.364		.262		.078		1.953		.086		.114	.088
2.156	54.8	1.933	2.364		.262		.078		1.953		.086		.104	.080
2.250	57.1	2.057	2.488		.262		.078		2.078		.086		.114	.088
2.375	60.3	2.180	2.610	±.012	.262	±.008	.078	±.003	2.203	±.006 .006 FIM3/	.086	+.005 -.000	.114	.088
2.500	63.5	2.304	2.734		.262		.078		2.328		.086		.114	.088
2.625	66.7	2.428	2.858		.262		.078		2.453		.086		.114	.088
2.750	69.8	2.518	3.049		.323		.093		2.544		.103		.143	.110
2.875	73.0	2.642	3.172		.323		.093		2.669		.103		.143	.110
3.000	76.2	2.754	3.294	±.015	.329		.093		2.794	±.006 .006 FIM3/	.103		.143	.110
3.250	82.5	3.013	3.542		.325		.093		3.044		.103		.144	.111
3.375	85.7	3.114	3.761		.395		.109		3.145		.120		.182	.140



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, i.e., ±.002 SHOULD BE +.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 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 B194.
3. HARDNESS:

TABLE II. HARDNESS

⌀SHAFT (REF)	CARBON STEEL	CORROSION RESISTANT STEEL	BERYLLIUM COPPER
.469 TO .625 INCL	66.5–71.5HR30N	44–51HRC	56.5–62HR30N
.669 TO 1.500 INCL	52.5–59.0HR45N	44–51HRC	–
1.562 TO 3.375 INCL	48.0–53.0HRC	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):
      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.
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.
3. UNLESS OTHERWISE SPECIFIED, ISSUES OF REFERENCED DOCUMENTS ARE THOSE IN EFFECT AT THE TIME OF SOLICITATION.

TABLE III. DASH NUMBERS FOR MS90708

ØS SHAFT (REF)	CARBON STEEL 1/ CADMIUM PLATE OR ZINC-NICKEL 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.
.469	-1046	-2046	-3046	-4046	-5046
.500	-1050	-2050	-3050	-4050	-5050
.594	-1059	-2059	-3059	-4059	-5059
.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
.984	-1098	-2098	-3098	-4098	-5098
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
1.969	-1196	-2196	-3196	-4196	
2.000	-1200	-2200	-3200	-4200	
2.125	-1212	-2212	-3212	-4212	
2.156	-1212	-2212	-3212	-4212	
2.250	-1225	-2225	-3225	-4225	
2.375	-1237	-2237	-3237	-4237	
2.500	-1250	-2250	-3250	-4250	
2.625	-1262	-2262	-3262	-4262	
2.750	-1275	-2275	-3275	-4275	
2.875	-1287	-2287	-3287	-4287	
3.000	-1300	-2300	-3300	-4300	
3.250	-1325	-2325	-3325	-4325	
3.375	-1337	-2337	-3337	-4337	

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)

ØS SHAFT (REF)	INACTIVE	SUBSTITUTE	SUBSTITUTE	SUBSTITUTE
	CARBON STEEL	CARBON STEEL CADMIUM PLATE 1/ OR ZINC-NICKEL PLATE	CARBON STEEL ZINC COAT 1/	CARBON STEEL PHOSPHATE COAT 1/
	MS90708	MS90708	MS90708	MS90708
.469	-46	-1046	-2046	-3046
.500	-50	-1050	-2050	-3050
.594	-59	-1059	-2059	-3059
.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
.984	-98	-1098	-2098	-3098
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
1.969	-196	-1196	-2196	-3196
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).

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 RPW LIMITS

⌀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 =

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

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 =

$$P = \frac{C_F \pi SdX}{F}$$

WHERE:

P = ALLOWABLE THRUST LOAD (POUNDS)
S = SHAFT DIAMETER (INCHES)
d = GROOVE DEPTH (INCHES)
Y = 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)

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.