



AEROSPACE STANDARD

AS4052™**REV. C**

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Reaffirmed 2021-02
Revised 2022-10

Superseding AS4052B

(R) Gland Design: Scraper, Landing Gear, Installation

RATIONALE

Previously, this SAE Aerospace Standard (AS) was missing metric equivalents. It was updated to include metric equivalents, similar to the updates previously completed on gland documents, such as AS4716, AS5857, and AS4832. In addition, the Type II gland retention details have been adjusted from historical values to effectively increase retention capabilities.

1. SCOPE

This SAE Aerospace Standard (AS) covers an alternate gland design for the installation of scraper/ wiper rings in the lower end of landing gear shock struts for the purpose of contaminant exclusion.

The defined scraper gland covered by this document, as shown in Table 1, is a variant of AS4716, the accepted gland standard for AS568, O-ring packing seals. Piston rod diameters, gland internal diameters, groove sidewall angles and the surface finish are all defined by AS4716, but the gland outer retaining wall diameter is changed. The traditional scraper design installed into the glands detailed in Table 1 typically utilize components made from PTFE, urethane, or nitrile materials. These scraper designs, while still acceptable, must be reviewed in consideration to deicing, cleaners and disinfectant fluids applied to or in contact with the landing gear, as the materials of construction for the installed scrapers may not be compatible to these fluids. Exposure of the scraper to incompatible fluids is likely to reduce the performance of the scraper.

In addition, an alternative scraper gland is also covered by this document and shown in Table 2. It is also a variant of AS4716; however, this gland has a reduced atmospheric gland lip and profiled lead in geometry to allow for a PTFE jacket metal spring energized scraper to be installed. The advantages of the PTFE jacket metal spring energized scraper design are that the materials of construction are chemically inert, greatly reducing the possibility of negative performance due to incompatibility with deicers, cleaners, and disinfectant fluids.

AS4088 is similar to the hardware design in Tables 1A and 1B of this document, which was developed by SAE A-6 for flight control and general-purpose cylinders. It differs from this document primarily by the clearance between the rod (piston) and outer gland wall.

1.1 Purpose

This document is intended to present a groove which will accommodate an improved scraper/wiper ring assembly design and is not intended to obsolete the MS33675 gland standard.

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2. 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 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 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS568 Aerospace Size Standard for O-Rings

AS4716 Gland Design, O-Ring and Other Seals

2.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-G-5514F Gland Design; Packings, Hydraulic, General Requirements for (Inactive for new designs)

MS28776 Scraper, Piston Rod (Inactive for new designs)

MS33675 Scraper, Installation, Packing Gland Ring (Inactive for new designs)

3. TECHNICAL REQUIREMENTS

3.1 General

Historically, the most common scraper gland has been an MS33675, which accepted either a MS28776 bronze scraper or a comparable TFE scraper. It has been noted that this arrangement is deficient in two aspects: the metal scraper ring is split, allowing contaminants to pass through and around it; and, being installed in a very abbreviated gland, the scraper frequently dislodges under conditions of shock strut deflection. An improved metal, plastic, or elastomeric endless scraper ring would require additional gland volume with greater retaining surfaces than specified by MS33675 and as detailed in this specification.

The gland length shown in Tables 1A, 1B, 2A, and 2B are AS4716 one backup O-ring groove lengths. This groove provides the desired roll stability with improved scraper assembly designs of plastic and elastomeric materials. A shorter gland (AS4716, zero backup length) was deleted from this document because of stability and increased ingression problems.

Gland surface finishes should be 63 µin (1.6 µm) Ra or better, and be free of nicks, scratches, or burrs which could damage the scraper on installation. The rod surface finish should be per the applicable AS4716 recommendation based on the rod material or coating, and respective inboard seal material in contact with the rod.

This AS is a design standard and not to be used as a part number.

Glands meeting the requirements of this document have been classified under FSC-1650.

3.2 Gland and Groove Details

3.2.1 Gland Major Dimensions

The gland major dimensions are separated into Type 1 and Type 2 glands and are shown in Figures 1, and 2, and Tables 1A, 1B, 2A, and 2B.

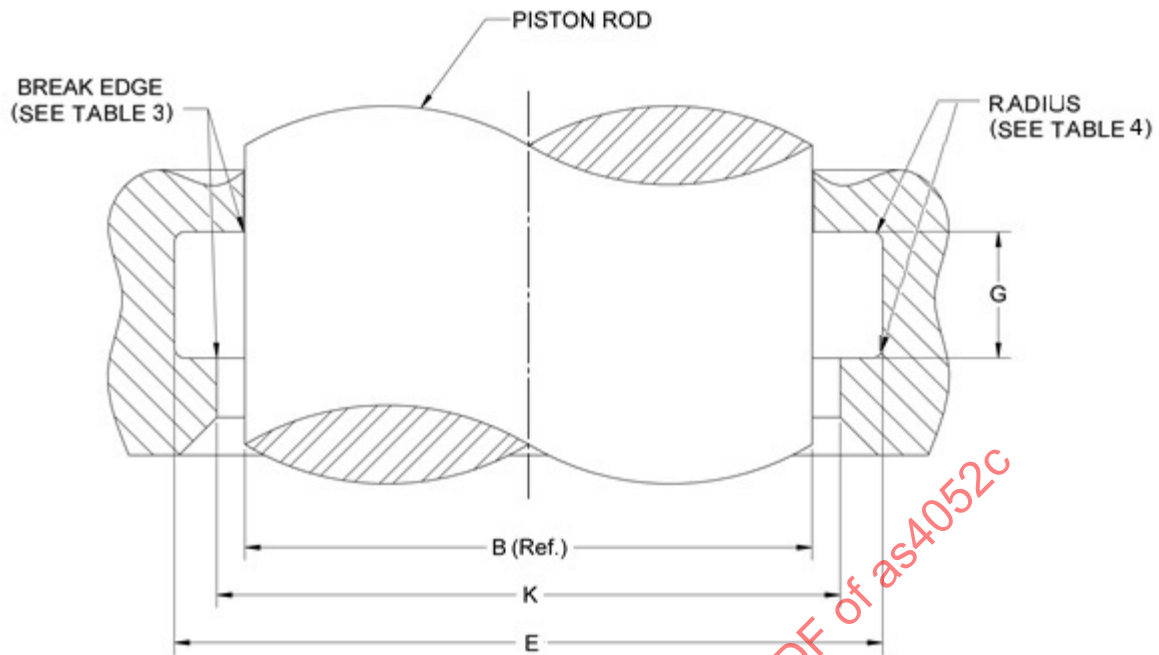


Figure 1 - To accompany Type 1 in Tables 1A and 1B

Table 1A - Type 1 gland dimensional information (all dimensions in inches)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
325	1.498	1.870	1.646	0.334 0.344
	1.496	1.872	1.636	
326	1.623	1.995	1.771	
	1.621	1.997	1.761	
327	1.748	2.120	1.896	
	1.746	2.122	1.886	
328	1.873	2.245	2.021	
	1.871	2.247	2.011	
329	1.998	2.370	2.146	
	1.996	2.372	2.136	
330	2.123	2.495	2.271	
	2.121	2.497	2.261	
331	2.248	2.620	2.396	
	2.246	2.622	2.386	
332	2.373	2.745	2.521	
	2.371	2.747	2.511	
333	2.498	2.870	2.646	
	2.496	2.872	2.636	
334	2.623	2.995	2.771	
	2.621	2.997	2.761	
335	2.748	3.120	2.896	
	2.746	3.122	2.886	
336	2.873	3.245	3.021	
	2.871	3.247	3.011	
337	2.997	3.369	3.145	
	2.995	3.371	3.135	
338	3.122	3.494	3.270	
	3.120	3.496	3.260	
339	3.247	3.619	3.395	
	3.245	3.621	3.385	
340	3.372	3.744	3.520	
	3.370	3.746	3.510	
341	3.497	3.869	3.645	
	3.495	3.871	3.635	
342	3.622	3.994	3.770	
	3.620	3.996	3.760	
343	3.747	4.119	3.895	
	3.745	4.121	3.885	
344	3.872	4.244	4.020	
	3.870	4.246	4.010	

Table 1A - Type 1 gland dimensional information (all dimensions in inches) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
345	3.997	4.369	4.145	0.334 0.344
	3.995	4.371	4.135	
346	4.122	4.494	4.270	
	4.120	4.496	4.260	
347	4.247	4.619	4.395	
	4.245	4.621	4.385	
348	4.372	4.744	4.520	
	4.370	4.746	4.510	
349	4.497	4.869	4.645	
	4.495	4.871	4.635	

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Table 1A - Type 1 gland dimensional information (all dimensions in inches) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
425	4.497	4.974	4.686	0.475 0.485
	4.494	4.977	4.676	
426	4.622	5.099	4.811	
	4.619	5.102	4.801	
427	4.747	5.224	4.936	
	4.744	5.227	4.926	
428	4.872	5.349	5.061	
	4.869	5.352	5.051	
429	4.997	5.474	5.186	
	4.994	5.477	5.176	
430	5.122	5.599	5.311	
	5.119	5.602	5.301	
431	5.247	5.724	5.436	
	5.244	5.727	5.426	
432	5.372	5.849	5.561	
	5.369	5.852	5.551	
433	5.497	5.974	5.686	
	5.494	5.977	5.676	
434	5.622	6.099	5.811	
	5.619	6.102	5.801	
435	5.747	6.224	5.936	
	5.744	6.227	5.926	
436	5.872	6.349	6.061	
	5.869	6.352	6.051	
437	5.997	6.474	6.186	
	5.994	6.477	6.176	
438	6.247	6.724	6.436	
	6.244	6.727	6.426	
439	6.497	6.974	6.686	
	6.494	6.977	6.676	
440	6.747	7.224	6.936	
	6.744	7.227	6.926	
441	6.997	7.474	7.186	
	6.994	7.477	7.176	
442	7.247	7.724	7.436	
	7.244	7.727	7.426	

Table 1A - Type 1 gland dimensional information (all dimensions in inches) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
443	7.497	7.974	7.686	0.475 0.485
	7.494	7.977	7.676	
444	7.747	8.224	7.936	
	7.744	8.227	7.926	
445	7.997	8.474	8.186	
	7.994	8.477	8.176	
446	8.497	8.974	8.686	
	8.494	8.977	8.676	
447	8.997	9.474	9.186	
	8.994	9.477	9.176	
448	9.497	9.974	9.686	
	9.494	9.977	9.676	
449	9.997	10.474	10.186	
	9.994	10.477	10.176	
450	10.497	10.974	10.686	
	10.494	10.977	10.676	
451	10.997	11.474	11.186	
	10.994	11.477	11.176	
452	11.497	11.974	11.686	
	11.494	11.977	11.676	
453	11.997	12.474	12.186	
	11.994	12.477	12.176	
454	12.497	12.974	12.686	
	12.494	12.977	12.676	
455	12.997	13.474	13.186	
	12.994	13.477	13.176	
456	13.497	13.974	13.686	
	13.494	13.977	13.676	
457	13.997	14.474	14.186	
	13.994	14.477	14.176	
458	14.497	14.974	14.686	
	14.494	14.977	14.676	
459	14.997	15.474	15.186	
	14.994	15.477	15.176	
460	15.497	15.974	15.686	
	15.494	15.977	15.676	

Table 1B - Type 1 gland dimensional information (all dimensions in millimeters)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
325	38.049	47.498	41.808	8.484 8.738
	37.998	47.549	41.554	
326	41.224	50.673	44.983	
	41.173	50.724	44.729	
327	44.399	53.848	48.158	
	44.348	53.899	47.904	
328	47.574	57.023	51.333	
	47.523	57.074	51.079	
329	50.749	60.198	54.508	
	50.698	60.249	54.254	
330	53.924	63.373	57.683	
	53.873	63.424	57.429	
331	57.099	66.548	60.858	
	57.048	66.599	60.604	
332	60.274	69.723	64.033	
	60.223	69.774	63.779	
333	63.449	72.898	67.208	
	63.398	72.949	66.954	
334	66.624	76.073	70.383	
	66.573	76.124	70.129	
335	69.799	79.248	73.558	
	69.748	79.299	73.304	
336	72.974	82.423	76.733	
	72.923	82.474	76.479	
337	76.124	85.573	79.883	
	76.073	85.623	79.629	
338	79.299	88.748	83.058	
	79.248	88.798	82.804	
339	82.474	91.923	86.233	
	82.423	91.973	85.979	
340	85.649	95.098	89.408	
	85.598	95.148	89.154	
341	88.824	98.273	92.583	
	88.773	98.323	92.329	
342	91.999	101.448	95.758	
	91.948	101.498	95.504	
343	95.174	104.623	98.933	
	95.123	104.673	98.679	
344	98.349	107.798	102.108	
	98.298	107.848	101.854	

Table 1B - Type 1 gland dimensional information (all dimensions in millimeters) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
345	101.524	110.973	105.283	8.484 8.738
	101.473	111.023	105.029	
346	104.699	114.148	108.458	
	104.648	114.198	108.204	
347	107.874	117.323	111.633	
	107.823	117.373	111.379	
348	111.049	120.498	114.808	
	110.998	120.548	114.554	
349	114.224	123.673	117.983	
	114.173	123.723	117.729	

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Table 1B - Type 1 gland dimensional information (all dimensions in millimeters) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
425	114.224	126.340	119.024	12.065 12.319
	114.148	126.416	118.770	
426	117.399	129.515	122.199	
	117.323	129.591	121.945	
427	120.574	132.690	125.374	
	120.498	132.766	125.120	
428	123.749	135.865	128.549	
	123.673	135.941	128.295	
429	126.924	139.040	131.724	
	126.848	139.116	131.470	
430	130.099	142.215	134.899	
	130.023	142.291	134.645	
431	133.274	145.390	138.074	
	133.198	145.466	137.820	
432	136.449	148.565	141.249	
	136.373	148.641	140.995	
433	139.624	151.740	144.424	
	139.548	151.816	144.170	
434	142.799	154.915	147.599	
	142.723	154.991	147.345	
435	145.974	158.090	150.774	
	145.898	158.166	150.520	
436	149.149	161.265	153.949	
	149.073	161.341	153.695	
437	152.324	164.440	157.124	
	152.248	164.516	156.870	
438	158.674	170.790	163.474	
	158.598	170.866	163.220	
439	165.024	177.140	169.824	
	164.948	177.216	169.570	
440	171.374	183.490	176.174	
	171.298	183.566	175.920	
441	177.724	189.840	182.524	
	177.648	189.916	182.270	
442	184.074	196.190	188.874	
	183.998	196.266	188.620	

Table 1B - Type 1 gland dimensional information (all dimensions in millimeters) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØK Retaining Lip Inside Diameter	G Gland Length
	Max Min	Min Max	Max Min	Min Max
443	190.424	202.540	195.224	12.065 12.319
	190.348	202.616	194.970	
444	196.774	208.890	201.574	
	196.698	208.966	201.320	
445	203.124	215.240	207.924	
	203.048	215.316	207.670	
446	215.824	227.940	220.624	
	215.748	228.016	220.370	
447	228.524	240.640	233.324	
	228.448	240.716	233.070	
448	241.224	253.340	246.024	
	241.148	253.416	245.770	
449	253.924	266.040	258.724	
	253.848	266.116	258.470	
450	266.624	278.740	271.424	
	266.548	278.816	271.170	
451	279.324	291.440	284.124	
	279.248	291.516	283.870	
452	292.024	304.140	296.824	
	291.948	304.216	296.570	
453	304.724	316.840	309.524	
	304.648	316.916	309.270	
454	317.424	329.540	322.224	
	317.348	329.616	321.970	
455	330.124	342.240	334.924	
	330.048	342.316	334.670	
456	342.824	354.940	347.624	
	342.748	355.016	347.370	
457	355.524	367.640	360.324	
	355.448	367.716	360.070	
458	368.224	380.340	373.024	
	368.148	380.416	372.770	
459	380.924	393.040	385.724	
	380.848	393.116	385.470	
460	393.624	405.740	398.424	
	393.548	405.816	398.170	

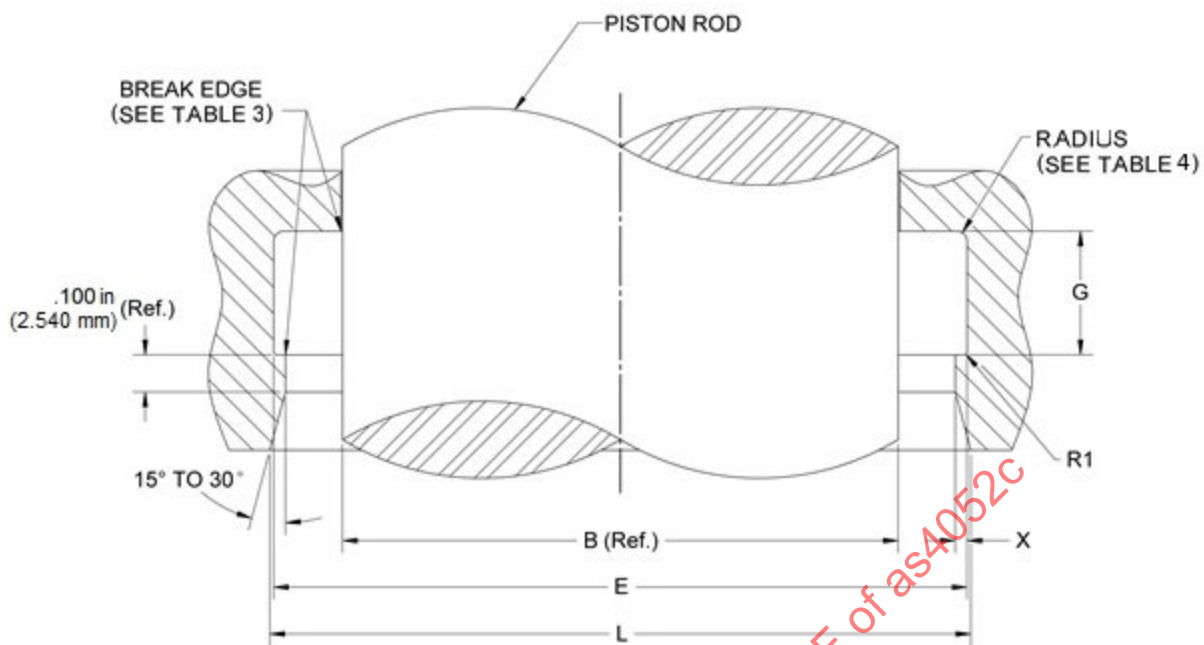


Figure 2 - To accompany Type 2 in Tables 2A and 2B

Table 2A - Type 2 "Click Fit" gland dimensional information (all dimensions in inches)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference) Max Min	ØE Rod Groove Diameter Min Max	ØL Lead in Diameter Minimum	X Retaining Lip Min Max	G Gland Length Min Max	R1 Atmospheric Corner Radius Maximum
325	1.498	1.870	1.888	0.050 0.055	0.334 0.344	0.009
	1.496	1.872				
326	1.623	1.995	2.013			
	1.621	1.997				
327	1.748	2.120	2.138			
	1.746	2.122				
328	1.873	2.245	2.263			
	1.871	2.247				
329	1.998	2.370	2.388			
	1.996	2.372				
330	2.123	2.495	2.513			
	2.121	2.497				
331	2.248	2.620	2.638			
	2.246	2.622				
332	2.373	2.745	2.763			
	2.371	2.747				
333	2.498	2.870	2.888			
	2.496	2.872				
334	2.623	2.995	3.013			
	2.621	2.997				

Table 2A - Type 2 “Click Fit” gland dimensional information (all dimensions in inches) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØL Lead in Diameter	X Retaining Lip	G Gland Length	R1 Atmospheric Corner Radius
	Max Min	Min Max	Minimum	Min Max	Min Max	Maximum
335	2.748	3.120	3.138	0.050 0.055	0.334 0.344	0.009
	2.746	3.122				
336	2.873	3.245	3.263			
	2.871	3.247				
337	2.997	3.369	3.387			
	2.995	3.371				
338	3.122	3.494	3.512			
	3.120	3.496				
339	3.247	3.619	3.637			
	3.245	3.621				
340	3.372	3.744	3.762			
	3.370	3.746				
341	3.497	3.869	3.887			
	3.495	3.871				
342	3.622	3.994	4.012			
	3.620	3.996				
343	3.747	4.119	4.137			
	3.745	4.121				
344	3.872	4.244	4.262			
	3.870	4.246				
345	3.997	4.369	4.387			
	3.995	4.371				
346	4.122	4.494	4.512			
	4.120	4.496				
347	4.247	4.619	4.637			
	4.245	4.621				
348	4.372	4.744	4.762			
	4.370	4.746				
349	4.497	4.869	4.887			
	4.495	4.871				

Table 2A - Type 2 “Click Fit” gland dimensional information (all dimensions in inches) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØL Lead in Diameter	X Retaining Lip	G Gland Length	R1 Atmospheric Corner Radius
	Max Min	Min Max	Minimum	Min Max	Min Max	Maximum
425	4.497	4.974	5.017	0.060 0.065	0.475 0.485	0.012
	4.494	4.977				
426	4.622	5.099	5.042			
	4.619	5.102				
427	4.747	5.224	5.267			
	4.744	5.227				
428	4.872	5.349	5.392			
	4.869	5.352				
429	4.997	5.474	5.517			
	4.994	5.477				
430	5.122	5.599	5.642			
	5.119	5.602				
431	5.247	5.724	5.767			
	5.244	5.727				
432	5.372	5.849	5.892			
	5.369	5.852				
433	5.497	5.974	6.017			
	5.494	5.977				
434	5.622	6.099	6.042			
	5.619	6.102				
435	5.747	6.224	6.267			
	5.744	6.227				
436	5.872	6.349	6.392			
	5.869	6.352				
437	5.997	6.474	6.517			
	5.994	6.477				
438	6.247	6.724	6.767			
	6.244	6.727				
439	6.497	6.974	7.017			
	6.494	6.977				
440	6.747	7.224	7.267			
	6.744	7.227				
441	6.997	7.474	7.517			
	6.994	7.477				
442	7.247	7.724	7.767			
	7.244	7.727				

Table 2A - Type 2 “Click Fit” gland dimensional information (all dimensions in inches) (continued)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØL Lead in Diameter	X Retaining Lip	G Gland Length	R1 Atmospheric Corner Radius
	Max Min	Min Max	Minimum	Min Max	Min Max	Maximum
443	7.497	7.974	8.017	0.060 0.065	0.475 0.485	0.012
	7.494	7.977				
444	7.747	8.224	8.267			
	7.744	8.227				
445	7.997	8.474	8.517			
	7.994	8.477				
446	8.497	8.974	9.017			
	8.494	8.977				
447	8.997	9.474	9.517			
	8.994	9.477				
448	9.497	9.974	10.017			
	9.494	9.977				
449	9.997	10.474	10.517			
	9.994	10.477				
450	10.497	10.974	11.017			
	10.494	10.977				
451	10.997	11.474	11.517			
	10.994	11.477				
452	11.497	11.974	12.017			
	11.494	11.977				
453	11.997	12.474	12.517			
	11.994	12.477				
454	12.497	12.974	13.017			
	12.494	12.977				
455	12.997	13.474	13.517			
	12.994	13.477				
456	13.497	13.974	14.017			
	13.494	13.977				
457	13.997	14.474	14.517			
	13.994	14.477				
458	14.497	14.974	15.017			
	14.494	14.977				
459	14.997	15.474	15.517			
	14.994	15.477				
460	15.497	15.974	16.017			
	15.494	15.977				

Table 2B - Type 2 “Click Fit” gland dimensional information (all dimensions in millimeters)

Gland and AS568 Dash No.	ØB Rod Diameter (For Reference)	ØE Rod Groove Diameter	ØL Lead in Diameter	X Retaining Lip	G Gland Length	R1 Atmospheric Corner Radius
	Max Min	Min Max	Minimum	Min Max	Min Max	Maximum
325	38.049	47.498	47.955	1.270 1.397	8.484 8.738	0.229
	37.998	47.549				
326	41.224	50.673	51.130			
	41.173	50.724				
327	44.399	53.848	54.305			
	44.348	53.899				
328	47.574	57.023	57.480			
	47.523	57.074				
329	50.749	60.198	60.655			
	50.698	60.249				
330	53.924	63.373	63.830			
	53.873	63.424				
331	57.099	66.548	67.005			
	57.048	66.599				
332	60.274	69.723	70.180			
	60.223	69.774				
333	63.449	72.898	73.355			
	63.398	72.949				
334	66.624	76.073	76.530			
	66.573	76.124				
335	69.799	79.248	79.705			
	69.748	79.299				
336	72.974	82.423	82.880			
	72.923	82.474				
337	76.124	85.573	86.030			
	76.073	85.623				
338	79.299	88.748	89.205			
	79.248	88.798				
339	82.474	91.923	92.380			
	82.423	91.973				
340	85.649	95.098	95.555			
	85.598	95.148				
341	88.824	98.273	98.730			
	88.773	98.323				
342	91.999	101.448	101.905			
	91.948	101.498				
343	95.174	104.623	105.080			
	95.123	104.673				
344	98.349	107.798	108.255			
	98.298	107.848				