



AEROSPACE STANDARD

AS5857™**REV. A**

Issued 2005-03
Revised 2010-11
Reaffirmed 2022-08

Superseding AS5857

Gland Design, O-Ring and Other Elastomeric Seals, Static Applications

RATIONALE

AS5857A has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This SAE Aerospace Standard (AS) provides standardized gland (groove) design criteria and dimensions for elastomeric seal glands for static applications. The glands have been specifically designed for applications using SAE AS568 size O-rings at pressures exceeding 1500 psi (10.3 MPa) utilizing one or two anti-extrusion (backup) rings and applications at pressures under 1500 psi (10.3 MPa) without backup rings. The glands have been sized to provide increased squeeze as compared to AS4716 for more effective sealing at low temperatures and low seal swell conditions. These glands are not recommended for dynamic use. Primary usage is for static external sealing.

The rod dimensions are the same as AS4716. The cylinder bore dimensions are the same as AS4716 except for sizes -001 thru -011 and -104 thru -113.

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
AS4716	Gland Design, O-ring and Other Elastomeric Seals
AS5860	Retainers, (Back-Up Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Single Turn, Static Gland
AS5861	Retainers, (Back-Up Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Solid, Static Gland
ARP4727	Gland Design, Computation of Squeeze and Gland Volume

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2.1.2 ASME Publications

Available from the American Society of Mechanical Engineers, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

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

2.1.3 National Aerospace Standard Publications

Available from Aerospace Industries Association, Inc., 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS 1611 Packing, Preformed O-Ring, Phosphate Ester Resistant

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 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 documents 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 (10.3 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 zero, one and two backup rings. The gland widths are designed to work with backup rings with maximum widths given in column 4 of Table 2.

For ease of manufacture it is recommended that piston style glands be used where possible. This also improves the assembly of the glands as the O-ring is less likely to be pinched.

3.1.2 Dimensions: The fits and tolerances are the same as those in AS4716 and also Figures 1 and 2 and Tables 3, 4 and 5 are the same. Rod OD (B) and Rod Bore (H) are the same as AS4716. Cylinder Bore (A) and Piston OD (C) are the same as AS4716 except for sizes -001 thru -011 and -104 thru -113 which are smaller to avoid excessive stretch. Changes have been made to the other gland dimensions to obtain a goal of 10% minimum squeeze at room temperature. This was achieved in the majority of the glands. See Table 1B. Changes have been made to the gland width dimensions to achieve 90% maximum gland occupancy at 275 °F (135 °C) in the zero backup gland width. The gland width of the one and two backup grooves is simply based on adding the maximum backup ring width to the width of the no backup groove plus an allowance for backup ring growth at 275 °F (135 °C). The additional allowance was added where needed to not exceed 90% fill of the space for the seal. A coefficient of thermal expansion of 7×10^{-5} unit length per °F (1.26×10^{-4} unit length per °C) was used for the backup ring material. A coefficient of thermal expansion of 1.5×10^{-4} unit length per °F (2.7×10^{-4} unit length per °C) was used for the elastomer. Gland wall angle and break edge dimensions have been included to permit these glands to be used at pressures up to 8000 psi (55.2 MPa).

- 3.1.3 Limitations: Some of the smaller sizes have the possibility of exceeding 5% stretch and/or 30% squeeze at worst case tolerances. See Table 1B. Those sizes should be avoided unless the designer is confident that the chosen elastomer will work under those conditions. Use of O-rings like NAS1611 which have tighter tolerances than AS568 will reduce the extremes of stretch and squeeze.

NOTE: The use of O-ring seals with a nominal cross section of less than 0.103 inch is problematic for two reasons: (1) The O-ring and gland tolerances are a large percentage of the nominal gland dimensions and the percentage increases as the O-ring cross section decreases. This causes a large range of resultant stretch and squeeze. (2) The ratio of area to volume of O-rings increases significantly as the O-ring cross section decreases. At the same time, the volume of the O-ring is decreasing. This makes the smaller cross section seals much more sensitive than large cross section seals to the rate of attack by the fluid to which they are exposed. Published data shows that some small cross section nitrile seals exposed to red oil have significantly more loss of swell and therefore loss of cross section diameter than larger cross section seals when exposed to the fluid for the same length of time at high temperature. Any seal material that suffers from loss of swell after exposure to a fluid will provide a more reliable seal if a larger cross section seal is used. Therefore, the use of O-ring sizes with a nominal cross section smaller than 0.103 inch or their equivalent proprietary shapes, is not recommended due to the increased possibility of leakage and the subsequent decrease in reliability of the installation.

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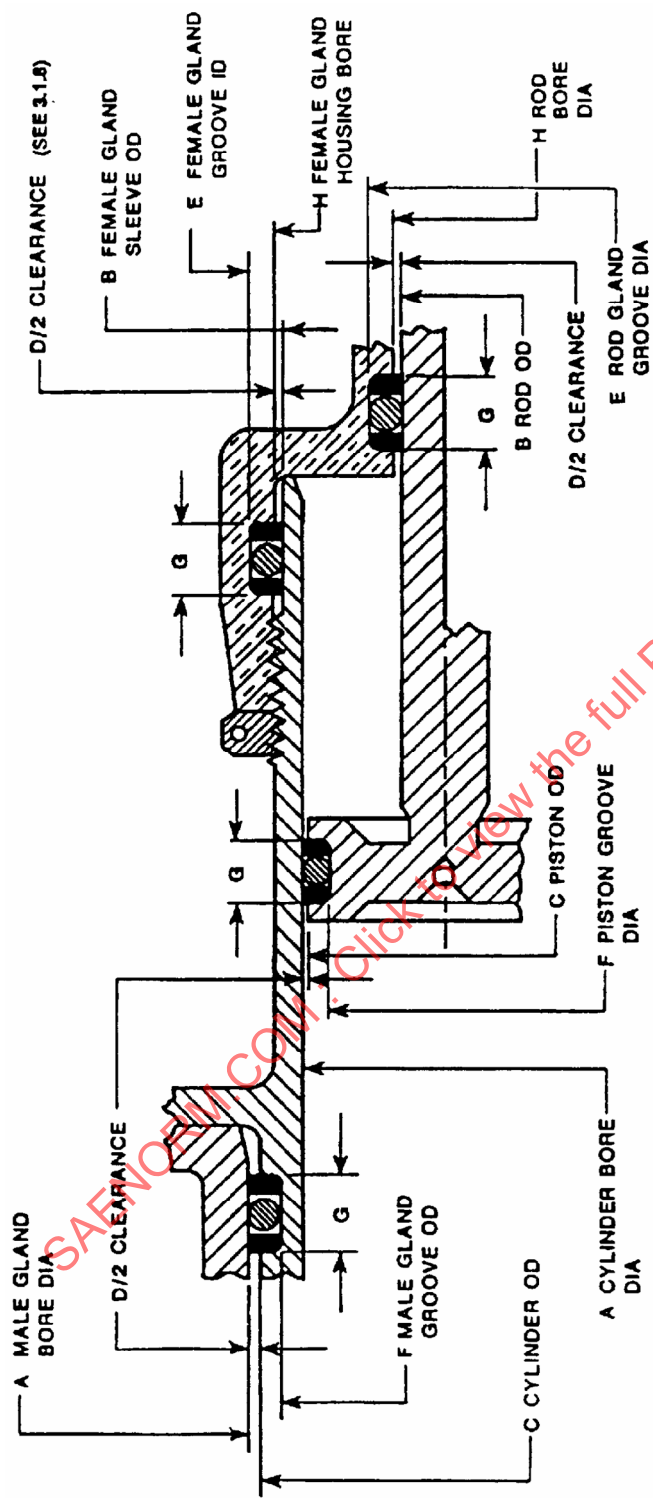
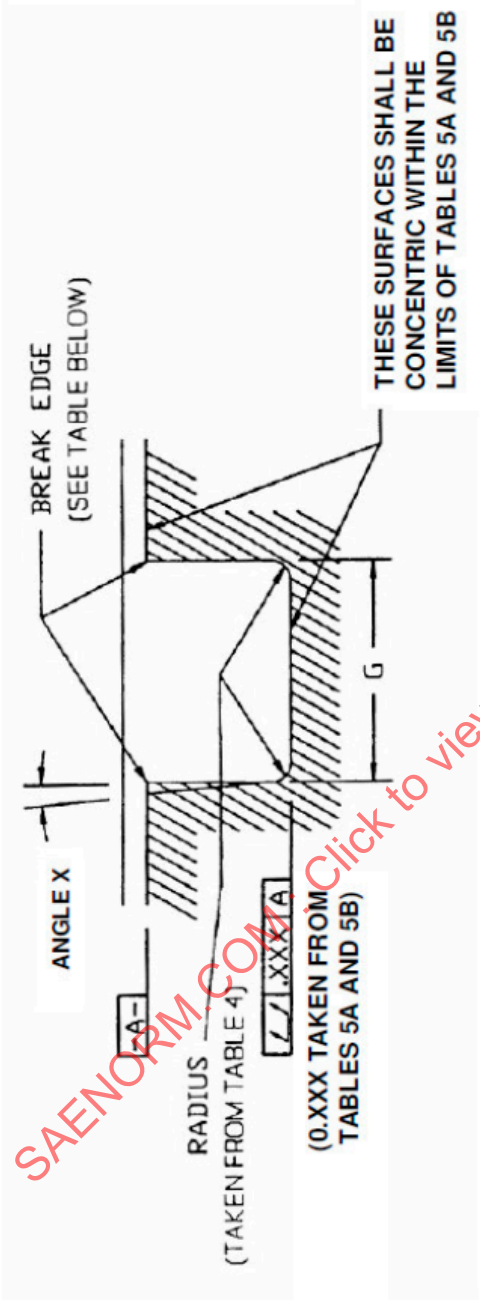


FIGURE 1 - GLAND DESIGN

Note: Dynamic applications are shown to illustrate the concept of rod and piston glands. This is not to imply that this standard is to be used for dynamic applications.



BREAK EDGE		
PRESSURE (PSIG)	PRESSURE (MPa)	GROOVE EDGE BREAK (inches)
≤ 4,000	≤ 27.6	.005 +.005/-0.00
> 4,000	> 27.6	.002 +.008/-0.00

GROOVE WALL ANGLE (Angle X)		
PRESSURE (PSIG)	PRESSURE (MPa)	Angle X (DEGREES)
≤ 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

FIGURE 2 - GLAND DETAILS

TABLE 1A - STANDARD GLAND DIMENSIONS 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
001	0.084 0.083	0.087 0.086	0.035 0.034	0.033 0.032	0.036 0.035	0.087 0.086
002	0.116 0.115	0.119 0.118	0.048 0.047	0.048 0.047	0.051 0.050	0.119 0.118
003	0.149 0.148	0.152 0.151	0.063 0.062	0.063 0.062	0.066 0.065	0.152 0.151
004	0.183 0.182	0.186 0.185	0.078 0.077	0.076 0.075	0.079 0.078	0.185 0.184
005	0.215 0.214	0.218 0.217	0.110 0.109	0.108 0.107	0.111 0.110	0.217 0.216
006	0.228 0.227	0.231 0.230	0.123 0.122	0.123 0.122	0.126 0.125	0.232 0.231
007	0.259 0.258	0.262 0.261	0.154 0.153	0.154 0.153	0.157 0.156	0.263 0.262
008	0.291 0.290	0.294 0.293	0.186 0.185	0.185 0.184	0.188 0.187	0.294 0.293
009	0.324 0.323	0.327 0.326	0.219 0.218	0.217 0.216	0.220 0.219	0.326 0.325
010	0.355 0.354	0.358 0.357	0.250 0.249	0.248 0.247	0.251 0.250	0.357 0.356
011	0.418 0.417	0.421 0.420	0.313 0.312	0.310 0.309	0.313 0.312	0.419 0.418
012	0.483 0.482	0.486 0.485	0.378 0.377	0.373 0.372	0.376 0.375	0.482 0.481
013	0.548 0.547	0.552 0.550	0.443 0.441	0.435 0.433	0.438 0.437	0.545 0.543
014	0.611 0.610	0.615 0.613	0.506 0.504	0.498 0.496	0.501 0.500	0.608 0.606
015	0.673 0.672	0.677 0.675	0.568 0.566	0.560 0.558	0.563 0.562	0.670 0.668
016	0.736 0.735	0.740 0.738	0.631 0.629	0.623 0.621	0.626 0.625	0.733 0.731

TABLE 1A - STANDARD GLAND DIMENSIONS 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
017	0.798 0.797	0.802 0.800	0.693 0.691	0.685 0.683	0.688 0.687	0.795 0.793
018	0.861 0.860	0.865 0.863	0.756 0.754	0.748 0.746	0.751 0.750	0.858 0.856
019	0.923 0.922	0.927 0.925	0.818 0.816	0.810 0.808	0.813 0.812	0.920 0.918
020	0.989 0.988	0.993 0.991	0.884 0.882	0.873 0.871	0.876 0.875	0.983 0.981
021	1.051 1.050	1.055 1.053	0.946 0.944	0.935 0.933	0.938 0.937	1.045 1.043
022	1.114 1.113	1.118 1.116	1.009 1.007	0.998 0.996	1.001 1.000	1.108 1.106
023	1.176 1.175	1.180 1.178	1.071 1.069	1.060 1.058	1.063 1.062	1.170 1.168
024	1.239 1.238	1.243 1.241	1.134 1.132	1.123 1.121	1.126 1.125	1.233 1.231
025	1.301 1.300	1.305 1.303	1.196 1.194	1.185 1.183	1.188 1.187	1.295 1.293
026	1.364 1.363	1.368 1.366	1.259 1.257	1.248 1.246	1.251 1.250	1.358 1.356
027	1.426 1.425	1.430 1.428	1.321 1.319	1.310 1.308	1.313 1.312	1.420 1.418
028	1.489 1.488	1.493 1.491	1.384 1.382	1.373 1.371	1.376 1.375	1.483 1.481
104	0.284 0.283	0.287 0.286	0.121 0.120	0.123 0.122	0.126 0.125	0.289 0.288
105	0.315 0.314	0.318 0.317	0.152 0.151	0.154 0.153	0.157 0.156	0.320 0.319
106	0.347 0.346	0.350 0.349	0.184 0.183	0.185 0.184	0.188 0.187	0.351 0.350
107	0.380 0.379	0.383 0.382	0.217 0.216	0.217 0.216	0.220 0.219	0.383 0.382

TABLE 1A - STANDARD GLAND DIMENSIONS 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
108	0.412 0.411	0.415 0.414	0.249 0.248	0.248 0.247	0.251 0.250	0.414 0.413
109	0.475 0.474	0.478 0.477	0.312 0.311	0.310 0.309	0.313 0.312	0.476 0.475
110	0.539 0.538	0.543 0.541	0.377 0.375	0.373 0.371	0.376 0.375	0.540 0.538
111	0.602 0.601	0.606 0.604	0.440 0.438	0.435 0.433	0.438 0.437	0.602 0.600
112	0.666 0.665	0.670 0.668	0.504 0.502	0.498 0.496	0.501 0.500	0.665 0.663
113	0.732 0.731	0.736 0.734	0.570 0.568	0.560 0.558	0.563 0.562	0.727 0.725
114	0.798 0.797	0.802 0.800	0.636 0.634	0.623 0.621	0.626 0.625	0.790 0.788
115	0.861 0.860	0.865 0.863	0.699 0.697	0.685 0.683	0.688 0.687	0.852 0.850
116	0.923 0.922	0.927 0.925	0.761 0.759	0.748 0.746	0.751 0.750	0.915 0.913
117	0.989 0.988	0.993 0.991	0.827 0.825	0.810 0.808	0.813 0.812	0.977 0.975
118	1.051 1.050	1.055 1.053	0.889 0.887	0.873 0.871	0.876 0.875	1.040 1.038
119	1.114 1.113	1.118 1.116	0.952 0.950	0.935 0.933	0.938 0.937	1.102 1.100
120	1.176 1.175	1.180 1.178	1.014 1.012	0.998 0.996	1.001 1.000	1.165 1.163
121	1.239 1.238	1.243 1.241	1.077 1.075	1.060 1.058	1.063 1.062	1.227 1.225
122	1.301 1.300	1.305 1.303	1.139 1.137	1.123 1.121	1.126 1.125	1.290 1.288
123	1.364 1.363	1.368 1.366	1.202 1.200	1.185 1.183	1.188 1.187	1.352 1.350

TABLE 1A - STANDARD GLAND DIMENSIONS 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
124	1.426	1.430	1.264	1.248	1.251	1.415
	1.425	1.428	1.262	1.246	1.250	1.413
125	1.489	1.493	1.327	1.310	1.313	1.477
	1.488	1.491	1.325	1.308	1.312	1.475
126	1.551	1.555	1.389	1.373	1.376	1.540
	1.550	1.553	1.387	1.371	1.375	1.538
127	1.614	1.618	1.452	1.435	1.439	1.602
	1.613	1.616	1.450	1.433	1.437	1.600
128	1.676	1.680	1.514	1.498	1.502	1.665
	1.675	1.678	1.512	1.496	1.500	1.663
129	1.739	1.743	1.577	1.560	1.564	1.727
	1.738	1.741	1.575	1.558	1.562	1.725
130	1.802	1.807	1.641	1.623	1.627	1.790
	1.801	1.805	1.639	1.621	1.625	1.788
131	1.864	1.869	1.703	1.685	1.689	1.852
	1.863	1.867	1.701	1.683	1.687	1.850
132	1.927	1.932	1.766	1.748	1.752	1.915
	1.926	1.930	1.764	1.746	1.750	1.913
133	1.989	1.994	1.828	1.810	1.815	1.977
	1.988	1.992	1.826	1.808	1.813	1.975
134	2.052	2.057	1.891	1.873	1.878	2.040
	2.051	2.055	1.889	1.871	1.876	2.038
135	2.115	2.120	1.954	1.936	1.941	2.103
	2.114	2.118	1.952	1.934	1.939	2.101
136	2.177	2.182	2.016	1.998	2.003	2.165
	2.176	2.180	2.014	1.996	2.001	2.163
137	2.240	2.245	2.079	2.061	2.066	2.228
	2.239	2.243	2.077	2.059	2.064	2.226
138	2.302	2.307	2.141	2.123	2.128	2.290
	2.301	2.305	2.139	2.121	2.126	2.288
139	2.365	2.370	2.204	2.186	2.191	2.353
	2.364	2.368	2.202	2.184	2.189	2.351

TABLE 1A - STANDARD GLAND DIMENSIONS 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
140	2.427 2.426	2.432 2.430	2.266 2.264	2.248 2.246	2.253 2.251	2.415 2.413
141	2.490 2.488	2.495 2.493	2.329 2.327	2.311 2.309	2.316 2.314	2.478 2.476
142	2.552 2.550	2.557 2.555	2.391 2.389	2.373 2.371	2.378 2.376	2.540 2.538
143	2.615 2.613	2.620 2.618	2.454 2.452	2.436 2.434	2.441 2.439	2.603 2.601
144	2.677 2.675	2.682 2.680	2.516 2.514	2.498 2.496	2.503 2.501	2.665 2.663
145	2.740 2.738	2.745 2.743	2.579 2.577	2.561 2.559	2.566 2.564	2.728 2.726
146	2.802 2.800	2.807 2.805	2.641 2.639	2.623 2.621	2.628 2.626	2.790 2.788
147	2.865 2.863	2.870 2.868	2.704 2.702	2.686 2.684	2.691 2.689	2.853 2.851
148	2.927 2.925	2.932 2.930	2.766 2.764	2.748 2.746	2.753 2.751	2.915 2.913
149	2.990 2.988	2.995 2.993	2.829 2.827	2.811 2.809	2.816 2.814	2.978 2.976
210	0.989 0.988	0.993 0.991	0.767 0.765	0.748 0.746	0.751 0.750	0.976 0.974
211	1.051 1.050	1.055 1.053	0.829 0.827	0.810 0.808	0.813 0.812	1.038 1.036
212	1.114 1.113	1.118 1.116	0.892 0.890	0.873 0.871	0.876 0.875	1.101 1.099
213	1.176 1.175	1.180 1.178	0.954 0.952	0.935 0.933	0.938 0.937	1.163 1.161
214	1.239 1.238	1.243 1.241	1.017 1.015	0.998 0.996	1.001 1.000	1.226 1.224
215	1.301 1.300	1.305 1.303	1.079 1.077	1.060 1.058	1.063 1.062	1.288 1.286

TABLE 1A - STANDARD GLAND DIMENSIONS 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
216	1.364 1.363	1.368 1.366	1.142 1.140	1.123 1.121	1.126 1.125	1.351 1.349
217	1.426 1.425	1.430 1.428	1.204 1.202	1.185 1.183	1.188 1.187	1.413 1.411
218	1.489 1.488	1.493 1.491	1.267 1.265	1.248 1.246	1.251 1.250	1.476 1.474
219	1.551 1.550	1.555 1.553	1.329 1.327	1.310 1.308	1.313 1.312	1.538 1.536
220	1.614 1.613	1.618 1.616	1.392 1.390	1.373 1.371	1.376 1.375	1.601 1.599
221	1.676 1.675	1.680 1.678	1.454 1.452	1.435 1.433	1.438 1.437	1.663 1.661
222	1.739 1.738	1.743 1.741	1.517 1.515	1.498 1.496	1.501 1.500	1.726 1.724
223	1.864 1.863	1.869 1.867	1.643 1.641	1.623 1.621	1.627 1.625	1.851 1.849
224	1.989 1.988	1.994 1.992	1.768 1.766	1.748 1.746	1.752 1.750	1.976 1.974
225	2.115 2.114	2.120 2.118	1.894 1.892	1.873 1.871	1.878 1.876	2.101 2.099
226	2.240 2.239	2.245 2.243	2.019 2.017	1.998 1.996	2.003 2.001	2.226 2.224
227	2.365 2.364	2.370 2.368	2.144 2.142	2.123 2.121	2.128 2.126	2.351 2.349
228	2.490 2.488	2.495 2.493	2.269 2.267	2.248 2.246	2.253 2.251	2.476 2.474
229	2.615 2.613	2.620 2.618	2.394 2.392	2.373 2.371	2.378 2.376	2.601 2.599
230	2.740 2.738	2.745 2.743	2.519 2.517	2.498 2.496	2.503 2.501	2.726 2.724
231	2.865 2.863	2.870 2.868	2.644 2.642	2.623 2.621	2.628 2.626	2.851 2.849

TABLE 1A - STANDARD GLAND DIMENSIONS 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
232	2.990 2.988	2.995 2.993	2.769 2.767	2.748 2.746	2.753 2.751	2.976 2.974
233	3.115 3.113	3.120 3.118	2.894 2.892	2.873 2.871	2.878 2.876	3.101 3.099
234	3.240 3.238	3.245 3.243	3.019 3.017	2.997 2.995	3.002 3.000	3.225 3.223
235	3.365 3.363	3.370 3.368	3.144 3.142	3.122 3.120	3.127 3.125	3.350 3.348
236	3.490 3.488	3.495 3.493	3.269 3.267	3.247 3.245	3.252 3.250	3.475 3.473
237	3.615 3.613	3.620 3.618	3.394 3.392	3.372 3.370	3.377 3.375	3.600 3.598
238	3.740 3.738	3.745 3.743	3.519 3.517	3.497 3.495	3.502 3.500	3.725 3.723
239	3.865 3.863	3.870 3.868	3.644 3.642	3.622 3.620	3.627 3.625	3.850 3.848
240	3.990 3.988	3.995 3.993	3.769 3.767	3.747 3.745	3.752 3.750	3.975 3.973
241	4.115 4.113	4.120 4.118	3.894 3.892	3.872 3.870	3.877 3.875	4.100 4.098
242	4.240 4.238	4.245 4.243	4.019 4.017	3.997 3.995	4.002 4.000	4.225 4.223
243	4.365 4.363	4.370 4.368	4.144 4.142	4.122 4.120	4.127 4.125	4.350 4.348
244	4.489 4.487	4.495 4.493	4.269 4.267	4.247 4.245	4.252 4.250	4.475 4.473
245	4.614 4.612	4.620 4.618	4.394 4.392	4.372 4.370	4.377 4.375	4.600 4.598
246	4.739 4.737	4.745 4.743	4.519 4.517	4.497 4.495	4.503 4.501	4.725 4.723
247	4.864 4.862	4.870 4.868	4.644 4.642	4.622 4.620	4.628 4.626	4.850 4.848

TABLE 1A - STANDARD GLAND DIMENSIONS 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
325	1.864 1.863	1.869 1.867	1.523 1.521	1.498 1.496	1.502 1.500	1.848 1.846
326	1.989 1.988	1.994 1.992	1.648 1.646	1.623 1.621	1.627 1.625	1.973 1.971
327	2.115 2.114	2.120 2.118	1.774 1.772	1.748 1.746	1.752 1.750	2.098 2.096
328	2.240 2.239	2.245 2.243	1.899 1.897	1.873 1.871	1.878 1.876	2.223 2.221
329	2.365 2.364	2.370 2.368	2.024 2.022	1.998 1.996	2.003 2.001	2.348 2.346
330	2.490 2.488	2.495 2.493	2.149 2.147	2.123 2.121	2.128 2.126	2.473 2.471
331	2.615 2.613	2.620 2.618	2.274 2.272	2.248 2.246	2.253 2.251	2.598 2.596
332	2.740 2.738	2.745 2.743	2.399 2.397	2.373 2.371	2.378 2.376	2.723 2.721
333	2.865 2.863	2.870 2.868	2.524 2.522	2.498 2.496	2.503 2.501	2.848 2.846
334	2.990 2.988	2.995 2.993	2.649 2.647	2.623 2.621	2.628 2.626	2.973 2.971
335	3.115 3.113	3.120 3.118	2.774 2.772	2.748 2.746	2.753 2.751	3.098 3.096
336	3.240 3.238	3.245 3.243	2.899 2.897	2.873 2.871	2.878 2.876	3.223 3.221
337	3.365 3.363	3.370 3.368	3.024 3.022	2.997 2.995	3.002 3.000	3.347 3.345
338	3.490 3.488	3.495 3.493	3.149 3.147	3.122 3.120	3.127 3.125	3.472 3.470
339	3.615 3.613	3.620 3.618	3.274 3.272	3.247 3.245	3.252 3.250	3.597 3.595
340	3.740 3.738	3.745 3.743	3.399 3.397	3.372 3.370	3.377 3.375	3.722 3.720

TABLE 1A - STANDARD GLAND DIMENSIONS 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
341	3.865 3.863	3.870 3.868	3.524 3.522	3.497 3.495	3.502 3.500	3.847 3.845
342	3.990 3.988	3.995 3.993	3.649 3.647	3.622 3.620	3.627 3.625	3.972 3.970
343	4.115 4.113	4.120 4.118	3.774 3.772	3.747 3.745	3.752 3.750	4.097 4.095
344	4.240 4.238	4.245 4.243	3.899 3.897	3.872 3.870	3.877 3.875	4.222 4.220
345	4.365 4.363	4.370 4.368	4.024 4.022	3.997 3.995	4.002 4.000	4.347 4.345
346	4.489 4.487	4.495 4.493	4.149 4.147	4.122 4.120	4.127 4.125	4.472 4.470
347	4.614 4.612	4.620 4.618	4.274 4.272	4.247 4.245	4.252 4.250	4.597 4.595
348	4.739 4.737	4.745 4.743	4.399 4.397	4.372 4.370	4.377 4.375	4.722 4.720
349	4.864 4.862	4.870 4.868	4.524 4.522	4.497 4.495	4.502 4.500	4.847 4.845
425	4.970 4.968	4.977 4.974	4.519 4.516	4.497 4.494	4.503 4.501	4.959 4.956
426	5.095 5.093	5.102 5.099	4.644 4.641	4.622 4.619	4.628 4.626	5.084 5.081
427	5.220 5.218	5.227 5.224	4.769 4.766	4.747 4.744	4.753 4.751	5.209 5.206
428	5.345 5.343	5.352 5.349	4.894 4.891	4.872 4.869	4.878 4.876	5.334 5.331
429	5.470 5.468	5.477 5.474	5.019 5.016	4.997 4.994	5.003 5.001	5.459 5.456
430	5.595 5.593	5.602 5.599	5.144 5.141	5.122 5.119	5.128 5.126	5.584 5.581
431	5.720 5.718	5.727 5.724	5.269 5.266	5.247 5.244	5.253 5.251	5.709 5.706

TABLE 1A - STANDARD GLAND DIMENSIONS 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
432	5.845 5.843	5.852 5.849	5.394 5.391	5.372 5.369	5.378 5.376	5.834 5.831
433	5.970 5.968	5.977 5.974	5.519 5.516	5.497 5.494	5.503 5.501	5.959 5.956
434	6.095 6.093	6.102 6.099	5.644 5.641	5.622 5.619	5.628 5.626	6.084 6.081
435	6.220 6.218	6.227 6.224	5.769 5.766	5.747 5.744	5.753 5.751	6.209 6.206
436	6.345 6.343	6.352 6.349	5.894 5.891	5.872 5.869	5.878 5.876	6.334 6.331
437	6.470 6.468	6.477 6.474	6.019 6.016	5.997 5.994	6.003 6.001	6.459 6.456
438	6.720 6.718	6.727 6.724	6.269 6.266	6.247 6.244	6.253 6.251	6.709 6.706
439	6.970 6.968	6.977 6.974	6.519 6.516	6.497 6.494	6.504 6.501	6.959 6.956
440	7.220 7.218	7.227 7.224	6.769 6.766	6.747 6.744	6.754 6.751	7.209 7.206
441	7.470 7.468	7.477 7.474	7.019 7.016	6.997 6.994	7.004 7.001	7.459 7.456
442	7.720 7.718	7.727 7.724	7.269 7.266	7.247 7.244	7.254 7.251	7.709 7.706
443	7.970 7.968	7.977 7.974	7.519 7.516	7.497 7.494	7.504 7.501	7.959 7.956
444	8.220 8.218	8.227 8.224	7.769 7.766	7.747 7.744	7.754 7.751	8.209 8.206
445	8.470 8.468	8.477 8.474	8.019 8.016	7.997 7.994	8.004 8.001	8.459 8.456
446	8.970 8.967	8.977 8.974	8.519 8.516	8.497 8.494	8.504 8.501	8.959 8.956
447	9.470 9.467	9.478 9.474	9.020 9.017	8.997 8.994	9.004 9.001	9.460 9.456

TABLE 1A - STANDARD GLAND DIMENSIONS 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
448	9.970 9.967	9.978 9.974	9.520 9.517	9.497 9.494	9.504 9.501	9.960 9.956
449	10.470 10.467	10.478 10.474	10.020 10.017	9.997 9.994	10.004 10.001	10.460 10.456
450	10.970 10.967	10.978 10.974	10.520 10.517	10.497 10.494	10.504 10.501	10.960 10.956
451	11.470 11.467	11.478 11.474	11.020 11.017	10.997 10.994	11.004 11.001	11.460 11.456
452	11.970 11.967	11.978 11.974	11.520 11.517	11.497 11.494	11.504 11.501	11.960 11.956
453	12.470 12.467	12.478 12.474	12.020 12.017	11.997 11.994	12.004 12.001	12.460 12.456
454	12.970 12.967	12.978 12.974	12.520 12.517	12.497 12.494	12.504 12.501	12.960 12.956
455	13.470 13.467	13.478 13.474	13.020 13.017	12.997 12.994	13.004 13.001	13.460 13.456
456	13.970 13.967	13.978 13.974	13.520 13.517	13.497 13.494	13.504 13.501	13.960 13.956
457	14.470 14.467	14.478 14.474	14.020 14.017	13.997 13.994	14.004 14.001	14.460 14.456
458	14.970 14.967	14.978 14.974	14.520 14.517	14.497 14.494	14.504 14.501	14.960 14.956
459	15.470 15.467	15.478 15.474	15.020 15.017	14.997 14.994	15.004 15.001	15.460 15.456
460	15.970 15.967	15.978 15.974	15.520 15.517	15.497 15.494	15.504 15.501	15.960 15.956

TABLE 1B - O-RING PERCENTAGE STRETCH AND SQUEEZE

Gland and AS568 Dash No.	Piston Minimum Stretch %	Piston Maximum Stretch %	Piston Minimum Squeeze +75 °F %	Piston Minimum Squeeze -65 °F %	Piston Maximum Squeeze 75 °F %	Piston Maximum Squeeze +275 °F %	Rod Minimum Squeeze +75 °F %	Rod Minimum Squeeze -65 °F %	Rod Maximum Squeeze +75 °F %	Rod Maximum Squeeze +275 °F %
001	3.0	40.0	11.4	9.5	45.5	47.1	10.5	8.6	44.2	45.8
002	2.2	26.3	10.6	8.7	37.8	39.6	10.6	8.7	37.8	39.6
003	3.3	21.2	10.2	8.3	33.0	34.9	10.2	8.3	33.0	34.9
004	2.7	20.0	8.6	6.6	29.1	31.2	8.7	6.8	29.1	31.2
005	2.8	14.6	9.3	7.4	29.0	31.1	9.3	7.4	28.9	31.0
006	2.5	12.8	9.7	7.7	29.1	31.2	8.9	6.9	28.4	30.5
007	2.0	10.0	10.3	8.3	29.2	31.3	9.5	7.6	28.5	30.6
008	2.2	8.8	10.5	8.6	29.1	31.2	10.0	8.0	28.6	30.7
009	2.3	7.9	10.0	8.0	28.6	30.6	9.7	7.7	28.3	30.4
010	2.0	6.8	10.5	8.5	28.7	30.8	10.1	8.2	28.4	30.5
011	2.0	5.7	11.0	9.1	28.8	30.9	10.7	8.8	28.6	30.7
012	2.2	5.3	11.2	9.3	28.7	30.8	11.1	9.2	28.7	30.8
013	2.3	5.2	9.0	7.0	28.6	30.7	9.2	7.2	28.8	30.9
014	2.0	4.5	9.3	7.3	28.7	30.8	9.4	7.4	28.9	31.0
015	1.4	4.4	9.3	7.4	29.0	31.1	9.3	7.4	29.2	31.2
016	1.0	4.3	9.4	7.4	29.3	31.3	9.3	7.3	29.5	31.5
017	0.9	3.9	9.6	7.6	29.4	31.4	9.4	7.5	29.5	31.5
018	0.8	3.6	9.7	7.8	29.4	31.5	9.5	7.6	29.5	31.5
019	0.7	3.3	9.9	7.9	29.5	31.5	9.6	7.7	29.5	31.5
020	1.0	3.4	9.8	7.9	29.3	31.4	9.7	7.8	29.5	31.5
021	1.0	3.2	9.9	8.0	29.3	31.4	9.8	7.9	29.5	31.5
022	0.8	3.1	9.9	8.0	29.5	31.5	9.8	7.9	29.5	31.5
023	0.8	2.9	10.0	8.1	29.5	31.5	9.9	7.9	29.5	31.5
024	0.7	2.7	10.1	8.2	29.5	31.6	9.9	8.0	29.5	31.5
025	0.6	2.7	10.1	8.2	29.6	31.7	9.9	8.0	29.5	31.5

TABLE 1B - O-RING PERCENTAGE STRETCH AND SQUEEZE (CONTINUED)

Gland and AS568 Dash No.	Piston Minimum Stretch %	Piston Maximum Stretch %	Piston Minimum Squeeze +75 °F %	Piston Minimum Squeeze -65 °F %	Piston Maximum Squeeze +75 °F %	Piston Maximum Squeeze +275 °F %	Rod Minimum Squeeze +75 °F %	Rod Minimum Squeeze -65 °F %	Rod Maximum Squeeze +75 °F %	Rod Maximum Squeeze +275 °F %
026	0.6	2.5	10.2	8.3	29.6	31.7	10.0	8.0	29.5	31.5
027	0.5	2.4	10.2	8.3	29.7	31.7	10.0	8.1	29.5	31.5
028	0.4	2.4	10.2	8.3	29.8	31.8	10.0	8.0	29.5	31.5
104	2.6	13.1	9.7	7.7	23.6	25.8	9.1	7.1	23.1	25.3
105	2.0	10.1	10.2	8.2	23.7	25.9	9.7	7.7	23.3	25.5
106	2.2	8.9	10.3	8.4	23.6	25.8	10.1	8.1	23.4	25.6
107	2.4	8.0	10.4	8.5	23.5	25.7	10.4	8.5	23.5	25.7
108	2.5	7.3	10.5	8.5	23.4	25.7	10.6	8.7	23.6	25.8
109	2.3	6.1	10.7	8.8	23.4	25.7	11.1	9.2	23.7	25.9
110	2.2	5.6	9.4	7.5	23.3	25.6	9.5	7.5	23.4	25.6
111	2.1	5.0	9.7	7.7	23.4	25.6	9.8	7.8	23.5	25.8
112	2.0	4.6	9.9	7.9	23.5	25.7	10.0	8.0	23.6	25.9
113	2.2	5.2	9.5	7.6	23.4	25.7	10.0	8.0	24.0	26.2
114	2.1	5.5	9.4	7.4	23.5	25.7	9.9	8.0	24.3	26.5
115	2.0	5.1	9.5	7.6	23.5	25.7	10.1	8.1	24.3	26.5
116	1.7	4.5	9.8	7.9	23.7	25.9	10.2	8.3	24.3	26.5
117	2.0	4.8	9.6	7.7	23.6	25.8	10.2	8.3	24.4	26.6
118	1.7	4.3	9.9	7.9	23.7	25.9	10.3	8.4	24.4	26.6
119	1.7	4.2	10.0	8.0	23.7	25.9	10.4	8.5	24.4	26.6
120	1.5	3.8	10.2	8.2	23.8	26.1	10.5	8.6	24.4	26.6
121	1.5	3.7	10.2	8.3	23.8	26.1	10.6	8.6	24.4	26.6
122	1.3	3.4	10.4	8.4	23.9	26.2	10.6	8.7	24.4	26.7
123	1.2	3.4	10.3	8.4	24.0	26.3	10.6	8.7	24.5	26.7
124	1.0	3.2	10.4	8.5	24.1	26.3	10.6	8.7	24.5	26.7
125	1.1	3.1	10.5	8.5	24.1	26.3	10.7	8.8	24.5	26.7

TABLE 1B - O-RING PERCENTAGE STRETCH AND SQUEEZE (CONTINUED)

Gland and AS568 Dash No.	Piston Minimum Stretch %	Piston Maximum Stretch %	Piston Minimum Squeeze +75 °F %	Piston Minimum Squeeze -65 °F %	Piston Maximum Squeeze +75 °F %	Piston Maximum Squeeze +275 °F %	Rod Minimum Squeeze +75 °F %	Rod Minimum Squeeze -65 °F %	Rod Maximum Squeeze +75 °F %	Rod Maximum Squeeze +275 °F %
126	0.9	2.9	10.6	8.6	24.2	26.4	10.7	8.8	24.5	26.7
127	1.0	2.8	10.6	8.7	24.2	26.4	10.3	8.4	25.0	27.2
128	0.9	2.6	10.7	8.8	24.3	26.5	10.3	8.4	25.0	27.2
129	0.7	2.8	10.6	8.7	24.4	26.6	10.2	8.3	25.0	27.2
130	0.7	2.8	10.1	8.2	24.8	27.0	10.3	8.3	25.0	27.2
131	0.7	2.7	10.2	8.2	24.9	27.0	10.3	8.4	25.0	27.2
132	0.7	2.6	10.2	8.3	24.9	27.1	10.3	8.4	25.0	27.2
133	0.7	2.5	10.2	8.3	24.9	27.1	9.9	7.9	25.5	27.6
134	0.6	2.4	10.3	8.4	24.9	27.1	9.9	8.0	25.5	27.6
135	0.5	2.4	10.3	8.4	25.0	27.2	9.9	7.9	25.5	27.6
136	0.5	2.3	10.3	8.4	25.0	27.2	9.9	8.0	25.5	27.6
137	0.5	2.3	10.4	8.4	25.0	27.2	9.9	8.0	25.5	27.6
138	0.5	2.2	10.4	8.5	25.0	27.2	9.9	8.0	25.5	27.6
139	0.5	2.1	10.4	8.5	25.1	27.2	10.0	8.0	25.5	27.6
140	0.4	2.1	10.5	8.5	25.1	27.2	10.0	8.1	25.5	27.6
141	0.3	2.1	9.9	8.0	25.6	27.8	9.9	8.0	25.5	27.6
142	0.3	2.1	9.9	8.0	25.6	27.8	9.9	8.0	25.5	27.6
143	0.3	2.0	10.0	8.0	25.7	27.8	10.0	8.0	25.5	27.6
144	0.3	2.0	10.0	8.1	25.7	27.8	10.0	8.1	25.5	27.6
145	0.3	1.9	10.0	8.1	25.7	27.8	10.0	8.1	25.5	27.6
146	0.3	1.9	10.1	8.1	25.7	27.8	10.0	8.1	25.5	27.6
147	0.2	1.9	10.0	8.1	25.7	27.9	10.0	8.1	25.5	27.6
148	0.2	1.9	10.1	8.1	25.7	27.9	10.0	8.1	25.5	27.6
149	0.2	1.8	10.1	8.2	25.7	27.9	10.0	8.1	25.5	27.6

TABLE 1B - O-RING PERCENTAGE STRETCH AND SQUEEZE (CONTINUED)

Gland and AS568 Dash No.	Piston Minimum Stretch %	Piston Maximum Stretch %	Piston Minimum Squeeze 75 °F %	Piston Minimum Squeeze -65 °F %	Piston Maximum Squeeze +75 °F %	Piston Maximum Squeeze +275 °F %	Rod Minimum Squeeze +75 °F %	Rod Minimum Squeeze -65 °F %	Rod Maximum Squeeze +75 °F %	Rod Maximum Squeeze +275 °F %
210	2.8	5.9	9.2	7.2	21.9	24.2	9.8	7.8	22.7	24.9
211	2.6	5.5	9.4	7.5	22.0	24.3	9.9	7.9	22.7	24.9
212	2.4	5.1	9.6	7.7	22.1	24.4	10.0	8.0	22.7	25.0
213	2.3	4.7	9.8	7.8	22.2	24.5	10.1	8.1	22.7	25.0
214	2.1	4.4	9.9	8.0	22.3	24.5	10.2	8.2	22.8	25.0
215	2.0	4.2	10.1	8.1	22.3	24.6	10.2	8.3	22.8	25.0
216	1.7	4.1	10.1	8.1	22.5	24.8	10.2	8.3	22.9	25.2
217	1.6	3.9	10.2	8.3	22.6	24.8	10.3	8.3	22.9	25.2
218	1.5	3.7	10.3	8.4	22.6	24.9	10.3	8.4	22.9	25.2
219	1.5	3.5	10.4	8.4	22.7	24.9	10.4	8.5	22.9	25.2
220	1.4	3.3	10.4	8.5	22.7	24.9	10.4	8.5	23.0	25.2
221	1.3	3.2	10.5	8.6	22.7	25.0	10.5	8.6	23.0	25.2
222	1.1	3.3	10.5	8.6	22.9	25.1	10.4	8.5	23.1	25.3
223	1.0	3.1	10.2	8.3	23.3	25.5	10.1	8.2	23.4	25.7
224	1.0	2.9	10.3	8.4	23.3	25.6	10.2	8.3	23.4	25.7
225	0.8	2.9	10.3	8.3	23.4	25.7	9.8	7.8	23.8	26.0
226	0.7	2.7	10.4	8.4	23.5	25.7	9.9	7.9	23.8	26.0
227	0.7	2.5	10.4	8.5	23.5	25.7	9.9	8.0	23.8	26.0
228	0.6	2.5	10.1	8.1	24.0	26.2	9.9	8.0	23.8	26.0
229	0.5	2.4	10.1	8.2	24.0	26.2	10.0	8.0	23.8	26.0
230	0.5	2.2	10.2	8.3	24.0	26.2	10.0	8.1	23.8	26.0
231	0.5	2.1	10.3	8.3	24.0	26.2	10.1	8.1	23.8	26.0
232	0.3	2.2	10.2	8.3	24.2	26.4	10.0	8.1	23.8	26.0
233	0.3	2.1	10.3	8.4	24.2	26.4	10.0	8.1	23.8	26.0
234	0.3	2.0	10.3	8.4	24.2	26.4	10.1	8.2	23.8	26.0

TABLE 1B - O-RING PERCENTAGE STRETCH AND SQUEEZE (CONTINUED)

Gland and AS568 Dash No.	Piston Minimum Stretch %	Piston Maximum Stretch %	Piston Minimum Squeeze +75 °F %	Piston Minimum Squeeze -65 °F %	Piston Maximum Squeeze +75 °F %	Piston Maximum Squeeze +275 °F %	Rod Minimum Squeeze +75 °F %	Rod Minimum Squeeze -65 °F %	Rod Maximum Squeeze +75 °F %	Rod Maximum Squeeze +275 °F %
235	0.3	1.9	10.4	8.5	24.2	26.4	10.1	8.2	23.8	26.0
236	0.3	1.8	10.4	8.5	24.2	26.4	10.2	8.2	23.8	26.0
237	0.3	1.8	10.5	8.6	24.2	26.4	10.2	8.3	23.8	26.0
238	0.3	1.7	10.5	8.6	24.2	26.4	10.2	8.3	23.8	26.0
239	0.1	1.8	10.5	8.6	24.3	26.5	10.2	8.2	23.8	26.0
240	0.1	1.7	10.5	8.6	24.3	26.5	10.2	8.3	23.8	26.0
241	0.1	1.6	10.6	8.6	24.3	26.5	10.2	8.3	23.8	26.0
242	0.1	1.6	10.6	8.7	24.3	26.5	10.3	8.3	23.8	26.0
243	0.1	1.5	10.6	8.7	24.3	26.5	10.3	8.4	23.8	26.0
244	0.1	1.5	10.2	8.3	24.7	26.9	10.3	8.3	23.8	26.0
245	0.1	1.5	10.3	8.4	24.7	26.9	10.3	8.4	23.8	26.0
246	0.1	1.5	10.3	8.4	24.7	26.9	9.9	8.0	24.1	26.3
247	0.1	1.4	10.3	8.4	24.7	26.9	9.9	8.0	24.1	26.3
325	2.1	4.3	10.0	8.1	20.4	22.7	9.9	8.0	20.5	22.8
326	1.9	4.0	10.2	8.3	20.5	22.8	10.0	8.1	20.5	22.8
327	1.8	3.7	10.3	8.4	20.5	22.8	10.1	8.2	20.6	22.9
328	1.7	3.5	10.4	8.5	20.6	22.9	9.9	8.0	20.8	23.1
329	1.5	3.4	10.5	8.6	20.7	23.0	9.9	8.0	20.9	23.3
330	1.4	3.2	10.3	8.4	21.0	23.3	10.0	8.1	21.0	23.3
331	1.3	3.0	10.4	8.5	21.1	23.4	10.1	8.1	21.0	23.3
332	1.2	2.9	10.5	8.6	21.1	23.4	10.1	8.2	21.0	23.3
333	1.1	2.8	10.5	8.6	21.2	23.5	10.1	8.2	21.1	23.4
334	1.0	2.7	10.6	8.7	21.3	23.6	10.2	8.2	21.1	23.4
335	1.0	2.6	10.6	8.7	21.3	23.6	10.2	8.3	21.1	23.4
336	0.9	2.4	10.7	8.8	21.3	23.6	10.3	8.3	21.1	23.4

TABLE 1B - O-RING PERCENTAGE STRETCH AND SQUEEZE (CONTINUED)

Gland and AS568 Dash No.	Piston Minimum Stretch %	Piston Maximum Stretch %	Piston Minimum Squeeze +75 °F %	Piston Minimum Squeeze -65 °F %	Piston Maximum Squeeze +75 °F %	Piston Maximum Squeeze +275 °F %	Rod Minimum Squeeze +75 °F %	Rod Minimum Squeeze -65 °F %	Rod Maximum Squeeze +75 °F %	Rod Maximum Squeeze +275 °F %
337	0.8	2.5	10.7	8.8	21.4	23.7	10.2	8.3	21.2	23.5
338	0.7	2.4	10.7	8.8	21.5	23.8	10.3	8.4	21.2	23.5
339	0.7	2.3	10.8	8.9	21.5	23.8	10.3	8.4	21.2	23.5
340	0.7	2.2	10.8	8.9	21.5	23.8	10.4	8.4	21.2	23.5
341	0.7	2.1	10.9	9.0	21.5	23.8	10.4	8.5	21.2	23.5
342	0.5	2.2	10.8	8.9	21.6	23.9	10.3	8.4	21.2	23.5
343	0.5	2.1	10.9	9.0	21.6	23.9	10.4	8.4	21.2	23.5
344	0.5	2.0	10.9	9.0	21.7	23.9	10.4	8.5	21.2	23.5
345	0.5	2.0	11.0	9.0	21.7	24.0	10.4	8.5	21.2	23.5
346	0.5	1.9	10.7	8.8	21.9	24.2	10.5	8.5	21.2	23.5
347	0.4	1.9	10.8	8.8	22.0	24.2	10.5	8.5	21.2	23.5
348	0.4	1.8	10.8	8.9	22.0	24.2	10.5	8.6	21.2	23.5
349	0.4	1.8	10.8	8.9	22.0	24.3	10.5	8.6	21.2	23.5
425	0.2	1.7	10.4	8.4	20.8	23.1	10.0	8.0	20.3	22.6
426	0.2	1.7	10.4	8.5	20.8	23.1	10.0	8.1	20.3	22.6
427	0.2	1.6	10.4	8.5	20.8	23.1	10.0	8.1	20.3	22.6
428	0.2	1.6	10.5	8.5	20.8	23.1	10.0	8.1	20.3	22.6
429	0.1	1.6	10.4	8.5	20.9	23.2	10.0	8.1	20.3	22.6
430	0.1	1.6	10.5	8.5	20.9	23.2	10.0	8.1	20.3	22.6
431	0.1	1.6	10.5	8.6	20.9	23.2	10.0	8.1	20.3	22.6
432	0.1	1.5	10.5	8.6	20.9	23.2	10.1	8.1	20.3	22.6
433	0.1	1.5	10.5	8.6	20.9	23.2	10.1	8.1	20.3	22.6
434	0.1	1.5	10.5	8.6	20.9	23.2	10.1	8.2	20.3	22.6
435	0.1	1.4	10.6	8.7	20.9	23.2	10.1	8.2	20.3	22.6
436	0.1	1.4	10.6	8.7	20.9	23.2	10.1	8.2	20.3	22.6

TABLE 1B - O-RING PERCENTAGE STRETCH AND SQUEEZE (CONTINUED)

Gland and AS568 Dash No.	Piston Minimum Stretch %	Piston Maximum Stretch %	Piston Minimum Squeeze +75 °F %	Piston Minimum Squeeze -65 °F %	Piston Maximum Squeeze +75 °F %	Piston Maximum Squeeze +275 °F %	Rod Minimum Squeeze +75 °F %	Rod Minimum Squeeze -65 °F %	Rod Maximum Squeeze +75 °F %	Rod Maximum Squeeze +275 °F %
437	0.1	1.4	10.6	8.7	20.9	23.2	10.1	8.2	20.3	22.6
438	0.0	1.4	10.6	8.7	20.9	23.2	10.1	8.2	20.3	22.6
439	0.0	1.3	10.7	8.7	20.9	23.2	10.0	8.0	20.5	22.8
440	0.0	1.3	10.7	8.8	20.9	23.2	10.0	8.1	20.5	22.8
441	0.0	1.2	10.7	8.8	20.9	23.2	10.0	8.1	20.5	22.8
442	-0.1	1.2	10.7	8.8	21.0	23.3	10.0	8.1	20.5	22.8
443	-0.1	1.2	10.7	8.8	21.0	23.3	10.0	8.1	20.5	22.8
444	-0.1	1.2	10.8	8.8	21.0	23.3	10.0	8.1	20.5	22.8
445	0.0	1.1	10.8	8.9	21.0	23.3	10.1	8.1	20.5	22.8
446	-0.2	1.2	10.6	8.6	21.2	23.5	10.0	8.1	20.5	22.8
447	-0.1	1.1	10.4	8.5	21.4	23.6	9.9	7.9	20.5	22.8
448	-0.1	1.1	10.4	8.5	21.4	23.6	9.9	8.0	20.5	22.8
449	-0.1	1.0	10.5	8.6	21.4	23.6	9.9	8.0	20.5	22.8
450	-0.2	1.0	10.5	8.6	21.4	23.6	9.9	8.0	20.5	22.8
451	-0.2	1.0	10.5	8.6	21.4	23.6	9.9	8.0	20.5	22.8
452	-0.2	0.9	10.6	8.6	21.4	23.6	10.0	8.0	20.5	22.8
453	-0.1	0.9	10.6	8.7	21.4	23.6	10.0	8.1	20.5	22.8
454	-0.1	0.8	10.6	8.7	21.4	23.6	10.0	8.1	20.5	22.8
455	-0.1	0.8	10.6	8.7	21.4	23.6	10.0	8.1	20.5	22.8
456	-0.2	0.9	10.6	8.7	21.4	23.6	10.0	8.1	20.5	22.8
457	-0.2	0.8	10.6	8.7	21.4	23.6	10.0	8.1	20.5	22.8
458	-0.2	0.8	10.6	8.7	21.4	23.6	10.0	8.1	20.5	22.8
459	-0.2	0.8	10.7	8.8	21.4	23.6	10.0	8.1	20.5	22.8
460	-0.2	0.7	10.7	8.8	21.4	23.6	10.1	8.1	20.5	22.8

TABLE 1C - STANDARD GLAND DIMENSIONS 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
001	2.134 2.108	2.210 2.184	0.889 0.864	0.838 0.813	0.914 0.889	2.210 2.184
002	2.946 2.921	3.023 2.997	1.219 1.194	1.219 1.194	1.295 1.270	3.023 2.997
003	3.785 3.759	3.861 3.835	1.600 1.575	1.600 1.575	1.676 1.651	3.861 3.835
004	4.648 4.623	4.724 4.699	1.981 1.956	1.930 1.905	2.007 1.981	4.699 4.674
005	5.461 5.436	5.537 5.512	2.794 2.769	2.743 2.718	2.819 2.794	5.512 5.486
006	5.791 5.766	5.867 5.842	3.124 3.099	3.124 3.099	3.200 3.175	5.893 5.867
007	6.579 6.553	6.655 6.629	3.912 3.886	3.912 3.886	3.988 3.962	6.680 6.655
008	7.391 7.366	7.468 7.442	4.724 4.699	4.699 4.674	4.775 4.750	7.468 7.442
009	8.230 8.204	8.306 8.280	5.563 5.537	5.512 5.486	5.588 5.563	8.280 8.255
010	9.017 8.992	9.093 9.068	6.350 6.325	6.299 6.274	6.375 6.350	9.068 9.042
011	10.617 10.592	10.693 10.668	7.950 7.925	7.874 7.849	7.950 7.925	10.643 10.617
012	12.268 12.243	12.344 12.319	9.601 9.576	9.474 9.449	9.550 9.525	12.243 12.217
013	13.919 13.894	14.021 13.970	11.252 11.201	11.049 10.998	11.125 11.100	13.843 13.792
014	15.519 15.494	15.621 15.570	12.852 12.802	12.649 12.598	12.725 12.700	15.443 15.392
015	17.094 17.069	17.196 17.145	14.427 14.376	14.224 14.173	14.300 14.275	17.018 16.967
016	18.694 18.669	18.796 18.745	16.027 15.977	15.824 15.773	15.900 15.875	18.618 18.567

TABLE 1C - STANDARD GLAND DIMENSIONS 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
017	20.269 20.244	20.371 20.320	17.602 17.551	17.399 17.348	17.475 17.450	20.193 20.142
018	21.869 21.844	21.971 21.920	19.202 19.152	18.999 18.948	19.075 19.050	21.793 21.742
019	23.444 23.419	23.546 23.495	20.777 20.726	20.574 20.523	20.650 20.625	23.368 23.317
020	25.121 25.095	25.222 25.171	22.454 22.403	22.174 22.123	22.250 22.225	24.968 24.917
021	26.695 26.670	26.797 26.746	24.028 23.978	23.749 23.698	23.825 23.800	26.543 26.492
022	28.296 28.270	28.397 28.346	25.629 25.578	25.349 25.298	25.425 25.400	28.143 28.092
023	29.870 29.845	29.972 29.921	27.203 27.153	26.924 26.873	27.000 26.975	29.718 29.667
024	31.471 31.445	31.572 31.521	28.804 28.753	28.524 28.473	28.600 28.575	31.318 31.267
025	33.045 33.020	33.147 33.096	30.378 30.328	30.099 30.048	30.175 30.150	32.893 32.842
026	34.646 34.620	34.747 34.696	31.979 31.928	31.699 31.648	31.775 31.750	34.493 34.442
027	36.220 36.195	36.322 36.271	33.553 33.503	33.274 33.223	33.350 33.325	36.068 36.017
028	37.821 37.795	37.922 37.871	35.154 35.103	34.874 34.823	34.950 34.925	37.668 37.617
104	7.214 7.188	7.290 7.264	3.073 3.048	3.124 3.099	3.200 3.175	7.341 7.315
105	8.001 7.976	8.077 8.052	3.861 3.835	3.912 3.886	3.988 3.962	8.128 8.103
106	8.814 8.788	8.890 8.865	4.674 4.648	4.699 4.674	4.775 4.750	8.915 8.890
107	9.652 9.627	9.728 9.703	5.512 5.486	5.512 5.486	5.588 5.563	9.728 9.703

TABLE 1C - STANDARD GLAND DIMENSIONS 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
108	10.465 10.439	10.541 10.516	6.325 6.299	6.299 6.274	6.375 6.350	10.516 10.490
109	12.065 12.040	12.141 12.116	7.925 7.899	7.874 7.849	7.950 7.925	12.090 12.065
110	13.691 13.665	13.792 13.741	9.576 9.525	9.474 9.423	9.550 9.525	13.716 13.665
111	15.291 15.265	15.392 15.342	11.176 11.125	11.049 10.998	11.125 11.100	15.291 15.240
112	16.916 16.891	17.018 16.967	12.802 12.751	12.649 12.598	12.725 12.700	16.891 16.840
113	18.593 18.567	18.694 18.644	14.478 14.427	14.224 14.173	14.300 14.275	18.466 18.415
114	20.269 20.244	20.371 20.320	16.154 16.104	15.824 15.773	15.900 15.875	20.066 20.015
115	21.869 21.844	21.971 21.920	17.755 17.704	17.399 17.348	17.475 17.450	21.641 21.590
116	23.444 23.419	23.546 23.495	19.329 19.279	18.999 18.948	19.075 19.050	23.241 23.190
117	25.121 25.095	25.222 25.171	21.006 20.955	20.574 20.523	20.650 20.625	24.816 24.765
118	26.695 26.670	26.797 26.746	22.581 22.530	22.174 22.123	22.250 22.225	26.416 26.365
119	28.296 28.270	28.397 28.346	24.181 24.130	23.749 23.698	23.825 23.800	27.991 27.940
120	29.870 29.845	29.972 29.921	25.756 25.705	25.349 25.298	25.425 25.400	29.591 29.540
121	31.471 31.445	31.572 31.521	27.356 27.305	26.924 26.873	27.000 26.975	31.166 31.115
122	33.045 33.020	33.147 33.096	28.931 28.880	28.524 28.473	28.600 28.575	32.766 32.715
123	34.646 34.620	34.747 34.696	30.531 30.480	30.099 30.048	30.175 30.150	34.341 34.290

TABLE 1C - STANDARD GLAND DIMENSIONS 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
124	36.220 36.195	36.322 36.271	32.106 32.055	31.699 31.648	31.775 31.750	35.941 35.890
125	37.821 37.795	37.922 37.871	33.706 33.655	33.274 33.223	33.350 33.325	37.516 37.465
126	39.395 39.370	39.497 39.446	35.281 35.230	34.874 34.823	34.950 34.925	39.116 39.065
127	40.996 40.970	41.097 41.046	36.881 36.830	36.449 36.398	36.551 36.500	40.691 40.640
128	42.570 42.545	42.672 42.621	38.456 38.405	38.049 37.998	38.151 38.100	42.291 42.240
129	44.171 44.145	44.272 44.221	40.056 40.005	39.624 39.573	39.726 39.675	43.866 43.815
130	45.771 45.745	45.898 45.847	41.681 41.631	41.224 41.173	41.326 41.275	45.466 45.415
131	47.346 47.320	47.473 47.422	43.256 43.205	42.799 42.748	42.901 42.850	47.041 46.990
132	48.946 48.920	49.073 49.022	44.856 44.806	44.399 44.348	44.501 44.450	48.641 48.590
133	50.521 50.495	50.648 50.597	46.431 46.380	45.974 45.923	46.101 46.050	50.216 50.165
134	52.121 52.095	52.248 52.197	48.031 47.981	47.574 47.523	47.701 47.650	51.816 51.765
135	53.721 53.696	53.848 53.797	49.632 49.581	49.174 49.124	49.301 49.251	53.416 53.365
136	55.296 55.270	55.423 55.372	51.206 51.156	50.749 50.698	50.876 50.825	54.991 54.940
137	56.896 56.871	57.023 56.972	52.807 52.756	52.349 52.299	52.476 52.426	56.591 56.540
138	58.471 58.445	58.598 58.547	54.381 54.331	53.924 53.873	54.051 54.000	58.166 58.115
139	60.071 60.046	60.198 60.147	55.982 55.931	55.524 55.474	55.651 55.601	59.766 59.715

TABLE 1C - STANDARD GLAND DIMENSIONS 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
140	61.646 61.620	61.773 61.722	57.556 57.506	57.099 57.048	57.226 57.175	61.341 61.290
141	63.246 63.195	63.373 63.322	59.157 59.106	58.699 58.649	58.826 58.776	62.941 62.890
142	64.821 64.770	64.948 64.897	60.731 60.681	60.274 60.223	60.401 60.350	64.516 64.465
143	66.421 66.370	66.548 66.497	62.332 62.281	61.874 61.824	62.001 61.951	66.116 66.065
144	67.996 67.945	68.123 68.072	63.906 63.856	63.449 63.398	63.576 63.525	67.691 67.640
145	69.596 69.545	69.723 69.672	65.507 65.456	65.049 64.999	65.176 65.126	69.291 69.240
146	71.171 71.120	71.298 71.247	67.081 67.031	66.624 66.573	66.751 66.700	70.866 70.815
147	72.771 72.720	72.898 72.847	68.682 68.631	68.224 68.174	68.351 68.301	72.466 72.415
148	74.346 74.295	74.473 74.422	70.256 70.206	69.799 69.748	69.926 69.875	74.041 73.990
149	75.946 75.895	76.073 76.022	71.857 71.806	71.399 71.349	71.526 71.476	75.641 75.590
210	25.121 25.095	25.222 25.171	19.482 19.431	18.999 18.948	19.075 19.050	24.790 24.740
211	26.695 26.670	26.797 26.746	21.057 21.006	20.574 20.523	20.650 20.625	26.365 26.314
212	28.296 28.270	28.397 28.346	22.657 22.606	22.174 22.123	22.250 22.225	27.965 27.915
213	29.870 29.845	29.972 29.921	24.232 24.181	23.749 23.698	23.825 23.800	29.540 29.489
214	31.471 31.445	31.572 31.521	25.832 25.781	25.349 25.298	25.425 25.400	31.140 31.090
215	33.045 33.020	33.147 33.096	27.407 27.356	26.924 26.873	27.000 26.975	32.715 32.664

TABLE 1C - STANDARD GLAND DIMENSIONS 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
216	34.646 34.620	34.747 34.696	29.007 28.956	28.524 28.473	28.600 28.575	34.315 34.265
217	36.220 36.195	36.322 36.271	30.582 30.531	30.099 30.048	30.175 30.150	35.890 35.839
218	37.821 37.795	37.922 37.871	32.182 32.131	31.699 31.648	31.775 31.750	37.490 37.440
219	39.395 39.370	39.497 39.446	33.757 33.706	33.274 33.223	33.350 33.325	39.065 39.014
220	40.996 40.970	41.097 41.046	35.357 35.306	34.874 34.823	34.950 34.925	40.665 40.615
221	42.570 42.545	42.672 42.621	36.932 36.881	36.449 36.398	36.525 36.500	42.240 42.189
222	44.171 44.145	44.272 44.221	38.532 38.481	38.049 37.998	38.125 38.100	43.840 43.790
223	47.346 47.320	47.473 47.422	41.732 41.681	41.224 41.173	41.326 41.275	47.015 46.965
224	50.521 50.495	50.648 50.597	44.907 44.856	44.399 44.348	44.501 44.450	50.190 50.140
225	53.721 53.696	53.848 53.797	48.108 48.057	47.574 47.523	47.701 47.650	53.365 53.315
226	56.896 56.871	57.023 56.972	51.283 51.232	50.749 50.698	50.876 50.825	56.540 56.490
227	60.071 60.046	60.198 60.147	54.458 54.407	53.924 53.873	54.051 54.000	59.715 59.665
228	63.246 63.195	63.373 63.322	57.633 57.582	57.099 57.048	57.226 57.175	62.890 62.840
229	66.421 66.370	66.548 66.497	60.808 60.757	60.274 60.223	60.401 60.350	66.065 66.015
230	69.596 69.545	69.723 69.672	63.983 63.932	63.449 63.398	63.576 63.525	69.240 69.190
231	72.771 72.720	72.898 72.847	67.158 67.107	66.624 66.573	66.751 66.700	72.415 72.365

TABLE 1C - STANDARD GLAND DIMENSIONS 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
232	75.946 75.895	76.073 76.022	70.333 70.282	69.799 69.748	69.926 69.875	75.590 75.540
233	79.121 79.070	79.248 79.197	73.508 73.457	72.974 72.923	73.101 73.050	78.765 78.715
234	82.296 82.245	82.423 82.372	76.683 76.632	76.124 76.073	76.251 76.200	81.915 81.864
235	85.471 85.420	85.598 85.547	79.858 79.807	79.299 79.248	79.426 79.375	85.090 85.039
236	88.646 88.595	88.773 88.722	83.033 82.982	82.474 82.423	82.601 82.550	88.265 88.214
237	91.821 91.770	91.948 91.897	86.208 86.157	85.649 85.598	85.776 85.725	91.440 91.389
238	94.996 94.945	95.123 95.072	89.383 89.332	88.824 88.773	88.951 88.900	94.615 94.564
239	98.171 98.120	98.298 98.247	92.558 92.507	91.999 91.948	92.126 92.075	97.790 97.739
240	101.346 101.295	101.473 101.422	95.733 95.682	95.174 95.123	95.301 95.250	100.965 100.914
241	104.521 104.470	104.648 104.597	98.908 98.857	98.349 98.298	98.476 98.425	104.140 104.089
242	107.696 107.645	107.823 107.772	102.083 102.032	101.524 101.473	101.651 101.600	107.315 107.264
243	110.871 110.820	110.998 110.947	105.258 105.207	104.699 104.648	104.826 104.775	110.490 110.439
244	114.021 113.970	114.173 114.122	108.433 108.382	107.874 107.823	108.001 107.950	113.665 113.614
245	117.196 117.145	117.348 117.297	111.608 111.557	111.049 110.998	111.176 111.125	116.840 116.789
246	120.371 120.320	120.523 120.472	114.783 114.732	114.224 114.173	114.376 114.325	120.015 119.964
247	123.546 123.495	123.698 123.647	117.958 117.907	117.399 117.348	117.551 117.500	123.190 123.139

TABLE 1C - STANDARD GLAND DIMENSIONS 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
325	47.346 47.320	47.473 47.422	38.684 38.633	38.049 37.998	38.151 38.100	46.939 46.888
326	50.521 50.495	50.648 50.597	41.859 41.808	41.224 41.173	41.326 41.275	50.114 50.063
327	53.721 53.696	53.848 53.797	45.060 45.009	44.399 44.348	44.501 44.450	53.289 53.238
328	56.896 56.871	57.023 56.972	48.235 48.184	47.574 47.523	47.701 47.650	56.464 56.413
329	60.071 60.046	60.198 60.147	51.410 51.359	50.749 50.698	50.876 50.825	59.639 59.588
330	63.246 63.195	63.373 63.322	54.585 54.534	53.924 53.873	54.051 54.000	62.814 62.763
331	66.421 66.370	66.548 66.497	57.760 57.709	57.099 57.048	57.226 57.175	65.989 65.938
332	69.596 69.545	69.723 69.672	60.935 60.884	60.274 60.223	60.401 60.350	69.164 69.113
333	72.771 72.720	72.898 72.847	64.110 64.059	63.449 63.398	63.576 63.525	72.339 72.288
334	75.946 75.895	76.073 76.022	67.285 67.234	66.624 66.573	66.751 66.700	75.514 75.463
335	79.121 79.070	79.248 79.197	70.460 70.409	69.799 69.748	69.926 69.875	78.689 78.638
336	82.296 82.245	82.423 82.372	73.635 73.584	72.974 72.923	73.101 73.050	81.864 81.813
337	85.471 85.420	85.598 85.547	76.810 76.759	76.124 76.073	76.251 76.200	85.014 84.963
338	88.646 88.595	88.773 88.722	79.985 79.934	79.299 79.248	79.426 79.375	88.189 88.138
339	91.821 91.770	91.948 91.897	83.160 83.109	82.474 82.423	82.601 82.550	91.364 91.313
340	94.996 94.945	95.123 95.072	86.335 86.284	85.649 85.598	85.776 85.725	94.539 94.488

TABLE 1C - STANDARD GLAND DIMENSIONS 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
341	98.171 98.120	98.298 98.247	89.510 89.459	88.824 88.773	88.951 88.900	97.714 97.663
342	101.346 101.295	101.473 101.422	92.685 92.634	91.999 91.948	92.126 92.075	100.889 100.838
343	104.521 104.470	104.648 104.597	95.860 95.809	95.174 95.123	95.301 95.250	104.064 104.013
344	107.696 107.645	107.823 107.772	99.035 98.984	98.349 98.298	98.476 98.425	107.239 107.188
345	110.871 110.820	110.998 110.947	102.210 102.159	101.524 101.473	101.651 101.600	110.414 110.363
346	114.021 113.970	114.173 114.122	105.385 105.334	104.699 104.648	104.826 104.775	113.589 113.538
347	117.196 117.145	117.348 117.297	108.560 108.509	107.874 107.823	108.001 107.950	116.764 116.713
348	120.371 120.320	120.523 120.472	111.735 111.684	111.049 110.998	111.176 111.125	119.939 119.888
349	123.546 123.495	123.698 123.647	114.910 114.859	114.224 114.173	114.351 114.300	123.114 123.063
425	126.238 126.187	126.416 126.340	114.783 114.706	114.224 114.148	114.376 114.325	125.959 125.882
426	129.413 129.362	129.591 129.515	117.958 117.881	117.399 117.323	117.551 117.500	129.134 129.057
427	132.588 132.537	132.766 132.690	121.133 121.056	120.574 120.498	120.726 120.675	132.309 132.232
428	135.763 135.712	135.941 135.865	124.308 124.231	123.749 123.673	123.901 123.850	135.484 135.407
429	138.938 138.887	139.116 139.040	127.483 127.406	126.924 126.848	127.076 127.025	138.659 138.582
430	142.113 142.062	142.291 142.215	130.658 130.581	130.099 130.023	130.251 130.200	141.834 141.757
431	145.288 145.237	145.466 145.390	133.833 133.756	133.274 133.198	133.426 133.375	145.009 144.932

TABLE 1C - STANDARD GLAND DIMENSIONS 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
432	148.463 148.412	148.641 148.565	137.008 136.931	136.449 136.373	136.601 136.550	148.184 148.107
433	151.638 151.587	151.816 151.740	140.183 140.106	139.624 139.548	139.776 139.725	151.359 151.282
434	154.813 154.762	154.991 154.915	143.358 143.281	142.799 142.723	142.951 142.900	154.534 154.457
435	157.988 157.937	158.166 158.090	146.533 146.456	145.974 145.898	146.126 146.075	157.709 157.632
436	161.163 161.112	161.341 161.265	149.708 149.631	149.149 149.073	149.301 149.250	160.884 160.807
437	164.338 164.287	164.516 164.440	152.883 152.806	152.324 152.248	152.476 152.425	164.059 163.982
438	170.688 170.637	170.866 170.790	159.233 159.156	158.674 158.598	158.826 158.775	170.409 170.332
439	177.038 176.987	177.216 177.140	165.583 165.506	165.024 164.948	165.202 165.125	176.759 176.682
440	183.388 183.337	183.566 183.490	171.933 171.856	171.374 171.298	171.552 171.475	183.109 183.032
441	189.738 189.687	189.916 189.840	178.283 178.206	177.724 177.648	177.902 177.825	189.459 189.382
442	196.088 196.037	196.266 196.190	184.633 184.556	184.074 183.998	184.252 184.175	195.809 195.732
443	202.438 202.387	202.616 202.540	190.983 190.906	190.424 190.348	190.602 190.525	202.159 202.082
444	208.788 208.737	208.966 208.890	197.333 197.256	196.774 196.698	196.952 196.875	208.509 208.432
445	215.138 215.087	215.316 215.240	203.683 203.606	203.124 203.048	203.302 203.225	214.859 214.782
446	227.838 227.762	228.016 227.940	216.383 216.306	215.824 215.748	216.002 215.925	227.559 227.482
447	240.538 240.462	240.741 240.640	229.108 229.032	228.524 228.448	228.702 228.625	240.284 240.182

TABLE 1C - STANDARD GLAND DIMENSIONS 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
448	253.238 253.162	253.441 253.340	241.808 241.732	241.224 241.148	241.402 241.325	252.984 252.882
449	265.938 265.862	266.141 266.040	254.508 254.432	253.924 253.848	254.102 254.025	265.684 265.582
450	278.638 278.562	278.841 278.740	267.208 267.132	266.624 266.548	266.802 266.725	278.384 278.282
451	291.338 291.262	291.541 291.440	279.908 279.832	279.324 279.248	279.502 279.425	291.084 290.982
452	304.038 303.962	304.241 304.140	292.608 292.532	292.024 291.948	292.202 292.125	303.784 303.682
453	316.738 316.662	316.941 316.840	305.308 305.232	304.724 304.648	304.902 304.825	316.484 316.382
454	329.438 329.362	329.641 329.540	318.008 317.932	317.424 317.348	317.602 317.525	329.184 329.082
455	342.138 342.062	342.341 342.240	330.708 330.632	330.124 330.048	330.302 330.225	341.884 341.782
456	354.838 354.762	355.041 354.940	343.408 343.332	342.824 342.748	343.002 342.925	354.584 354.482
457	367.538 367.462	367.741 367.640	356.108 356.032	355.524 355.448	355.702 355.625	367.284 367.182
458	380.238 380.162	380.441 380.340	368.808 368.732	368.224 368.148	368.402 368.325	379.984 379.882
459	392.938 392.862	393.141 393.040	381.508 381.432	380.924 380.848	381.102 381.025	392.684 392.582
460	405.638 405.562	405.841 405.740	394.208 394.132	393.624 393.548	393.802 393.725	405.384 405.282

TABLE 2A - 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	Backup Ring Width 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	.037	.043	--	.090	.095	--	--	--	--
002	.047	.053	--	.095	.100	--	--	--	--
003	.057	.063	--	.105	.110	--	--	--	--
004 to 007	.067	.073	.056	.115	.120	.174	.184	.230	.240
008 to 028	.067	.073	.056	.105	.110	.164	.174	.220	.230
104 to 109	.100	.106	.060	.150	.160	.210	.220	.275	.285
110 to 149	.100	.106	.060	.140	.150	.200	.210	.265	.275
210 to 247	.135	.143	.065	.185	.195	.250	.260	.320	.330
325 to 349	.205	.215	.090	.270	.280	.360	.370	.455	.465
425 to 460	.269	.281	.130	.345	.355	.475	.485	.610	.620

TABLE 2B - 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	Backup Ring Width 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	0.940	1.092	--	2.286	2.413	--	--	--	--
002	1.194	1.346	--	2.413	2.540	--	--	--	--
003	1.448	1.600	--	2.667	2.794	--	--	--	--
004 to 007	1.702	1.854	1.422	2.921	3.048	4.420	4.674	5.842	6.096
008 to 028	1.702	1.854	1.422	2.667	2.794	4.166	4.420	5.588	5.842
104 to 109	2.540	2.692	1.524	3.810	4.064	5.334	5.588	6.985	7.239
110 to 149	2.540	2.692	1.524	3.556	3.810	5.080	5.334	6.731	6.985
210 to 247	3.429	3.632	1.651	4.699	4.953	6.350	6.604	8.128	8.382
325 to 349	5.207	5.461	2.286	6.858	7.112	9.144	9.398	11.557	11.811
425 to 460	6.833	7.137	3.302	8.763	9.017	12.065	12.319	15.494	15.748

TABLE 3A - STANDARD GLAND DIAMETRAL CLEARANCE DIMENSIONS IN INCHES

Gland and AS568 Dash No.	O-ring Cross Section W	O-ring Cross Section W	Diametral Clearance	
	Min	Max	D Max Exterior	D Max Interior
001	.037	.043	.004	.004
002	.047	.053	.004	.004
003	.057	.063	.004	.004
004 to 012	.067	.073	.004	.004
013 to 028	.067	.073	.005	.005
104 to 109	.100	.106	.004	.004
110 to 126	.100	.106	.005	.005
127 to 129	.100	.106	.005	.006
130 to 132	.100	.106	.006	.006
133 to 140	.100	.106	.006	.007
141 to 149	.100	.106	.007	.007
210 to 222	.135	.143	.005	.005
223 and 224	.135	.143	.006	.006
225 to 227	.135	.143	.006	.007
228 to 243	.135	.143	.007	.007
244 and 245	.135	.143	.008	.007
246 and 247	.135	.143	.008	.008
325 to 327	.205	.215	.006	.006
328 and 329	.205	.215	.006	.007
330 to 345	.205	.215	.007	.007
346 to 349	.205	.215	.008	.007
425 to 438	.269	.281	.009	.009
439 to 445	.269	.281	.009	.010
446	.269	.281	.010	.010
447 to 460	.269	.281	.011	.010

TABLE 3B - STANDARD GLAND DIAMETRAL CLEARANCE DIMENSIONS IN MILLIMETERS

Gland and AS568 Dash No.	O-ring Cross Section W	O-ring Cross Section W	Diametral Clearance	
	Min	Max	D Max Exterior	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	0.279	0.254

TABLE 4 - 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 5 - 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 6 (indicated as surface roughness as defined in ASME B46.1 or ISO 4287) shall be used:

TABLE 6 – SURFACE ROUGHNESS REQUIREMENTS

Part on Unit	Surface Roughness Ra (µin) per ASME B46.1	Surface Roughness Ra (µm) per ISO 4287-1
Cylinder bore or piston rod (diameter over which O-ring must slide at assembly)	32 (max)	0.8 (max)
O-ring groove diameter:	32 (max)	0.8 (max)
O-ring groove sides when no backup ring is used:	63 (max)	1.6 (max)
O-ring groove sides when backup rings are used	63 (max)	1.6 (max)

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. Glands for pneumatic applications may require smoother finishes.

- 3.1.5 Minimum O-ring Squeeze: The minimum percentage squeeze in Table 1B is calculated as the difference (interference) between the minimum cross-section of the installed O-ring and the maximum permitted gland depth, divided by minimum cross-section of the installed O-ring. 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 dimensions 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 effects of temperature are applied to the O-ring as installed in the groove.

- 3.1.6 Maximum O-ring Squeeze: The maximum percentage squeeze in Table 1B is calculated as the difference (interference) between the maximum cross-section of the installed O-ring and the minimum permitted gland depth, divided by maximum cross-section of the installed O-ring. 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 is that obtained using gland dimensions that provide the minimum possible diametral clearance, maximum eccentricity of gland parts and maximum possible radial displacement of the gland parts in the direction to cause minimum gland depth and maximum seal squeeze at the seal location that is in the direction of radial displacement. The effects of temperature are applied to the O-ring as installed in the groove.

The formulae 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. See ARP4727 for further information on calculating seal squeeze.

- 3.1.7 O-ring Stretch: Most piston glands have increased stretch over AS4716 since the piston groove diameter has been increased. See Table 1B. Rod glands have same Rod OD (B) as AS4716 which causes little if any stretch. Percent minimum stretch is calculated as the change in ID of the largest permitted O-ring when installed in the smallest permitted piston groove, divided by the ID of the largest permitted O-ring. No temperature effects are involved since it is assumed that assembly takes place at room temperature. It is theorized that at low temperatures the stretch will increase (due to the seal shrinking) which would cause additional loss of squeeze. This second order affect has not been quantified by test and has not been included in Table 1B. This affect would cause some increase in squeeze at elevated temperatures.

The formulae used for calculating the O-ring stretch for piston and rod type glands are listed in Appendix C.

- 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 Table 3.
- 3.1.9 Temperature Considerations in Gland Design: The temperature effects on squeeze are based on the elastomer having a coefficient of thermal expansion of 1.5×10^{-4} unit length per °F (2.7×10^{-4} unit length per °C). This relatively large value was chosen to account for the changes in the seal for most of the seal compounds in use today. For elastomers which have a lower coefficient of thermal expansion, the difference could be applied to offset thermal effects of the gland. The calculations used in this standard have been based on an initial room 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. For good low temperature performance the mating gland materials must have similar coefficients of thermal expansion. This becomes increasingly important as the gland diameter increases in size.

- 3.1.10 Use of Anti-extrusion Rings: For pressures above 1500 psi (10.3 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 one or two backup rings are shown in Tables 2A and 2B. 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 Tables 2A and 2B for one backup ring may be used, as applicable. For applications where the pressure does not exceed 1500 psi (10.3 MPa), backup rings are not required but may be used to provide greater extrusion protection. At pressures above 3000 psi (20.7 MPa) it is recommended that the backup rings be made of a material with stronger shear strength than unfilled PTFE.

Proper fit and limit conditions can only be achieved with the use of backup rings per AS5860 and AS5861.

The formulae used for calculating gland fill and O-ring occupancy are listed in Appendix B.

- 3.1.11 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 4.
- 3.1.12 Eccentricity: The eccentricity, referred to in Table 5, 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 5.
- 3.1.13 Cylinder Breathing: For operating pressures of 3000 psi (20.7 MPa) and lower, radial expansion of the cylinder bore (i.e., cylinder wall "breathing") shall be limited to 0.002 in/in of cylinder bore at operating pressure. For operating pressures greater than 3000 psig (20.7 MPa), radial expansion of the cylinder bore shall be limited to 0.0015 in/in of cylinder bore at operating pressure. Effects of breathing on squeeze have not been included in the calculations. It is considered that if the O-ring seals at low pressure, then increasing pressure will energize the seal so that it will follow the increasing bore. If the seal is so hard at low temperatures that it can not be energized by pressure then a better choice of elastomer should be made.
- 3.1.14 O-ring Assembly: To facilitate O-ring assembly, the edge where the piston and O-ring assembly enters a cylinder bore should be chamfered to prevent pinching or other damage to the O-ring seal (see Figure 3). The O-ring shall be completely coated with hydraulic fluid or other compatible assembly lubricant at time of installation. After installing the O-ring in the groove it should be checked to be sure it is not spiraled (twisted).

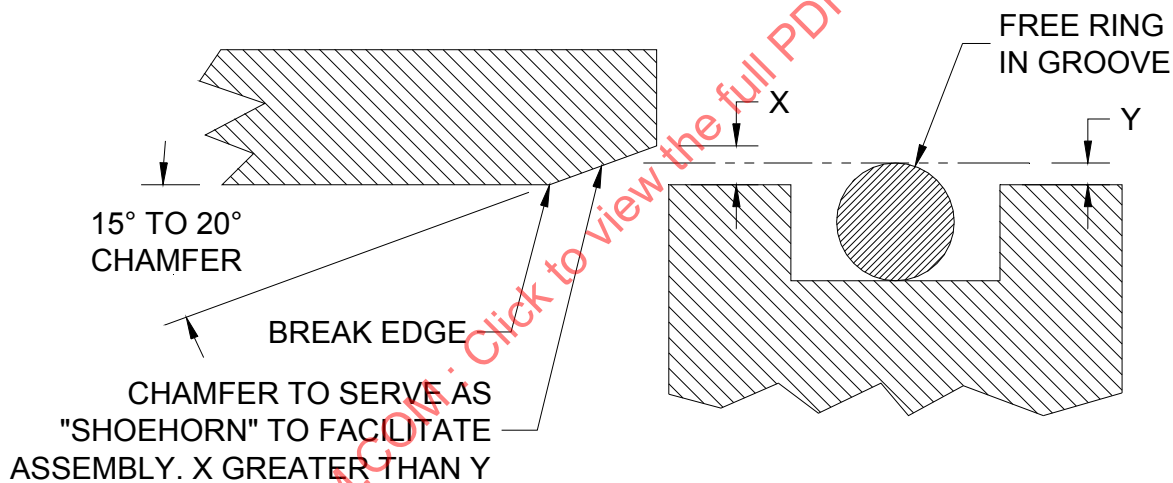


FIGURE 3 - O-RING ASSEMBLY

4. NOTES:

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