

 <i>An SAE International Group</i>	AEROSPACE STANDARD	SAE AS4716	REV. B
		Issued 1993-06 Revised 2011-03	
		Superseding AS4716A	
(R) Gland Design, O-ring and Other Elastomeric Seals			

RATIONALE

Revision B to AS4716 is a general update using current SAE format, minor corrections and dimensional tables added in metric units. Reference to AS5857 for static external (overboard to atmosphere) glands has also been added.

1. SCOPE

1.1 Scope

This SAE Aerospace Standard (AS) provides standardized gland (groove) design criteria and dimensions for elastomeric seal glands for static and dynamic applications. The glands have been specifically designed for applications using SAE AS568 size O-rings, with related class 2 tolerances, at pressures exceeding 1500 psi (10.34 MPa) utilizing one or two anti-extrusion (backup) rings and applications at pressures below 1500 psi (10.34 MPa) without backup rings. The glands have been sized to provide sufficient squeeze for effective sealing while at the same time limiting squeeze to allow satisfactory operation in dynamic applications. While this specification covers the basic design criteria and recommendations for use with standard size O-rings, these glands are also suitable for use with other elastomeric, and polytetrafluoroethylene (PTFE) based seals. For static external applications i.e. where the application is overboard and sealing to atmosphere, glands should be designed in accordance with AS5857.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS568	Aerospace Size Standard for O-rings
AS5781	Retainers (Backup Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Single Turn, Scarf-Cut, For Use in AS4716 Glands
AS5782	Retainers (Backup Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Solid, Un-Cut, For Use in AS4716 Glands
AS5857	Gland Design, O-ring and Other Elastomeric Seals, Static Applications

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<http://www.sae.org/technical/standards/AS4716B>

AS8791 Hydraulic and Pneumatic Retainers, (Back-Up Rings), Polytetrafluoroethylene (PTFE) Resin

ARP4727 Gland Design, Computation of Seal Squeeze and Gland Volume

2.1.2 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, Box2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org

ASME B46.1 Surface Texture (Surface roughness, waviness & lay)

2.1.3 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <https://assist.daps.dla.mil/quicksearch/>.

MIL-G-5514 Gland Design; Packing, Hydraulic, General Requirements For (Inactive for New Design)

2.1.4 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 4287-1 Geometrical Product Specifications (GPS) — Surface Texture: Profile Method — Terms, Definitions and Surface Texture Parameters

2.2 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. TECHNICAL REQUIREMENTS

3.1 Gland Configuration

3.1.1 General

As a general rule, O-rings and other elastomeric seals operating above 1500 psi (10.34 MPa) should utilize backup rings or other devices of this nature to prevent seal extrusion. O-ring seal glands designed for backup ring use must be increased in width. Therefore, this document depicts gland widths for applications using none, one and two backup rings. While these glands are sized based on standard O-rings, they are to be used with other elastomeric and PTFE seals. These other seals should be designed to perform in AS4716 standard size glands.

3.1.2 Dimensions

The dimensions listed in Tables 3 through 7 are similar to the dimensions in MIL-G- 5514 Revision G. Changes have been made to the Gland OD (F) and the Gland ID (E) to obtain the desired O-ring squeeze as stated in Tables 3A and 3B (also see Figures 1 and 2). Changes have been made to the gland width dimensions to achieve a design goal of 85% maximum gland occupancy. (This was achieved except for sizes -004, -008, -010, -013 and -110 in which the gland occupancy slightly exceeds 85%.) Also, gland wall angle and break edge dimensions have been included to permit these glands to be used at pressures up to 8000 psi (55.16 MPa).

3.1.3 Limitations

The design criteria and standard glands set forth in this document are intended for use in static and dynamic applications with SAE AS568 O-rings. Dash numbers 013 through 028, 117 through 149 and 223 through 247 are intended for static applications only due to the possibility of spiral failure occurring in these smaller cross-section - larger diameter O-ring sizes. Also, glands conforming to the dimensions listed herein for dash numbers 001 through 004 do not meet the squeeze goal of an installed deflection of at least 0.005 in (0.127 mm) on the O-ring cross-section using the most adverse accumulation of tolerances and O-ring stretch (see Appendix A). Therefore, the -001 through -004 sizes may not be suitable for many applications. Glands are designed so that they will not have more than 85% gland occupancy (15% free space) at 75 °F (24 °C). (See Appendix B.) The standard glands described herein are designed for up to 8000 psig (55.16 MPa) applications and for use in seal applications where the free swell is limited to 20%.

NOTE: The general use of 0.070 in (1.78 mm) O-ring cross-sections and smaller is not recommended for applications subject to external leakage due to the increased possibility of leakage.

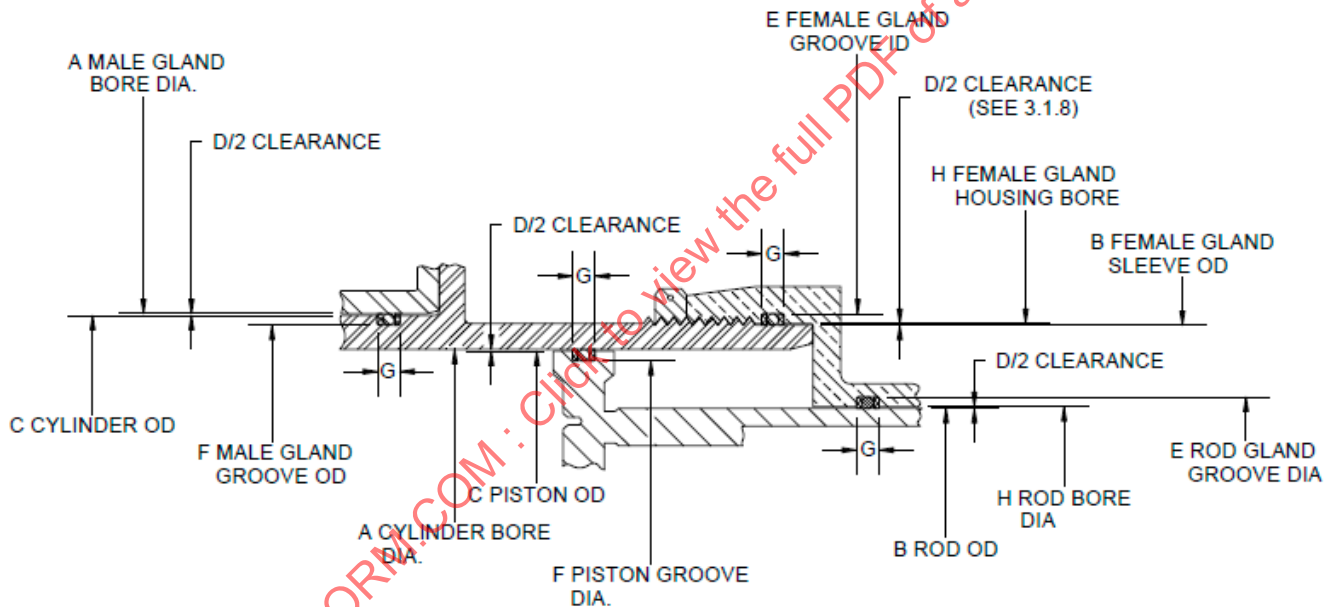


FIGURE 1 - GLAND DESIGN

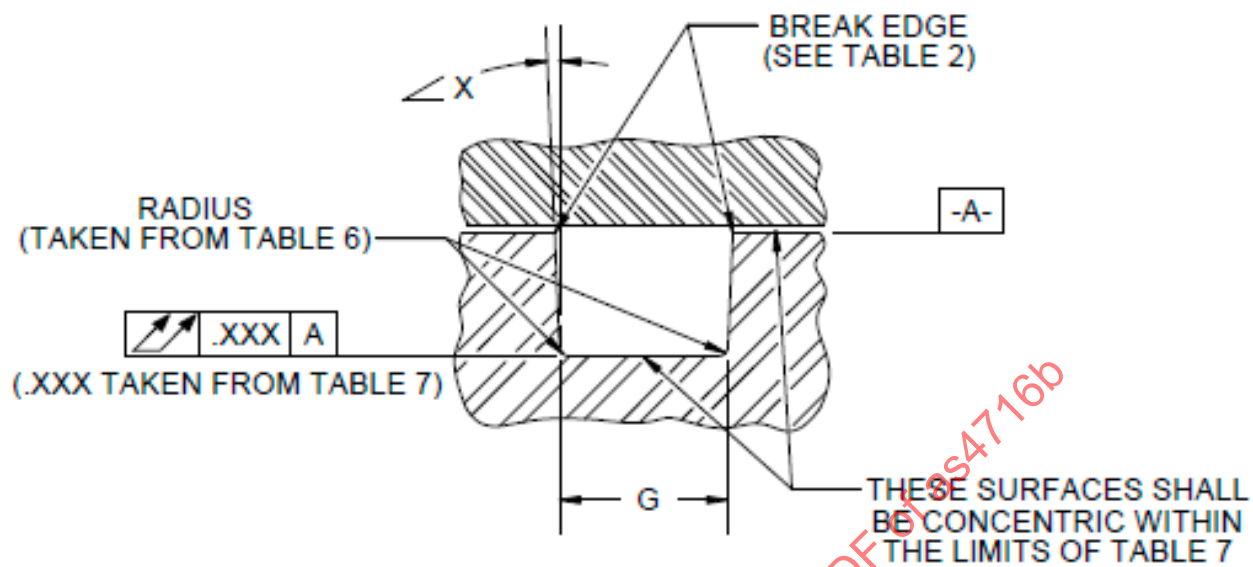


FIGURE 2 - GROOVE DETAILS

TABLE 1 - GROOVE WALL ANGLE DETAILS

Groove Wall Angle ($\angle X$)		
Pressure (psig)	Pressure (MPa)	$\angle X$ Degrees
$\leq 3,000$	≤ 20.7	$0.0 + 5.0 / -0.0$
4,000 to 6,000	27.6 to 41.3	$0.0 + 2.0 / 0.0$
$> 6,000$ to 8,000	> 41.3 to 55.1	0.0 ± 0.5

TABLE 2 - GROOVE BREAK EDGE DETAILS

System Pressure		Break Edge Requirements	
Pressure (psig)	Pressure (MPa)	Groove Edge Break (inches)	Groove Edge Break (mm)
$\leq 4,000$	≤ 27.6	$0.005 + .005 / -.000$	$0.127 + .127 / -.000$
$> 4,000$	> 27.6	$0.002 + .008 / -.000$	$0.051 + .203 / -.000$

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES

Gland and AS568 Dash No.	Piston Or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
001	0.093 0.092	0.095 0.096	0.033 0.032	0.033 0.032	0.035 0.036	0.095 0.096	0.0000 0.0000	0.0145 0.0145
002	0.126 0.125	0.128 0.129	0.048 0.047	0.048 0.047	0.050 0.051	0.128 0.129	0.0000 0.0000	0.0147 0.0147
003	0.157 0.156	0.159 0.160	0.063 0.062	0.063 0.062	0.065 0.066	0.159 0.160	0.0015 0.0015	0.0164 0.0164
004	0.188 0.187	0.190 0.191	0.076 0.075	0.076 0.075	0.078 0.079	0.190 0.191	0.0026 0.0026	0.0182 0.0182
005	0.219 0.218	0.221 0.222	0.115 0.114	0.108 0.107	0.110 0.111	0.217 0.218	0.0051 0.0054	0.0200 0.0204
006	0.233 0.232	0.235 0.236	0.129 0.128	0.123 0.122	0.125 0.126	0.232 0.233	0.0052 0.0052	0.0199 0.0199
007	0.264 0.263	0.266 0.267	0.158 0.157	0.154 0.153	0.156 0.157	0.264 0.265	0.0052 0.0051	0.0197 0.0196
008	0.295 0.294	0.297 0.298	0.189 0.188	0.185 0.184	0.187 0.188	0.294 0.295	0.0057 0.0059	0.0199 0.0202
009	0.327 0.326	0.329 0.330	0.220 0.219	0.217 0.216	0.219 0.220	0.327 0.328	0.0052 0.0052	0.0192 0.0193
010	0.358 0.357	0.360 0.361	0.250 0.249	0.248 0.247	0.250 0.251	0.359 0.360	0.0052 0.0050	0.0190 0.0189
011	0.420 0.419	0.422 0.423	0.312 0.311	0.310 0.309	0.312 0.313	0.421 0.422	0.0057 0.0054	0.0193 0.0191
012	0.483 0.482	0.485 0.486	0.375 0.374	0.373 0.372	0.375 0.376	0.484 0.485	0.0060 0.0057	0.0194 0.0192
013	0.548 0.547	0.550 0.552	0.441 0.439	0.435 0.433	0.437 0.438	0.545 0.547	0.0050 0.0050	0.0196 0.0198
014	0.611 0.610	0.613 0.615	0.504 0.502	0.498 0.496	0.500 0.501	0.608 0.610	0.0052 0.0051	0.0197 0.0199
015	0.673 0.672	0.675 0.677	0.566 0.564	0.560 0.558	0.562 0.563	0.670 0.672	0.0052 0.0051	0.0200 0.0202
016	0.736 0.735	0.738 0.740	0.629 0.627	0.623 0.621	0.625 0.626	0.733 0.735	0.0052 0.0051	0.0203 0.0205
017	0.798 0.797	0.800 0.802	0.691 0.689	0.685 0.683	0.687 0.688	0.795 0.797	0.0054 0.0052	0.0204 0.0205
018	0.861 0.860	0.863 0.865	0.753 0.751	0.748 0.746	0.750 0.751	0.858 0.860	0.0050 0.0053	0.0200 0.0205
019	0.923 0.922	0.925 0.927	0.815 0.813	0.810 0.808	0.812 0.813	0.920 0.922	0.0051 0.0053	0.0200 0.0205
020	0.989 0.988	0.991 0.993	0.881 0.879	0.873 0.871	0.875 0.876	0.983 0.985	0.0050 0.0054	0.0198 0.0205
021	1.051 1.050	1.053 1.055	0.943 0.941	0.935 0.933	0.937 0.938	1.045 1.047	0.0051 0.0055	0.0199 0.0205

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston Or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
022	1.114 1.113	1.116 1.118	1.006 1.004	0.998 0.996	1.000 1.001	1.108 1.110	.0051 .0055	.0200 .0205
023	1.176 1.175	1.178 1.180	1.068 1.066	1.060 1.058	1.062 1.063	1.170 1.172	.0052 .0055	.0200 .0205
024	1.239 1.238	1.241 1.243	1.131 1.129	1.123 1.121	1.125 1.126	1.233 1.235	.0052 .0056	.0200 .0205
025	1.301 1.300	1.303 1.305	1.193 1.191	1.185 1.183	1.187 1.188	1.295 1.297	.0052 .0056	.0201 .0205
026	1.364 1.363	1.366 1.368	1.256 1.254	1.248 1.246	1.250 1.251	1.358 1.360	.0053 .0056	.0201 .0205
027	1.426 1.425	1.428 1.430	1.318 1.316	1.310 1.308	1.312 1.313	1.420 1.422	.0053 .0056	.0202 .0205
028	1.489 1.488	1.491 1.493	1.381 1.379	1.373 1.371	1.375 1.376	1.483 1.485	.0053 .0056	.0203 .0205
104	0.295 0.294	0.297 0.298	0.128 0.127	0.123 0.122	0.125 0.126	0.295 0.296	0.0051 0.0051	0.0204 0.0205
105	0.327 0.326	0.329 0.330	0.158 0.157	0.154 0.153	0.156 0.157	0.327 0.328	0.0052 0.0052	0.0201 0.0203
106	0.358 0.357	0.360 0.361	0.187 0.186	0.185 0.184	0.187 0.188	0.359 0.360	0.0052 0.0052	0.0199 0.0199
107	0.389 0.388	0.391 0.392	0.215 0.214	0.217 0.216	0.219 0.220	0.392 0.393	0.0050 0.0050	0.0195 0.0196
108	0.420 0.419	0.422 0.423	0.246 0.245	0.248 0.247	0.250 0.251	0.423 0.424	0.0052 0.0053	0.0196 0.0197
109	0.483 0.482	0.485 0.486	0.308 0.307	0.310 0.309	0.312 0.313	0.486 0.487	0.0051 0.0053	0.0192 0.0194
110	0.548 0.547	0.550 0.552	0.379 0.377	0.373 0.371	0.375 0.376	0.546 0.548	0.0053 0.0052	0.0204 0.0204
111	0.611 0.610	0.613 0.615	0.441 0.439	0.435 0.433	0.437 0.438	0.609 0.611	0.0052 0.0050	0.0202 0.0201
112	0.673 0.672	0.675 0.677	0.502 0.500	0.498 0.496	0.500 0.501	0.672 0.674	0.0053 0.0053	0.0201 0.0203
113	0.736 0.735	0.738 0.740	0.565 0.563	0.560 0.558	0.562 0.563	0.734 0.736	0.0052 0.0052	0.0204 0.0207
114	0.798 0.797	0.800 0.802	0.627 0.625	0.623 0.621	0.625 0.626	0.797 0.799	0.0053 0.0052	0.0210 0.0211
115	0.861 0.860	0.863 0.865	0.689 0.687	0.685 0.683	0.687 0.688	0.859 0.861	0.0050 0.0054	0.0206 0.0212
116	0.923 0.922	0.925 0.927	0.751 0.749	0.748 0.746	0.750 0.751	0.923 0.925	0.0053 0.0050	0.0208 0.0207
117	0.989 0.988	0.991 0.993	0.817 0.815	0.810 0.808	0.812 0.813	0.985 0.987	0.0050 0.0050	0.0205 0.0209

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston Or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
118	1.051 1.050	1.053 1.055	0.879 0.877	0.873 0.871	0.875 0.876	1.048 1.050	0.0052 0.0051	0.0207 0.0209
119	1.114 1.113	1.116 1.118	0.942 0.940	0.935 0.933	0.937 0.938	1.110 1.112	0.0053 0.0052	0.0206 0.0209
120	1.176 1.175	1.178 1.180	1.003 1.001	0.998 0.996	1.000 1.001	1.173 1.175	0.0050 0.0053	0.0204 0.0209
121	1.239 1.238	1.241 1.243	1.066 1.064	1.060 1.058	1.062 1.063	1.235 1.237	0.0050 0.0054	0.0203 0.0209
122	1.301 1.300	1.303 1.305	1.128 1.126	1.123 1.121	1.125 1.126	1.298 1.300	0.0052 0.0055	0.0204 0.0209
123	1.364 1.363	1.366 1.368	1.191 1.189	1.185 1.183	1.187 1.188	1.360 1.362	0.0051 0.0054	0.0205 0.0210
124	1.426 1.425	1.428 1.430	1.253 1.251	1.248 1.246	1.250 1.251	1.423 1.425	0.0052 0.0055	0.0206 0.0210
125	1.489 1.488	1.491 1.493	1.316 1.314	1.310 1.308	1.312 1.313	1.485 1.487	0.0052 0.0055	0.0206 0.0210
126	1.551 1.550	1.553 1.555	1.378 1.376	1.373 1.371	1.375 1.376	1.548 1.550	0.0053 0.0056	0.0207 0.0210
127	1.614 1.613	1.616 1.618	1.441 1.439	1.435 1.433	1.437 1.439	1.610 1.612	0.0053 0.0051	0.0206 0.0215
128	1.676 1.675	1.678 1.680	1.503 1.501	1.498 1.496	1.500 1.502	1.673 1.675	0.0054 0.0052	0.0207 0.0215
129	1.739 1.738	1.741 1.743	1.566 1.564	1.560 1.558	1.562 1.564	1.735 1.737	0.0053 0.0051	0.0208 0.0215
130	1.802 1.801	1.805 1.807	1.631 1.629	1.623 1.621	1.625 1.627	1.798 1.800	0.0053 0.0051	0.0217 0.0215
131	1.864 1.863	1.867 1.865	1.693 1.691	1.685 1.683	1.687 1.689	1.860 1.862	0.0053 0.0052	0.0217 0.0215
132	1.927 1.926	1.930 1.932	1.756 1.754	1.748 1.746	1.750 1.752	1.923 1.925	0.0054 0.0052	0.0217 0.0215
133	1.989 1.988	1.992 1.994	1.818 1.816	1.810 1.808	1.813 1.815	1.984 1.986	0.0054 0.0052	0.0218 0.0225
134	2.052 2.051	2.055 2.057	1.881 1.879	1.873 1.871	1.876 1.878	2.047 2.049	0.0055 0.0053	0.0218 0.0225
135	2.115 2.114	2.118 2.120	1.944 1.942	1.936 1.934	1.939 1.941	2.110 2.112	0.0054 0.0052	0.0219 0.0225
136	2.177 2.176	2.180 2.182	2.006 2.004	1.998 1.996	2.001 2.003	2.172 2.174	0.0055 0.0053	0.0219 0.0225
137	2.240 2.239	2.243 2.245	2.069 2.067	2.061 2.059	2.064 2.066	2.235 2.237	0.0055 0.0053	0.0219 0.0225
138	2.302 2.301	2.305 2.307	2.131 2.129	2.123 2.121	2.126 2.128	2.297 2.299	0.0055 0.0053	0.0219 0.0225

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
139	2.365 2.364	2.368 2.370	2.194 2.192	2.186 2.184	2.189 2.191	2.360 2.362	0.0056 0.0054	0.0219 0.0225
140	2.427 2.426	2.430 2.432	2.256 2.254	2.248 2.246	2.251 2.253	2.422 2.424	0.0056 0.0054	0.0219 0.0225
141	2.490 2.488	2.493 2.495	2.319 2.317	2.311 2.309	2.314 2.316	2.485 2.487	0.0050 0.0053	0.0225 0.0225
142	2.552 2.550	2.555 2.557	2.381 2.379	2.373 2.371	2.376 2.378	2.547 2.549	0.0051 0.0053	0.0225 0.0225
143	2.615 2.613	2.618 2.620	2.444 2.442	2.436 2.434	2.439 2.441	2.610 2.612	0.0051 0.0054	0.0225 0.0225
144	2.677 2.675	2.680 2.682	2.506 2.504	2.498 2.496	2.501 2.503	2.672 2.674	0.0051 0.0054	0.0225 0.0225
145	2.740 2.738	2.743 2.745	2.569 2.567	2.561 2.559	2.564 2.566	2.735 2.737	0.0052 0.0054	0.0225 0.0225
146	2.802 2.800	2.805 2.807	2.631 2.629	2.623 2.621	2.626 2.628	2.797 2.799	0.0052 0.0054	0.0225 0.0225
147	2.865 2.863	2.868 2.870	2.694 2.692	2.686 2.684	2.689 2.691	2.860 2.862	0.0051 0.0054	0.0225 0.0225
148	2.927 2.925	2.930 2.932	2.756 2.754	2.748 2.746	2.751 2.753	2.922 2.924	0.0052 0.0054	0.0225 0.0225
149	2.990 2.988	2.993 2.995	2.819 2.817	2.811 2.809	2.814 2.816	2.985 2.987	0.0052 0.0054	0.0225 0.0225
210	0.989 0.988	0.991 0.993	0.750 0.748	0.748 0.746	0.750 0.751	0.989 0.991	0.0052 0.0054	0.0244 0.0247
211	1.051 1.050	1.053 1.055	0.812 0.810	0.810 0.808	0.812 0.813	1.051 1.053	0.0054 0.0055	0.0244 0.0248
212	1.114 1.113	1.116 1.118	0.874 0.872	0.873 0.871	0.875 0.876	1.115 1.117	0.0051 0.0052	0.0242 0.0243
213	1.176 1.175	1.178 1.180	0.936 0.934	0.935 0.933	0.937 0.938	1.177 1.179	0.0052 0.0053	0.0242 0.0244
214	1.239 1.238	1.241 1.243	0.999 0.997	0.998 0.996	1.000 1.001	1.240 1.242	0.0054 0.0054	0.0243 0.0244
215	1.301 1.300	1.303 1.305	1.061 1.059	1.060 1.058	1.062 1.063	1.302 1.304	0.0055 0.0056	0.0243 0.0244
216	1.364 1.363	1.366 1.368	1.124 1.122	1.123 1.121	1.125 1.126	1.365 1.367	0.0054 0.0055	0.0246 0.0247
217	1.426 1.425	1.428 1.430	1.186 1.184	1.185 1.183	1.187 1.188	1.427 1.429	0.0055 0.0056	0.0246 0.0247
218	1.489 1.488	1.491 1.493	1.249 1.247	1.248 1.246	1.250 1.251	1.490 1.492	0.0056 0.0057	0.0246 0.0247
219	1.551 1.550	1.553 1.555	1.311 1.309	1.310 1.308	1.312 1.313	1.552 1.554	0.0057 0.0058	0.0246 0.0248

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
220	1.614 1.613	1.616 1.618	1.374 1.372	1.373 1.371	1.375 1.376	1.615 1.617	0.0058 0.0059	0.0247 0.0248
221	1.676 1.675	1.678 1.680	1.436 1.434	1.435 1.433	1.437 1.438	1.677 1.679	0.0059 0.0059	0.0247 0.0248
222	1.739 1.738	1.741 1.743	1.499 1.497	1.498 1.496	1.500 1.501	1.740 1.742	0.0057 0.0058	0.0250 0.0250
223	1.864 1.863	1.867 1.869	1.625 1.623	1.623 1.621	1.625 1.627	1.865 1.867	0.0053 0.0054	0.0254 0.0255
224	1.989 1.988	1.992 1.994	1.750 1.748	1.748 1.746	1.750 1.752	1.990 1.992	0.0055 0.0056	0.0254 0.0255
225	2.115 2.114	2.118 2.120	1.876 1.874	1.873 1.871	1.876 1.878	2.115 2.117	0.0054 0.0050	0.0255 0.0260
226	2.240 2.239	2.243 2.245	2.001 1.999	1.998 1.996	2.001 2.003	2.240 2.242	0.0055 0.0051	0.0255 0.0260
227	2.365 2.364	2.368 2.370	2.126 2.124	2.123 2.121	2.126 2.128	2.365 2.367	0.0056 0.0052	0.0255 0.0260
228	2.490 2.488	2.493 2.495	2.251 2.249	2.248 2.246	2.251 2.253	2.490 2.492	0.0051 0.0052	0.0260 0.0260
229	2.615 2.613	2.618 2.620	2.376 2.374	2.373 2.371	2.376 2.378	2.615 2.617	0.0051 0.0053	0.0260 0.0260
230	2.740 2.738	2.743 2.745	2.501 2.499	2.498 2.496	2.501 2.503	2.740 2.742	0.0052 0.0054	0.0260 0.0260
231	2.865 2.863	2.868 2.870	2.626 2.624	2.623 2.621	2.626 2.628	2.865 2.867	0.0053 0.0054	0.0260 0.0260
232	2.990 2.988	2.993 2.995	2.751 2.749	2.748 2.746	2.751 2.753	2.990 2.992	0.0052 0.0053	0.0260 0.0260
233	3.115 3.113	3.118 3.120	2.876 2.874	2.873 2.871	2.876 2.878	3.115 3.117	0.0053 0.0054	0.0260 0.0260
234	3.240 3.238	3.243 3.245	3.001 2.999	2.997 2.995	3.000 3.002	3.239 3.241	0.0053 0.0055	0.0260 0.0260
235	3.365 3.363	3.368 3.370	3.126 3.124	3.122 3.120	3.125 3.127	3.364 3.366	0.0054 0.0055	0.0260 0.0260
236	3.490 3.488	3.493 3.495	3.251 3.249	3.247 3.245	3.250 2.252	3.489 3.491	0.0054 0.0056	0.0260 0.0260
237	3.615 3.613	3.618 3.620	3.376 3.374	3.372 3.370	3.375 3.377	3.614 3.616	0.0055 0.0056	0.0260 0.0260
238	3.740 3.738	3.743 3.745	3.501 3.499	3.497 3.495	3.500 3.502	3.739 3.741	0.0055 0.0057	0.0260 0.0260
239	3.865 3.863	3.868 3.870	3.626 3.624	3.622 3.620	3.625 3.627	3.864 3.866	0.0055 0.0056	0.0260 0.0260
240	3.990 3.988	3.993 3.995	3.751 3.749	3.747 3.745	3.750 3.752	3.989 3.991	0.0055 0.0056	0.0260 0.0260

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
241	4.115 4.113	4.118 4.120	3.876 3.874	3.872 3.870	3.875 3.877	4.114 4.116	0.0056 0.0057	0.0260 0.0260
242	4.240 4.238	4.243 4.245	4.001 3.999	3.997 3.995	4.000 4.002	4.239 4.241	0.0056 0.0057	0.0260 0.0260
243	4.365 4.363	4.368 4.370	4.126 4.124	4.122 4.120	4.125 4.127	4.364 4.366	0.0056 0.0057	0.0260 0.0260
244	4.489 4.487	4.493 4.495	4.251 4.249	4.247 4.245	4.250 4.252	4.489 4.491	0.0051 0.0057	0.0265 0.0260
245	4.614 4.612	4.618 4.620	4.376 4.374	4.372 4.370	4.375 4.377	4.614 4.616	0.0051 0.0058	0.0265 0.0260
246	4.739 4.737	4.743 4.745	4.501 4.499	4.497 4.495	4.501 4.503	4.739 4.741	0.0052 0.0053	0.0265 0.0265
247	4.864 4.862	4.868 4.870	4.626 4.624	4.622 4.620	4.626 4.628	4.864 4.866	0.0052 0.0053	0.0265 0.0265
325	1.864 1.863	1.867 1.869	1.495 1.493	1.498 1.496	1.500 1.502	1.870 1.872	0.0081 0.0079	0.0322 0.0318
326	1.989 1.988	1.992 1.994	1.620 1.618	1.623 1.621	1.625 1.627	1.995 1.997	0.0083 0.0081	0.0323 0.0319
327	2.115 2.114	2.118 2.120	1.746 1.744	1.748 1.746	1.750 1.752	2.120 2.122	0.0085 0.0083	0.0322 0.0320
328	2.240 2.239	2.243 2.245	1.871 1.869	1.873 1.871	1.876 1.878	2.245 2.247	0.0087 0.0080	0.0323 0.0325
329	2.365 2.364	2.368 2.370	1.996 1.994	1.998 1.996	2.001 2.003	2.370 2.372	0.0086 0.0080	0.0326 0.0329
330	2.490 2.488	2.493 2.495	2.121 2.119	2.123 2.121	2.126 2.128	2.495 2.497	0.0083 0.0081	0.0332 0.0330
331	2.615 2.613	2.618 2.620	2.246 2.244	2.248 2.246	2.251 2.253	2.620 2.622	0.0084 0.0083	0.0332 0.0330
332	2.740 2.738	2.743 2.745	2.371 2.369	2.373 2.371	2.376 2.378	2.745 2.747	0.0085 0.0084	0.0332 0.0330
333	2.865 2.863	2.868 2.870	2.496 2.494	2.498 2.496	2.501 2.503	2.870 2.872	0.0085 0.0084	0.0334 0.0332
334	2.990 2.988	2.993 2.995	2.621 2.619	2.623 2.621	2.626 2.628	2.995 2.997	0.0087 0.0085	0.0334 0.0332
335	3.115 3.113	3.118 3.120	2.746 2.744	2.748 2.746	2.751 2.753	3.120 3.122	0.0088 0.0087	0.0334 0.0332
336	3.240 3.238	3.243 3.245	2.871 2.869	2.873 2.871	2.876 2.878	3.245 3.247	0.0089 0.0088	0.0334 0.0332
337	3.365 3.363	3.368 3.370	2.996 2.994	2.997 2.995	3.000 3.002	3.369 3.371	0.0087 0.0087	0.0335 0.0335
338	3.490 3.488	3.493 3.495	3.121 3.119	3.122 3.120	3.125 3.127	3.494 3.496	0.0088 0.0088	0.0335 0.0335

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze -----Piston/ Rod
339	3.615 3.613	3.618 3.620	3.246 3.244	3.247 3.245	3.250 3.252	3.619 3.621	0.0089 0.0089	0.0335 0.0335
340	3.740 3.738	3.743 3.745	3.371 3.369	3.372 3.370	3.375 3.377	3.744 3.746	0.0090 0.0090	0.0335 0.0335
341	3.865 3.863	3.868 3.870	3.496 3.494	3.497 3.495	3.500 3.502	3.869 3.871	0.0091 0.0090	0.0335 0.0335
342	3.990 3.988	3.993 3.995	3.621 3.619	3.622 3.620	3.625 3.627	3.994 3.996	0.0090 0.0089	0.0335 0.0335
343	4.115 4.113	4.118 4.120	3.746 3.744	3.747 3.745	3.750 3.752	4.119 4.121	0.0090 0.0090	0.0335 0.0335
344	4.240 4.238	4.243 4.245	3.871 3.869	3.872 3.870	3.875 3.877	4.244 4.246	0.0091 0.0091	0.0335 0.0335
345	4.365 4.363	4.368 4.370	3.996 3.994	3.997 3.995	4.000 4.002	4.369 4.371	0.0092 0.0091	0.0335 0.0335
346	4.489 4.487	4.493 4.495	4.121 4.119	4.122 4.120	4.125 4.127	4.494 4.496	0.0087 0.0092	0.0340 0.0335
347	4.614 4.612	4.618 4.620	4.246 4.244	4.247 4.245	4.250 4.252	4.619 4.621	0.0087 0.0092	0.0340 0.0335
348	4.739 4.737	4.743 4.745	4.371 4.369	4.372 4.370	4.375 4.377	4.744 4.746	0.0088 0.0092	0.0340 0.0335
349	4.864 4.862	4.868 4.870	4.496 4.494	4.497 4.495	4.500 4.502	4.869 4.871	0.0088 0.0093	0.0340 0.0335
425	4.970 4.968	4.974 4.977	4.497 4.494	4.497 4.494	4.501 4.503	4.974 4.977	0.0175 0.0175	0.0480 0.0480
426	5.095 5.093	5.099 5.102	4.622 4.619	4.622 4.619	4.626 4.628	5.099 5.102	0.0176 0.0176	0.0480 0.0480
427	5.220 5.218	5.224 5.227	4.747 4.744	4.747 4.744	4.751 4.753	5.224 5.227	0.0176 0.0176	0.0480 0.0480
428	5.345 5.343	5.349 5.352	4.872 4.869	4.872 4.869	4.876 4.878	5.349 5.352	0.0177 0.0177	0.0480 0.0480
429	5.470 5.468	5.474 5.477	4.997 4.994	4.997 4.994	5.001 5.003	5.474 5.477	0.0176 0.0176	0.0480 0.0480
430	5.595 5.593	5.599 5.602	5.122 5.119	5.122 5.119	5.126 5.128	5.599 5.602	0.0176 0.0176	0.0480 0.0480
431	5.720 5.718	5.724 5.727	5.247 5.244	5.247 5.244	5.251 5.253	5.724 5.727	0.0177 0.0177	0.0480 0.0480
432	5.845 5.843	5.849 5.852	5.372 5.369	5.372 5.369	5.376 5.378	5.849 5.852	0.0178 0.0178	0.0480 0.0480
433	5.970 5.968	5.974 5.977	5.497 5.494	5.497 5.494	5.501 5.503	5.974 5.977	0.0178 0.0178	0.0480 0.0480
434	6.095 6.093	6.099 6.102	5.622 5.619	5.622 5.619	5.626 5.628	6.099 6.102	0.0179 0.0179	0.0480 0.0480

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
435	6.220 6.218	6.224 6.227	5.747 5.744	5.747 5.744	5.751 5.753	6.224 6.227	0.0179 0.0179	0.0480 0.0480
436	6.345 6.343	6.349 6.352	5.872 5.869	5.872 5.869	5.876 5.878	6.349 6.352	0.0180 0.0180	0.0480 0.0480
437	6.470 6.468	6.474 6.477	5.997 5.994	5.997 5.994	6.001 6.003	6.474 6.477	0.0180 0.0180	0.0480 0.0480
438	6.720 6.718	6.724 6.727	6.247 6.244	6.247 6.244	6.251 6.253	6.724 6.727	0.0180 0.0180	0.0480 0.0480
439	6.970 6.968	6.974 6.977	6.497 6.494	6.497 6.494	6.501 6.504	6.974 6.977	0.0181 0.0176	0.0480 0.0485
440	7.220 7.218	7.224 7.227	6.747 6.744	6.747 6.744	6.751 6.754	7.224 7.227	0.0182 0.0177	0.0480 0.0485
441	7.470 7.468	7.474 7.477	6.997 6.994	6.997 6.994	7.001 7.004	7.474 7.477	0.0182 0.0177	0.0480 0.0485
442	7.720 7.718	7.724 7.727	7.247 7.244	7.247 7.244	7.251 7.254	7.724 7.727	0.0181 0.0176	0.0480 0.0485
443	7.970 7.968	7.974 7.977	7.497 7.494	7.497 7.494	7.501 7.504	7.974 7.977	0.0182 0.0177	0.0480 0.0485
444	8.220 8.218	8.224 8.227	7.747 7.744	7.747 7.744	7.751 7.754	8.224 8.227	0.0183 0.0178	0.0480 0.0485
445	8.470 8.468	8.474 8.477	7.997 7.994	7.997 7.994	8.001 8.004	8.474 8.477	0.0183 0.0178	0.0480 0.0485
446	8.970 8.967	8.974 8.977	8.497 8.494	8.497 8.494	8.501 8.504	8.974 8.977	0.0177 0.0177	0.0485 0.0485
447	9.470 9.467	9.474 9.478	8.997 8.994	8.997 8.994	9.001 9.004	9.474 9.478	0.0168 0.0173	0.0485 0.0485
448	9.970 9.967	9.974 9.978	9.497 9.494	9.497 9.494	9.501 9.504	9.974 9.978	0.0169 0.0174	0.0485 0.0485
449	10.470 10.467	10.474 10.478	9.997 9.994	9.997 9.994	10.001 10.004	10.474 10.478	0.0170 0.0175	0.0485 0.0485
450	10.970 10.967	10.974 10.978	10.497 10.494	10.497 10.494	10.501 10.504	10.974 10.978	0.0170 0.0175	0.0485 0.0485
451	11.470 11.467	11.474 11.478	10.997 10.994	10.997 10.994	11.001 11.004	11.474 11.478	0.0170 0.0176	0.0485 0.0485
452	11.970 11.967	11.974 11.978	11.497 11.494	11.497 11.494	11.501 11.504	11.974 11.978	0.0171 0.0176	0.0485 0.0485
453	12.470 12.467	12.474 12.478	11.997 11.994	11.997 11.994	12.001 12.004	12.474 12.478	0.0172 0.0177	0.0485 0.0485
454	12.970 12.967	12.974 12.978	12.497 12.494	12.497 12.494	12.501 12.504	12.974 12.978	0.0173 0.0178	0.0485 0.0485
455	13.470 13.467	13.474 13.478	12.997 12.994	12.997 12.994	13.001 13.004	13.474 13.478	0.0173 0.0178	0.0485 0.0485

TABLE 3A - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN INCHES (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
456	13.970 13.967	13.974 13.978	13.497 13.494	13.497 13.494	13.501 13.504	13.974 13.978	0.0172 0.0177	0.0485 0.0485
457	14.470 14.467	14.474 14.478	13.997 13.994	13.997 13.994	14.001 14.004	14.474 14.478	0.0173 0.0178	0.0485 0.0485
458	14.970 14.967	14.974 14.978	14.497 14.494	14.497 14.494	14.501 14.504	14.974 14.978	0.0173 0.0178	0.0485 0.0485
459	15.470 15.467	15.474 15.478	14.997 14.994	14.997 14.994	15.001 15.004	15.474 15.478	0.0174 0.0179	0.0485 0.0485
460	15.970 15.967	15.974 15.978	15.497 15.494	15.497 15.494	15.501 15.504	15.974 15.978	0.0174 0.0179	0.0485 0.0485

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TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
001	2.362 2.337	2.413 2.438	0.838 0.813	0.838 0.813	0.889 0.914	2.413 2.438	0.000 0.000	0.368 0.368
002	3.200 3.175	3.251 3.277	1.219 1.194	1.219 1.194	1.270 1.295	3.251 3.277	0.000 0.000	0.373 0.373
003	3.988 3.962	4.039 4.064	1.600 1.575	1.600 1.575	1.651 1.676	4.039 4.064	0.038 0.038	0.417 0.417
004	4.775 4.750	4.826 4.851	1.930 1.905	1.930 1.905	1.981 2.007	4.826 4.851	0.066 0.066	0.462 0.462
005	5.563 5.537	5.613 5.639	2.921 2.896	2.743 2.718	2.794 2.819	5.512 5.537	0.130 0.137	0.508 0.518
006	5.918 5.893	5.969 5.994	3.277 3.251	3.124 3.099	3.175 3.200	5.893 5.918	0.132 0.132	0.505 0.505
007	6.706 6.680	6.756 6.782	4.013 3.988	3.912 3.886	3.962 3.988	6.706 6.731	0.132 0.130	0.500 0.498
008	7.493 7.468	7.544 7.569	4.801 4.775	4.699 4.674	4.750 4.775	7.468 7.493	0.145 0.150	0.505 0.513
009	8.306 8.280	8.357 8.382	5.588 5.563	5.512 5.486	5.563 5.588	8.306 8.331	0.132 0.132	0.488 0.490
010	9.093 9.068	9.144 9.169	6.350 6.325	6.299 6.274	6.350 6.375	9.119 9.144	0.132 0.127	0.483 0.480
011	10.668 10.643	10.719 10.744	7.925 7.899	7.874 7.849	7.925 7.950	10.693 10.719	0.145 0.137	0.490 0.485
012	12.268 12.243	12.319 12.344	9.525 9.500	9.474 9.449	9.525 9.550	12.294 12.319	0.152 0.145	0.493 0.488
013	13.919 13.894	13.970 13.995	11.201 11.151	11.049 10.998	11.100 11.125	13.919 13.894	0.127 0.127	0.498 0.503
014	15.519 15.494	15.570 15.596	12.802 12.751	12.649 12.598	12.700 12.725	15.443 15.494	0.132 0.130	0.500 0.505
015	17.094 17.069	17.145 17.170	14.376 14.326	14.224 14.173	14.275 14.300	17.018 17.069	0.132 0.130	0.508 0.513
016	18.694 18.669	18.745 18.771	15.977 15.926	15.824 15.773	15.875 15.900	18.618 18.669	0.132 0.130	0.516 0.521
017	20.269 20.244	20.320 20.345	17.551 17.501	17.399 17.348	17.450 17.475	20.193 20.244	0.137 0.132	0.518 0.521
018	21.869 21.844	21.920 21.946	19.126 19.075	18.999 18.948	19.050 19.075	21.793 21.844	0.127 0.135	0.508 0.521
019	23.444 23.419	23.495 23.520	20.701 20.650	20.574 20.523	20.625 20.650	23.368 23.419	0.130 0.135	0.508 0.521
020	25.121 25.095	25.171 25.197	22.377 22.327	22.174 22.123	22.225 22.250	24.968 25.019	0.127 0.137	0.503 0.521
021	26.695 26.670	26.746 26.772	23.952 23.901	23.749 23.698	23.800 23.825	26.543 26.594	0.130 0.140	0.505 0.521

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
022	28.296 28.270	28.346 28.397	25.552 25.502	25.349 25.298	25.400 25.425	28.143 28.194	0.130 0.006	0.508 0.021
023	29.870 29.845	29.921 29.972	27.127 27.076	26.924 26.873	26.975 27.000	29.718 29.769	0.132 0.006	0.508 0.021
024	31.471 31.445	31.521 31.572	28.727 28.677	28.524 28.473	28.575 28.600	31.318 31.369	0.132 0.006	0.508 0.021
025	33.045 33.020	33.096 33.147	30.302 30.251	30.099 30.048	30.150 30.175	32.893 32.944	0.132 0.006	0.511 0.021
026	34.646 34.620	34.696 34.747	31.902 31.852	31.699 31.648	31.750 31.775	34.493 34.544	0.135 0.006	0.511 0.021
027	36.220 36.195	36.271 36.322	33.477 33.426	33.274 33.223	33.325 33.350	36.068 36.119	0.135 0.006	0.513 0.021
028	37.821 37.795	37.871 37.922	35.077 35.027	34.874 34.823	34.925 34.950	37.668 37.719	0.135 0.006	0.516 0.021
104	7.493 7.468	7.544 7.569	3.251 3.226	3.124 3.099	3.175 3.200	7.493 7.518	0.130 0.006	0.518 0.021
105	8.306 8.280	8.357 8.382	4.013 3.988	3.912 3.886	3.962 3.988	8.306 8.331	0.132 0.006	0.511 0.021
106	9.093 9.068	9.144 9.169	4.750 4.724	4.699 4.674	4.750 4.775	9.119 9.144	0.132 0.006	0.505 0.021
107	9.881 9.855	9.931 9.957	5.461 5.436	5.512 5.486	5.563 5.588	9.957 9.982	0.127 0.006	0.495 0.021
108	10.668 10.643	10.719 10.744	6.248 6.223	6.299 6.274	6.350 6.375	10.744 10.770	0.132 0.006	0.498 0.021
109	12.268 12.243	12.319 12.344	7.823 7.798	7.874 7.849	7.925 7.950	12.344 12.370	0.130 0.006	0.488 0.021
110	13.919 13.894	13.970 14.021	9.627 9.576	9.474 9.423	9.525 9.550	13.868 13.919	0.135 0.006	0.518 0.021
111	15.519 15.494	15.570 15.621	11.201 11.151	11.049 10.998	11.100 11.125	15.469 15.519	0.132 0.006	0.513 0.021
112	17.094 17.069	17.145 17.196	12.751 12.700	12.649 12.598	12.700 12.725	17.069 17.120	0.135 0.006	0.511 0.021
113	18.694 18.669	18.745 18.796	14.351 14.300	14.224 14.173	14.275 14.300	18.644 18.694	0.132 0.006	0.518 0.021
114	20.269 20.244	20.320 20.371	15.926 15.875	15.824 15.773	15.875 15.900	20.244 20.295	0.135 0.006	0.533 0.021
115	21.869 21.844	21.920 21.971	17.501 17.450	17.399 17.348	17.450 17.475	21.819 21.869	0.127 0.006	0.523 0.021
116	23.444 23.419	23.495 23.546	19.075 19.025	18.999 18.948	19.050 19.075	23.444 23.495	0.135 0.006	0.528 0.021
117	25.121 25.095	25.171 25.222	20.752 20.701	20.574 20.523	20.625 20.650	25.019 25.070	0.127 0.006	0.521 0.021

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
118	26.695 26.670	26.746 26.797	22.327 22.276	22.174 22.123	22.225 22.250	26.619 26.670	0.132 0.130	0.526 0.531
119	28.296 28.270	28.346 28.397	23.927 23.876	23.749 23.698	23.800 23.825	28.194 28.245	0.135 0.132	0.523 0.531
120	29.870 29.845	29.921 29.972	25.476 25.425	25.349 25.298	25.400 25.425	29.794 29.845	0.127 0.135	0.518 0.531
121	31.471 31.445	31.521 31.572	27.076 27.026	26.924 26.873	26.975 27.000	31.369 31.420	0.127 0.137	0.516 0.531
122	33.045 33.020	33.096 33.147	28.651 28.600	28.524 28.473	28.575 28.600	32.969 33.020	0.132 0.140	0.518 0.531
123	34.646 34.620	34.696 34.747	30.251 30.201	30.099 30.048	30.150 30.175	34.544 34.595	0.130 0.137	0.521 0.533
124	36.220 36.195	36.271 36.322	31.826 31.775	31.699 31.648	31.750 31.775	36.144 36.195	0.132 0.140	0.523 0.533
125	37.821 37.795	37.871 37.922	33.426 33.376	33.274 33.223	33.325 33.350	37.719 37.770	0.132 0.140	0.523 0.533
126	39.395 39.370	39.446 39.497	35.001 34.950	34.874 34.823	34.925 34.950	39.319 39.370	0.135 0.142	0.526 0.533
127	40.996 40.970	41.046 41.097	36.601 36.551	36.449 36.398	36.500 36.551	40.894 40.945	0.135 0.130	0.523 0.546
128	42.570 42.545	42.621 42.672	38.176 38.125	38.049 37.998	38.100 38.151	42.494 42.545	0.137 0.132	0.526 0.546
129	44.171 44.145	44.221 44.272	39.776 39.726	39.624 39.573	39.675 39.726	44.069 44.120	0.135 0.130	0.528 0.546
130	45.771 45.745	45.847 45.898	41.427 41.377	41.224 41.173	41.275 41.326	45.669 45.720	0.135 0.130	0.551 0.546
131	47.346 47.320	47.422 47.473	43.002 42.951	42.799 42.748	42.850 42.901	47.244 47.295	0.135 0.132	0.551 0.546
132	48.946 48.920	49.022 49.073	44.602 44.552	44.399 44.348	44.450 44.501	48.844 48.895	0.137 0.132	0.551 0.546
133	50.521 50.495	50.597 50.648	46.177 46.126	45.974 45.923	46.050 46.101	50.394 50.444	0.137 0.132	0.554 0.572
134	52.121 52.095	52.197 52.248	47.777 47.727	47.574 47.523	47.650 47.701	51.994 52.045	0.140 0.135	0.554 0.572
135	53.721 53.696	53.797 53.848	49.378 49.327	49.174 49.124	49.251 49.301	53.594 53.645	0.137 0.132	0.556 0.572
136	55.296 55.270	55.372 55.423	50.952 50.902	50.749 50.698	50.825 50.876	55.169 55.220	0.140 0.135	0.556 0.572
137	56.896 56.871	56.972 57.023	52.553 52.502	52.349 52.299	52.426 52.476	56.769 56.820	0.140 0.135	0.556 0.572
138	58.471 58.445	58.547 58.598	54.127 54.077	53.924 53.873	54.000 54.051	58.344 58.395	0.140 0.135	0.556 0.572

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash	Piston or Cylinder OD	Cylinder Bore ID	Gland OD	Rod or Gland Sleeve OD	Rod Bore ID	Gland ID	Actual Minimum Squeeze	Actual Maximum Squeeze
No.	C	A	F	B	H	E	Piston/ Rod	Piston/ Rod
139	60.071 60.046	60.147 60.198	55.728 55.677	55.524 55.474	55.601 55.651	59.944 59.995	0.142 0.137	0.556 0.572
140	61.646 61.620	61.722 61.773	57.302 57.252	57.099 57.048	57.175 57.226	61.519 61.570	0.142 0.137	0.556 0.572
141	63.246 63.195	63.322 63.373	58.903 58.852	58.699 58.649	58.776 58.826	63.119 63.170	0.127 0.135	0.572 0.572
142	64.821 64.770	64.897 64.948	60.477 60.427	60.274 60.223	60.350 60.401	64.694 64.745	0.130 0.135	0.572 0.572
143	66.421 66.370	66.497 66.548	62.078 62.027	61.874 61.824	61.951 62.001	66.294 66.345	0.130 0.137	0.572 0.572
144	67.996 67.945	68.072 68.123	63.652 63.602	63.449 63.398	63.525 63.576	67.869 67.920	0.130 0.137	0.572 0.572
145	69.596 69.545	69.672 69.723	65.253 65.202	65.049 64.999	65.126 65.176	69.469 69.520	0.132 0.137	0.572 0.572
146	71.171 71.120	71.247 71.298	66.827 66.777	66.624 66.573	66.700 66.751	71.044 71.095	0.132 0.137	0.572 0.572
147	72.771 72.720	72.847 72.898	68.428 68.377	68.224 68.174	68.301 68.351	72.644 72.695	0.130 0.137	0.572 0.572
148	74.346 74.295	74.422 74.473	70.002 69.952	69.799 69.748	69.875 69.926	74.219 74.270	0.132 0.137	0.572 0.572
149	75.946 75.895	76.022 76.073	71.603 71.552	71.399 71.349	71.476 71.526	75.819 75.870	0.132 0.137	0.572 0.572
210	25.121 25.095	25.171 25.222	19.050 18.999	18.999 18.948	19.050 19.075	25.121 25.171	0.132 0.137	0.620 0.627
211	26.695 26.670	26.746 26.797	20.625 20.574	20.574 20.523	20.625 20.650	26.695 26.746	0.137 0.140	0.620 0.630
212	28.296 28.270	28.346 28.397	22.200 22.149	22.174 22.123	22.225 22.250	28.321 28.372	0.130 0.132	0.615 0.617
213	29.870 29.845	29.921 29.972	23.774 23.724	23.749 23.698	23.800 23.825	29.896 29.947	0.132 0.135	0.615 0.620
214	31.471 31.445	31.521 31.572	25.375 25.324	25.349 25.298	25.400 25.425	31.496 31.547	0.137 0.137	0.617 0.620
215	33.045 33.020	33.096 33.147	26.949 26.899	26.924 26.873	26.975 27.000	33.071 33.122	0.140 0.142	0.617 0.620
216	34.646 34.620	34.696 34.747	28.550 28.499	28.524 28.473	28.575 28.600	34.671 34.722	0.137 0.140	0.625 0.627
217	36.220 36.195	36.271 36.322	30.124 30.074	30.099 30.048	30.150 30.175	36.246 36.297	0.140 0.142	0.625 0.627
218	37.821 37.795	37.871 37.922	31.725 31.674	31.699 31.648	31.750 31.775	37.846 37.897	0.142 0.145	0.625 0.627
219	39.395	39.446	33.299	33.274	33.325	39.421	0.145 0.147	0.625 0.630

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
220	40.996 40.970	41.046 41.097	34.900 34.849	34.874 34.823	34.925 34.950	41.021 41.072	0.147 0.150	0.627 0.630
221	42.570 42.545	42.621 42.672	36.474 36.424	36.449 36.398	36.500 36.525	42.596 42.647	0.150 0.150	0.627 0.630
222	44.171 44.145	44.221 44.272	38.075 38.024	38.049 37.998	38.100 38.125	44.196 44.247	0.145 0.147	0.635 0.635
223	47.346 47.320	47.422 47.473	41.275 41.224	41.224 41.173	41.275 41.326	47.371 47.422	0.135 0.137	0.645 0.648
224	50.521 50.495	50.597 50.648	44.450 44.399	44.399 44.348	44.450 44.501	50.546 50.597	0.140 0.142	0.645 0.648
225	53.721 53.696	53.797 53.848	47.650 47.600	47.574 47.523	47.650 47.701	53.721 53.772	0.137 0.127	0.648 0.660
226	56.896 56.871	56.972 57.023	50.825 50.775	50.749 50.698	50.825 50.876	56.896 56.947	0.140 0.130	0.648 0.660
227	60.071 60.046	60.147 60.198	54.000 53.950	53.924 53.873	54.000 54.051	60.071 60.122	0.142 0.132	0.648 0.660
228	63.246 63.195	63.322 63.373	57.175 57.125	57.099 57.048	57.175 57.226	63.246 63.297	0.130 0.132	0.660 0.660
229	66.421 66.370	66.497 66.548	60.350 60.300	60.274 60.223	60.350 60.401	66.421 66.472	0.130 0.135	0.660 0.660
230	69.596 69.545	69.672 69.723	63.525 63.475	63.449 63.398	63.525 63.576	69.596 69.647	0.132 0.137	0.660 0.660
231	72.771 72.720	72.847 72.898	66.700 66.650	66.624 66.573	66.700 66.751	72.771 72.822	0.135 0.137	0.660 0.660
232	75.946 75.895	76.022 76.073	69.875 69.825	69.799 69.748	69.875 69.926	75.946 75.997	0.132 0.135	0.660 0.660
233	79.121 79.070	79.197 79.248	73.050 73.000	72.974 72.923	73.050 73.101	79.121 79.172	0.135 0.137	0.660 0.660
234	82.296 82.245	82.372 82.423	76.225 76.175	76.124 76.073	76.200 76.251	82.271 82.321	0.135 0.140	0.660 0.660
235	85.471 85.420	85.547 85.598	79.400 79.350	79.299 79.248	79.375 79.426	85.446 85.496	0.137 0.140	0.660 0.660
236	88.646 88.595	88.722 88.773	82.575 82.525	82.474 82.423	82.550 82.601	88.621 88.671	0.137 0.142	0.660 0.660
237	91.821 91.770	91.897 91.948	85.750 85.700	85.649 85.598	85.725 85.776	91.796 91.846	0.140 0.142	0.660 0.660
238	94.996 94.945	95.072 95.123	88.925 88.875	88.824 88.773	88.900 88.951	94.971 95.021	0.140 0.145	0.660 0.660
239	98.171 98.120	98.247 98.298	92.100 92.050	91.999 91.948	92.075 92.126	98.146 98.196	0.140 0.142	0.660 0.660
240	101.346 101.295	101.422 101.473	95.275 95.225	95.174 95.123	95.250 95.301	101.321 101.371	0.140 0.142	0.660 0.660

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
241	104.521 104.470	104.597 104.648	98.450 98.400	98.349 98.298	98.425 98.476	104.496 104.546	0.142 0.145	0.660 0.660
242	107.696 107.645	107.772 107.823	101.625 101.575	101.524 101.473	101.600 101.651	107.671 107.721	0.142 0.145	0.660 0.660
243	110.871 110.820	110.947 110.998	104.800 104.750	104.699 104.648	104.775 104.826	110.846 110.896	0.142 0.145	0.660 0.660
244	114.021 113.970	114.122 114.173	107.975 107.925	107.874 107.823	107.950 108.001	114.021 114.071	0.130 0.145	0.673 0.660
245	117.196 117.145	117.297 117.348	111.150 111.100	111.049 110.998	111.125 111.176	117.196 117.246	0.130 0.147	0.673 0.660
246	120.371 120.320	120.472 120.523	114.325 114.275	114.224 114.173	114.325 114.376	120.371 120.421	0.132 0.135	0.673 0.673
247	123.546 123.495	123.647 123.698	117.500 117.450	117.399 117.348	117.500 117.551	123.546 123.596	0.132 0.135	0.673 0.673
325	47.346 47.320	47.422 47.473	37.973 37.922	38.049 37.998	38.100 38.151	47.498 47.549	0.206 0.201	0.818 0.808
326	50.521 50.495	50.597 50.648	41.148 41.097	41.224 41.173	41.275 41.326	50.673 50.724	0.211 0.206	0.820 0.810
327	53.721 53.696	53.797 53.848	44.348 44.298	44.399 44.348	44.450 44.501	53.848 53.899	0.216 0.211	0.818 0.813
328	56.896 56.871	56.972 57.023	47.523 47.473	47.574 47.523	47.650 47.701	57.023 57.074	0.221 0.203	0.820 0.826
329	60.071 60.046	60.147 60.198	50.698 50.648	50.749 50.698	50.825 50.876	60.198 60.249	0.218 0.203	0.828 0.836
330	63.246 63.195	63.322 63.373	53.873 53.823	53.924 53.873	54.000 54.051	63.373 63.424	0.211 0.206	0.843 0.838
331	66.421 66.370	66.497 66.548	57.048 56.998	57.099 57.048	57.175 57.226	66.548 66.599	0.213 0.211	0.843 0.838
332	69.596 69.545	69.672 69.723	60.223 60.173	60.274 60.223	60.350 60.401	69.723 69.774	0.216 0.213	0.843 0.838
333	72.771 72.720	72.847 72.898	63.398 63.348	63.449 63.398	63.525 63.576	72.898 72.949	0.216 0.213	0.848 0.843
334	75.946 75.895	76.022 76.073	66.573 66.523	66.624 66.573	66.700 66.751	76.073 76.124	0.221 0.216	0.848 0.843
335	79.121 79.070	79.197 79.248	69.748 69.698	69.799 69.748	69.875 69.926	79.248 79.299	0.224 0.221	0.848 0.843
336	82.296 82.245	82.372 82.423	72.923 72.873	72.974 72.923	73.050 73.101	82.423 82.474	0.226 0.224	0.848 0.843
337	85.471 85.420	85.547 85.598	76.098 76.048	76.124 76.073	76.200 76.251	85.573 85.623	0.221 0.221	0.851 0.851
338	88.646	88.722	79.273	79.299	79.375	88.748	0.224 0.224	0.851 0.851

NOTE: Highlighted dash sizes (-013 to -028) , (-117 to -149) and (-223 to -247) are for static use only.

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
339	91.821 91.770	91.897 91.948	82.448 82.398	82.474 82.423	82.550 82.601	91.923 91.973	0.226 0.226	0.851 0.851
340	94.996 94.945	95.072 95.123	85.623 85.573	85.649 85.598	85.725 85.776	95.098 95.148	0.229 0.229	0.851 0.851
341	98.171 98.120	98.247 98.298	88.798 88.748	88.824 88.773	88.900 88.951	98.273 98.323	0.231 0.229	0.851 0.851
342	101.346 101.295	101.422 101.473	91.973 91.923	91.999 91.948	92.075 92.126	101.448 101.498	0.229 0.226	0.851 0.851
343	104.521 104.470	104.597 104.648	95.148 95.098	95.174 95.123	95.250 95.301	104.623 104.673	0.229 0.229	0.851 0.851
344	107.696 107.645	107.772 107.823	98.323 98.273	98.349 98.298	98.425 98.476	107.798 107.848	0.231 0.231	0.851 0.851
345	110.871 110.820	110.947 110.998	101.498 101.448	101.524 101.473	101.600 101.651	110.973 111.023	0.234 0.231	0.851 0.851
346	114.021 113.970	114.122 114.173	104.673 104.623	104.699 104.648	104.775 104.826	114.148 114.198	0.221 0.234	0.864 0.851
347	117.196 117.145	117.297 117.348	107.848 107.798	107.874 107.823	107.950 108.001	117.323 117.373	0.221 0.234	0.864 0.851
348	120.371 120.320	120.472 120.523	111.023 110.973	111.049 110.998	111.125 111.176	120.498 120.548	0.224 0.234	0.864 0.851
349	123.546 123.495	123.647 123.698	114.198 114.148	114.224 114.173	114.300 114.351	123.673 123.723	0.224 0.236	0.864 0.851
425	126.238 126.187	126.340 126.416	114.224 114.148	114.224 114.148	114.325 114.376	126.340 126.416	0.445 0.445	1.219 1.219
426	129.413 129.362	129.515 129.591	117.399 117.323	117.399 117.323	117.500 117.551	129.515 129.591	0.447 0.447	1.219 1.219
427	132.588 132.537	132.690 132.766	120.574 120.498	120.574 120.498	120.675 120.726	132.690 132.766	0.447 0.447	1.219 1.219
428	135.763 135.712	135.865 135.941	123.749 123.673	123.749 123.673	123.850 123.901	135.865 135.941	0.450 0.450	1.219 1.219
429	138.938 138.887	139.040 139.116	126.924 126.848	126.924 126.848	127.025 127.076	139.040 139.116	0.447 0.447	1.219 1.219
430	142.113 142.062	142.215 142.291	130.099 130.023	130.099 130.023	130.200 130.251	142.215 142.291	0.447 0.447	1.219 1.219
431	145.288 145.237	145.390 145.466	133.274 133.198	133.274 133.198	133.375 133.426	145.390 145.466	0.450 0.450	1.219 1.219
432	148.463 148.412	148.565 148.641	136.449 136.373	136.449 136.373	136.550 136.601	148.565 148.641	0.452 0.452	1.219 1.219
433	151.638 151.587	151.740 151.816	139.624 139.548	139.624 139.548	139.725 139.776	151.740 151.816	0.452 0.452	1.219 1.219
434	154.813 154.762	154.915 154.991	142.799 142.723	142.799 142.723	142.900 142.951	154.915 154.991	0.455 0.455	1.219 1.219

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
435	157.988 157.937	158.090 158.166	145.974 145.898	145.974 145.898	146.075 146.126	158.090 158.166	0.455 0.455	1.219 1.219
436	161.163 161.112	161.265 161.341	149.149 149.073	149.149 149.073	149.250 149.301	161.265 161.341	0.457 0.457	1.219 1.219
437	164.338 164.287	164.440 164.516	152.324 152.248	152.324 152.248	152.425 152.476	164.440 164.516	0.457 0.457	1.219 1.219
438	170.688 170.637	170.790 170.866	158.674 158.598	158.674 158.598	158.775 158.826	170.790 170.866	0.457 0.457	1.219 1.219
439	177.038 176.987	177.140 177.216	165.024 164.948	165.024 164.948	165.125 165.202	177.140 177.216	0.460 0.447	1.219 1.232
440	183.388 183.337	183.490 183.566	171.374 171.298	171.374 171.298	171.475 171.552	183.490 183.566	0.462 0.450	1.219 1.232
441	189.738 189.687	189.840 189.916	177.724 177.648	177.724 177.648	177.825 177.902	189.840 189.916	0.462 0.450	1.219 1.232
442	196.088 196.037	196.190 196.266	184.074 183.998	184.074 183.998	184.175 184.252	196.190 196.266	0.460 0.447	1.219 1.232
443	202.438 202.387	202.540 202.616	190.424 190.348	190.424 190.348	190.525 190.602	202.540 202.616	0.462 0.450	1.219 1.232
444	208.788 208.737	208.890 208.966	196.774 196.698	196.774 196.698	196.875 196.952	208.890 208.966	0.465 0.452	1.219 1.232
445	215.138 215.087	215.240 215.316	203.124 203.048	203.124 203.048	203.225 203.302	215.240 215.316	0.465 0.452	1.219 1.232
446	227.838 227.762	227.940 228.016	215.824 215.748	215.824 215.748	215.925 216.002	227.940 228.016	0.450 0.450	1.232 1.232
447	240.538 240.462	240.640 240.741	228.524 228.448	228.524 228.448	228.625 228.702	240.640 240.741	0.427 0.439	1.232 1.232
448	253.238 253.162	253.340 253.441	241.224 241.148	241.224 241.148	241.325 241.402	253.340 253.441	0.429 0.442	1.232 1.232
449	265.938 265.862	266.040 266.141	253.924 253.848	253.924 253.848	254.025 254.102	266.040 266.141	0.432 0.445	1.232 1.232
450	278.638 278.562	278.740 278.841	266.624 266.548	266.624 266.548	266.725 266.802	278.740 278.841	0.432 0.445	1.232 1.232
451	291.338 291.262	291.440 291.541	279.324 279.248	279.324 279.248	279.425 279.502	291.440 291.541	0.432 0.447	1.232 1.232
452	304.038 303.962	304.140 304.241	292.024 291.948	292.024 291.948	292.125 292.202	304.140 304.241	0.434 0.447	1.232 1.232
453	316.738 316.662	316.840 316.941	304.724 304.648	304.724 304.648	304.825 304.902	316.840 316.941	0.437 0.450	1.232 1.232
454	329.438 329.362	329.540 329.641	317.424 317.348	317.424 317.348	317.525 317.602	329.540 329.641	0.439 0.452	1.232 1.232
455	342.138 342.062	342.240 342.341	330.124 330.048	330.124 330.048	330.225 330.302	342.240 342.341	0.439 0.452	1.232 1.232

TABLE 3B - STANDARD GLAND DIMENSIONS AND O-RING SQUEEZE IN MILLIMETERS (CONTINUED)

Gland and AS568 Dash No.	Piston or Cylinder OD C	Cylinder Bore ID A	Gland OD F	Rod or Gland Sleeve OD B	Rod Bore ID H	Gland ID E	Actual Minimum Squeeze ----- Piston/ Rod	Actual Maximum Squeeze ----- Piston/ Rod
456	354.838 354.762	354.940 355.041	342.824 342.748	342.824 342.748	342.925 343.002	354.940 355.041	0.437 0.450	1.232 1.232
457	367.538 367.462	367.640 367.741	355.524 355.448	355.524 355.448	355.625 355.702	367.640 367.741	0.439 0.452	1.232 1.232
458	380.238 380.162	380.340 380.441	368.224 368.148	368.224 368.148	368.325 368.402	380.340 380.441	0.439 0.452	1.232 1.232
459	392.938 392.862	393.040 393.141	380.924 380.848	380.924 380.848	381.025 381.102	393.040 393.141	0.442 0.455	1.232 1.232
460	405.638 405.562	405.740 405.841	393.624 393.548	393.624 393.548	393.725 393.802	405.740 405.841	0.442 0.455	1.232 1.232

TABLE 4A - STANDARD GLAND WIDTH FOR ZERO, ONE, AND TWO BACKUP IN INCHES

Gland and AS568 Dash No.	O-ring Cross Section W Min	O-ring Cross Section W Max	Gland Width G No Backup Ring Min	Gland Width G No Backup Ring Max	Gland Width G One Backup Ring Min	Gland Width G One Backup Ring Max	Gland Width G Two Backup Rings Min	Gland Width G Two Backup Rings Max
001	0.037	0.043	0.070	0.075	--	--	--	--
002	0.047	0.053	0.077	0.082	--	--	--	--
003	0.057	0.063	0.088	0.093	--	--	--	--
004 to 009	0.067	0.073	0.098	0.103	0.154	0.164	0.210	0.220
010 to 028	0.067	0.073	0.094	0.099	0.150	0.160	0.207	0.217
104 to 149	0.100	0.106	0.141	0.151	0.183	0.193	0.245	0.255
210 to 247	0.135	0.143	0.188	0.198	0.235	0.245	0.304	0.314
325 to 349	0.205	0.215	0.281	0.291	0.334	0.344	0.424	0.434
424 to 460	0.269	0.281	0.375	0.385	0.475	0.485	0.579	0.589

TABLE 4B - STANDARD GLAND WIDTH FOR ZERO, ONE, AND TWO BACKUP IN MILLIMETERS

Gland and AS568 Dash No.	O-ring Cross Section W Min	O-ring Cross Section W Max	Gland Width G No Backup Ring Min	Gland Width G No Backup Ring Max	Gland Width G One Backup Ring Min	Gland Width G One Backup Ring Max	Gland Width G Two Backup Rings Min	Gland Width G Two Backup Rings Max
001	0.94	1.09	1.78	1.91	--	--	--	--
002	1.19	1.35	1.96	2.08	--	--	--	--
003	1.45	1.60	2.24	2.36	--	--	--	--
004 to 009	1.70	1.85	2.49	2.62	3.91	4.17	5.33	5.59
010 to 028	1.70	1.85	2.39	2.51	3.81	4.06	5.26	5.51
104 to 149	2.54	2.69	3.58	3.84	4.65	4.90	6.22	6.48
210 to 247	3.43	3.63	4.78	5.03	5.97	6.22	7.72	7.98
325 to 349	5.21	5.46	7.14	7.39	8.48	8.74	10.77	11.02
424 to 460	6.83	7.14	9.53	9.78	12.07	12.32	14.71	14.96

TABLE 5A - STANDARD GLAND DIAMETRAL CLEARANCE DIMENSIONS IN INCHES

Gland and AS568 Dash No.	O-ring Cross Section W Min	O-ring Cross Section W Max	Diametral Clearance D Max Exterior	Diametral Clearance D Max Interior
001	0.037	0.043	0.004	0.004
002	0.047	0.053	0.004	0.004
003	0.057	0.063	0.004	0.004
004 to 012	0.067	0.073	0.004	0.004
013 to 028	0.067	0.073	0.005	0.005
104 to 109	0.100	0.106	0.004	0.004
110 to 126	0.100	0.106	0.005	0.005
127 to 129	0.100	0.106	0.005	0.006
130 to 132	0.100	0.106	0.006	0.006
133 to 140	0.100	0.106	0.006	0.007
141 to 149	0.100	0.106	0.007	0.007
210 to 222	0.135	0.143	0.005	0.005
223 and 224	0.135	0.143	0.006	0.006
225 to 227	0.135	0.143	0.006	0.007
228 to 243	0.135	0.143	0.007	0.007
244 and 245	0.135	0.143	0.008	0.007
246 and 247	0.135	0.143	0.008	0.008
325 to 327	0.205	0.215	0.006	0.006
328 and 329	0.205	0.215	0.006	0.007
330 to 345	0.205	0.215	0.007	0.007
346 to 349	0.205	0.215	0.008	0.007
425 to 438	0.269	0.281	0.009	0.009
439 to 445	0.269	0.281	0.009	0.010
446	0.269	0.281	0.010	0.010
447 to 460	0.269	0.281	0.011	0.010

TABLE 5B - STANDARD GLAND DIAMETRAL CLEARANCE DIMENSIONS IN MILLIMETERS

Gland and AS568 Dash No.	O-ring Cross Section W Min	O-ring Cross Section W Max	Diametral Clearance D Max Exterior	Diametral Clearance D Max Interior
001	0.940	1.092	0.102	0.102
002	1.194	1.346	0.102	0.102
003	1.448	1.600	0.102	0.102
004 to 012	1.702	1.854	0.102	0.102
013 to 028	1.702	1.854	0.127	0.127
104 to 109	2.540	2.692	0.102	0.102
110 to 126	2.540	2.692	0.127	0.127
127 to 129	2.540	2.692	0.127	0.152
130 to 132	2.540	2.692	0.152	0.152
133 to 140	2.540	2.692	0.152	0.178
141 to 149	2.540	2.692	0.178	0.178
210 to 222	3.429	3.632	0.127	0.127
223 and 224	3.429	3.632	0.152	0.152
225 to 227	3.429	3.632	0.152	0.178
228 to 243	3.429	3.632	0.178	0.178
244 and 245	3.429	3.632	0.203	0.178
246 and 247	3.429	3.632	0.203	0.203
325 to 327	5.207	5.461	0.152	0.152
328 and 329	5.207	5.461	0.152	0.178
330 to 345	5.207	5.461	0.178	0.178
346 to 349	5.207	5.461	0.203	0.178
425 to 438	6.833	7.137	0.229	0.229
439 to 445	6.833	7.137	0.229	0.254
446	6.833	7.137	0.254	0.254
447 to 460	6.833	7.137	0.229	0.254

TABLE 6 - STANDARD CORNER RADIUS DIMENSIONS IN INCHES & MILLIMETERS

Gland and AS568 Dash No.	Inches		Millimeters	
	Corner Radius Maximum	Corner Radius Minimum	Corner Radius Maximum	Corner Radius Minimum
001 to 028	.015	.005	0.381	0.127
104 to 149	.015	.005	0.381	0.127
210 to 247	.025	.010	0.635	0.254
325 to 349	.035	.020	0.889	0.508
425 to 460	.035	.020	0.889	0.508

TABLE 7 - ECCENTRICITY FOR STANDARD GLANDS IN INCHES & MILLIMETERS

Gland and AS568 Dash No.	Maximum Eccentricity Inches	Maximum Eccentricity Millimeters
001 to 028	.002	0.051
104 to 149	.002	0.051
210 to 247	.003	0.076
325 to 349	.004	0.102
425 to 460	.005	0.127

3.1.4 Surface Finishes of Glands

The following surface finishes in Table 8 (indicated as surface roughness as defined in ASME B46.1 (ISO4287-1)) shall be used in units containing O-ring and other elastomeric seals:

TABLE 8 SURFACE ROUGHNESS REQUIREMENTS

Part on Unit	Surface Roughness Ra (μ in) per ASME B46.1	Surface Roughness Ra (μ m) per ISO 4287-1
Cylinder bore or piston rod (diameter over which packaging must slide)	16 (max) See Note	0.4 (max) See Note
O-ring groove diameter:		
Dynamic Seals	32 (max)	0.8 (max)
Static Seals	63 (max)	1.6 (max)
O-ring groove sides when no backup ring is used:		
Dynamic Seals	32 (max)	0.8 (max)
Static Seals	63 (max)	1.6 (max)
O-ring groove sides when backup rings are used	63 (max)	1.6 (max)
Note: Optimum recommended roughness for dynamic application is 4 to 12 μ in (0.1 to 0.3 μ m) Ra. The use of HVOF (High Velocity Oxygenated Fuel) coatings will require a 4 μ in (0.1 μ m) Ra (max) roughness with consideration to post process super-finishing / polishing.		

The groove surfaces must be free from all machining irregularities exceeding the above values. Groove edges shall be smooth and true and free of nicks, scratches, and burrs, etc.

3.1.5 O-Ring Seal Squeeze

(Reference ARP4727, Gland Design, Computation of Seal Squeeze and Gland Volume) The minimum squeeze (see Tables 3A and 3B) is represented by the difference (interference) between the minimum cross-section of the installed O-ring and the maximum permitted gland depth. The O-ring used to calculate minimum squeeze is one with the minimum free cross-section diameter and minimum ID. The minimum cross-section diameter of the installed O-ring is obtained by subtracting the change in the minimum free cross-section diameter, caused by the stretching of the O-ring during installation, from the minimum free cross-section diameter. The maximum gland depth is that obtained using gland parts that provide the maximum possible diametral clearance, maximum eccentricity of gland parts and maximum possible radial displacement of the gland parts in the direction to cause maximum gland depth and minimum seal squeeze at the seal location that is 180 degrees away from the direction of radial displacement.

The maximum O-ring squeeze in Table 3A and 3B is represented by the difference between the maximum cross-section diameter of an installed O-ring and the minimum gland depth. The O-ring used to calculate maximum squeeze is an O-ring of maximum free cross-section diameter and maximum ID. The maximum cross-section diameter of the installed O-ring is obtained by subtracting the change in the maximum free cross-section diameter, caused by the stretching of the O-ring during installation, from the maximum free cross-section diameter. The minimum gland depth for a piston type gland is that obtained using MIN bore diameter, MIN piston diameter, maximum eccentricity of gland parts and maximum possible radial displacement of the MIN piston diameter with respect to the MIN bore diameter. The minimum gland depth for a rod type gland is that obtained using MAX rod diameter, MAX rod clearance diameter, maximum eccentricity of gland parts and maximum possible radial displacement of the MAX rod diameter with respect to the MAX rod clearance diameter.

The formulas used for calculating the reduced seal cross-section for piston and rod type glands under minimum and maximum squeeze conditions are listed in Appendix A. The formulas used to calculate the minimum and maximum seal squeeze (listed in Tables 3A and 3B) for piston and rod type glands are also listed in Appendix A.

3.1.6 Temperature Considerations in Gland Design

The calculations used in this standard have been based on a temperature of 75 °F (24 °C). The suitability of the glands should be verified for the temperature extremes expected in service. Differences in the coefficient of expansion of different metals can result in differences in diametral clearance which may be a factor at temperature extremes. Even more important is the difference in the coefficient of thermal expansion of the seal material and the gland materials. Elastomers may have a coefficient of expansion as much as 10 times that of steel. Gland overfill at high temperatures must be avoided. Elastomer contraction at low temperatures may require some modification of the gland dimensions herein to assure adequate squeeze at low temperatures, particularly those lower than -40 °F (-40 °C). A particularly severe application occurs when an unpressurized cylinder at low temperature is pressurized. Leakage is likely to occur until such time as warmer fluid causes expansion of the elastomer. Leakage can be prevented in such cases by ensuring that adequate squeeze is provided by taking into account changes in gland and elastomer dimensions that occur at low temperature plus the radial expansion (i.e., gland "breathing") that will occur with the application of pressure. Usually, satisfactory designs can be achieved within the dimensions of this standard by simply reducing the permitted tolerances on mating parts to achieve increased squeeze.

3.1.7 Installation of Anti-extrusion (Backup) Rings

For pressures above 1500 psi (10.34 MPa), the use of two backup rings in each gland, one on either side of the O-ring seal, is recommended to insure proper extrusion protection. Dimensions for gland widths to accommodate the use of two backup rings are shown in Table 4A and 4B. Where it is self evident that pressure can be applied from one direction only and space requirements for two rings create a hardship, a single backup ring may be used. This ring is to be placed on the side of the O-ring away from the pressure. The groove width dimensions shown in Table 4A and 4B for one backup ring may be used, as applicable. For applications where the pressure does not exceed 1500 psi (10.34 MPa), backup rings are not required but may be used to provide greater extrusion protection.

NOTE: The AS4716 gland dimensions are different from the previous MIL-G-5514 for the -0XX, -1XX and the -2XX series dash sizes and the application of AS8791 and "MS" backup rings may result in a compressive radial fit and are not recommended for use.

Optimum fit and limit conditions can be achieved with the use of backup rings per AS5781 and AS5782.

3.1.8 Diametral Clearances

The diametral clearance, "D" in Figure 1, is the total difference between the bore ID (A) and the piston OD (C) or the total difference between the rod OD (B) and the rod bore ID (H). The diametral clearance shall be as listed in Tables 5A and 5B.

3.1.9 Groove Detail

Details for the standard groove design, including edge break and groove wall angle requirements, are depicted in Figure 2. Groove corner radius shall be in accordance with Table 6.

3.1.10 Eccentricity

The eccentricity, referred to in Table 7, is the total indicator reading, between the groove and the adjacent bearing surface (see Figure 2). As indicated in Figure 1, the designated surfaces shall be concentric within the limits of Table 7.

3.1.11 Cylinder Breathing

For operating pressures of 3000 psig (20.68 MPa) and lower, radial expansion of the cylinder bore (i.e., cylinder wall "breathing") shall be limited to 0.002 in/in (0.002 mm/mm) of cylinder bore at operating pressure. For operating pressures greater than 3000 psig (20.68 MPa), radial expansion of the cylinder bore shall be limited to 0.0015 in/in (0.15 mm/mm) of cylinder bore at operating pressure.

3.1.12 O-ring Assembly

To facilitate O-ring assembly, the edge where the piston and O-ring assembly enters a cylinder bore should be chamfered with a suitable blend radius to prevent pinching or other damage to the O-ring seal (see Figure 3).

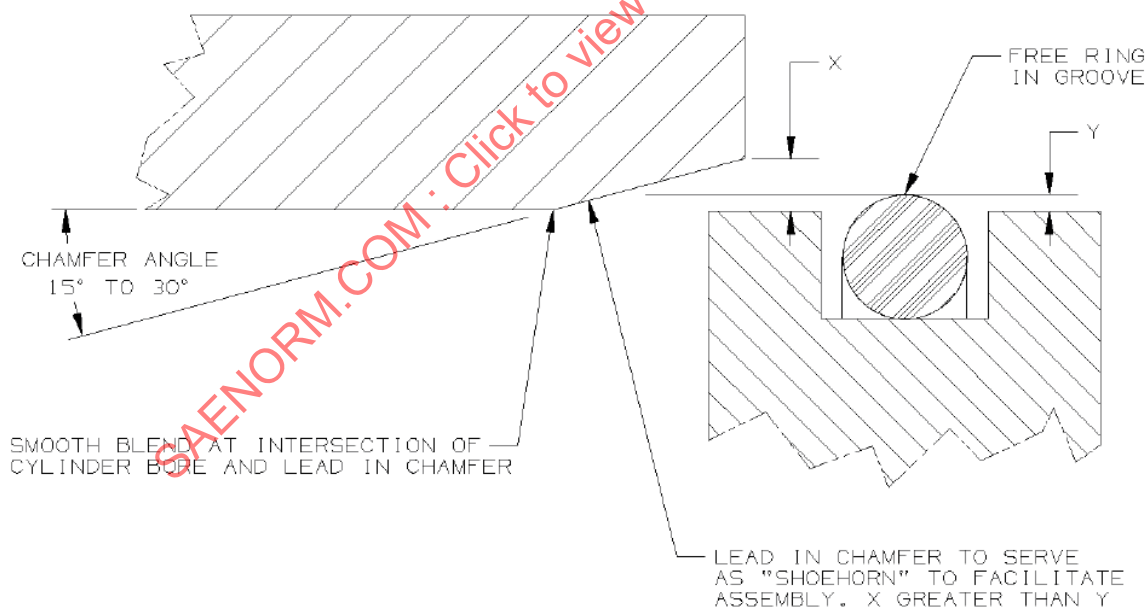


FIGURE 3 - O-RING ASSEMBLY

4. NOTES

- 4.1 A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.