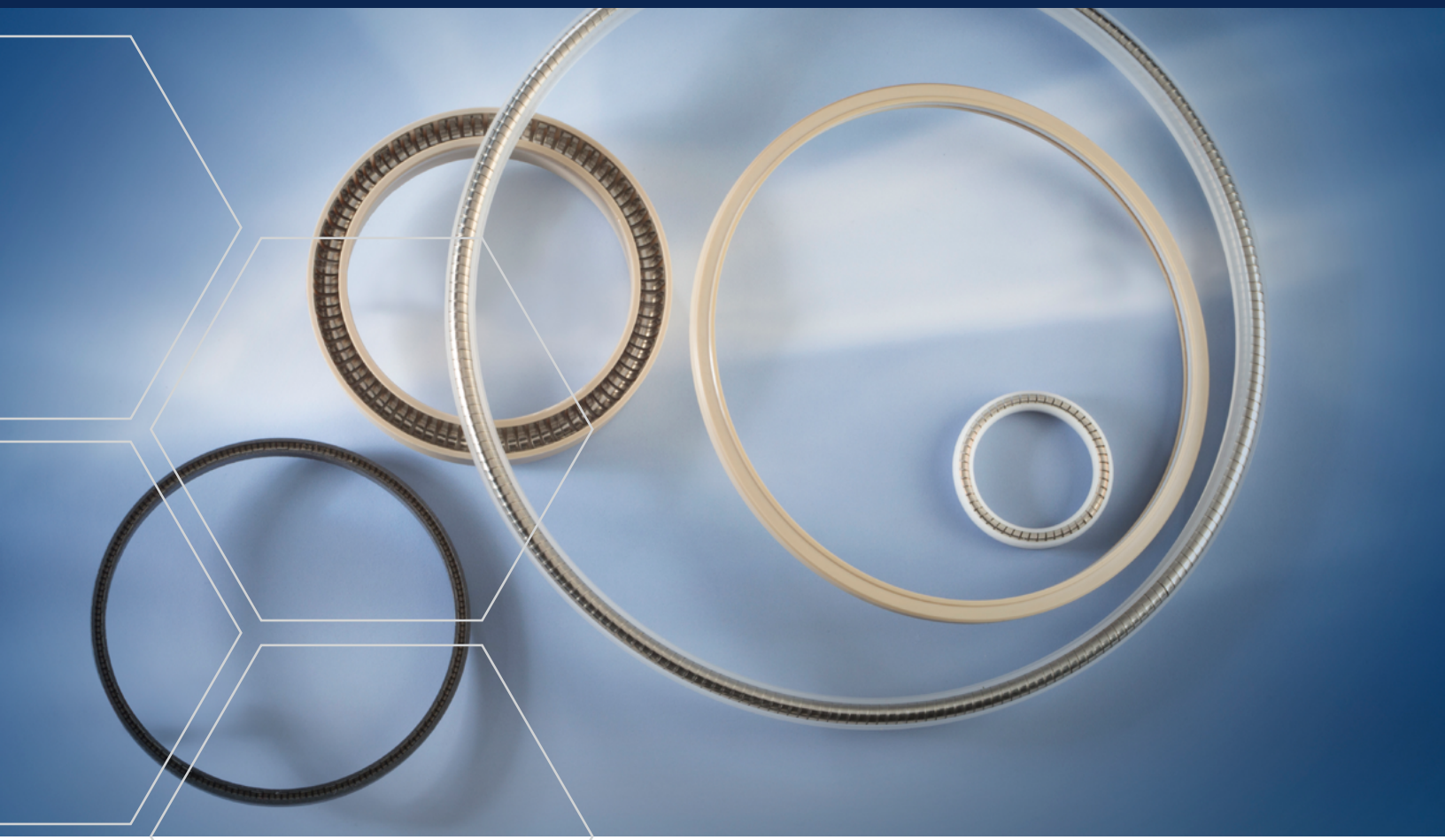
MSE® SEAL

Versatile Sealing Performance



The MSE® (Metal Spring Energized) Seal's superior designed dual-lip body offers improved sealing performance. An unlimited number of custom-engineered MSE® configurations are available.

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MSE® FINGER SPRING SEAL

MSE® COIL SPRING SEAL

MSE® CANTED COIL SPRING SEAL

GREENE TWEED'S MSE® (METAL SPRING ENERGIZED) SEALS:

- The MSE® seal's superior designed dual-lip body offers improved sealing performance in virtually unlimited media service and the widest temperature range
- Spring design and alternative spring options compensate for seal wear over time to maintain sealing and application requirements
- Offer unlimited shelf life
- Are available in sizes from 0.110 in. (0.279 cm) to 60 in. (152.4 cm) in diameter
- Seal in dynamic or static applications
- Custom cross sections and diameters for special applications.
- Available in rod, piston, or face configurations

FEATURES & BENEFITS

Low friction

- Precise and uniform movement without stick/slip
- Low power absorption and torque requirements
- Friction can be adjusted and controlled
- Can run dry or lubricated giving a long service life

Able to withstand corrosive environments

- Virtually unlimited media service with one seal
- Will not contaminate sensitive media

Wide temperature performance envelope

- Cryogenic to 550°F (288°C), providing excellent performance at extreme temperatures

Operates effectively at pressures from vacuum to 19,000 psi (1,310 bar) and up to 30,000 psi (2,068 bar) with custom designed anti-extrusion ring.*

*Please contact your Greene Tweed team for custom design options.

APPLICATION EXAMPLES

Aerospace

- Aircraft engines
- APUs (auxiliary power units)
- Brakes
- Fuel controls, pumps, valves
- Gearboxes
- Hydraulic systems
- Oxygen systems
- Scrapers across various platforms
- Utility and landing gear actuation systems

Energy

- Blow-out preventor
- Chemical mixers
- Compressors
- Cryogenic systems
- Downhole tools
- Drilling and completion tools
- Fluid dispensing systems
- Pipeline equipment
- Valve stems

Semiconductor

- CVD chambers
- Etch chambers
- Wafer elevators
- Quartz windows

Industrial

- Fluid loading arms
- Furnaces
- Gas inlets
- Mechanical seals
- Refrigeration systems
- Robotics

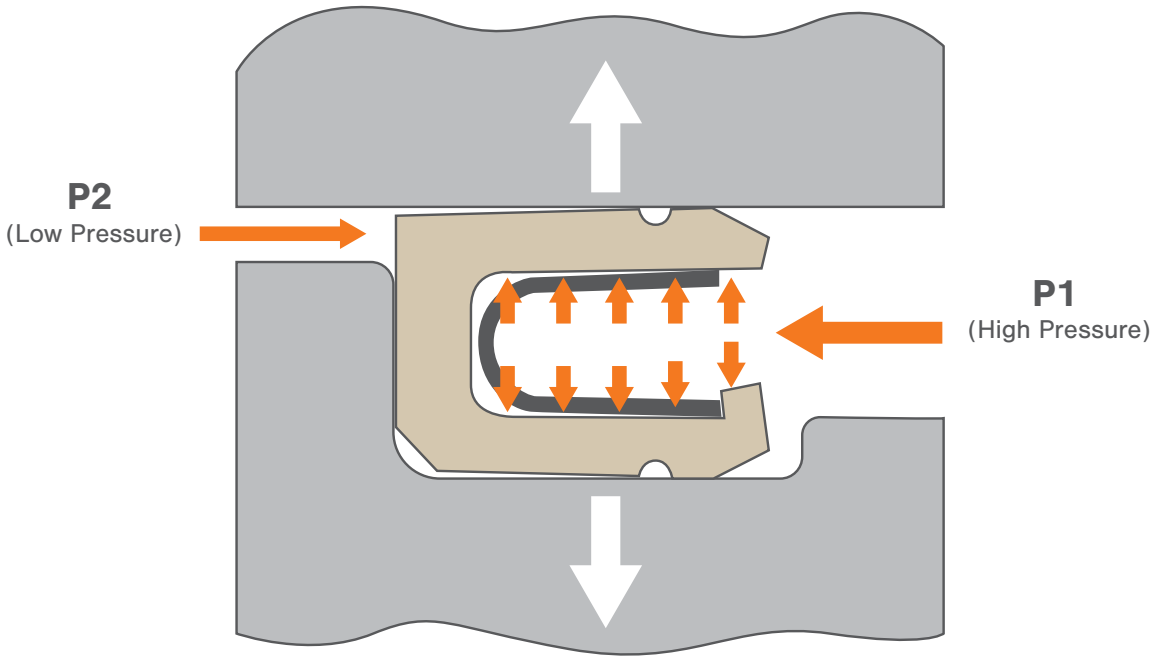
HOW MSE® SEALS WORK

MSE® (Metal Spring Energized) seals have a thermoplastic jacket material with a metal spring inside. Because an MSE® jacket lacks elastomeric qualities and relies on system pressure to actuate, the deflected spring is necessary to create an initial seal until adequate system pressure is applied. This initial spring deflection is enough to create a low-pressure seal; however, as the higher system pressure is applied to the MSE®, the seal jacket lips are actuated, thereby increasing the sealing force.

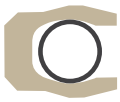
The cavity of the MSE® seal must face the higher system pressure to seal properly. Figure 1 shows how the higher pressure acts on the inside surfaces of the cavity and provides an increased sealing force exerted at the static and dynamic contact surfaces of the thermoplastic jacket. The higher the pressure, the more the lips will deform, which will increase the sealing footprint. At some point the pressure in the cavity will become the dominate contributor to the total sealing force exerted by the jacket lips onto the mating hardware.

As the system pressure is transmitted through the MSE®, the original sealing force is increased and equal to the original squeeze pressure plus the system pressure. This combination of squeeze and system pressure creates the total sealed pressure, which creates a seal. Sealed pressure is defined as ΔP, which equals P1-P2.

Figure 1: Sealed Pressure (ΔP = P1 – P2)



MSE® PRODUCT CHART — PART NUMBER SERIES

SEAL CROSS SECTION		AEROSPACE (AS4716)	GENERAL APPLICATION	METRIC	MAX PRESSURE RATING*	DESCRIPTION
FINGER SPRING ENERGIZED MSE®						
	Dual Lip	2060	2070	2010	4000 PSI (276 bar)	Dual lip seals are energized by a medium load metal finger spring designed for general use under static or dynamic conditions. Dual lip seals are available in both rod and piston type configurations.
	Scraper Lip	2061	2071	2011	4000 PSI (276 bar)	The scraper lip design is best suited for nonlubricated applications where abrasive media are present and space is limited. The scraper lip keeps abrasive media from getting between the seal and the hardware, thus decreasing abrasion. Available in rod and piston designs. Applicable to both static and dynamic applications.
	Extended Heel Dual Lip	2360	2370	2310	7000 PSI (483 bar)	The Extended Heel Series is preferred for high-temperature/ high-pressure applications. Rod and piston types use one back-up gland width.
	Extended Heel Scraper Lip	2361	2371	2311	7000 PSI (483 bar)	
	Flanged Dual Lip	2060	2070	2010	4000 PSI (276 bar)	Flange dual lip seals are energized by a medium load metal finger spring designed for general use under static or dynamic conditions and to prevent rotation within the gland. Flange dual lip seals are available in both rod and piston type configurations.
	Flanged Scraper Lip	2061	2071	2011	4000 PSI (276 bar)	The flange scraper lip design is best suited for nonlubricated applications where abrasive media are present and space is limited. The scraper lip keeps abrasive media from getting between the seal and the hardware, thus decreasing abrasion while also preventing rotation within the gland. Available in rod and piston designs. Applicable to both static and dynamic applications.
	Face Seal	2060	2070	2010	7000 PSI (483 bar)	MSE® internal and external pressure face seals are intended for static applications. Pressure operation is higher for face seals as the design assumes that the hardware clearance gap is reduced compared to standard clearances or assumes no clearance gap.
COIL SPRING ENERGIZED MSE®						
	Dual Lip	3060	3070	3010	4000 PSI (276 bar)	3000 Series Coil Spring seals are energized by a high-loading coil spring. Series 3000 seals are mainly designed for static applications.
	Extended Heel Dual Lip	3306	3370	3310	7000 PSI (483 bar)	The Extended Heel Series is preferred for high-temperature/ high-pressure applications. Rod and piston types use one back-up gland width. 3000 Series Coil Spring seals with extended heel are energized by a high-loading coil spring. Series 3000 seals are mainly designed for static applications.
	Face Seal	3060	3070	3010	7000 PSI (483 bar)	MSE® internal and external pressure face seals are intended for static applications. Pressure operation is higher for face seals as the design assumes that the hardware clearance gap is reduced compared to standard clearances or assumes no clearance gap.
CANTED COIL SPRING ENERGIZED MSE®						
	Dual Lip	1060	1070	1010	4000 PSI (276 bar)	Canted Coil Spring Energized MSE® seals allows for lower seal friction at low pressure. The Canted Coil Spring has a flatter spring rate curve compared to finger and regular coil springs, allowing for more consistent spring force through out its deflection. The Extended Heel Series is preferred for high-temperature/high-pressure applications. Rod and piston types use one Extended back-up gland width.
	Extended Heel Dual Lip	1360	1370	1310	7000 PSI (483 bar)	

*Please contact Greene Tweed for performance requirements exceeding these specifications.

MSE® PART NUMBERING SYSTEM

The part numbering system requires the use of the material designator tables found on page 9.

Please contact Greene Tweed for custom design options, see page 33.

H X X X X X – XXX X XXX

- **R** Rod
- **P** Piston
- **S** Flange
- **I** Internal Pressure Face Seal
- **E** External Pressure Face Seal

- **1** Canted Coil Spring
- **2** Finger Spring
- **3** Coil Spring

- **0** Standard – 0 Backup Gland Width
- **3** Extended Heel –1 Backup Gland Width

- **6** Aerospace
- **7** Industrial

- **0** Standard Seal Lip
- **1** Scraper Lip

Aerospace – Dash Size per AS4716 (Refer to page 13 for AS4716 hardware dimensions)

Industrial Gland Standard (Refer to page 24 for Energy/General hardware dimensions)

Spring Material Designator

Jacket Material Designator

Part Numbering Example

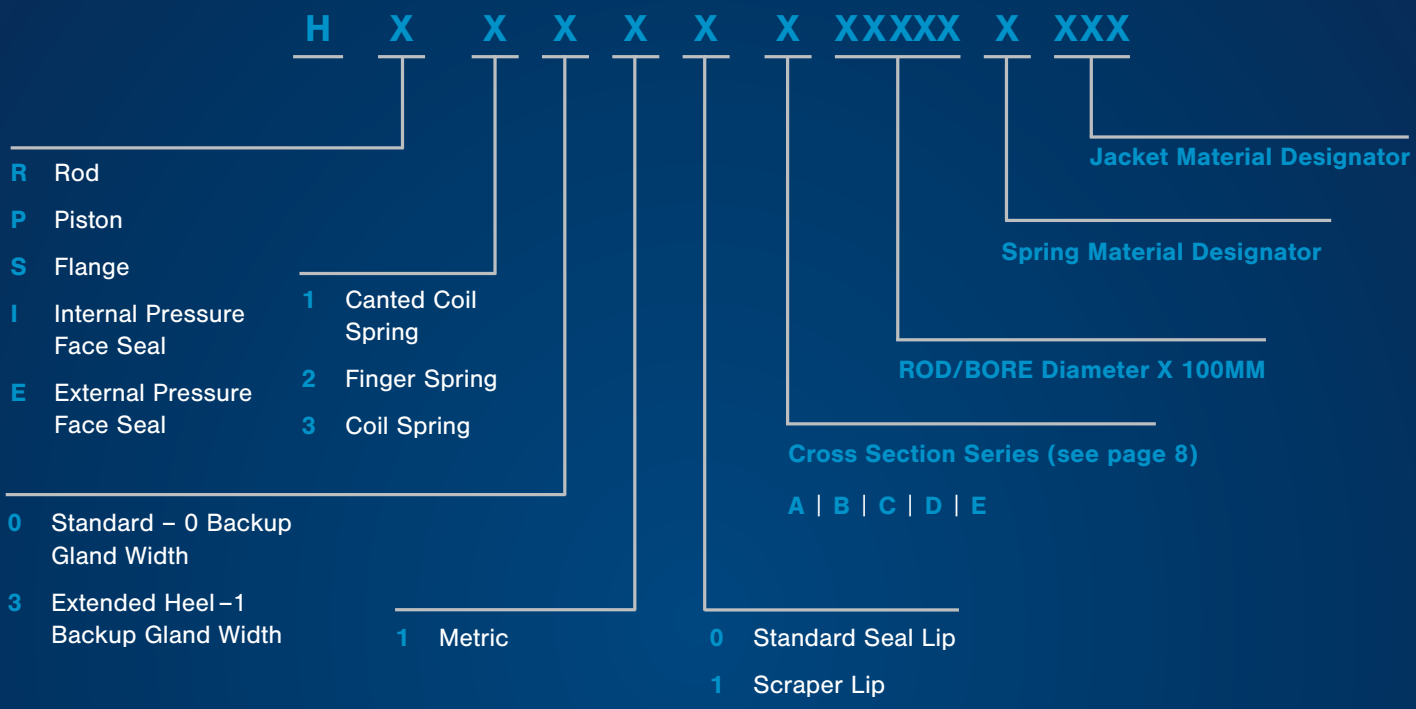
H R 2 3 6 1 – 214 E 389

- **H R** – Rod
- **2 3 6 1** – Finger Spring; Extended Heel 1 BU Width; Aerospace; Scraper Lip
- **214** – 0.998 in. Rod Diameter Per AS4716
- **E** – Elgiloy® Spring
- **389** – Avalon® 89 Jacket

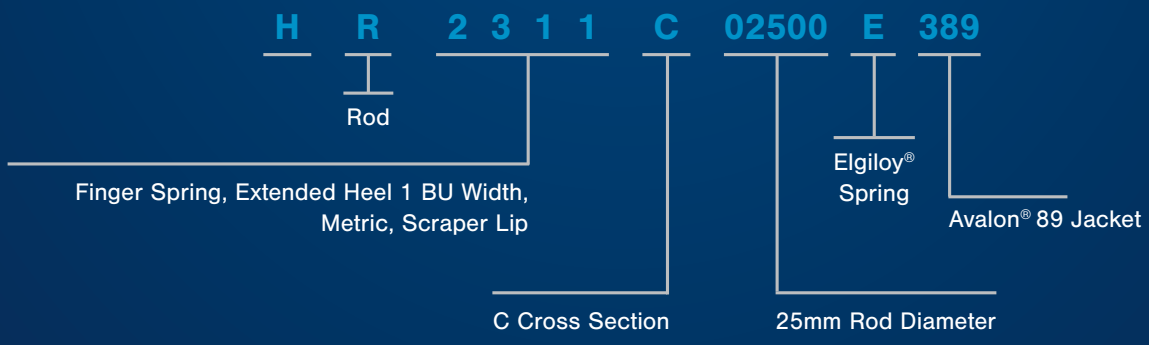
MSE® METRIC PART NUMBERING SYSTEM

The part numbering system requires the use of the material designator tables found on page 9.

Please contact Greene Tweed for custom design options, see page 27.

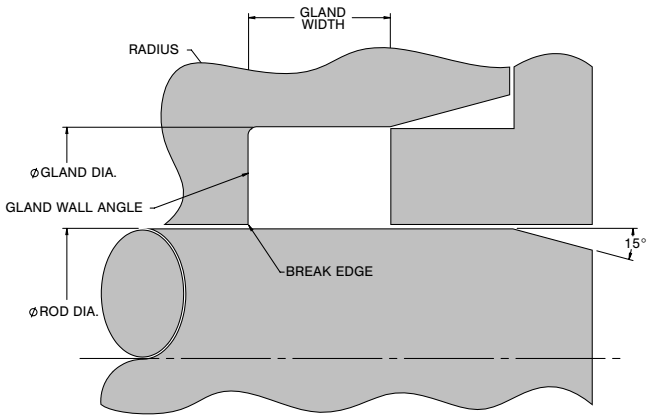


Part Numbering Example

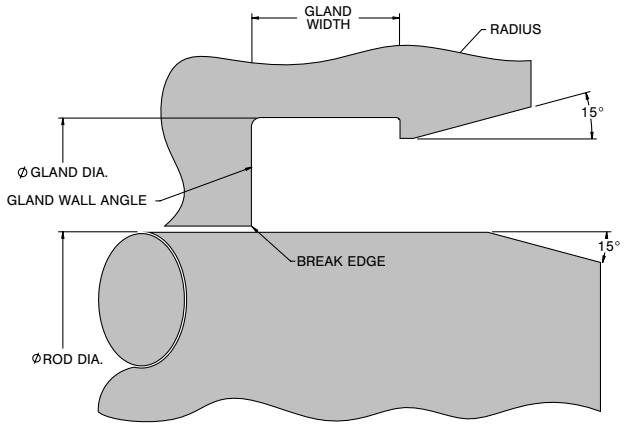


METRIC GROOVE DETAILS							
CROSS SECTION SERIES	GLAND CROSS SECTION (mm)	RADIUS (mm)	GROOVE WALL ANGLES X° (ALL DASH SIZES)	RUNOUT (mm)	BREAK EDGE (mm)	ZERO BU GLAND LENGTH +.25 / -.00 mm	ONE BU GLAND LENGTH +.25 / -.00 mm
A	1.42	.13/.38	ΔP ≤413 bar then ΔX° = 0.0°/5.0° ΔP >413 bar then ΔX° = 0.0° ± 0.5°	0.05	.005/.010	2.49	3.91
B	2.21	.13/.38		0.05		3.58	4.65
C	3.10	.25/.64		0.08		4.76	5.97
D	4.70	.51/.89		0.10		7.14	4.48
E	6.07	.51/.89		0.13	.13/.25	9.53	12.07

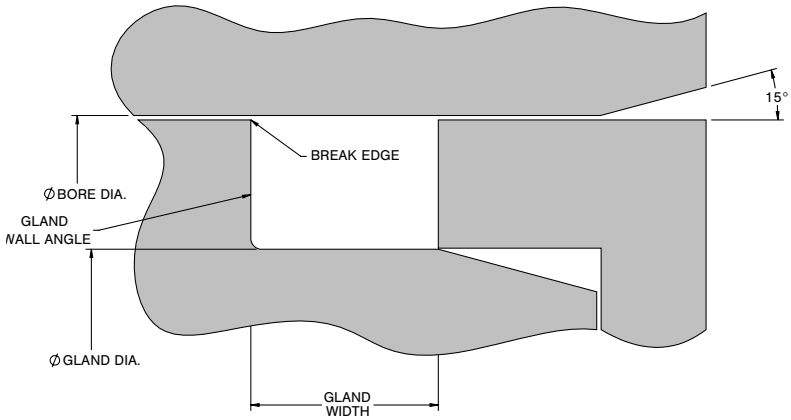
Rod – 2 piece gland configuration



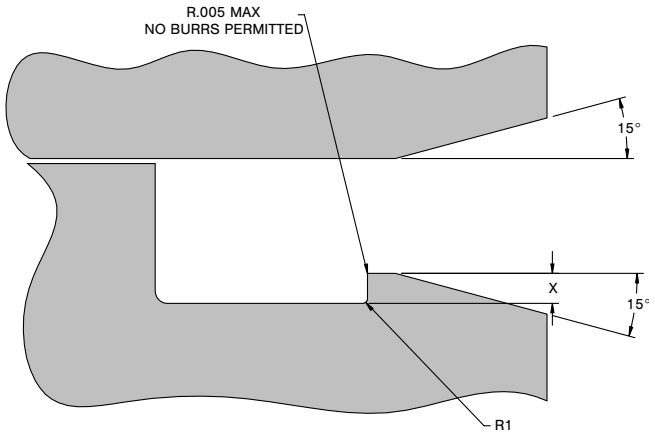
Rod – click-fit gland configuration



Piston – 2 piece gland configuration



Piston – click-fit gland configuration



MSE® JACKET MATERIAL DESIGNATOR TABLE

MATERIAL CODE	MATERIAL NAME	DESCRIPTION	DESCRIPTION
301	Avalon® 01	Virgin PTFE	For static, low-pressure applications
043	Avalon® 07	Molybdenum filled	Offers improved wear resistance, stiffness, and low friction
019	Avalon® 09	Graphite filled	Offers improved wear resistance and lubricity
344	Avalon® 44	Mineral, Molybdenum filled	Offers improved wear resistance and compressive strength as well as low creep relaxation and friction
069	Avalon® 50	Linear aromatic polyester filled	Offers improved wear resistance with low abrasion
356	Avalon® 56	Virgin (Modified) PTFE	Offers low gas permeation and creep relaxation
357	Avalon® 57	Polyimide filled	Offers improved wear, deformation, and extrusion resistance with low abrasion and friction
379	Avalon® 69	Polyphenylene Sulfide (PPS) filled	Offers improved wear, deformation, and extrusion resistance with excellent thermal stability and abrasion properties
387	Avalon® 87	Glass filled	Offers improved wear resistance and compressive strength as well as low creep relaxation
389	Avalon® 89	Carbon, Polyphenylene Sulfide (PPS) filled	Offers improved wear, deformation, and extrusion resistance with excellent thermal stability and abrasion properties

Additional MSE jacket materials available upon request. Please contact GT regarding any material-based questions. Please refer to Page 33 for GT contact details.

MSE® SPRING MATERIAL DESIGNATOR TABLE

MATERIAL CODE	MATERIAL NAME	FINGER SPRING	COIL SPRING	CANTED COIL SPRING
K	**302 Stainless Steel**	**—**	**—**	**Standard**
H	**C-276 Hastelloy**	**—**	**—**	**Optional**
S	**301 Stainless Steel**	**Standard**	**Optional**	**—**
P	**17-7 ph Stainless Steel**	**Optional**	**Standard**	**—**
T	**316 Stainless Steel**	**Optional**	**Optional**	**Optional**
E*	**Elgiloy 45% and 85% Cold Reduced**	**Standard**	**Standard**	**—**
I	**Inconel X750 Spring Tempered**	**Optional**	**Optional**	**Optional**

Spring load force data is available on request

***** Oil field and standard NACE-approved corrosion-resistance, high-heat spring material.

RECOMMENDED HARDWARE SURFACE FINISH

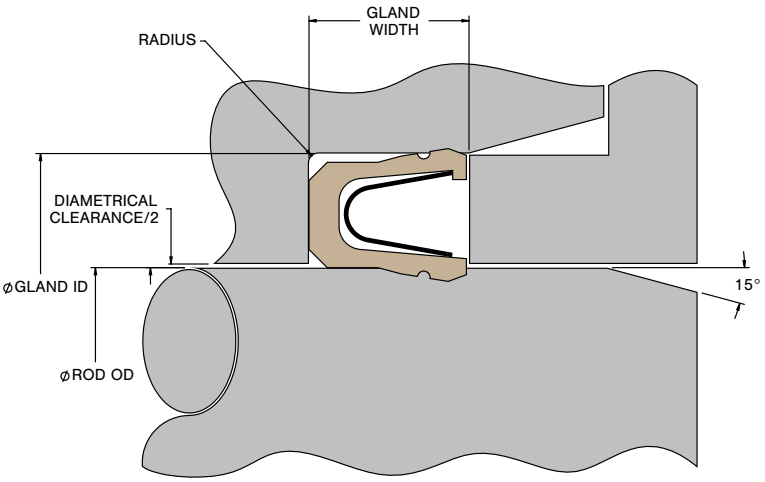
Hardware Coating	Ra Value		Rp Value		Rz Value		Rmr (TP) %		Rsk
	Ra µIN	Ra µM	Rp µIN	Rp µIN	Rz µIN	Rz µM	Dynamic	Static	—
Rod or Bore ø Chrome Plating Stainless Steel Aluminium	4–8	0.1–0.2	—	—	50	1.27	50–70	70–100	—
Nitriding	8–12	0.2–0.3	—	—	50	1.27	50–70	70–100	—
HVOF	2–4	0.05–0.1	8 Max	0.2 Max	40	1.0	70–90		-0.5 to -1.5
Gland Diameter ø	16 Max	0.4 Max	—	—	—	—	—	—	—
Gland Side Wall	63 Max	1.6 Max	—	—	—	—	—	—	—

GLAND (GROOVE) CONFIGURATIONS

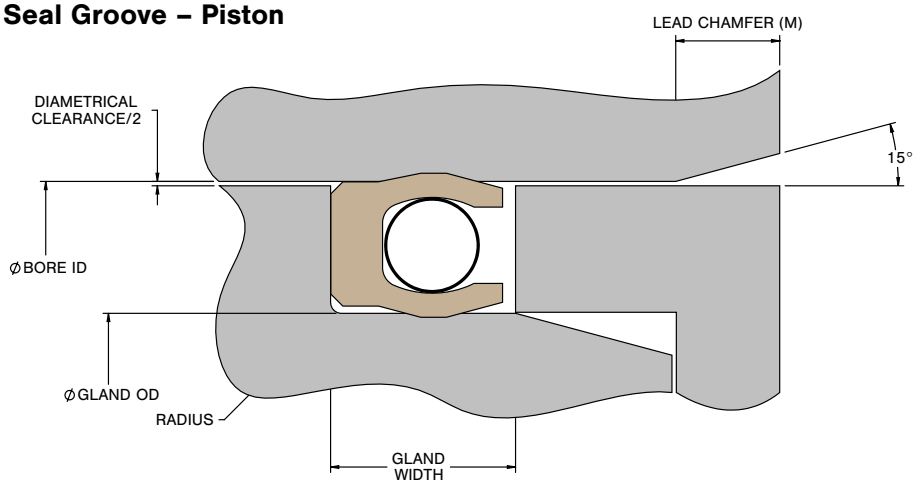
Open or Two Piece gland shown below are recommended standard gland design for optimum ease of installation. The Open or Two Piece gland is the only gland design available for Flanged Seal series. Click-Fit groove is recommended when Open or Two Piece gland design is not possible and there is no known back pressure loading. Closed gland is only used when hardware changes are not practical.

Seal Gland Dimensions

Seal Groove – Rod



Seal Groove – Piston



ROD AND PISTON GROOVE CHAMFER DIMENSIONS	
DASH NO.	LEAD CHAMFER (M) INCHES
-006 – 028	0.075
-110 – 149	0.100
-210 – 247	0.120
-325 – 349	0.150
-425 – 460	0.190

ROD AND PISTON GROOVE CHAMFER DIMENSIONS (METRIC)	
DASH NO.	LEAD CHAMFER (M) MM
A	1.91
B	62.5
C	3.05
D	3.81
E	4.83

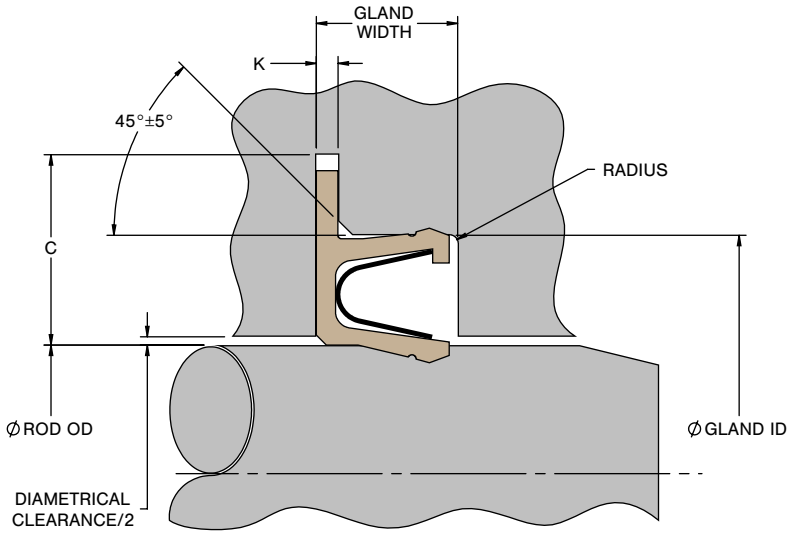
Note: See gland tables for rod and piston diameters and gland widths (see page 13)

GLAND (GROOVE) CONFIGURATIONS

Groove for Flange Seal

Special consideration should be given to applications that require sealing at temperatures below -65°F (-54°C). The thermal contraction of PTFE materials must be overcome to ensure positive sealing. This is best accomplished by 1) trapping the PTFE on the flanged OD to prevent shrinkage away from the hardware, and 2) geometry changes in the jacket and spring design to ensure positive loading. Both are accomplished by flanged seal designs.

Seal Groove — Flange



FLANGED SEAL GROOVE DIMENSIONS			
DASH NO.	C	J	K
-006 – 028	0.156/0.160	0.015	0.010/0.013
-110 – 149	0.186/0.190	0.020	0.016/0.020
-210 – 247	0.218/0.255	0.025	0.024/0.027
-325 – 349	0.343/0.350	0.035	0.028/0.032
-425 – 460	0.437/0.445	0.045	0.041/0.045

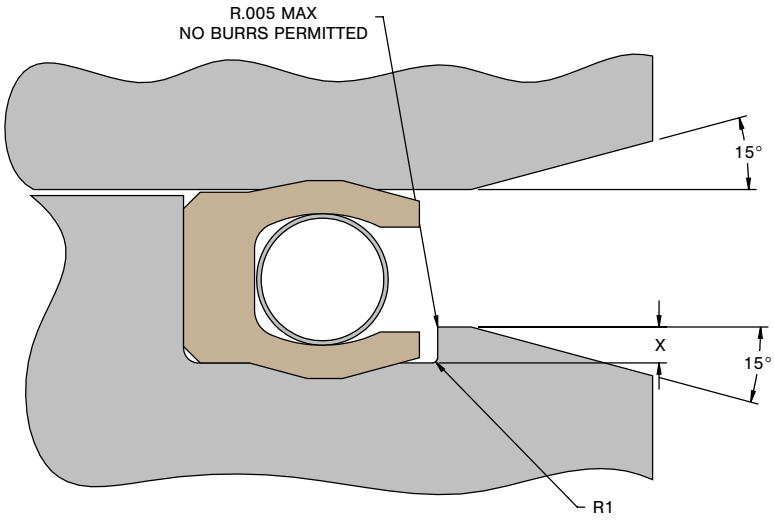
FLANGED SEAL GROOVE DIMENSIONS (METRICS)			
DASH NO.	C	J	K
A	3.96 / 4.06	0.38	0.25 / 0.33
B	4.72 / 4.83	0.51	0.41 / 0.51
C	5.54 / 6.48	0.64	0.61 /0 .69
D	8.71 / 8.89	0.89	0.71 / 0.81
E	11.10 / 11.303	1.14	1.04 / 1.14

Note: Use standard Gland Tables for Gland ID, Rod OD, Gland Length, Diametrical Clearance and Radius.

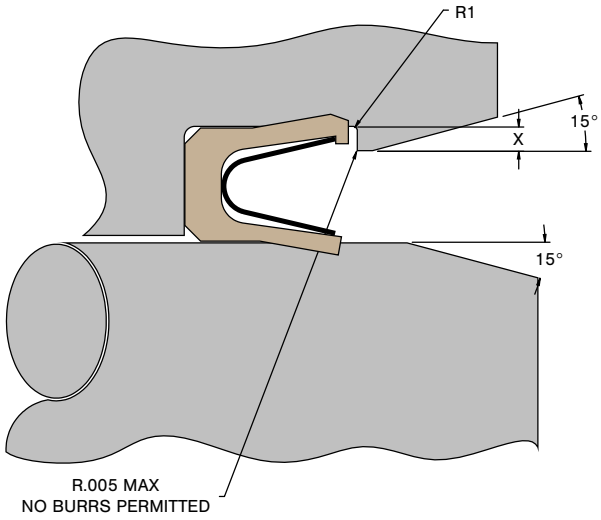
GLAND (GROOVE) CONFIGURATIONS

Seal Gland Dimensions

Click-Fit Groove – Rod



Click-Fit Groove – Piston



ROD AND PISTON GROOVE CLICK-FIT HARDWARE DESIGN			
DASH NO.	RECOMMENDED MAX GLAND LIP RADIUS R1	X	
		DIMENSION	TOL.
-006 – 028	0.005	0.017	±0.001
-110 – 149	0.007	0.021	±0.001
-210 – 247	0.007	0.021	±0.001
-325 – 349	0.009	0.032	±0.002
-425 – 460	0.012	0.042	±0.002

ROD AND PISTON GROOVE CLICK-FIT HARDWARE DESIGN (METRIC)			
DASH NO.	RECOMMENDED MAX GLAND LIP RADIUS R1	X	
		DIMENSION	TOL.
A	0.13	0.43	±0.03
B	0.18	0.53	±0.03
C	0.18	0.53	±0.03
D	0.23	0.81	±0.05
E	0.3	1.07	±0.05

Note: For numbers -006 through -015 and -110 through -114 a two-piece gland is recommended.

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4716

GROOVE DETAILS						
DASH SERIES	RADIUS	GROOVE WALL ANGLES X° (ALL DASH SIZES)	RUNOUT	BREAK EDGE	ZERO BU GLAND LENGTH +.010 / -.000	ONE BU GLAND LENGTH +.010 / -.000
-0XX	.005/.015″	ΔP ≤6000 psi then ΔX° = 0.0°/5.0° ΔP >6000+ psi then ΔX° = 0.0° ± 0.5°	0.002	.005/.010″	0.098	0.154
-1XX	.005/.015″		0.002		0.141	0.183
-2XX	.010/.025″		0.003		0.188	0.235
-3XX	.020/.035″		0.004		0.281	0.334
-4XX	.020/.035″		0.005		0.375	0.475

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL CLEARANCE	
	CYLINDER BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-006	0.235	+.001 -.000	0.129	+.000 -.001	0.123	+.000 -.001	0.232	+.001 -.000	.004	.004
-007	0.266		0.158		0.154		0.264			
-008	0.297		0.189		0.185		0.294			
-009	0.329		0.220		0.217		0.327			
-010	0.360		0.250		0.248		0.359			
-011	0.422		0.312		0.310		0.421			
-012	0.485		0.375		0.373		0.484			
-013	0.550	+.002 -.000	0.441	+.000 -.002	0.435	+.000 -.002	0.545	+.000 -.002	.005	.005
-014	0.613		0.504		0.498		0.608			
-015	0.675		0.566		0.560		0.670			
-016	0.738		0.629		0.623		0.733			
-017	0.800		0.691		0.685		0.795			
-018	0.863		0.753		0.748		0.858			
-019	0.925		0.815		0.810		0.920			
-020	0.991		0.881		0.873		0.983			
-021	1.053		0.943		0.935		1.045			
-022	1.116		1.006		0.998		1.108			
-023	1.178		1.068		1.060		1.170			
-024	1.241		1.131		1.123		1.233			
-025	1.303		1.193		1.185		1.295			
-026	1.366		1.256		1.248		1.358			
-027	1.428		1.318		1.310		1.420			
-028	1.491		1.381		1.373		1.483			
-110	0.550		0.379		0.373		0.546			
-111	0.613		0.441		0.435		0.609			
-112	0.675		0.502		0.498		0.672			
-113	0.738		0.565		0.560		0.734			
-114	0.800		0.627		0.623		0.797			
-115	0.863		0.689		0.685		0.859			
-116	0.925		0.751		0.748		0.923			
-117	0.991		0.817		0.810		0.985			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4716

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL CLEARANCE	
	CYLINDER BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-118	1.053		0.879		0.873		1.048			
-119	1.116		0.942		0.935		1.110			
-120	1.178		1.003		0.998		1.173			
-121	1.241		1.066		1.060		1.235			
-122	1.303		1.128		1.123		1.298			.005
-123	1.366		1.191		1.185		1.360			
-124	1.428		1.253		1.248		1.423		.005	
-125	1.491		1.316		1.310		1.485			
-126	1.553		1.378		1.373		1.548			
-127	1.616		1.441		1.435		1.610			
-128	1.678		1.503		1.498		1.673			
-129	1.741		1.566		1.560		1.735			.006
-130	1.805		1.631		1.623		1.798			
-131	1.867		1.693		1.685		1.860			
-132	1.930		1.756		1.748		1.923			
-133	1.992		1.818		1.810		1.984			
-134	2.055		1.881		1.873		2.047			
-135	2.118		1.944		1.936		2.110		.006	
-136	2.180		2.006		1.998		2.172			
-137	2.243	+.002 -.000	2.069	+.000 -.002	2.061	+.000 -.002	2.235	+.002 -.000		
-138	2.305		2.131		2.123		2.297			
-139	2.368		2.194		2.186		2.360			
-140	2.430		2.256		2.248		2.422			
-141	2.493		2.319		2.311		2.485			.007
-142	2.555		2.381		2.373		2.547			
-143	2.618		2.444		2.436		2.610			
-144	2.680		2.506		2.498		2.672			
-145	2.743		2.569		2.561		2.735		.007	
-146	2.805		2.631		2.623		2.797			
-147	2.868		2.694		2.686		2.860			
-148	2.930		2.756		2.748		2.922			
-149	2.993		2.819		2.811		2.985			
-210	0.991		0.750		0.748		0.989			
-211	1.053		0.812		0.810		1.051			
-212	1.116		0.874		0.873		1.115			
-213	1.178		0.936		0.935		1.177		.005	.005
-214	1.241		0.999		0.998		1.240			
-215	1.303		1.061		1.060		1.302			
-216	1.366		1.124		1.123		1.365			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4716

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL CLEARANCE	
	CYLINDER BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-217	1.428		1.186		1.185		1.427		.005	.005
-218	1.491		1.249		1.248		1.490			
-219	1.553		1.311		1.310		1.552			
-220	1.616		1.374		1.373		1.615			
-221	1.678		1.436		1.435		1.677			
-222	1.741		1.499		1.498		1.740			
-223	1.867		1.625		1.623		1.865			
-224	1.992		1.750		1.748		1.990		.006	.006
-225	2.118		1.876		1.873		2.115			
-226	2.243		2.001		1.998		2.240			.007
-227	2.368		2.126		2.123		2.365			
-228	2.493		2.251		2.248		2.490		.007	
-229	2.618		2.376		2.373		2.615			
-230	2.743		2.501		2.498		2.740			
-231	2.868		2.626		2.623		2.865			
-232	2.993		2.751		2.748		2.990			
-233	3.118		2.876		2.873		3.115			
-234	3.243		3.001		2.997		3.239			
-235	3.368		3.126		3.122		3.364			
-236	3.493	+.002 -.000	3.251	+.000 -.002	3.247	+.000 -.002	3.489	+.002 -.000		
-237	3.618		3.376		3.372		3.614			
-238	3.743		3.501		3.497		3.739			
-239	3.868		3.626		3.622		3.864			
-240	3.993		3.751		3.747		3.989			
-241	4.118		3.876		3.872		4.114			
-242	4.243		4.001		3.997		4.239			
-243	4.368		4.126		4.122		4.364			
-244	4.493		4.251		4.247		4.489		.008	
-245	4.618		4.376		4.372		4.614			
-246	4.743		4.501		4.497		4.739			.008
-247	4.868		4.626		4.622		4.864			
-325	1.867		1.495		1.498		1.870		.006	.006
-326	1.992		1.620		1.623		1.995			
-327	2.118		1.746		1.748		2.120			
-328	2.243		1.871		1.873		2.245			.007
-329	2.368		1.996		1.998		2.370			
-330	2.493		2.121		2.123		2.495		.007	
-331	2.618		2.246		2.248		2.620			
-332	2.743		2.371		2.373		2.745			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4716

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL CLEARANCE	
	CYLINDER BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-333	2.868		2.496		2.498		2.870			
-334	2.993		2.621		2.623		2.995			
-335	3.118		2.746		2.748		3.120			
-336	3.243		2.871		2.873		3.245			
-337	3.368		2.996		2.997		3.369			
-338	3.493		3.121		3.122		3.494			
-339	3.618		3.246		3.247		3.619		.007	
-340	3.743		3.371		3.372		3.744			
-341	3.868	+.002 -.000	3.496	+.000 -.002	3.497	+.000 -.002	3.869	+.002 -.000		.007
-342	3.993		3.621		3.622		3.994			
-343	4.118		3.746		3.747		4.119			
-344	4.243		3.871		3.872		4.244			
-345	4.368		3.996		3.997		4.369			
-346	4.493		4.121		4.122		4.494			
-347	4.618		4.246		4.247		4.619		.008	
-348	4.743		4.371		4.372		4.744			
-349	4.868		4.496		4.497		4.869			
-425	4.974		4.497		4.497		4.974			
-426	5.099		4.622		4.622		5.099			
-427	5.224		4.747		4.747		5.224			
-428	5.349		4.872		4.872		5.349			
-429	5.474		4.997		4.997		5.474			
-430	5.599		5.122		5.122		5.599			
-431	5.724		5.247		5.247		5.724			
-432	5.849		5.372		5.372		5.849			
-433	5.974		5.497		5.497		5.974			
-434	6.099		5.622		5.622		6.099			
-435	6.224	+.003	5.747	+.000	5.747	+.000	6.224	+.003	.009	.009
-436	6.349	-.000	5.872	-.003	5.872	-.003	6.349	-.000		
-437	6.474		5.997		5.997		6.474			
-438	6.724		6.247		6.247		6.724			
-439	6.974		6.497		6.497		6.974			
-440	7.224		6.747		6.747		7.224			
-441	7.474		6.997		6.997		7.474			
-442	7.724		7.247		7.247		7.724			
-443	7.974		7.497		7.497		7.974			
-444	8.224		7.747		7.747		8.224			
-445	8.474		7.997		7.997		8.474			
-446	8.974		8.497		8.497		8.974		.010	

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4716

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL CLEARANCE	
	CYLINDER BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-447	9.474		8.997		8.997		9.474			
-448	9.974		9.497		9.497		9.974			.009
-449	10.474		9.997		9.997		10.474			
-450	10.974		10.497		10.497		10.974			
-451	11.474		10.997		10.997		11.474			
-452	11.974		11.497		11.497		11.974			
-453	12.474	+.004 -.000	11.997	+.000 -.003	11.997	+.000 -.003	12.474	+.004 -.000	.011	
-454	12.974		12.497		12.497		12.974			
-455	13.474		12.997		12.997		13.474			.010
-456	13.974		13.497		13.497		13.974			
-457	14.474		13.997		13.997		14.474			
-458	14.974		14.497		14.497		14.974			
-459	15.474		14.997		14.997		15.474			
-460	15.974		15.497		15.497		15.974			

AS4088 GLAND TABLES

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4088

DASH SIZE	ROD TYPE							
	ROD OD		GLAND ID		RETAINING LIP ID (K)		GLAND WIDTH	
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	TOL
108	0.248	+.000 -.001	0.423	+.001 -.000	0.278			
109	0.310		0.486		0.340		.183	
110	0.373		0.546		0.403			
111	0.435		0.609		0.465			
206	0.498		0.741		0.528			
207	0.056		0.803		0.590			
208	0.623		0.866		0.653			
209	0.685		0.928		0.715			
210	0.748		0.989		0.778	+.010 -.000		+.010 -.000
211	0.810	+.000 -.002	1.051	+.002 -.000	0.825			
212	0.873		1.115		0.915		.235	
213	0.935		1.117		0.977			
214	0.998		1.240		1.040			
215	1.060		1.302		1.102			
216	1.123		1.365		1.165			
217	1.185		1.427		1.227			
218	1.248		1.490		1.290			
219	1.310		1.552		1.352			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4088

DASH SIZE	ROD TYPE							
	ROD OD		GLAND ID		RETAINING LIP ID (K)		GLAND WIDTH	
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	TOL
220	1.373	+.000 -.002	1.615	+.002 -.000	1.415	+.010 -.000	.235	+.010 -.000
221	1.435		1.677		1.477			
222	1.498		1.740		1.540			
325	1.498	+.000 -.002	1.870	+.002 -.000	1.540	+.010 -.000	.334	+.010 -.000
326	1.623		1.995		1.665			
327	1.748		2.120		1.790			
328	1.873		2.245		1.915			
329	1.998		2.370		2.040			
330	2.123		2.495		2.165			
331	2.248		2.620		2.290			
332	2.373		2.745		2.415			
333	2.498		2.870		2.540			
334	2.623		2.995		2.665			
335	2.748		3.120		2.790			
336	2.873		3.245		2.915			
337	2.997		3.369		3.039			
338	3.122		3.494		3.164			
339	3.247		3.619		3.289			
340	3.372		3.744		3.414			
341	3.497		3.869		3.539			
342	3.622		3.994		3.664			
343	3.747		4.119		3.789			
344	3.872		4.244		3.914			
345	3.997		4.369		4.039			
346	4.122		4.494		4.164			
347	4.247		4.649		4.289			
348	4.372		4.744		4.414			
349	4.497		4.869		4.539			
425	4.497	+.000 -.003	4.974	+.003 -.000	4.539	+.010 -.000	.475	+.010 -.000
426	4.622		5.099		4.664			
427	4.747		5.224		4.789			
428	4.872		5.349		4.914			
429	4.997		5.474		5.039			
430	5.122		5.599		5.614			
431	5.247		5.724		5.289			
432	5.372		5.849		5.414			
433	5.497		5.974		5.539			
434	5.622		6.099		5.664			
435	5.747		6.224		5.789			
436	5.872		6.349		5.914			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4088

DASH SIZE	ROD TYPE							
	ROD OD		GLAND ID		RETAINING LIP ID (K)		GLAND WIDTH	
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	TOL
437	5.997	+.000 -.003	6.474	+.003 -.000	6.039	+.010 -.000	.475	+.010 -.000
438	6.247		6.724		6.289			
439	6.497		6.974		6.539			
440	6.747		7.224		6.789			
441	6.997		7.474		7.039			
442	7.247		7.724		7.289			
443	7.497		7.974		7.539			
444	7.747		8.224		7.789			
445	7.997		8.474		8.339			
446	8.497		8.974		8.539			
447	8.997		9.474		9.039			
448	9.497		9.974		9.539			
449	9.997		10.474		10.039			
450	10.497		10.974		10.539			
451	10.997		11.474		11.039			
452	11.497		11.974		11.539			
453	11.997		12.474		12.039			
454	12.497		12.974		12.539			
455	12.997		13.474		13.039			
456	13.497		13.974		13.539			
457	13.997		14.474		14.039			
458	14.497		14.974		14.539			
459	14.997		15.474		15.039			
460	15.497		15.974		15.539			

AS4052 GLAND TABLES

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4052

DASH SIZE	ROD TYPE							
	ROD OD		GLAND ID		RETAINING LIP ID (K)		GLAND WIDTH	
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	TOL
325	1.498	+.000 -.002	1.87	+.002 -.000	1.646	+.000 -.010	.334	+.010 -.000
326	1.623		1.995		1.771			
327	1.748		2.120		1.896			
328	1.873		2.245		2.021			
329	1.998		2.370		2.146			
330	2.123		2.495		2.271			
331	2.248		2.62		2.396			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4052

DASH SIZE	ROD TYPE							
	ROD OD		GLAND ID		RETAINING LIP ID (K)		GLAND WIDTH	
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	TOL
332	2.373		2.745		2.521			
333	2.498		2.870		2.646			
334	2.623		2.995		2.771			
335	2.748		3.120		2.896			
336	2.873		3.245		3.021			
337	2.997		3.369		3.145			
338	3.122		3.494		3.270			
339	3.247		3.619		3.395			
340	3.372	+.000	3.744	+.002	3.520	+.000	.334	+.010
341	3.497	-.002	3.869	-.000	3.645	-.010		-.000
342	3.622		3.994		3.770			
343	3.747		4.119		3.895			
344	3.872		4.244		4.020			
345	3.997		4.369		4.145			
346	4.122		4.494		4.270			
347	4.247		4.649		4.395			
348	4.372		4.744		4.520			
349	4.497		4.869		4.645			
425	4.497		4.974		4.686			
426	4.622		5.099		4.811			
427	4.747		5.224		4.936			
428	4.872		5.349		5.061			
429	4.997		5.474		5.186			
430	5.122		5.599		5.311			
431	5.247		5.724		5.436			
432	5.372		5.849		5.561			
433	5.497		5.974		5.686			
434	5.622		6.099		5.811			
435	5.747	+.000	6.224	+.003	5.936	+.000	.475	+.010
436	5.872	-.003	6.349	-.000	6.061	-.010		-.000
437	5.997		6.474		6.186			
438	6.247		6.724		6.436			
439	6.497		6.974		6.686			
440	6.747		7.224		6.936			
441	6.997		7.474		7.186			
442	7.247		7.724		7.436			
443	7.497		7.974		7.686			
444	7.747		8.224		7.936			
445	7.997		8.474		8.186			
446	8.497		8.974		8.686			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4052

DASH SIZE	ROD TYPE							
	ROD OD		GLAND ID		RETAINING LIP ID (K)		GLAND WIDTH	
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	TOL
447	8.997	+.000 -.003	9.474	+.003 -.000	9.186	+.000 -.010	.475	+.010 -.000
448	9.497		9.974		9.686			
449	9.997		10.474		10.186			
450	10.497		10.974		10.686			
451	10.997		11.474		11.186			
452	11.497		11.974		11.686			
453	11.997		12.474		12.186			
454	12.497		12.974		12.686			
455	12.997		13.474		13.186			
456	13.497		13.974		13.686			
457	13.997		14.474		14.186			
458	14.497		14.974		14.686			
459	14.997		15.474		15.186			
460	15.497		15.974		15.686			

AS4052 CLICK-FIT GLAND TABLES

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4052 CLICK-FIT

DASH SIZE	ROD TYPE									
	ROD OD		GLAND ID		GLAND WIDTH		LEAD IN DIA	RETAINING LIP X		R1 ATMOSPHERIC CORNER RAD
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	MIIN	TOL	MAX
325	1.498	+.000 -.002	1.870	+.002 -.000	.334	+.010 -.000	1.888	.032	+.005 -.000	.009
326	1.623		1.995				2.013			
327	1.748		2.120				2.138			
328	1.873		2.245				2.263			
329	1.998		2.370				2.388			
330	2.123		2.495				2.513			
331	2.248		2.620				2.638			
332	2.373		2.745				2.763			
333	2.498		2.870				2.888			
334	2.623		2.995				3.013			
335	2.748		3.120				3.138			
336	2.873		3.245				3.263			

AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4052 CLICK-FIT

DASH SIZE	ROD TYPE									
	ROD OD		GLAND ID		GLAND WIDTH		LEAD IN DIA	RETAINING LIP X		R1 ATMOSPHERIC CORNER RAD
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	MIIN	TOL	MAX
337	2.997	+.000 -.002	3.369	+.002 -.000	.334	+.010 -.000	3.387	.032	+.005 -.000	.009
338	3.122		3.494				3.512			
339	3.247		3.619				3.637			
340	3.372		3.744				3.762			
341	3.497		3.869				3.887			
342	3.622		3.994				4.012			
343	3.747		4.119				4.137			
344	3.872		4.244				4.262			
345	3.997		4.369				4.387			
346	4.122		4.494				4.512			
347	4.247		4.649				4.637			
348	4.372		4.744				4.762			
349	4.497		4.869				4.887			
425	4.497	+.000 -.003	4.974	+.003 -.000	.475	+.010 -.000	5.017	.042	+.005 -.000	.012
426	4.622		5.099				5.042			
427	4.747		5.224				5.267			
428	4.872		5.349				5.392			
429	4.997		5.474				5.517			
430	5.122		5.599				5.642			
431	5.247		5.724				5.767			
432	5.372		5.849				5.892			
433	5.497		5.974				6.017			
434	5.622		6.099				6.042			
435	5.747		6.224				6.267			
436	5.872		6.349				6.392			
437	5.997		6.474				6.517			
438	6.247		6.724				6.767			
439	6.497		6.974				7.017			
440	6.747		7.224				7.267			

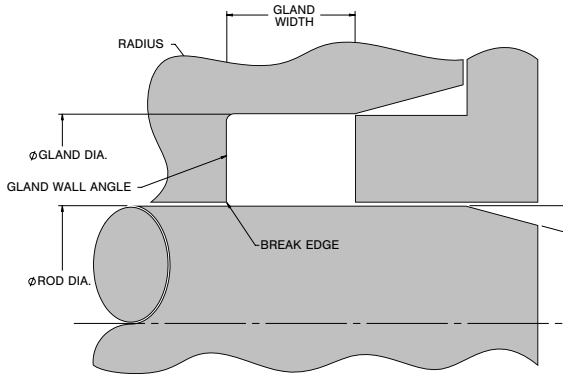
AEROSPACE APPLICATION GLAND DIMENSIONS PER GLAND SPECIFICATION AS4052 CLICK-FIT

DASH SIZE	ROD TYPE									
	ROD OD		GLAND ID		GLAND WIDTH		LEAD IN DIA	RETAINING LIP X		R1 ATMOSPHERIC CORNER RAD
	MAX	TOL	MIN	TOL	MIN	TOL	MIN	MIIN	TOL	MAX
441	6.997	+.000 -.003	7.474	+.003 -.000	.475	+.010 -.000	7.517	.042	+.005 -.000	.012
442	7.247		7.724				7.767			
443	7.497		7.974				8.017			
444	7.747		8.224				8.267			
445	7.997		8.474				8.517			
446	8.497		8.974				9.017			
447	8.997		9.474				5.517			
448	9.497		9.974				10.017			
449	9.997		10.474				10.517			
450	10.497		10.974				11.017			
451	10.997		11.474				11.517			
452	11.497		11.974				12.017			
453	11.997		12.474				12.517			
454	12.497		12.974				13.017			
455	12.997		13.474				13.517			
456	13.497		13.974				14.017			
457	13.997		14.474				14.517			
458	14.497		14.974				15.017			
459	14.997		15.474				15.517			
460	15.497		15.974				16.017			

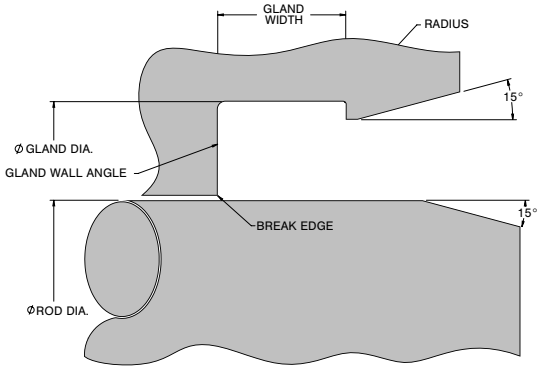
INDUSTRIAL APPLICATION GLAND DIMENSION FOR MSE® 2070 AND 2370

GROOVE DETAILS						
DASH SERIES	RADIUS	GROOVE WALL ANGLES X° (ALL DASH SIZES)	RUNOUT	BREAK EDGE	ZERO BU GLAND LENGTH +.010 / -.000	ONE BU GLAND LENGTH +.010 / -.000
-0XX	.005/.015″	ΔP ≤6000 psi then ΔX° = 0.0°/5.0° ΔP >6000+ psi then ΔX° = 0.0° ± 0.5°	0.002	.005/.010″	0.098	0.154
-1XX	.005/.015″		0.002		0.141	0.183
-2XX	.010/.025″		0.003		0.188	0.235
-3XX	.020/.035″		0.004		0.281	0.334
-4XX	.020/.035″		0.005		0.375	0.475

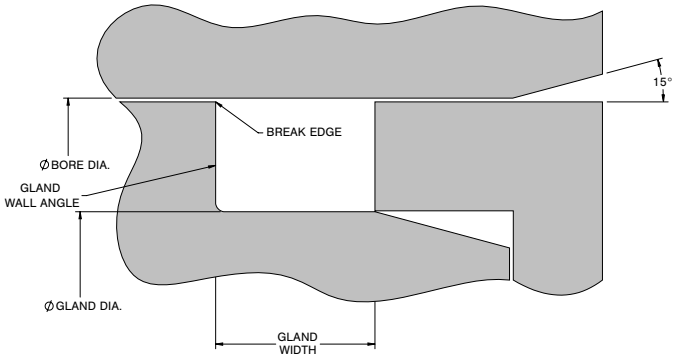
Rod – 2 piece gland configuration



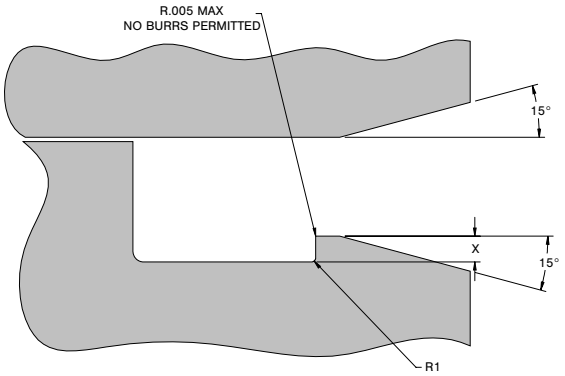
Rod – click-fit gland configuration



Piston – 2 piece gland configuration



Piston – click-fit gland configuration



DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL	
	BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-006	.250	+.001 -.000	.125	+.000 -.001	.123	+.001 -.000	.248	+.001 -.000	.004	.004
-007	.281		.156		.154		.279			
-008	.312		.187		.185		.310			
-009	.343		.218		.217		.342			
-010	.375		.250		.248		.373			
-011	.437		.312		.310		.435			
-012	.500		.375		.373		.498			
-013	.562	+.002 -.000	.437	+.000 -.002	.435	+.002 -.000	.560	+.002 -.000	.005	.005
-014	.625		.500		.498		.623			
-015	.687		.562		.560		.685			
-016	.750		.625		.623		.748			

INDUSTRIAL APPLICATION GLAND DIMENSION FOR MSE® 2070 AND 2370

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL	
	BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-017	.812		.687		.685		.810			
-018	.875		.750		.748		.873			
-019	.937		.812		.810		.935			
-020	1.000		.875		.873		.998			
-021	1.062		.937		.935		1.060			
-022	1.125		1.000		.998		1.123			
-023	1.187		1.062		1.060		1.185			
-024	1.250		1.125		1.123		1.248			
-025	1.312		1.187		1.185		1.310			
-026	1.375		1.250		1.248		1.373			
-027	1.437		1.312		1.310		1.435			
-028	1.500		1.375		1.373		1.498			
-104	.313		.126		.123		.311			
-105	.344		.157		.154		.342			
-106	.375		.188		.185		.373			
-107	.406		.219		.217		.405			
-108	.438		.251		.248		.436			
-109	.500		.313		.310		.498			.005
-110	.563		.376		.373		.561			
-111	.625		.438		.435		.623			
-112	.688	+.002 -.000	.501	+.000 -.002	.498	+.002 -.000	.686	+.002 -.000	.005	
-113	.750		.563		.560		.748			
-114	.813		.626		.623		.811			
-115	.875		.688		.685		.873			
-116	.938		.751		.748		.936			
-117	1.000		.813		.810		.998			
-118	1.063		.876		.873		1.061			
-119	1.125		.938		.935		1.123			
-120	1.188		1.001		.998		1.186			
-121	1.250		1.063		1.060		1.248			
-122	1.313		1.126		1.123		1.311			
-123	1.375		1.188		1.185		1.373			
-124	1.438		1.251		1.248		1.436			
-125	1.500		1.313		1.310		1.498			
-126	1.563		1.376		1.373		1.561			
-127	1.625		1.438		1.435		1.623			
-128	1.688		1.501		1.498		1.686			
-129	1.750		1.563		1.560		1.748			.006
-130	1.813		1.626		1.623		1.811			
-131	1.875		1.688		1.685		1.873			
-132	1.938		1.751		1.748		1.936			
-133	2.000		1.813		1.810		1.998			.007

INDUSTRIAL APPLICATION GLAND DIMENSION FOR MSE® 2070 AND 2370

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL	
	BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-134	2.063		1.876		1.873		2.061			
-135	2.125		1.938		1.936		2.124			
-136	2.188		2.001		1.998		2.186			
-137	2.250		2.063		2.061		2.249		.005	
-138	2.313		2.126		2.123		2.311			
-139	2.375		2.188		2.186		2.374			
-140	2.438		2.251		2.248		2.436			
-141	2.500		2.313		2.311		2.499			.007
-142	2.563		2.376		2.373		2.561			
-143	2.625		2.438		2.436		2.624			
-144	2.688		2.501		2.498		2.686			
-145	2.750		2.563		2.561		2.749		.007	
-146	2.813		2.626		2.623		2.811			
-147	2.875		2.688		2.686		2.874			
-148	2.938		2.751		2.748		2.936			
-149	3.000		2.813		2.811		2.999			
-210	1.000		.750		.748		.998			
-211	1.063		.813		.810		1.060			
-212	1.125		.875		.873		1.123			
-213	1.188		.938		.935		1.185			
-214	1.250	+.002 -.000	1.000	+.000 -.002	.998	+.000 -.002	1.248	+.002 -.000	.005	.005
-215	1.313		1.063		1.060		1.310			
-216	1.375		1.125		1.123		1.373			
-217	1.438		1.188		1.185		1.435			
-218	1.500		1.250		1.248		1.498			
-219	1.563		1.313		1.310		1.560			
-220	1.625		1.375		1.373		1.623			
-221	1.688		1.438		1.435		1.685			
-222	1.750		1.500		1.498		1.748			
-223	1.875		1.625		1.623		1.873			.006
-224	2.000		1.750		1.748		1.998			
-225	2.125		1.875		1.873		2.123		.006	
-226	2.250		2.000		1.998		2.248			
-227	2.375		2.125		2.123		2.373			
-228	2.500		2.250		2.248		2.498			.007
-229	2.625		2.375		2.373		2.623			
-230	2.750		2.500		2.498		2.748			
-231	2.875		2.625		2.623		2.873		.007	
-232	3.000		2.750		2.748		2.998			
-233	3.125		2.875		2.873		3.123			
-234	3.250		3.000		2.997		3.247			
-235	3.375		3.125		3.122		3.372			

INDUSTRIAL APPLICATION GLAND DIMENSION FOR MSE® 2070 AND 2370

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL	
	BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-236	3.500		3.250		3.247		3.497			
-237	3.625		3.375		3.372		3.622			
-238	3.750		3.500		3.497		3.747			
-239	3.875		3.625		3.622		3.872		.007	
-240	4.000		3.750		3.747		3.997			
-241	4.125		3.875		3.872		4.122			.007
-242	4.250		4.000		3.997		4.247			
-243	4.375		4.125		4.122		4.372			
-244	4.500		4.250		4.247		4.497			
-245	4.625		4.375		4.372		4.622		.008	
-246	4.750		4.500		4.497		4.747			.008
-247	4.875		4.625		4.622		4.872			
-325	1.875		1.500		1.498		1.873			.006
-326	2.000		1.625		1.623		1.998			
-327	2.125		1.750		1.748		2.123		.006	
-328	2.250		1.875		1.873		2.248			
-329	2.375		2.000		1.998		2.373			
-330	2.500		2.125		2.123		2.498			
-331	2.625	+.002 -.000	2.250	+.000 -.002	2.248	+.000 -.002	2.623	+.002 -.000		
-332	2.750		2.375		2.373		2.748			
-333	2.875		2.500		2.498		2.873		.007	.007
-334	3.000		2.625		2.623		2.998			
-335	3.125		2.750		2.748		3.123			
-336	3.250		2.875		2.873		3.248			
-337	3.375		3.000		2.997		3.372			
-338	3.500		3.125		3.122		3.497			
-339	3.625		3.250		3.247		3.622			
-340	3.750		3.375		3.372		3.747			
-341	3.875		3.500		3.497		3.872			
-342	4.000		3.625		3.622		3.997			
-343	4.125		3.750		3.747		4.122			
-344	4.250		3.875		3.872		4.247			
-345	4.375		4.000		3.997		4.372			
-346	4.500		4.125		4.122		4.497			
-347	4.625		4.250		4.247		4.622		.008	
-348	4.750		4.375		4.372		4.747			
-349	4.875		4.500		4.497		4.872			
-425	5.000		4.500		4.497		4.997			
-426	5.125		4.625		4.622		5.122			
-427	5.250	+.003 -.000	4.750	+.000 -.003	4.747	+.000 -.003	5.247	+.003 -.000	.009	.009
-428	5.375		4.875		4.872		5.372			
-429	5.500		5.000		4.997		5.497			

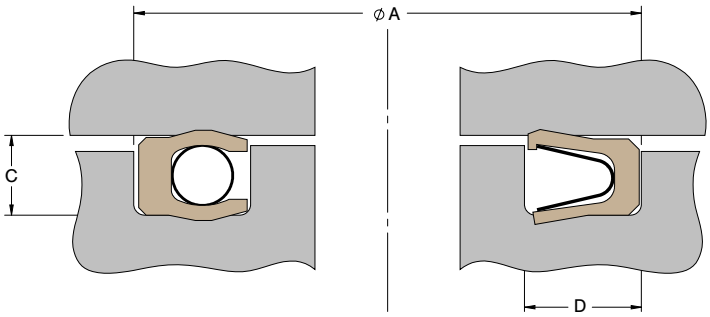
INDUSTRIAL APPLICATION GLAND DIMENSION FOR MSE® 2070 AND 2370

DASH SIZE	PISTON TYPE				ROD TYPE				MAXIMUM DIAMETRICAL	
	BORE ID		GLAND OD		ROD OD		GLAND ID			
	MIN	TOL	MAX	TOL	MAX	TOL	MIN	TOL	PISTON	ROD
-430	5.625		5.125		5.122		5.622			
-431	5.750		5.250		5.247		5.747			
-432	5.875		5.375		5.372		5.872			
-433	6.000		5.500		5.497		5.997			
-434	6.125		5.625		5.622		6.122			.009
-435	6.250		5.750		5.747		6.247			
-436	6.375		5.875		5.872		6.372			
-437	6.500		6.000		5.997		6.497			
-438	6.750	+.003 -.000	6.250	+.000 -.003	6.247	+.000 -.003	6.747	+.003 -.000	.009	
-439	7.000		6.500		6.497		6.997			
-440	7.250		6.750		6.747		7.247			
-441	7.500		7.000		6.997		7.497			
-442	7.750		7.250		7.247		7.747			
-443	8.000		7.500		7.497		7.997			
-444	8.250		7.750		7.747		8.247			
-445	8.500		8.000		7.997		8.497			
-446	9.000		8.500		8.497		8.997		.010	
-447	9.500		9.000		8.997		9.497			
-448	10.000		9.500		9.497		9.997			
-449	10.500		10.000		9.997		10.497			
-450	11.000		10.500		10.497		10.997			.010
-451	11.500		11.000		10.997		11.497			
-452	12.000		11.500		11.497		11.997			
-453	12.500	+.004 -.000	12.000	+.000 -.004	11.997	+.000 -.004	12.497	+.004 -.000	.011	
-454	13.000		12.500		12.497		12.997			
-455	13.500		13.000		12.997		13.497			
-456	14.000		13.500		13.497		13.997			
-457	14.500		14.000		13.997		14.497			
-458	15.000		14.500		14.497		14.997			
-459	15.500		15.000		14.997		15.497			
-460	16.000		15.500		15.497		15.997			

Internal Pressure Face Seals Dimensional Information (in Inches)

DASH NO.	ØA +0.000 -0.005	C ±0.001	D +0.010 -0.000
012*	0.504	0.057	0.094
013*	0.566		
014*	0.629		
015*	0.691		
016*	0.754		
017*	0.816		
018*	0.879		
019	0.941		
020	1.004		
021	1.066		
022	1.129		
023	1.191		
024	1.254		
025	1.316		
026	1.379		
027	1.441		
028	1.504		
113	0.755	0.090	0.141
114	0.818		
115	0.880		
116	0.943		
117	1.005		
118	1.068		
119	1.130		
120	1.193		
121	1.255		
122	1.318		
123	1.380		
124	1.443		
125	1.505		
126	1.568		
127	1.630		
128	1.693		
129	1.755		
130	1.818		
131	1.880		
132	1.943		
133	2.005		
134	2.068		
135	2.131		
210	1.012	0.122	0.188
211	1.074		
212	1.137		
213	1.199		
214	1.262		
215	1.324		
216	1.387		
217	1.449		
218	1.512		
219	1.574		
220	1.637		
221	1.699		
222	1.762		
223	1.887		
224	2.012		
225	2.137		
226	2.262		
227	2.387		
228	2.512		
229	2.637		
230	2.762		
231	2.887		
232	3.012		
233	3.137		
234	3.262		
235	3.387		

SFS (Static Face Seal) Finger Spring in Gland



Our Static Face Seal Gland follows AS6235A standard.

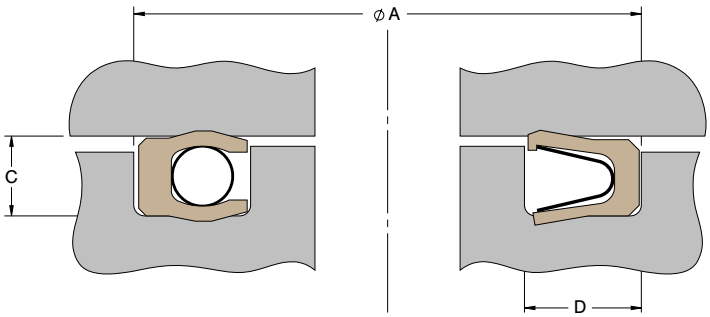
DASH NO.	ØA +0.000 -0.005	C ±0.001	D +0.010 -0.000
236	3.512	0.122	0.188
237	3.637		
238	3.762		
239	3.887		
240	4.012		
241	4.137		
242	4.262		
243	4.387		
244	4.512		
245	4.637		
246	4.762		
247	4.887		
328	2.270	0.187	0.281
329	2.395		
330	2.520		
331	2.645		
332	2.770		
333	2.895		
334	3.020		
335	3.145		
336	3.270		
337	3.395		
338	3.520		
339	3.645		
340	3.770		
341	3.895		
342	4.020		
343	4.145		
344	4.270		
345	4.395		
346	4.520		
347	4.645		
348	4.770		
349	4.895		

*Coil spring will go from 012 – 028 but finger spring will only go as small as 019

Internal Pressure Face Seals Dimensional Information (in millimeters)

DASH NO.	ØA +0.000 -0.13	C ±0.03	D +0.25 -0
12	12.80	1.45	2.39
13	14.38		
14	15.98		
15	17.55		
16	19.15		
17	20.73		
18	22.33		
19	23.90		
20	25.50		
21	27.08		
22	28.68		
23	30.25		
24	31.85		
25	33.43		
26	35.03		
27	36.60		
28	38.20		
113	19.18	2.29	3.58
114	20.78		
115	22.35		
116	23.95		
117	25.53		
118	27.13		
119	28.70		
120	30.30		
121	31.88		
122	33.48		
123	35.05		
124	36.65		
125	38.23		
126	39.83		
127	41.40		
128	43.00		
129	44.58		
130	46.18		
131	47.75		
132	49.35		
133	50.93		
134	52.53		
135	54.13		
210	25.70	3.10	4.78
211	27.28		
212	28.88		
213	30.45		
214	32.05		
215	33.63		
216	35.23		
217	36.80		
218	38.40		
219	39.98		
220	41.58		
221	43.15		
222	44.75		
223	47.93		
224	51.10		
225	54.28		
226	57.45		
227	60.63		
228	63.80		
229	66.98		
230	70.15		
231	73.33		
232	76.50		
233	79.68		
234	82.85		
235	86.03		

SFS (Static Face Seal) Finger Spring in Gland



Our Static Face Seal Gland follows AS6235A standard.

DASH NO.	ØA +0.000 -0.005	C ±0.001	D +0.010 -0.000
236	86.03	3.10	4.78
237	89.20		
238	92.38		
239	95.55		
240	98.73		
241	101.90		
242	105.08		
243	108.25		
244	111.43		
245	114.60		
246	117.78		
328	120.95		
329	57.66	4.75	7.14
330	60.83		
331	64.01		
332	67.18		
333	70.36		
334	73.53		
335	76.71		
336	79.88		
337	83.06		
338	86.23		
339	89.41		
340	92.58		
341	95.76		
342	98.93		
343	102.11		
344	105.28		
345	108.46		
346	111.63		
347	114.81		
348	117.98		
348	121.16		

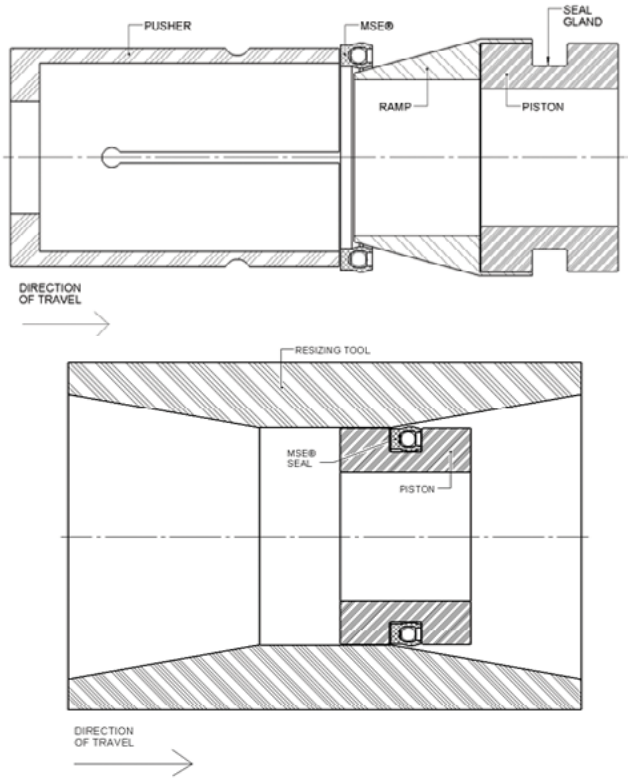
*Coil spring will go from 012 – 028 but finger spring will only go as small as 019

INSTALLATION

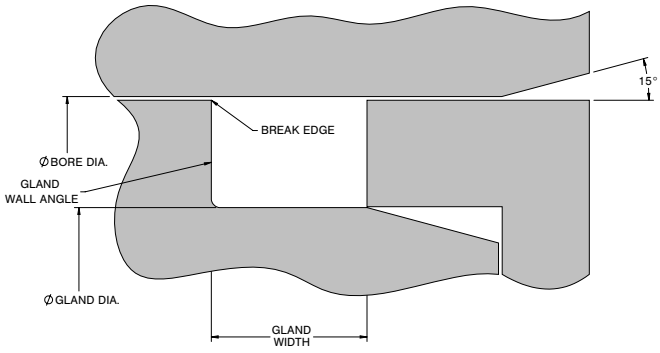
This method is particularly recommended when installing Greene Tweed MSE® seals in a closed piston type gland as it eliminates damaging material deformations. Please note that the gland hardware (housing) and installation tooling shown here are typical and for reference only. Actual hardware and tooling arrangement may vary. For rod type installations, Greene Tweed can offer a pusher tool design which will help with pushing the MSE into the click-fit style hardware configuration.

Installation Procedure of a MSE® Seal in a Piston Type Application

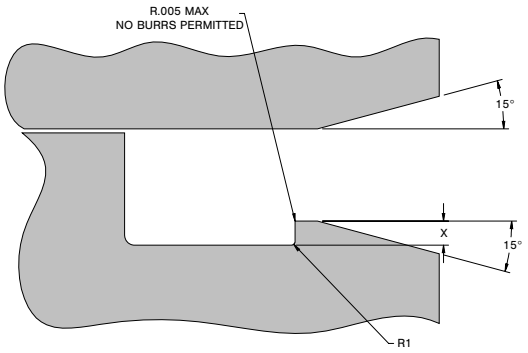
1. Carefully inspect the hardware and installation tools for any nicks, burrs or sharp edges and, if necessary, de-burr, chamfer or radius any sharp edges that may cause damage to the MSE® seal assembly.
2. If possible thoroughly lubricate all hardware, installation tools, and seal components with same media to be used in the system. **Note:** Ensure that the lubricating media does not contain fluorinated fluids or alkali metals which may be damaging to the MSE® seal.
3. Locate the expansion mandrel (ramp) into position.
4. Locate the MSE® seal in front of the pusher tool. In order to stretch the MSE® seal evenly, with a single motion, use the pusher component of the installation tools to gently drive the MSE® seal into its position. **Note:** Ensure MSE® seal is stretched evenly towards the groove.
5. In order to ensure proper seating of the MSE® seal, resize the stretched MSE® seal with the resizing tool. In order to properly resize the MSE® seal, the resizing tool should be pushed over the MSE® seal until the minor inner diameter of the resizing tool completely covers the MSE® seal. The resizing tool must be left on the MSE® seal for at least one hour. This method ensures maximum recovery of the MSE® seal. **Note:** The proper installation and the use of appropriate installation tools are imperative for the correct installation of the MSE® seal. Several MSE® seal failures can be attributed to damaged seals resulting from improper installation.



Piston – 2 piece gland configuration



Piston – Click-fit gland configuration



INSTALLATION

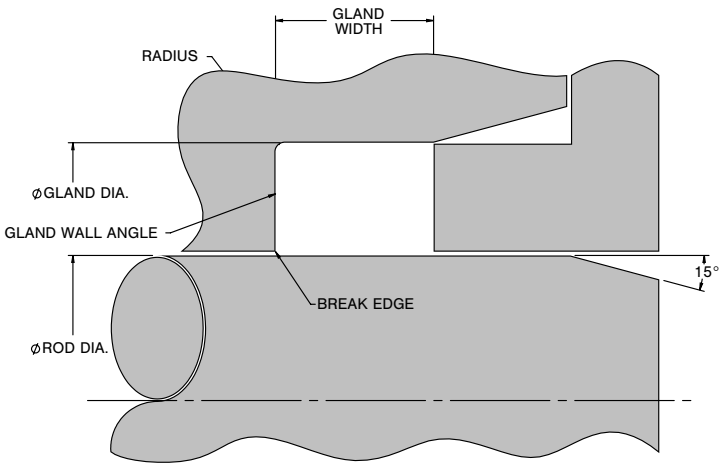
Installation Procedure of a MSE seal in a Rod Type Application

1 Carefully inspect the hardware and installation tools for any nicks, burrs or sharp edges and, if necessary, de-burr, chamfer or radius any sharp edges that may cause damage to the MSE® seal assembly.

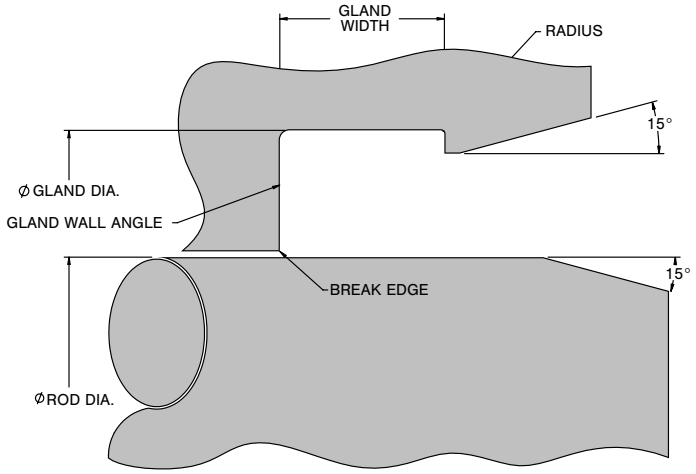
2 If possible thoroughly lubricate all hardware and seal components with same media to be used in the system. **Note:** Ensure that the lubricating media does not contain fluorinated fluids or alkali metals which may be damaging to the MSE® seal.

3 When installing the rod type MSE into the click-fit gland, ensure that the rod is not installed into the hardware. Install the MSE into the gland, applying a uniform pressure to the circumference of jacket (Do NOT push the MSE into the gland by pushing inside the MSE spring cavity). Once the MSE has been pushed past the click-fit hardware feature, the MSE will click into the gland and the installation procedure of the rod type MSE is now complete.

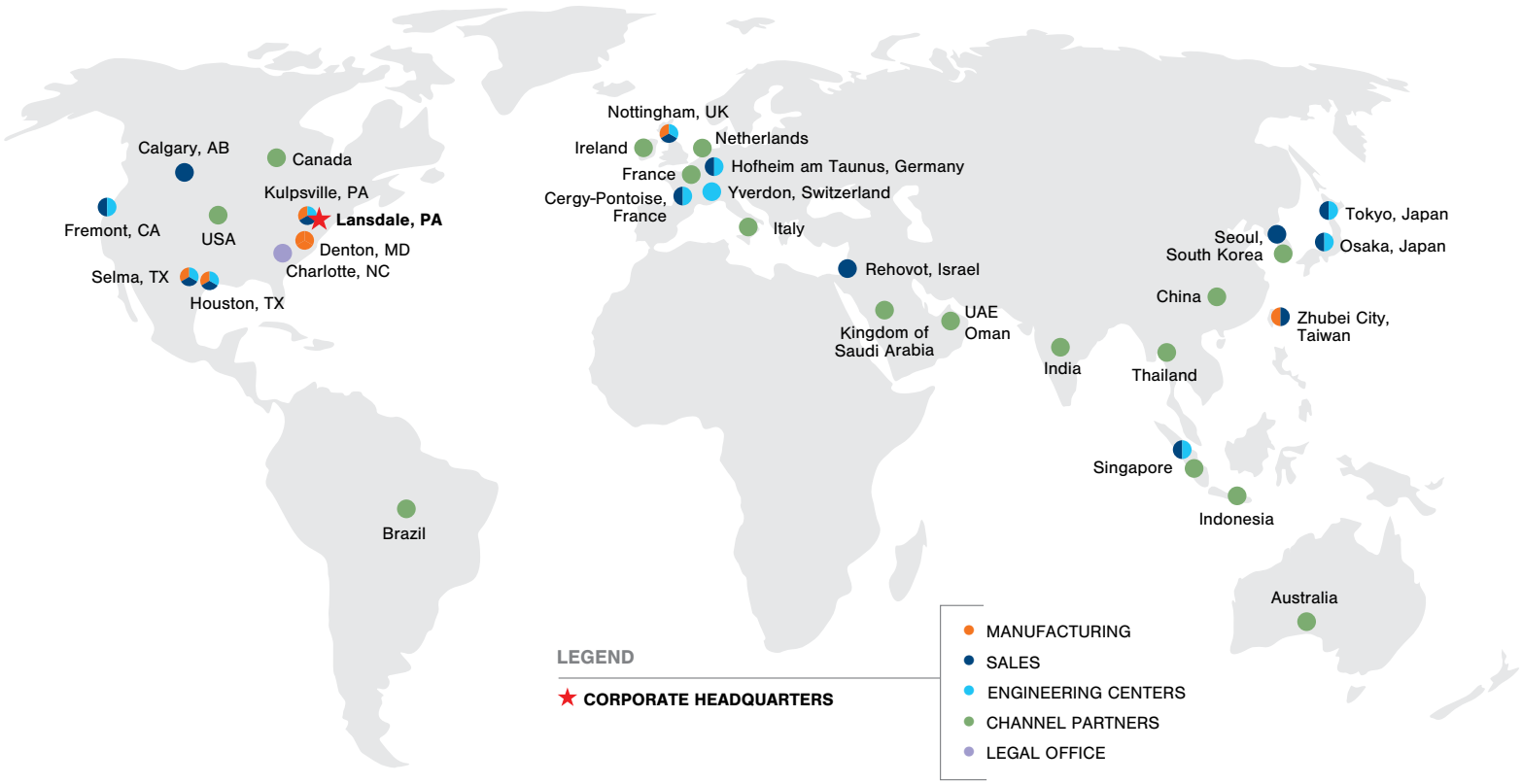
Rod – 2 piece gland configuration



Rod – Click-fit gland configuration



GREENE TWEED LOCATIONS



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