MSE®

MSE® SEAL

Optimum Sealing Solutions

HIGH-PERFORMANCE, LOW-FRICTION SEAL

The MSE® seal's superior designed "dual-lip body" gives improved sealing performance. Because our expertise in custom design and fabrication leads innovative designs, special configurations of MSE seals are limitless.

Anti-Blowout MSE Seals

Greene, Tweed has developed a specially configured MSE Seal for applications where the dynamic sealing surface is withdrawn past the seal interface while the seal remains under pressure.

The seal and housing geometry shown allows the withdrawal/ removal of the dynamic sealing surface without the seal being "blown" from its gland.

The seal is manufactured from Greene, Tweed's proprietary grades of PTFE, creating extremely low-friction characteristics. Seals operate at pressures to 6,000 psi; however, higher pressures can be achieved.

The seals unique design gives secure sealing over repeated demanding applications.

FEATURES & BENEFITS

Low Friction

- Low power absorption and torque requirements
- Friction can be adjusted and controlled
- Ability to run dry or lubricated giving a long service life

Chemically inert

- Virtually unlimited media service with one seal
- Low-cost alternative to expensive elastomers
- Sensitive media not contaminate

Wide temperature performance envelope

- Cryogenic to 600°F (316°C) with excellent performance at extreme temperatures

Pressure range from vacuum to 4,000 bar (58,000 psi) and above. Unlimited shelf life. Machinable for fitting existing O-ring grooves and sizes from 1/8" to 120" (3mm to 304.8mm)

APPLICATIONS

- Pumps
- Valves
- Metering
- Dispensing equipment
- Pressure switches
- Blowout preventors
- Blast hole drills
- Well heads
- Rock hammers
- Ball valves/gate valves
- Butterfly valves
- Drilling equipment
- Subsea safety valves
- Logging equipment
- Cementing equipment

Contact Us

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MSE® SEALS

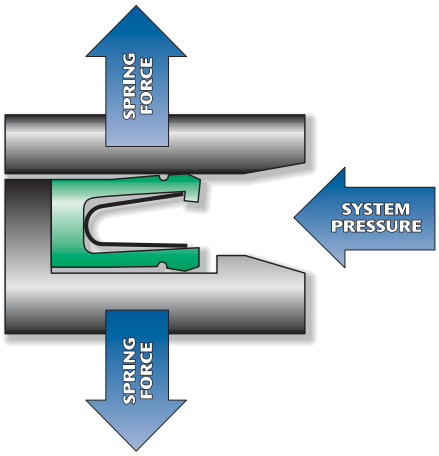

Figure 5-1 *Elastomer-Loaded MSE Seal*

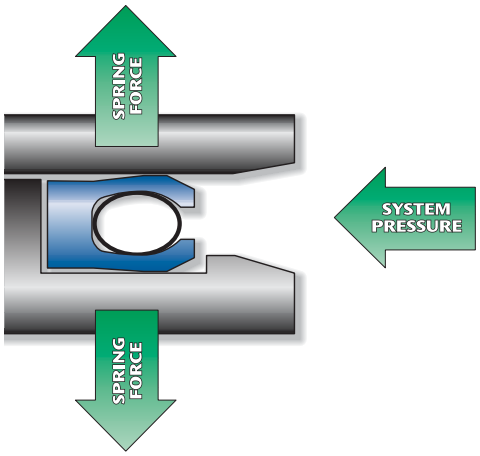

Figure 5-2 *Elastomer-Loaded MSE Seal*

How MSE® Seals Work

The MSE seal is a sealing device consisting of a PTFE or other polymeric component, energized by a corrosion-resistant metal spring or an elastomeric O-ring. When the seal is seated in the gland, the spring is under compression applying force on the gland sealing surfaces, thereby creating a tight barrier to prevent gas or fluids from leaking. The spring also provides resiliency to compensate for seal wear, gland misalignment or eccentricity. While spring force provides adequate force for sealing at low pressure, at high pressure the system pressure augments the spring force to provide an even tighter seal. The MSE seals are precision machined from PTFE, filled PTFE and other high-performance polymers.

MSE seals are recommended for applications where elastomeric seals do not work satisfactorily due to extreme operating conditions.

Greene, Tweed & Co. offers over 100 seal materials, a variety of standard spring materials and three standard spring designs to meet your needs. These options allow the design engineer great latitude in developing the best seal for the job.

Features and Benefits

Chemically Inert

- Virtually unlimited chemical compatibility (except molten alkali metals, fluorine gas at high temperatures and chlorine trifluoride ClF_3)

Low Friction

- Smooth and consistent breakout and running friction
- Low power absorption and torque requirements
- Capable of running dry or lubricated

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MSE® SEALS

MSE® Seal Types

Finger Spring (Series 2000)

Operating Temperature		Vacuum Sealability
Min	Max	
-65° C	260° C	Fair
Application		
This type of seal is designed mainly for dynamic applications with a balance of good sealability, long life and low friction. Use this type seal in applications where the seals are expected to last over 50,000 inches of travel at speeds up to 250 ft/min. Seals are available in piston, rod, face and special configurations.		

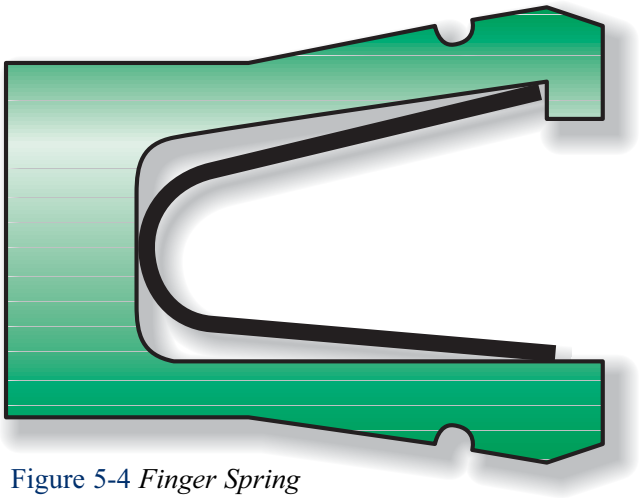

Figure 5-4 *Finger Spring*

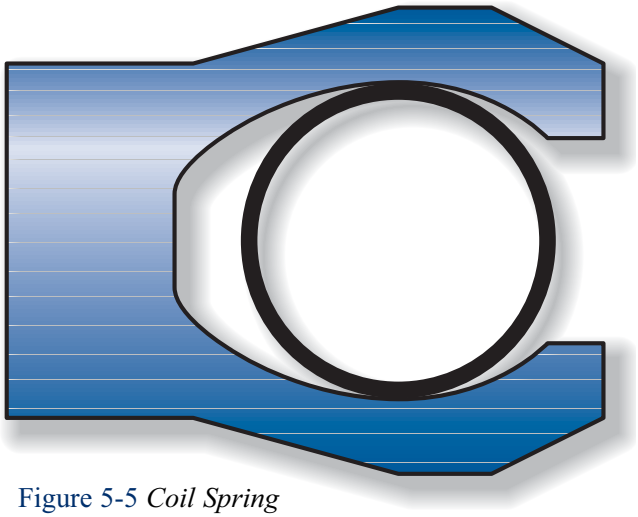

Figure 5-5 *Coil Spring*

Coil Spring (Series 3000)

Operating Temperature		Vacuum Sealability
Min	Max	
-173° C	260° C	Good
Application		
This type of seal is designed for static and slow dynamic applications; sacrificing some flexibility for improved sealability. Use this type of seal where the application is mostly static with occasional dynamic function. Seals are available in piston, rod, face and special configurations.		

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MSE® SEALS

Double Coil Spring (Series 5000)

Operating Temperature		Vacuum Sealability
Min	Max	
-268° C	260° C	Best
Application		
This type of seal is designed for static applications. The high spring load ensures better sealability than a single spring seal. Use this type of seal where sealability is most critical. Seals are available in piston, rod, face and special configurations.		

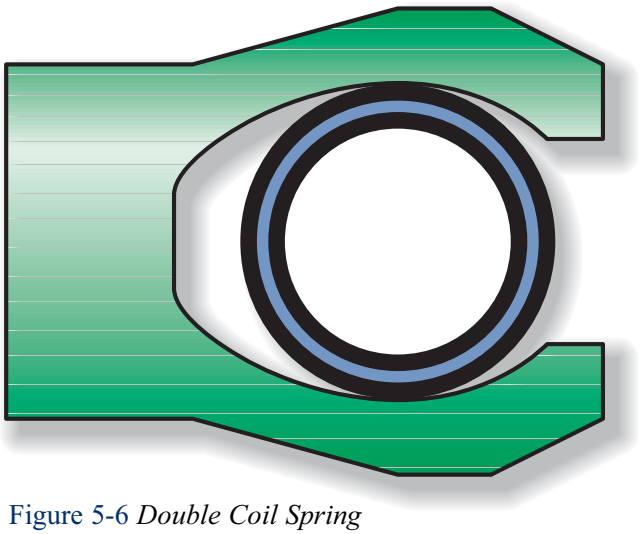

Figure 5-6 *Double Coil Spring*

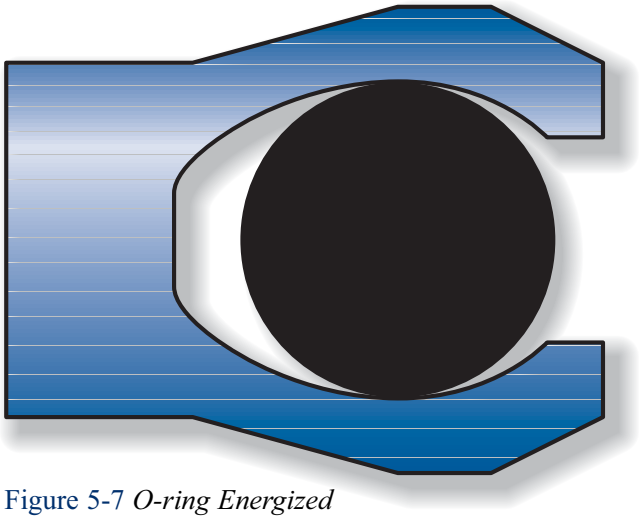

Figure 5-7 *O-ring Energized*

O-Ring Energized

Operating Temperature		Vacuum Sealability
Min	Max	
*	*	Good
Application		
This type of seal is designed for static or dynamic applications. The O-ring energizer is used in cases where a metal spring is not desirable. Seals are available in piston, rod, face and special configurations.		

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MSE® SEALS

Machined Metal Spring (Series 7000)

Operating Temperature		Vacuum Sealability
Min	Max	
-273° C	288° C	Best
Application		
This type of seal is designed for static applications only, where sealability is most important. The solid spring design ensures low permeation and uniform spring loading, providing best leakage control. Seals are available in face seal configuration only.		

Special design MSE seals are also available and are recommended for applications where the temperature exceeds the temperatures shown. The shapes shown are the typical configurations. Every design has many possible permutations and adaptations.

Figure 5-8 *Machined Metal Spring*

How to Order an MSE® Seal from Greene, Tweed

MSE seals are available in a variety of designs, spring materials and jacket materials. Select the seal that best fits your application.

Part Number Selection

Standard MSE seals can be ordered by determining the Greene, Tweed part number. Special designs and sizes require Greene, Tweed Engineering Department input for part number assignment.

X XXXX - XXX X XXX
1 2 3 4 5

MSE Seal Standard Part Number

Field # 1 – Seal Type
R = Rod Seal
P = Piston Seal
E = External Pressure Face Seal
I = Internal Pressure Face Seal

Field # 2 – Seal Series
(See MSE Seal Types, table 5-12)

Field # 3 – Dash Size
(See Gland Dimensions, table 5-11)

Field # 4 – Spring Material
(See Spring Materials, table 5-17)

Field # 5 – Jacket Material
(See Jacket Materials, table 5-18)

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MSE® SEALS

Gland Dimensions

To select the dash size, refer to Figure 5-9 and Tables 5-10, 5-11 for rod and piston seals and Figure 5-12 and Tables 5-13, 5-14 for internal and external pressure face seals. For diameters larger than the ones shown on these tables, consult the MSE® Seal Design Guide.

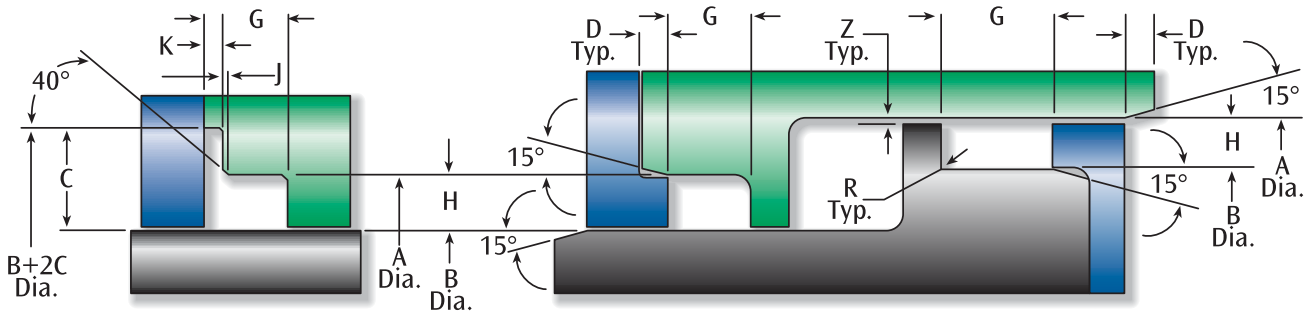

Figure 5-9

Table 5-10: *Rod and Piston Gland Designs for MSE® Seals*

Dash Size	Nominal X-Section	H Ref	G	C	D Min	J	K	R Max	Z Max
			+.010 -.000	+.004 -.004		+.003 -.003	+.002 -.002		
-006 through -033	1/16"	0.062	0.094	0.158	0.075	0.012	0.012	0.015	0.003
-106 through -150	3/32"	0.094	0.141	0.188	0.100	0.016	0.018	0.015	0.003
-202 through -246	1/8"	0.125	0.188	0.222	0.120	0.018	0.025	0.015	0.003
-318 through -362	3/16"	0.187	0.281	0.347	0.150	0.028	0.030	0.020	0.004
-405 through -449	1/4"	0.250	0.375	0.442	0.190	0.028	0.043	0.030	0.004

Dimensions in inches.

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MSE® SEALS

Table 5-11: *Rod and Piston Gland Sizes for MSE® Seals*

G = .094/.104		
Dash Size	A Dia	B Dia
	+.002 -.002	+.000 -.002
-006	0.250	0.125
-007	0.281	0.156
-008	0.312	0.187
-009	0.343	0.218
-010	0.375	0.250
-011	0.437	0.312
-012	0.500	0.375
-013	0.562	0.437
-014	0.625	0.500
-015	0.687	0.562
-016	0.750	0.625
-017	0.812	0.687
-018	0.875	0.750
-019	0.937	0.812
-020	1.000	0.875
-021	1.062	0.937
-022	1.125	1.000
-023	1.187	1.062
-024	1.250	1.125
-025	1.312	1.187
-026	1.375	1.250
-027	1.437	1.312
-028	1.500	1.375
-029	1.625	1.500
-030	1.750	1.625
-031	1.875	1.750
-032	2.000	1.875
-033	2.125	2.000

G = .141/.151		
Dash Size	A Dia	B Dia
	+.002 -.002	+.000 -.002
-106	0.375	0.188
-107	0.406	0.219
-108	0.437	0.250
-109	0.500	0.313
-110	0.562	0.375
-111	0.625	0.438
-112	0.687	0.500
-113	0.750	0.563
-114	0.812	0.625
-115	0.875	0.688
-116	0.937	0.750
-117	1.000	0.813
-118	1.062	0.875
-119	1.125	0.938
-120	1.187	1.000
-121	1.250	1.063
-122	1.312	1.125
-123	1.375	1.188
-124	1.437	1.250
-125	1.500	1.313
-126	1.562	1.375
-127	1.625	1.438
-128	1.687	1.500
-129	1.750	1.563
-130	1.812	1.625
-131	1.875	1.688
-132	1.937	1.750
-133	2.000	1.813
-134	2.062	1.875
-135	2.125	1.938
-136	2.187	2.000
-137	2.250	2.063
-138	2.312	2.125
-139	2.375	2.188
-140	2.437	2.250
-141	2.500	2.313
-142	2.562	2.375
-143	2.625	2.438
-144	2.687	2.500
-145	2.750	2.563
-146	2.812	2.625
-147	2.875	2.688
-148	2.937	2.750
-149	3.000	2.813
-150	3.062	2.875

G = .188/.198		
Dash Size	A Dia	B Dia
	+.002 -.002	+.000 -.002
-202	0.500	0.250
-203	0.562	0.312
-204	0.625	0.375
-205	0.687	0.437
-206	0.750	0.500
-207	0.812	0.562
-208	0.875	0.625
-209	0.937	0.687
-210	1.000	0.750
-211	1.062	0.812
-212	1.125	0.875
-213	1.187	0.937
-214	1.250	1.000
-215	1.312	1.062
-216	1.375	1.125
-217	1.437	1.187
-218	1.500	1.250
-219	1.562	1.312
-220	1.625	1.375
-221	1.687	1.437
-222	1.750	1.500
-223	1.875	1.625
-224	2.000	1.750
-225	2.125	1.875
-226	2.250	2.000
-227	2.375	2.125
-228	2.500	2.250
-229	2.625	2.375
-230	2.750	2.500
-231	2.875	2.625
-232	3.000	2.750
-233	3.125	2.875
-234	3.250	3.000
-235	3.375	3.125
-236	3.500	3.250
-237	3.625	3.375
-238	3.750	3.500
-239	3.875	3.625
-240	4.000	3.750
-241	4.125	3.875
-242	4.250	4.000
-243	4.375	4.125
-244	4.500	4.250
-245	4.625	4.375
-246	4.750	4.500

G = .281/.291		
Dash Size	A Dia	B Dia
	+.002 -.002	+.000 -.002
-318	1.375	1.000
-319	1.437	1.062
-320	1.500	1.125
-321	1.562	1.187
-322	1.625	1.250
-323	1.687	1.312
-324	1.750	1.375
-325	1.875	1.500
-326	2.000	1.625
-327	2.125	1.750
-328	2.250	1.875
-329	2.375	2.000
-330	2.500	2.125
-331	2.625	2.250
-332	2.750	2.375
-333	2.875	2.500
-334	3.000	2.625
-335	3.125	2.750
-336	3.250	2.875
-337	3.375	3.000
-338	3.500	3.125
-339	3.625	3.250
-340	3.750	3.375
-341	3.875	3.500
-342	4.000	3.625
-343	4.125	3.750
-344	4.250	3.875
-345	4.375	4.000
-346	4.500	4.125
-347	4.625	4.250
-348	4.750	4.375
-349	4.875	4.500
-350	5.000	4.625
-351	5.125	4.750
-352	5.250	4.875
-353	5.375	5.000
-354	5.500	5.125
-355	5.625	5.250
-356	5.750	5.375
-357	5.875	5.500
-358	6.000	5.625
-359	6.125	5.750
-360	6.250	5.875
-361	6.375	6.000
-362	6.625	6.250

G = .375/.385		
Dash Size	A Dia	B Dia
	+.002 -.002	+.000 -.002
-405	2.500	2.000
-406	2.625	2.125
-407	2.750	2.250
-408	2.875	2.375
-409	3.000	2.500
-410	3.125	2.625
-411	3.250	2.750
-412	3.375	2.875
-413	3.500	3.000
-414	3.625	3.125
-415	3.750	3.250
-416	3.875	3.375
-417	4.000	3.500
-418	4.125	3.625
-419	4.250	3.750
-420	4.375	3.875
-421	4.500	4.000
-422	4.625	4.125
-423	4.750	4.250
-424	4.875	4.375
-425	5.000	4.500
-426	5.125	4.625
-427	5.250	4.750
-428	5.375	4.875
-429	5.500	5.000
-430	5.625	5.125
-431	5.750	5.250
-432	5.875	5.375
-433	6.000	5.500
-434	6.125	5.625
-435	6.250	5.750
-436	6.375	5.875
-437	6.500	6.000
-438	6.750	6.250
-439	7.000	6.500
-440	7.250	6.750
-441	7.500	7.000
-442	7.750	7.250
-443	8.000	7.500
-444	8.250	7.750
-445	8.500	8.000
-446	9.000	8.500
-447	9.500	9.000
-448	10.000	9.500
-449	10.500	10.000

Dimensions in inches.

Greene Tweed
The Inside Advantage®

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MSE® SEALS

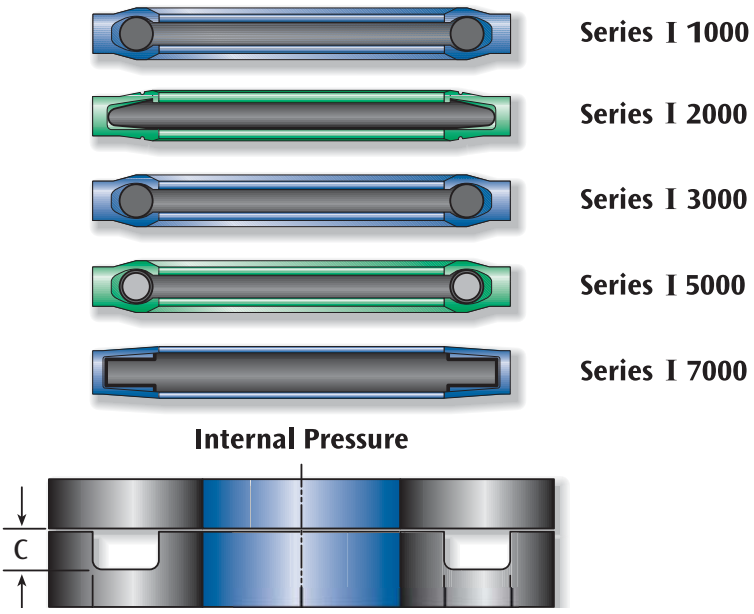

Figure 5-12

Table 5-13: *Gland Depth and Length for MSE® Face Seals*

Dash Size	Nominal X-Section	Gland Depth D	Gland Length L
-0XX	1/16"	0.061/0.063	0.094/0.104
-1XX	3/32"	0.093/0.095	0.141/0.151
-2XX	1/8"	0.124/0.126	0.188/0.198
-3XX	3/16"	0.186/0.188	0.281/0.291
-4XX	1/4"	0.249/0.251	0.375/0.385

Dimensions in inches.

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Table 5-14: *Gland Dimensions for Internal and External Pressure MSE® Face Seals*

D = .062 +/- .001 L = .094/.104		
Dash Size	A Dia	B Dia
	+.010 -.000	+.000 -.010
-016	0.750	0.625
-017	0.812	0.687
-018	0.875	0.750
-019	0.937	0.812
-020	1.000	0.875
-021	1.062	0.937
-022	1.125	1.000
-023	1.187	1.062
-024	1.250	1.125
-025	1.312	1.187
-026	1.375	1.250
-027	1.437	1.312
-028	1.500	1.375
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-030	1.750	1.625
-031	1.875	1.750
-032	2.000	1.875
-033	2.125	2.000
-034	2.250	2.125
-035	2.375	2.250
-036	2.500	2.375
-037	2.625	2.500
-038	2.750	2.625
-039	2.875	2.750
-040	3.000	2.875
-041	3.250	3.125
-042	3.500	3.375
-043	3.625	3.500
-044	3.875	3.750
-045	4.125	4.000
-046	4.375	4.250
-047	4.625	4.500

Dimensions in inches.

D = .094 +/- .001 L = .141/.151		
Dash Size	A Dia	B Dia
	+.010 -.000	+.000 -.010
-120	1.187	1.000
-121	1.250	1.063
-122	1.312	1.125
-123	1.375	1.188
-124	1.437	1.250
-125	1.500	1.313
-126	1.562	1.375
-127	1.625	1.438
-128	1.687	1.500
-129	1.750	1.563
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-135	2.125	1.938
-136	2.187	2.000
-137	2.250	2.063
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-149	3.000	2.813
-150	3.062	2.875
-151	3.187	3.000
-152	3.437	3.250
-153	3.687	3.500
-154	3.937	3.750
-155	4.187	4.000
-156	4.437	4.250
-157	4.687	4.500
-158	4.937	4.750
-159	5.187	5.000
-160	5.437	5.250
-161	5.687	5.500

D = .125 +/- .001 L = .188/.198		
Dash Size	A Dia	B Dia
	+.010 -.000	+.000 -.010
-216	1.375	1.125
-217	1.437	1.187
-218	1.500	1.250
-219	1.562	1.312
-220	1.625	1.375
-221	1.687	1.437
-222	1.750	1.500
-223	1.875	1.625
-224	2.000	1.750
-225	2.125	1.875
-226	2.250	2.000
-227	2.375	2.125
-228	2.500	2.250
-229	2.625	2.375
-230	2.750	2.500
-231	2.875	2.625
-232	3.000	2.750
-233	3.125	2.875
-234	3.250	3.000
-235	3.375	3.125
-236	3.500	3.250
-237	3.625	3.375
-238	3.750	3.500
-239	3.875	3.625
-240	4.000	3.750
-241	4.125	3.875
-242	4.250	4.000
-243	4.375	4.125
-244	4.500	4.250
-245	4.625	4.375
-246	4.750	4.500
-247	4.875	4.625
-248	5.000	4.750
-249	5.125	4.875
-250	5.250	5.000
-251	5.375	5.125
-252	5.500	5.250
-253	5.625	5.375
-254	5.750	5.500
-255	5.875	5.625
-256	6.000	5.750
-257	6.125	5.875

D = .187 +/- .001 L = .281/.291		
Dash Size	A Dia	B Dia
	+.010 -.000	+.000 -.010
-329	2.375	2.000
-330	2.500	2.125
-331	2.625	2.250
-332	2.750	2.375
-333	2.875	2.500
-334	3.000	2.625
-335	3.125	2.750
-336	3.250	2.875
-337	3.375	3.000
-338	3.500	3.125
-339	3.625	3.250
-340	3.750	3.375
-341	3.875	3.500
-342	4.000	3.625
-343	4.125	3.750
-344	4.250	3.875
-345	4.375	4.000
-346	4.500	4.125
-347	4.625	4.250
-348	4.750	4.375
-349	4.875	4.500
-350	5.000	4.625
-351	5.125	4.750
-352	5.250	4.875
-353	5.375	5.000
-354	5.500	5.125
-355	5.625	5.250
-356	5.750	5.375
-357	5.875	5.500
-358	6.000	5.625
-359	6.125	5.750
-360	6.250	5.875
-361	6.375	6.000
-362	6.625	6.250
-363	6.875	6.500
-364	7.125	6.750
-365	7.375	7.000
-366	7.625	7.250
-367	7.875	7.500
-368	8.125	7.750
-369	8.375	8.000
-370	8.625	8.250

D = .250 +/- .001 L = .375/.385		
Dash Size	A Dia	B Dia
	+.010 -.000	+.000 -.010
-413	3.500	3.000
-414	3.625	3.125
-415	3.750	3.250
-416	3.875	3.375
-417	4.000	3.500
-418	4.125	3.625
-419	4.250	3.750
-420	4.375	3.875
-421	4.500	4.000
-422	4.625	4.125
-423	4.750	4.250
-424	4.875	4.375
-425	5.000	4.500
-426	5.125	4.625
-427	5.250	4.750
-428	5.375	4.875
-429	5.500	5.000
-430	5.625	5.125
-431	5.750	5.250
-432	5.875	5.375
-433	6.000	5.500
-434	6.125	5.625
-435	6.250	5.750
-436	6.375	5.875
-437	6.500	6.000
-438	6.750	6.250
-439	7.000	6.500
-440	7.250	6.750
-441	7.500	7.000
-442	7.750	7.250
-443	8.000	7.500
-444	8.250	7.750
-445	8.500	8.000
-446	9.000	8.500
-447	9.500	9.000
-448	10.000	9.500
-449	10.500	10.000
-450	11.000	10.500
-451	11.500	11.000
-452	12.000	11.500
-453	12.500	12.000
-454	13.000	12.500

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The Inside Advantage®

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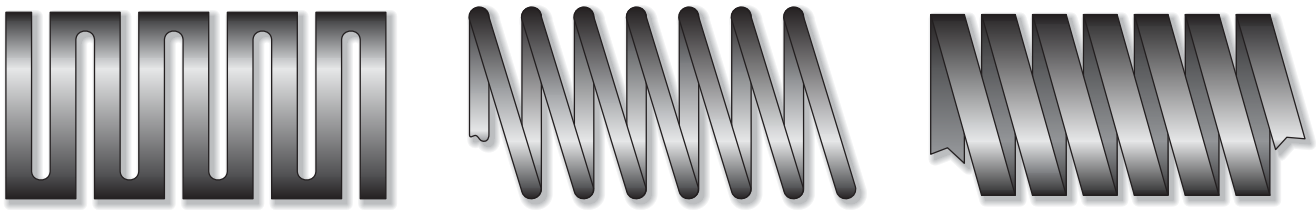
MSE® SEALS

Spring Materials

The MSE® seal is energized by a corrosion-resistant metal spring. The spring compresses to apply force for sealing and provides resiliency to compensate for wear and misalignment.

Finger Springs are made by punching the pattern on a metal ribbon and then forming it into a "V" shape by the use of a force slide or a punch press.

Coil Springs are made by slicing a metal ribbon to the desired width, and then coiling it to a specified diameter with a coiling machine.



Finger Spring **Canted Coil Spring** **Flat Ribbon Coil Spring**

Figure 5-15

Table 5-16: *Composition*

Element		301 SS	17-7	Elgiloy†
		%	%	%
Carbon	C	0.15 - 2.0	0.09 max	0.1
Silicone	Si	1.0 max	1.0	—
Phosphorus	P	0.045 max	0.04	—
Sulphur	S	0.03 max	0.03	—
Chromium	Cr	16 - 18	16 - 18	20.0
Nickel	Ni	6 - 8	6.50 - 7.75	15.0
Manganese	Mn	—	1.0	2.0
Molybdenum	Mo	—	—	7.0
Cobalt	Co	—	—	40.0
Berylium	Be	—	—	0.04
Aluminum	Al	—	1.125	—
Iron	Fe	Balance	Balance	Balance

† Registered trademark of the Elgiloy Company.

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MSE® SEALS

Material		301 SS	17-7	Elgiloy
Material Code		S	P	E
Condition		FH	Condition C	45% CR
Tensile Strength	psi	185,000	220,000	220,000
Yield Strength	psi	140,000	190,000	185,000
Elongation	%	8	5	4
Hardness	Rc	41	43	45
Temperature Rating	°C	260	315	315
Corrosion Resistance		Good	Better	Best

Table 5-17: *Typical Physical Properties*

Jacket Materials

MSE® seals are available in a variety of seal jacket materials, all designed for virtually unlimited chemical compatibility, low friction and a wide range of temperatures and pressures.

Avalon® 01 — High-quality virgin material with high tensile and elongation properties. Best chemical resistance.

Avalon® 40 — Good chemical and electrical properties, better creep resistance than PTFE or PFA, low permeability and more resistant to swelling by solvents than other polymers. CTFE material is also excellent in cryogenic applications.

Avalon® 48 — Mineral-filled PTFE. Good chemical and wear properties, nonabrasive in dynamic applica tions. Not recommended for aqueous applications, since the minerals tend to dissolve.

Avalon® 50 — Polyester-filled PTFE. Good wear, chemical and temperature properties. Not compatible with halogens.

Avalon® 56 — Modified PTFE. Excellent high temperature, creep and chemical resistance.

Avalon® 57 — Polyimide-filled PTFE. Excellent chemical wear and creep resistance. Recommended for dynamic applications. Nonabrasive against soft metals.

Table 5-18: *Typical MSE® Seal Materials Used for Fluid Handling Applications*

Material	Material Code	Description	Color	Tensile Strength	Elongation	Def. Under Load	Wear Factor
				psi	%	%	(K) x 10^{-10} in^3-min/lb-ft-hr
Avalon 01	301	Virgin PTFE	White	5,000	350	8	2,500
Avalon 40	081	CTFE	Transparent White	5,700	150	—	—
Avalon 48	348	Filled PTFE	White	3,000	275	5	1
Avalon 50	069	Filled PTFE	Tan	3,500	300	6	2
Avalon 56	356	Modified PTFE	White	4,600	500	3	2,500
Avalon 57	357	Filled PTFE	Light Brown	2,600	300	2	2

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MSE® SEALS

Hardware Surface Finish and Hardness Recommendations

Dynamic surface finish and hardness play a key role in hardware design. Good surface finish will reduce seal friction and increase seal life, while a high surface hardness will increase seal life as well as protect the hardware from being abraded by the seal material or by contaminants in the system.

Seal Installation and Installation Tools

The proper installation and the use of appropriate installation tools is imperative for the correct functioning of the seals. Most seal failures can be attributed to damaged seals resulting from improper installation.

Although MSE® seals can be slightly stretched or compressed (see Table 5-21), *it is strongly recommended that one-piece glands (non-split)* are avoided. If it is absolutely necessary to use one-piece glands, follow the suggestions on gland design and use proper installation tools. Avoid the use of screwdrivers and other metal tools, since the seals can be easily scratched and leakage will result.

Table 5-19: *Hardware Surface Finish*

Media	Dynamic Surface	Static Surface
Cryogenic Freon Helium Gas Hydrogen Gas	4 - 8 RMA	4 - 8 RMA
Air Argon	6 - 12 RMA	12 - 32 RMA
Water	8 - 16 RMA	16 - 32 RMA

Table 5-20: *Hardware Surface Hardness*

Service	Optimum Hardness Rockwell "C" Scale
Static	Any hardness
Reciprocating	Rc 45 minimum
Rotary	Rc 55 minimum

Table 5-21: *Maximum % of Seal Stretch or Compression Recommended*

Piston Seals (Stretch)			Rod Seals (Compress)		
Series 2000	Series 3000	Series 5000	Series 2000	Series 3000	Series 5000
8%	20%	15%	8%	15%	12%

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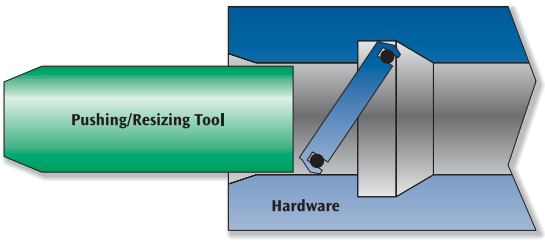
MSE® SEALS

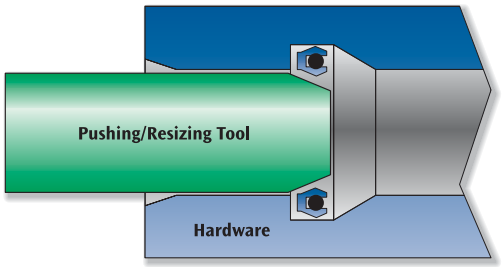
Installation of Piston Seals into Closed Glands

When installing MSE® seals into blind glands, it is important not to overstress the seal material or the spring at localized points. In order to stretch the seal evenly, the use of a ramp and pushing device are recommended. After stretching, the seal will partially return to its original size. To ensure total recovery, the seal needs to be resized with a tool, which has the same inside diameter as the bore of the hardware.

The installation tools can be made out of Delrin,‡ UHMW (Ultra High Molecular Weight Polyethylene), PFA or PTFE.

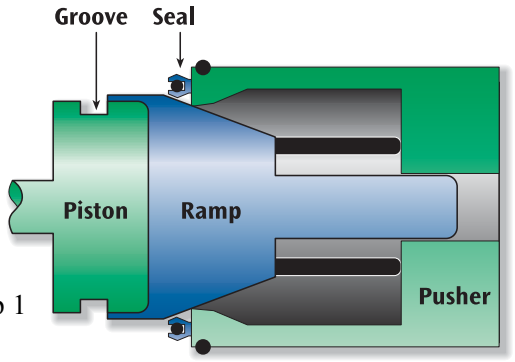


Step 1

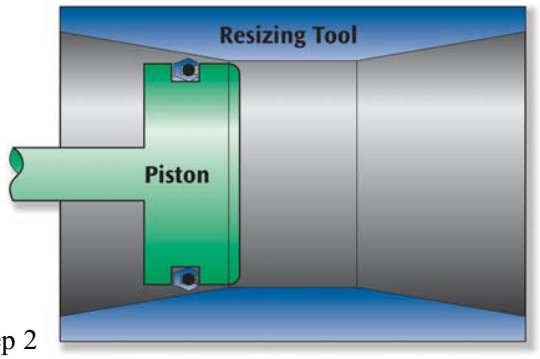


Step 2

Figure 5-23



Step 1



Step 2

Figure 5-22

Installation of Rod Seals into Closed Glands

To minimize the possibility of damage to the seal during installation, it is recommended to make the gland width at least 1.5 times the width of the seal plus a 45° angle at the front of the groove. The seal should be installed sideways until one side rests in the groove; then with the help of a pushing tool, work the rest of the seal into the groove. With the opposite end of the tool, resize the seal into the groove. The installation procedure can be eased by lubricants and by heating up the seal before installation.

‡ Delrin is a registered trademark of DuPont-Dow Elastomers.

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Fluid Handling PRODUCTS

APPLICATION DATA SHEET

If your application parameters do not fit with-in th guidelines defined in this catalog, and you would like a complete Engineering review for your specific applications, fill out this Data Sheet and mail it or fax it to:

Greene, Tweed & Co. · 7101 Patterson Drive · Garden Grove, CA 92645
Phone (714) 897-8764 · Fax (714) 373-1763

COMPANY INFORMATION

COMPANY _____ ENGRG. CONTACT _____
STREET _____ TEL.NO. _____
CITY _____ PURCH. CONTACT _____
STATE & ZIP CODE _____ TEL. NO. _____

APPLICATION DATA

OPERATING CONDITIONS

MEDIA FLUID _____
OPERATING PRESS. _____
MAX. PRESS. _____
OPERATING TEMP. _____
MAX. TEMP. _____
MOTION _____
SPEED/RATE _____
STROKE _____
ALLOWABLE LEAKAGE _____
FRICTION REQ'D _____
LIFE REQ'D _____

HARDWARE DATA

SEAL TYPE (rod, piston, if, of) _____
BORE DIA. _____
ROD DIA. _____
GROOVE DIA. _____
GLAND WIDTH _____
GLAND CROSS-SECTION _____
MATERIAL-BORE _____ ROD _____
FINISH-BORE _____ ROD _____
HARDNESS-BORE _____ ROD _____

COMMENTS/SKETCHES

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Greene Tweed
The Inside Advantage®

Elastomeric Seal Stack

VEE RINGS AND CUSTOM DESIGNED VEE STACKS

SEALING SOLUTIONS

Greene, Tweed has extensive experience in designing and manufacturing Vee rings and seal stacks incorporating elastomeric and/or thermoplastic end and central adapters.

SPECIALTY COMPOUNDS

Vee Ring applications require specially developed elastomer and thermoplastic compounds. Below are some compounds and their features.

COMPOUNDS		FEATURES
CR	980	High strength, fiber filled
NBR	160	Low-temperature applications
HNBR	209	High-performance nitrile
FKM	926,929	Explosive decompression-resistant elastomer, fiber reinforced
FLOURAZ®	799, 790	High-temperature, steam resistant elastomer
CHEMRAZ®	510, 522, 526	The ultimate chemically resistant elastomer, explosive decompression-resistant compound

CUSTOM DESIGNS

Thermoplastics utilized include:

- Arlon®—Greene, Tweed developed various proprietary grades of PEEK that give strength/high temperature/resistance to erosion/high pressure capability and excellent chemical compatibility
- Avalon®—Greene, Tweed has developed several chemically and physically superior proprietary grades of PTFE for the oilfield industry.

When used in open glands, Greene, Tweed designers can accurately control the FSH (free stack height) and CSH (confined stack height) ensuring optimum performance.

Service-proven designs combine elastomer and thermoplastic adapters.

- Vee seal stacks can be supplied as a complete assembly incorporating thermoplastic end and central adapters.
- Thermoplastic adapters are noncorrosive and nongalling at tighter tolerances and designed to act as bearing and debris barriers.

The staging effect of elastomeric and thermoplastic sealing elements gives sealing integrity across a broad range of service conditions.

Arlon® is manufactured from PEEK™.
Greene, Tweed is part of Victrex's partnership program of key suppliers of quality product. Manufactured from PEEK™ polymer developed by Victrex.

Contact Us

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02/05-GT DS-US-OF-004

NONELASTOMERIC SEAL STACK

Solutions for High-Pressure Condensate Pumps

CASE STUDY

- Saves over $40,000 per year in lubrication costs
- Increases seal life four fold
- Provides zero leakage and ability to run dry

Equipment

- Condensate pump on a gas platform in the southern North Sea

Existing Seals

- Braided packings with virgin PTFE backups

Problem

- The condensate was leaking, and a specific lubrication was required to prevent any contamination of the condensate. The lubrication costs were approximately £47,000 per year ($78,000 U.S.) for six pumps. Neither the pump manufacturer nor the existing seal supplier offered help with the problem.

Solution

- After visiting the platform and gathering data, we designed a solution that removed the need for expensive lubricants. Greene, Tweed's solution involved a new seal stack capable of running without lubrication, removing the requirement for a complicated delivery system as well as creating considerable cost savings.

SEAL CONFIGURATION

Female—End Adapter

This component acts as backup for the seal stack, preventing extrusion of the softer primary seal materials and providing a stable base for the seal stack to rely on during higher loading.

Manufactured from a proprietary Greene, Tweed material, Arlon® 1000, the female-end adapter has very tight tolerances, enabling it to act as a bearing surface to prevent concentricity problems.

Vee Ring

This component, manufactured from a proprietary-filled PTFE, gives the sealing redundancy within the stack, offering support to the primary seal ahead of it and helping to create the column mechanical load throughout the stack that makes the assembly so effective.

Metal Spring Energized (MSE®) Lip Seal

This primary seal consists of a wholly machined jacket of proprietary PTFE energized by a single metallic finger spring. The MSE offers low friction coefficient, excellent wear rate and full fluid compatibility.

Hat Ring

As the initial element in the seal arrangement, the hat ring provides a number of functions. Manufactured from Arlon 1000, it protects the sealing lips of the MSE from any unforeseen damage during reciprocation of the plunger by preventing the sealing lips from slamming against the groove wall.

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02/05-GT CS-US-OF-001

ELASTOMERIC/THERMOPLASTIC VEE RINGS

SEALING SOLUTIONS

A multi-lip (redundant), pressure-activated seal is constructed of elastomeric and/or thermoplastic components. Pressure differential develops across each lip and a column mechanical load expands across the entire packing set and is constant at any point in the set.

Vector forces acting on the lips of the Vee induce a radial load that is a function of the Vee ring design.

The redundancy concept of the multiple lips maintains sealing integrity over all application parameters, minimizing the chances of catastrophic failure.

SEAL CONFIGURATION

Gland Design

Greene, Tweed designers prefer open gland configurations to accurately control the FSH and CSH (Free and Confined Stack Heights) to give optimum seal performance.

Adapters

End and central adapters are manufactured from Greene, Tweed proprietary thermoplastics.

Thermoplastics do not gall or corrode and can be designed as a bearing or debris barrier.

Note: Please refer to Greene, Tweed & Co. Houston Engineering for part number.

ELASTOMER SELECTION

HNBR	209
NBR	979
FKM	929 fiber reinforced 926 explosive decompression resistant
CR	980
Fluoraz®	790, 799
Chemraz®	510, 526

** Please refer to GT for design constraints and recommendations*

THERMOPLASTIC SELECTION

Arlon®	Proprietary grades of PEEK™
Arlon® 1000	Virgin, injection molded
Arlon® 1160	Glass-reinforced grade
Arlon® 1260	Carbon-fiber-reinforced grade
Arlon® 1330	Lubricated grade
Arlon® 1555	Carbon fiber/Lubricated grade
Avalon	Proprietary reinforced grades of PTFE
Polyphenylene Sulphide (PPS)	

** Please refer to GT for design constraints and recommendations*

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03/05-GT DS-US-OF-009

HPHT Seal Design Options

High Pressure, High Temperature

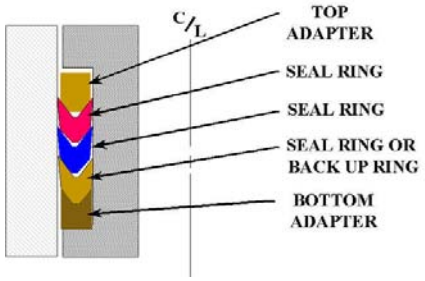
ELASTOMERS & THERMOPLASTICS

When using elastomers and thermoplastics in critical service applications, there are a number of options in terms of seal configuration and material choice that effectively seal and provide maximum product reliability. These combinations vary based on the sealing conditions faced. Greene, Tweed design engineers pick the best matched material characteristics for optimum seal performance. The table below focuses on designs of multiple redundant seal stack combinations for both uni- and bi-directional HPHT (High Pressure High Temperature) and LPLT (Low Pressure Low Temperature) applications.

SPECIFICATIONS

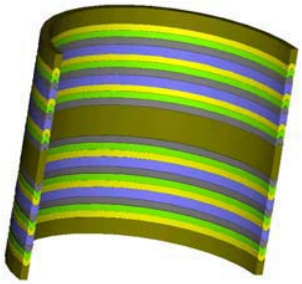
Unidirectional

Vee stacks were introduced from a redundancy perspective but used the same compound across the stack. Greene, Tweed introduced the composite stack that combines different elastomers, thermoplastics and metals to cover all service conditions. The following design geometries incorporate materials developed specifically for downhole environment.



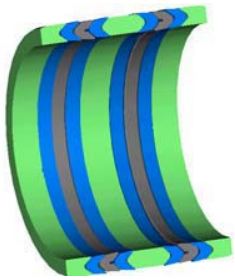
Bi-directional

This design incorporates end adapters, center adapters and combinations of steel, elastomeric, Ryton (PPS) and filled PTFE (Avalon®) Vee Rings. In this specific example Arlon® 1000, Fluoraz® 799 and Avalon 16 are used. The combination of elastomer, steel and thermoplastic will seal at both HPHT and LPLT.



Bi-directional—Nonelastomeric MSE®

This design incorporates end adapters, center adapters and combinations of thermoplastic and filled PTFE (Avalon) Vee rings. In this specific example Arlon 1000, Fluoraz 799 and Avalon 16 are used. The combination of elastomer and thermoplastic will seal at both HPHT and LPLT. The multiple redundancy concept ensures reliable sealing.



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MSE® with Back-up Ring MSE® Stack Assemblies

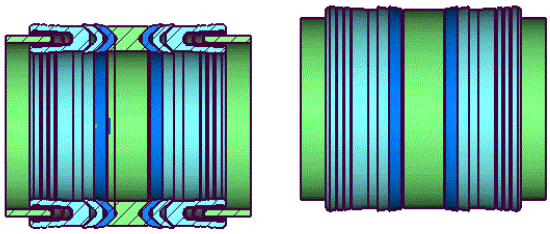
Unidirectional MSE assembly on a choke valve featuring an MSE with a proprietary Avalon jacket with a Elgiloy double-coil spring and Arlon 1000 back-up ring. The Avalon jacket was chosen to pass a 200 psi (1.38 Mpa) nitrogen gas test at ambient temperaure. In addition, it also had to hold 15000 psi (103.42 Mpa) at a higher temperature (350°F, 177°C). It has a cam-activated Arlon 1000 back-up ring to prevent creep and extrusion of the jacket. For static applications the cam-activated back-up ring is preferred because it encourages the backup to close any extrusion gap.
MSE assembly Jacket, **Avalon®** MSE70-100321, Back-up Ring **Arlon® 1000** 5670-1683-0450

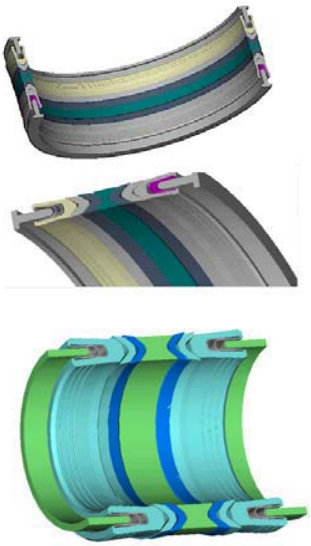
MSE®—Bi-directional with Hat Rings

Typically two separate grooves are used to handle bi-directional pressure. Greene, Tweed looked at this and developed a single seal assembly capable of handling pressure from both sides, reducing machining cost, simplifying hardware design and installation. The hat ring stabilizes and supports the stack while eliminating damage to the seal. This, in effect, is a modified end adapter. The center adapter prevents twisting and ensures the seal stack remains stable in the gland. This is an effective seal at 350°F (177°C) and 15,000 psi (103.42 Mpa).

MSE®—Combination Stack Assembly

The next evolutionary step is the MSE stack assembly. This incorporates primary and secondary sealing to ensure multiple redundancy. The MSE is the primary seal, the inclusion of Vee-style seals allows the design to feature combinations of thermoplastics capable of resisting various hostile conditions. This seal is capable of holding 20,000 psi at 350°F (177°C) and passing ports at shifting pressures of 1500 and 4500 psi (31.03 Mpa). Our proprietary Avalon material is a high-wear material suited for erosive conditions.





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CSA (COIL SPRING ACTIVATED)

Seal Stack Solutions for Riser/Coupling Applications

csa \ case study

SEALING DESIGN SOLUTIONS

- Increased seal life, no measurable leakage
- Handled high ovality and pressure effectively
- Proved easy to install
- Should be considered for application with large clearances or where ovality may cause problems

Equipment

- Coupling application, such as riser joints

Existing Seals

- U-Cup elastomer seal

Problem

- A coupling application, e.g., riser joints, utilizing a U-cup elastomer seal was experiencing problems with the pressure capability of existing seals and problems caused by high ovality in riser applications.

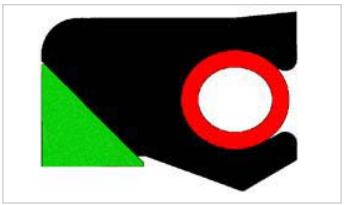
Solution

- The CSA gives the benefits of a true elastomer accommodating large changes in squeeze caused by ovalization, high-diametral clearances or large eccentricities caused by wide tolerances.

  The CSA seal, giving a virtually constant force, provides optimum seal performance at both low and high temperatures. Dependent upon material used, temperature performance can range from 65ºF to 500ºF (18ºC to 260ºC). The CSA seal has tested to pressures of 15,000 psi. The CSA seal is ideal for use on coupling applications, such as riser joints, or where hardware sees excessive side forces.

The solution consisted of a three-part assembly arranged as follows:

- Elastomer jacket (black)
- Metal spring (red)
- Arlon heel bearing (green)



Testing

The CSA was tested in singular and combined applications of tension, internal pressure (water unless otherwise stated) and bending and then stabilized for 15 minutes.

1. Internal pressure to 15,000 psi.
2. Breakout, inspect, make-up, then apply bending to 220,000 ft-lb. with 100 psi internal monitor pressure.
3. Tension of 1.2 million lb. with 100 psi internal monitor pressure.
4. Breakout, inspect, make-up, then repeat. The monitor pressure was maintained during load changes and left overnight.

No observable leakage occurred during the test.
The next test sequence was for combined loading with 8,000 psi continuously maintained internal pressure as follows:

5. 110,000 ft-lb. bending only.
6. 72,000 ft-lb. bending, 200,000 lb. tension.
7. 36,000 ft-lb. bending, 400,000 lb. tension repeated.

During the combined load testing, no loss of pressure was observed, even during load changes.
Gas testing with nitrogen was then carried out as follows:

8. Pressure to 500 psi, stabilize and hold for 15 minutes.
9. Pressure to 10,000 psi, stabilize and hold for 15 minutes.

No measurable leakage occurred.

Rating

Tension 800,000 lb.; pressure 10,000 psi; bending 150,000 ft-lb.

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