BAL SEAL ENGINEERING

Reciprocating Seal Catalog
DM-6

Sealing Solutions for Reciprocating, Static and Face Applications

Low Friction
Chemical Compatibility
Extreme Temperatures
Custom Engineering
for High Performance

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Design Features and Benefits

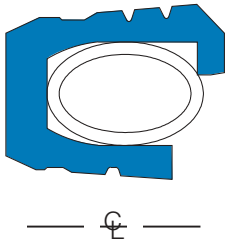
SHORTENED DYNAMIC LIP

Provides improved sealing ability with wiping action and increases life performance, with lower friction than previous Full Dynamic Seal Lip designs.

Series 13 for Housing Mounting

Series 14 for Piston Mounting

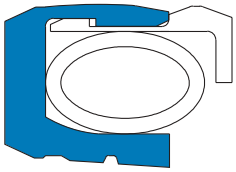
Short lip optimizes the force of a spring energizer. This allows the usage of a lighter spring than previous designs without compromising the sealing effectiveness. The sealing zone is mechanically optimized for longer life, better sealing, lower friction.



METAL RETAINING RING

Series KS13

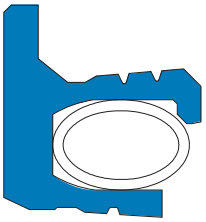
Features self-retaining of the seal with metal-to-metal contact between housing material and metal locking ring.
This unique design has easy installation and allows greater thermal cycling capabilities.



FLANGED SEAL

Series R13

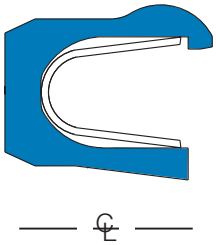
Reduces seal shuttling and provides secondary sealing on the flange. More elaborate seal gland design is necessary.
A flange on the I.D. can also be provided.



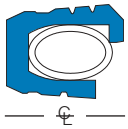
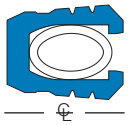
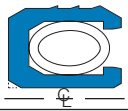
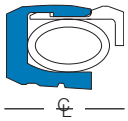
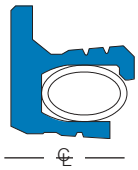
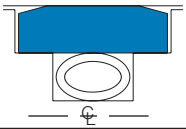
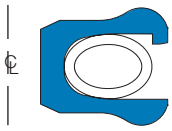
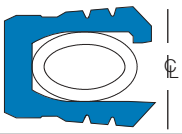
V-SPRING SEAL

Series VSI2

Ideal for scraping and wiping of viscous media, food or abrasive media and easy cleaning.



Reciprocating/Static Light Duty

Seal Design	Series	Description/Applications	Pressure Limit (psi) *	Cross Section Range (inch)	Inside Diameter Range (inch)
	13 14	Canted coil spring energized Wiping, Low friction, longer life. A break-through design.	3000	0.031 – 0.500	0.062 – 34.00
	15	Canted coil spring energized. Symmetrical design for piston or sealing rod.	3000	0.031 – 0.500	0.062 – 76.00
	C10 OC10	Canted coil spring energized. Very small diameters possible.	3000	0.016 – 0.031	0.020 – 0.125
	KS13	Spring energized. For thermal cycling and self-retaining with a metal locking ring	3000	0.062 – 0.500	0.125 – 34.00
	R13 IR14	Canted coil spring energized. Flanged-mounted. Reduces seal movement. Low friction, longer life.	3000	0.031 – 0.500	0.062 – 76.00
	VSI20 OVSI20	V-spring energized. Better wiper seal. Ideal for food service. Viscous and abrasive media. Easy cleaning.	3000	0.062 – 0.250	0.188 – 7.500
	PW	Spring energized. Guide ring. Better piston guidance and alignment.	NA	0.031 – 0.500	0.062 – 60+
	S2 IS2	Spring energized. Face seal. Static sealing. Slow rotary applications. Use under internal or external pressure conditions.	3000 (static)	0.062 – 0.250	0.188 – 36.00
	S15 IS15	Spring energized. Face seal. Better dynamic sealing.	3000	0.062 – 0.250	0.188 – 36.00

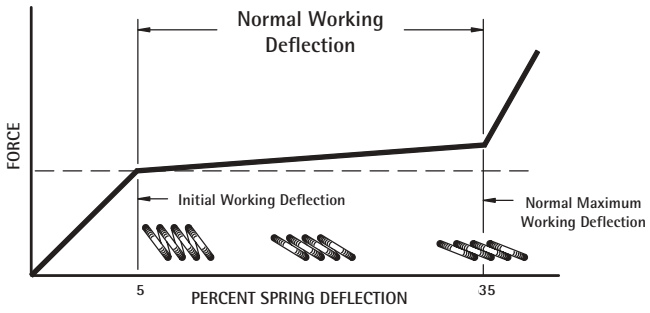
* For medium and high pressure designs and other special designs, see page 17 or contact Bal Seal Engineering for assistance.

Bal Seal Materials

Material Code/Description	Temperature Range °F (C)	Wear Resistance 5=Excellent 1=Fair	Pressure/Extrusion Resistance 5=Excellent 1=Fair
T VIRGIN PTFE Light duty service. Lowest friction. Excellent chemical compatibility. FDA approved. Color: White	-450 to 450 (-268 to 232)	1	1
G GRAPHITE-FILLED PTFE Light duty service. Low friction. Very good chemical compatibility. Good wear resistance in liquids, humid conditions. Color: Black	-450 to 500 (-268 to 232)	2	2
GC GRAPHITE-CARBON-PTFE General light duty. Low friction. Very good chemical compatibility. Good wear resistance in liquids, humid conditions. Color: Black	-450 to 475 (-268 to 246)	3	3
TA PTFE - LOW PERMEABILITY Superior mechanical properties with good surface finishes, good sealing ability in gases and vacuum. Suitable for semiconductor applications. FDA approved. Color: White	-450 to 450 (-268 to 232)	2	2
GFPA GRAPHITE FIBER REINFORCED PTFE Moderate service conditions. Excellent performance in high temperature applications with moderate speed and pressure. Color: Black	-320 to 500 (-196 to 260)	4	5
GFPA-HT GRAPHITE FIBER REINFORCED PTFE Similar to GFPA. Provides greater stability at higher temperatures to 550˚F (288˚C). Color: Black	-320 to 550 (-196 to 288)	4	5
GFPMA MOS2-REINFORCED PTFE Severe dry and liquid service. Excellent wear and extrusion resistance in liquids, inert gases, vacuum. Color: Black	-320 to 500 (-196 to 260)	5	5
UPC-10 POLYETHYLENE BLEND Aqueous service. Good wear and extrusion resistance in aqueous media. For general service. FDA approved. Color: Translucent White	-320 to 180 (-196 to 82)	4 (Water Only)	5
UPC-14 POLYETHYLENE BLEND Aqueous service. Excellent wear resistance in water. Excellent performance in applications at very low speed and pressure. For medical and food application. FDA approved. Color: Translucent White	-450 to 180 (-268 to 82)	5 (Water Only)	5
UP-30 UHMW POLYETHYLENE For the ultimate performance . Excellent wear resistance in aqueous media, high impact resistance. Color: Gold	-70 to 180 (-57 to 82)	5 (Water Only)	5
SP-45 POLYMER FILLED PTFE General service conditions. Good wear resistance in liquid or dry environments. Low abrasion to dynamic mating surfaces. Suitable for high speed low pressure. Food compatible. Color: Light Green	-320 to 475 (-196 to 246)	5	4
SP-50 POLYMER FILLED PTFE General service applications. Excellent wear resistance in gases, air and vacuum. Limited wear resistance in water. Low abrasion to dynamic surfaces. Suitable for high speed low pressure. Food compatible. Color: Brown	-320 to 475 (-196 to 246)	4	4
GL-20 GLASS FIBER FILLED PTFE Severe dry/vacuum service. Excellent wear and extrusion resistance, and low outgassing. Color: White	-320 to 475 (-196 to 246)	5	5
GLMO-4 GLASS-MOLLY FILLED PTFE For severe conditions, excellent extrusion resistance. May be abrasive to soft mating materials. Color: Black	-320 to 500 (-196 to 260)	5	5
P-41 A PEEK based material for high temperature service. FDA approved. Color: Beige	-70 to 600 (-57 to 316)	5	5

PATENTED CANTED COIL SPRING

Bal Seal Engineering is the original developer of the canted coil spring. Our patented design holds the spring force nearly constant over a wide deflection range, so as wear occurs to the seal jacket, the spring continues to provide the same sealing force. Standard spring loads are interchangeable, enabling the customer to specify the proper loading force for the best friction, sealing and wear performance. The canted coil spring is the best energizer for small diameters.



SPRING MATERIALS

Spring Material	P/N Code	Corrosion Resistance	High Temp. Performance
302 Stainless Steel	302	F	F
316 Stainless Steel	316	G	F
Hastelloy C-276/Nickel Alloy	HST	E	G
MP35N/Nickel Alloy	MPN	E	G
Inconel X-750/Nickel Alloy	INC	E	E
Titanium Grade 2	TNM	E	F

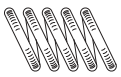
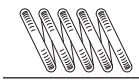
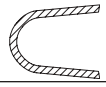
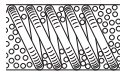
Rating Symbols: E=Excellent, G=Good, F=Fair

V-SPRING ENERGIZER

The V-Spring energizer is a good choice when sealing viscous media such as paint, ink, epoxy, food, etc., where ease of cleaning is a primary requirement. These springs function well in static or slow dynamic applications.

OTHER ENERGIZERS

O-Rings may also by substituted for springs to minimize dead volume or to avoid adding metal to a system.

Spring Load	Spring Code	Relative Loading	Friction	Sealing	Wear	Small Dia	High Speed	Vacuum Gas	High Pressure
	LB	Light	Low	Low	Low	Y	E	NR	NR
	MB	Medium	Mod	Mod	Mod	Y	G	F	F
	HB	High	High	High	High	N	F	G	G
	V	High	High	High	High	N	NR	E	E
	OR (O-Ring)	High	High	High	High	N	NR	E	G
	SF (Filled Canted-Coil Spring)	Med/Hi	High	High	High	Y	NR	E	NR

Rating Symbols: E=Excellent, G=Good, F=Fair, NR=Not Recommended, Y=Yes, N=No

Bal Seal Ordering Information

CALL OUT:	XXX	X	XX	-	XXX	-	XXX	-	XXX
STEP NO:	①	②	③		④		⑤		⑥

Example: 13 4 LB-210-GFP-HST

① Seal Design

13, 14, 15, C10, OC10, KS13, R13, IR14, VSI20, OVSI20, PW, S2, IS2, SI5, IS15, U13, U15, CU10, UVS120, UR13 and others. Refer to Bal Seal Selection Guide page 3.

② Seal Cross Section

2, 1, 0, 4, 5, 6, 7, 8, and 9
Refer to Standard Cross Sections table on this page below.

③ Spring Force

LB, MB, HB and others.
Refer to page 5 for description of standard spring loads.

④ Size

Use size codes for standard seal sizes. Enter seal ID (inches) for sizes not shown. See pages 8 and 9 for standard sizes.

⑤ Seal Material

T, G, GC, GFP, GFPA, GFPM, UPC10, UPC14, UP30, SP31, SP45, SP50, GL20, GLM04 and others.
Refer to Bal Seal Materials Guide on page 4.

⑥ Spring Material

302, 316, HST, MPN, INC, TNM, and others.
Refer to page 5 for description of standard spring materials.

STANDARD CROSS SECTIONS FROM 1/64 TO 1/2 INCH

The following table shows the standard Bal Seal cross sections. To indicate the cross section code in a Bal Seal part number, combine the seal design code with the cross section code. For example, combine 13 with 5 to specify a low friction seal with a 1/8-inch cross section (135). Seals with a 1/64-inch cross section (Cross-section code 2) are available only in the C10 seal design.

BAL SEAL STANDARD CROSS SECTIONS

Cross Section	Nominal Cross Section (inch)	Typical ID Sizes (inch)	Seal Design/Cross Section Examples			
2	1/64 (.015)	0.015 to 0.437	C102	CR102	-	-
1	1/32 (.031)	0.030 to 0.625	131	R131	S21	etc.
0	1/16 (.062)	0.062 to 1.500	130	R130	S20	etc.
4	3/32 (.093)	0.125 to 2.500	134	R134	S24	etc.
5	1/8 (.125)	0.187 to 10.000	135	R135	S25	etc.
6	3/16 (.187)	0.250 to 15.000	136	R136	S26	etc.
7	1/4 (.250)	0.750 to 25.000	137	R137	S27	etc.
8	3/8 (.375)	1.000 to 77.000	138	R138	S28	etc.
9	1/2 (.500)	2.000 to 77.000	139	R139	S29	etc.

Other seal cross sections are available. Millimeter cross sections are also available as standards. Bal Seal Engineering Company can retrofit its seal designs featuring the canted-coil spring for most glands. Call our technical sales department for details.

SEAL APPLICATION DATA

To simplify seal selection, you can complete a copy of this application data sheet, and send it to the Bal Seal Technical sales department. Our technical staff will immediately respond with a Bal Seal design proposal, a detailed drawing of the seal and gland with recommended gland dimensions and other design information.

FROM: Date: _____

Name: _____ Title: _____

Company: _____ Dept: _____

Address: _____

City/State/Zip: _____

Phone: _____ Fax: _____

E-mail: _____ Web: _____

PRODUCT

_____

_____

SERVICE

- ◦ Reciprocating
- ◦ Rotary
- ◦ Oscillating
- ◦ Static
- ◦ Other _____

USAGE

- ◦ Continuous
- ◦ Intermittent
- ◦ Infrequent
- ◦ Other _____

TEMPERATURE

Max. _____ ◦ °F ◦ °C
Min. _____ ◦ °F ◦ °C
Oper. _____ ◦ °F ◦ °C

PRESSURE

Max. _____ ◦ psi ◦ kg/cm²
Oper. _____ ◦ psi ◦ kg/cm²

SPEED

_____ ◦ fpm ◦ m/sec
_____ ◦ rpm ◦ cpm ◦ Hz

LENGTH OF STROKE

_____ ◦ in. ◦ mm

SEAL MEDIA

_____

- ◦ Gas
- ◦ Liquid
- ◦ Solid
- ◦ Abrasives
- ◦ Corrosive
- ◦ Viscous
- ◦ Other _____

CRITICAL FACTORS

- ◦ Sealing Ability
- ◦ Friction
- ◦ Life
- ◦ Other _____

GLAND DIMENSIONS

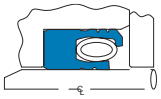
I.D. _____ ◦ in ◦ mm
O.D. _____ ◦ in ◦ mm
Width _____ ◦ in ◦ mm

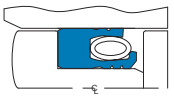
SHAFT/PISTON

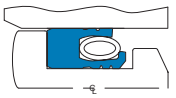
Material _____
Plating/Coating _____
Hardness _____ Rc
Sur. Finish: _____ ◦ Ra ◦ µin ◦ µm ◦ s

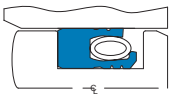
BORE/HOUSING

Material _____
Plating/Coating _____
Hardness _____ Rc
Sur. Finish: _____ ◦ Ra ◦ µin ◦ µm ◦ s


TWO-PIECE HOUSING


TWO-PIECE PISTON


ONE-PIECE PISTON
Stepped Gland


ONE-PIECE PISTON
Solid Gland

MOUNTING

- ◦ Two-Piece Housing
- ◦ Two-Piece Piston
- ◦ One-Piece Piston,* Stepped
- ◦ One-Piece Piston,* Solid

*Limited to Larger Dimensions

FLEXIBLE DELIVERY SCHEDULES AVAILABLE

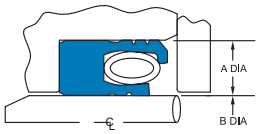
Bal Seal products are usually made to order. Standard delivery for larger-quantity orders is four to five weeks. Orders for prototypes and smaller quantities can be expedited. We can accommodate JIT, MRP, planning, and special scheduling, and we encourage scheduling of blanket orders. Expedited deliveries are possible for a nominal extra charge. We can also expedite items shipped factory direct in North America.

Reciprocating/Slow Rotary—Common Industrial Sizes and Gland Diameters

HOUSING MOUNTED

SEAL DESIGNS

13	U13
15	U15
C10	CU10
VSI20	UVSI20
R13	UR13
KS13	

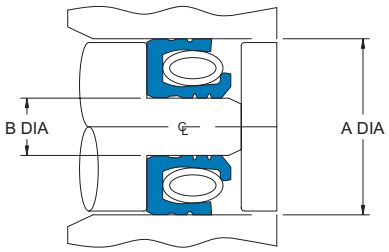


TWO-PIECE HOUSING

PISTON MOUNTED

SEAL DESIGNS

14	U14
15	U15
OC10	OCU10
OVSI20	OUVSI20
IR14	UIR14



SIZE No.	B Diameter	A Diameter
C10, CU10 Seals Only **1/64-Inch Nominal Cross Section** **Cross Section Code 2**		
	+0.0000 −0.0005	+0.0005 −0.0000
(0.020)	0.020	0.051
(0.025)	0.025	0.056
(0.031)	0.031	0.062
(0.035)	0.035	0.066
(0.040)	0.040	0.071
C10, CU10 Seals Only **1/32-Inch Nominal Cross Section** **Cross Section Code 1**		
	+0.0000 −0.0005	+0.0005 −0.0000
(0.025)	0.025	0.087
(0.031)	0.031	0.094
(0.050)	0.050	0.112
(0.062)	0.062	0.125
(0.070)	0.070	0.132
(0.094)	0.094	0.156
(0.125)	0.125	0.187
All Seal Designs **1/32-Inch Nominal Cross Section** **Cross Section Code 1**		
	+0.0000 −0.0005	+0.0005 −0.0000
002	0.062	0.125
003	0.094	0.156
004	0.125	0.187
005	0.187	0.250
006	0.250	0.312
007	0.312	0.375
007½	0.375	0.437
	+0.000 −0.001	+0.001 −0.000
008	0.437	0.500
008½	0.500	0.562
009	0.562	0.625
009½	0.625	0.687
0010	0.687	0.750

SIZE No.	B Diameter	A Diameter
All Seal Designs **1/16-Inch Nominal Cross Section** **Cross Section Code 0**		
	+0.0000 −0.0005	+0.0005 −0.0000
05	0.094	0.219
06	0.125	0.250
07	0.156	0.281
08	0.187	0.312
09	0.219	0.344
010	0.250	0.375
011	0.312	0.437
012	0.375	0.500
	+0.000 −0.001	+0.001 −0.000
013	0.437	0.562
014	0.500	0.625
015	0.562	0.687
016	0.625	0.750
017	0.687	0.812
018	0.750	0.875
019	0.812	0.937
020	0.875	1.000
021	0.937	1.062
022	1.000	1.125
023	1.062	1.187
024	1.125	1.250
025	1.187	1.312
026	1.250	1.375
027	1.312	1.437
028	1.375	1.500
029	1.500	1.625
	+0.0000 −0.0015	+0.0015 −0.0000
030	1.625	1.750
031	1.750	1.875
032	1.875	2.000
033	2.000	2.125
034	2.125	2.250
035	2.250	2.375
036	2.375	2.500
037	2.500	2.625

SIZE No.	B Diameter	A Diameter
All Seal Designs **3/32-Inch Nominal Cross Section** **Cross Section Code 4**		
	+0.0000 −0.0005	+0.0005 −0.0000
103	0.094	0.281
104	0.125	0.312
105	0.156	0.344
106	0.187	0.375
107	0.219	0.406
108	0.250	0.437
109	0.312	0.500
110	0.375	0.562
	+0.000 −0.001	+0.001 −0.000
111	0.437	0.625
112	0.500	0.687
113	0.562	0.750
114	0.625	0.812
115	0.687	0.875
116	0.750	0.937
117	0.812	1.000
118	0.875	1.062
119	0.937	1.125
120	1.000	1.187
121	1.062	1.250
122	1.125	1.312
124	1.250	1.437
125	1.312	1.500
128	1.500	1.687
	+0.0000 −0.0015	+0.0015 −0.0000
132	1.750	1.937
133	1.812	2.000
136	2.000	2.187
141	2.312	2.500
144	2.500	2.687
	+0.000 −0.002	+0.002 −0.000
149	2.812	3.000
151	3.000	3.187
153	3.500	3.687
155	4.000	4.187

Shaft/bore diameter tolerances are suggested for optimum performance. Some applications may require greater tolerances. Seals energized with a canted coil spring accommodate larger tolerances better than other sealing devices.

Reciprocating/Slow Rotary—Common Industrial Sizes and Gland Diameters

All Seal Designs
1/8-Inch Nominal Cross Section
Cross Section Code 5

SIZE No.	B Diameter	A Diameter
	+0.0000 −0.0005	+0.0005 −0.0000
201	0.187	0.437
202	0.250	0.500
204	0.375	0.625
	+0.000 −0.001	+0.001 −0.000
206	0.500	0.750
208	0.625	0.875
210	0.750	1.000
212	0.875	1.125
214	1.000	1.250
218	1.250	1.500
222	1.500	1.750
	+0.0000 −0.0015	+0.0015 −0.0000
224	1.750	2.000
226	2.000	2.250
228	2.250	2.500
230	2.500	2.750
	+0.000 −0.002	+0.002 −0.000
232	2.750	3.000
234	3.000	3.250
236	3.250	3.500
238	3.500	3.750
240	3.750	4.000
242	4.000	4.250
	+0.000 −0.003	+0.003 −0.000
244	4.250	4.500
246	4.500	4.750
248	4.750	5.000
250	5.000	5.250
252	5.250	5.500
254	5.500	5.750
256	5.750	6.000
258	6.000	6.250
(6.250)	6.250	6.500
(6.500)	6.500	6.750
(6.750)	6.750	7.000
(7.000)	7.000	7.250
(7.250)	7.250	7.500
(7.500)	7.500	7.750
(7.750)	7.750	8.000
(8.000)	8.000	8.250
(8.250)	8.250	8.500
(8.500)	8.500	8.750
(8.750)	8.750	9.000
(9.000)	9.000	9.250

All Seal Designs
3/16-Inch Nominal Cross Section
Cross Section Code 6

SIZE No.	B Diameter	A Diameter
	+0.000 −0.001	+0.001 −0.000
(0.500)	0.500	0.875
(0.625)	0.625	1.000
(0.750)	0.750	1.125
(0.875)	0.875	1.250
(1.000)	1.000	1.375
(1.125)	1.125	1.500
(1.250)	1.250	1.625
324	1.375	1.750
325	1.500	1.875
	+0.0000 −0.0015	+0.0015 −0.0000
326	1.625	2.000
329	2.000	2.375
330	2.125	2.500
333	2.500	2.875
	+0.000 −0.002	+0.0020 −0.0000
334	2.625	3.000
337	3.000	3.375
338	3.125	3.500
341	3.500	3.875
342	3.625	4.000
345	4.000	4.375

All Seal Designs
1/4-Inch Nominal Cross Section
Cross Section Code 7

SIZE No.	B Diameter	A Diameter
	+0.0000 −0.0015	+0.0015 −0.0000
403	1.750	2.250
405	2.000	2.500
407	2.250	2.750
409	2.500	3.000
	+0.000 −0.002	+0.002 −0.000
411	2.750	3.250
413	3.000	3.500
417	3.500	4.000
421	4.000	4.500
	+0.000 −0.003	+0.003 −0.000
425	4.500	5.000
429	5.000	5.500
433	5.500	6.000
437	6.000	6.500
439	6.500	7.000
441	7.000	7.500
443	7.500	8.000

All Seal Designs
3/8-Inch Nominal Cross Section
Cross Section Code 8

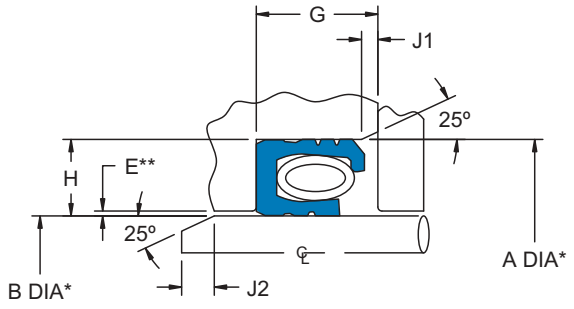
SIZE No.	B Diameter	A Diameter
	+0.000 −0.003	+0.003 −0.000
(4.250)	4.250	5.000
(5.000)	5.000	5.750
(6.750)	6.750	7.500
(7.500)	7.500	8.250
(9.250)	9.250	10.000
(10.000)	10.000	10.750
(11.750)	11.750	12.500
(12.500)	12.500	13.250
(14.250)	14.250	15.000
(15.000)	15.000	15.750
(19.250)	19.250	20.000
(24.250)	24.250	25.000
(25.000)	25.000	25.750
(29.250)	29.250	30.000
(30.000)	30.000	30.750
(34.250)	34.250	35.000
(35.000)	35.000	35.750
(39.250)	39.250	40.000
(40.000)	40.000	40.750

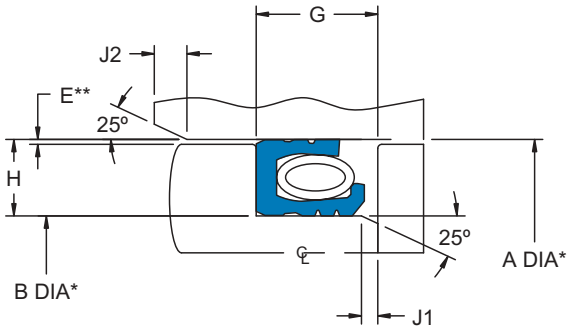
All Seal Designs
1/2-Inch Nominal Cross Section
Cross Section Code 9

SIZE No.	B Diameter	A Diameter
	+0.000 −0.003	+0.003 −0.000
(5.000)	5.000	6.000
(9.000)	9.000	10.000
(10.000)	10.000	11.000
(14.000)	14.000	15.000
(19.000)	19.000	20.000
(24.000)	24.000	25.000
(25.000)	25.000	26.000
(29.000)	29.000	30.000
(30.000)	30.000	31.000
(39.000)	39.000	40.000
(40.000)	40.000	41.000
(49.000)	49.000	50.000
(50.000)	50.000	51.000
(59.000)	59.000	60.000
(60.000)	60.000	61.000
(69.000)	69.000	70.000
(70.000)	70.000	71.000
(74.000)	74.000	75.000
(75.000)	75.000	76.000

Because of space limitations, only the most common sizes are shown. Other sizes up to 78 inches are available. Contact our Technical Sales department for more information.

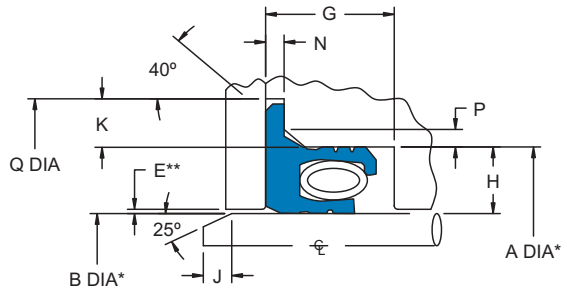
Reciprocating/Slow Rotary—Seal Gland Dimensions

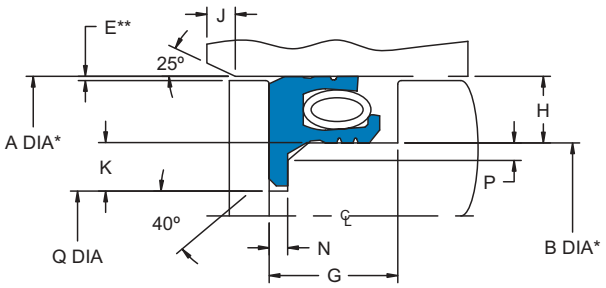




Cross Section Code	H Gland Height	G GLAND LENGTH		CHAMFER LENGTH	
		Standard Seals	U Seals	J1 Max.	J2 Min.
2	0.015/0.016	0.029/0.034	0.055/0.058	-	-
1	0.030/0.032	0.053/0.058	0.071/0.076	0.010	0.031
0	0.061/0.063	0.098/0.103	0.120/0.125	0.015	0.035
4	0.093/0.095	0.144/0.154	0.183/0.193	0.020	0.040
5	0.125/0.127	0.183/0.193	0.263/0.273	0.025	0.045
6	0.187/0.189	0.263/0.273	0.351/0.366	0.030	0.050
7	0.250/0.252	0.351/0.366	0.523/0.543	0.035	0.055
8	0.375/0.377	0.523/0.543	0.686/0.711	0.048	0.065
9	0.500/0.502	0.686/0.711	0.911/0.931	0.055	0.075

*Check pages 8 and 9 for gland diameters of common seal sizes.
**Clearance (E) varies with service conditions. A recommended clearance is shown on design proposal drawing.

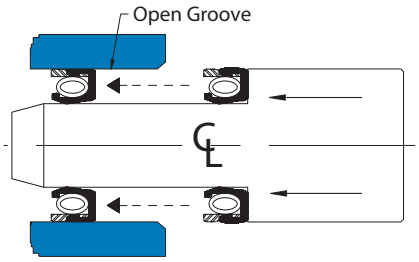




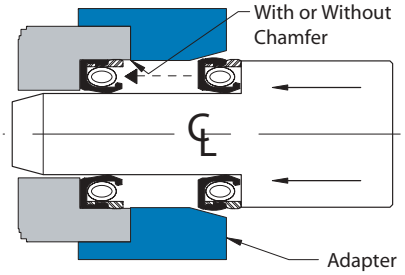
Cross Section Code	H Gland Height	G GLAND LENGTH		N Flange Depth	P Chamfer Height	K Flange Height Min.	Q BORE/SHAFT DIA		J Chamfer Length Min.
		R/IR Seals	UR/UIR Seals				R/UR Seals ±0.002	IR/UIR Seals ±0.002	
1	0.030/0.032	0.075/0.095	0.092/0.112	0.012/0.013	0.012/0.017	0.048	A + 0.096	B - 0.096	0.031
0	0.061/0.063	0.117/0.137	0.138/0.158	0.012/0.013	0.017/0.023	0.068	A + 0.135	B - 0.135	0.035
4	0.093/0.095	0.171/0.191	0.203/0.223	0.019/0.020	0.028/0.035	0.071	A + 0.143	B - 0.143	0.040
5	0.125/0.127	0.220/0.240	0.259/0.279	0.026/0.027	0.040/0.049	0.077	A + 0.155	B - 0.155	0.045
6	0.187/0.189	0.280/0.300	0.351/0.371	0.031/0.032	0.057/0.067	0.123	A + 0.246	B - 0.246	0.050
7	0.250/0.252	0.375/0.395	0.489/0.509	0.044/0.045	0.069/0.080	0.153	A + 0.306	B - 0.306	0.055
8	0.375/0.377	0.565/0.585	0.741/0.761	0.088/0.090	0.080/0.092	0.192	A + 0.384	B - 0.384	0.065
9	0.500/0.502	0.743/0.763	0.980/1.000	0.088/0.090	0.092/0.103	0.240	A + 0.480	B - 0.480	0.075

*Check pages 8 and 9 for gland diameters of common seal sizes.
**Clearance (E) varies with service conditions. A recommended clearance is shown on design proposal drawing.

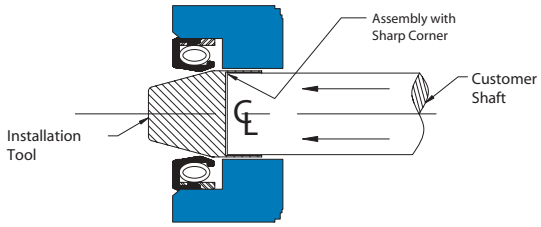
Installation Configurations



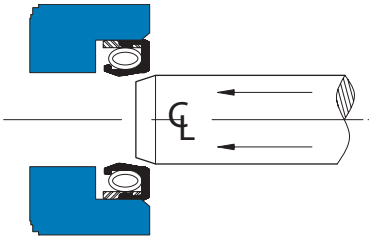
Assembly in an Open Gland



An Open Gland With Sharp Entry Corner



Assembly of Shaft From Forward Direction



Assembly of Shaft From Forward Direction

Other specialized assembly methods are available. Consult Technical Sales.

SUGGESTED SHAFT AND HOUSING TOLERANCES

Diameter Range (Inches)	Shaft Tolerances (Inches)	Housing Tolerances (Inches)	Diameter Range (Inches)	Shaft Tolerances (Inches)	Housing Tolerances (Inches)
0.0200 to 0.1875	+0.0000 / -0.0005	+0.0005 / -0.0000	2.001 to 3.500	+0.000 / -0.002	+0.002 / -0.000
0.1876 to 0.3750	+0.0000 / -0.0007	+0.0007 / -0.0000	3.501 to 6.000	+0.000 / -0.003	+0.003 / -0.000
0.3751 to 1.0000	+0.0000 / -0.0010	+0.0010 / -0.0000	6.001 to 15.000	+0.000 / -0.004	+0.004 / -0.000
1.0001 to 2.0000	+0.0000 / -0.0015	+0.0015 / -0.0000	15.001 to 34.000	+0.000 / -0.005	+0.005 / -0.000

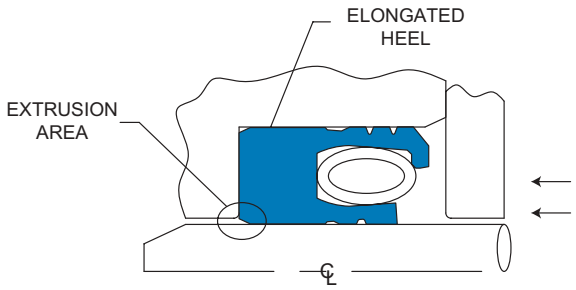
(50-606-1)

RADIAL CLEARANCE "E" (Inches) @ 70˚ F (21˚ C)

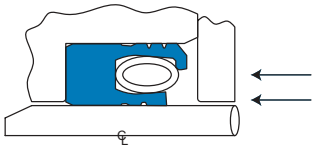
Code	Cross Section	Pressure (psi)			
		150	300	500	1000
1	1/32" (0.031)	0.004	0.003	0.0025	0.002
0	1/16" (0.063)	0.005	0.004	0.0025	0.003
4	3/32" (0.094)	0.006	0.005	0.004	0.003
5	1/8" (0.125)	0.007	0.006	0.005	0.004
6	3/16" (0.188)	0.007	0.006	0.005	0.004
7	1/4" (0.250)	0.008	0.007	0.006	0.005
8	3/8" (0.375)	0.010	0.008	0.007	0.006
9	1/2" (0.500)	0.012	0.010	0.008	0.007

HIGH PRESSURE SEAL DESIGNS

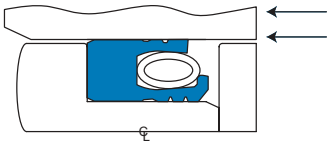
Seals for high pressure and high temperature reduce possible seal material extrusion at the clearance area of the gland. The seal's elongated heel section absorbs the load created by the high pressure and offsets reduced properties created by high temperatures. High-pressure seals provide low friction, compatibility, wear resistance, and sealing reliability in severe conditions. Canted-coil deflection spring supplies pre-load for sealing reliability at lower pressures.



- Pressures from vacuum to 10,000 psi at 70°F
- Temperatures from cryogenic to 550°F using GFPA HT
- Seals liquid and gas media
- Slow rotary service to 100 fpm



U13 SEAL DESIGN

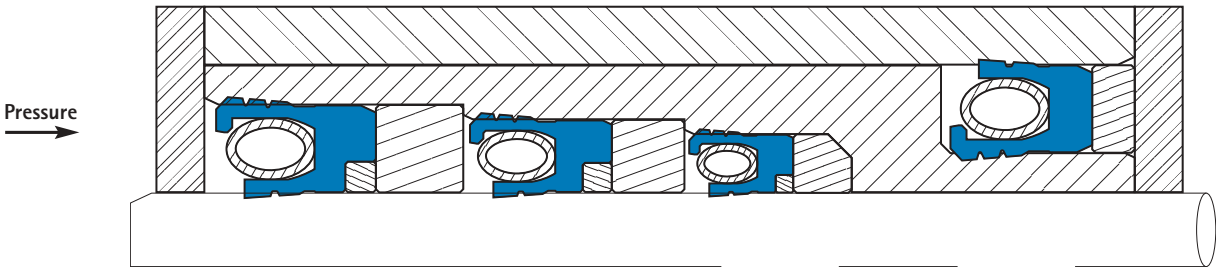


U14 SEAL DESIGN

VERY HIGH PRESSURE SEALS (TO 100,000 PSI)

Bal Seal Eng. Co. makes seals for very high-pressure applications. These seals consist of a high-pressure seal and one or more backup rings. Backup rings add support and supplement the extrusion resistance needed to hold the seal at very high pressures.

Because high pressures can be hazardous, we request that you ask our technical sales department to propose a seal design for high-pressure applications.



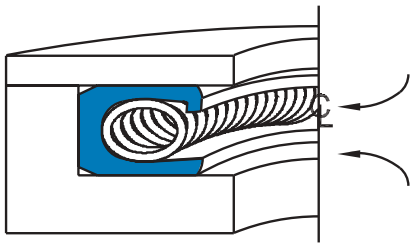
Bal Seal IHU13x
High Pressure
Cartridge Assembly

Face Seals

Bal Seal face seals assemble into a gland or counterbore between plates for internal or external pressure, static or dynamic sealing. Because the Bal Seal canted-coil energizing spring provides nearly constant load over a wide range of deflection, variations in gland depth tolerance have a minor effect on seal load. PTFE-based seal materials make the seal compatible with a substantial variety of liquid and gas applications.

INTERNAL PRESSURE

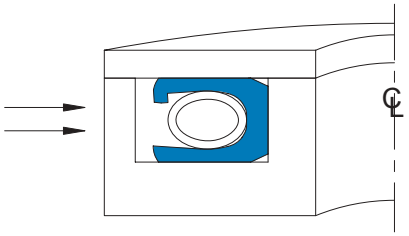
Spring cavity on the seal ID allows the internal pressure to aid in providing a positive seal as pressure increases. A heavy spring force is typical for static applications. Lighter spring forces can customize the load for dynamic service and applications needing a lighter force.



Seal Designs:
S1, S2, and S15

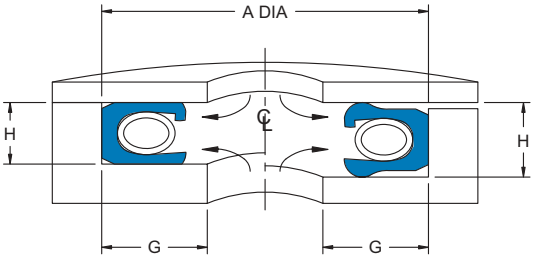
EXTERNAL PRESSURE

Spring cavity on the seal OD aids in providing a positive seal under external pressure or vacuum. A heavy spring force is typically specified for static and vacuum service. Lighter spring forces can customize the load for dynamic service and applications needing a lighter closing force.

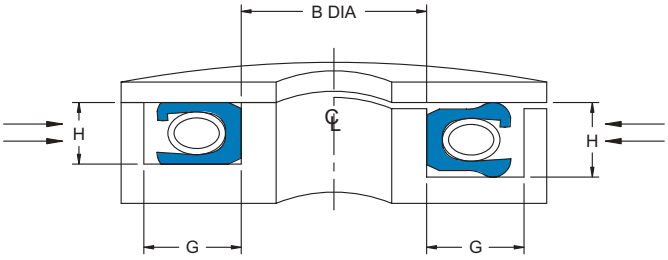


Seal Designs:
IS1, IS2, and IS15

FACE SEAL GLAND DIMENSIONS



STATIC GLAND DYNAMIC GLAND

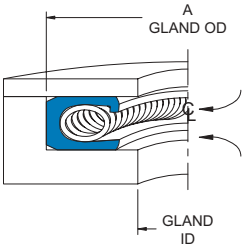


STATIC GLAND DYNAMIC GLAND

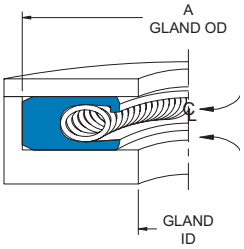
Cross Section Code	H GLAND HEIGHT		G GLAND LENGTH	
	Static Service	Dynamic Service	S/IS Seals Min.	US/UIS Seals Min.
0	0.059/0.061	0.069/0.071	0.103	0.148
4	0.089/0.091	0.109/0.111	0.148	0.187
5	0.121/0.123	0.152/0.154	0.187	0.265
6	0.177/0.179	0.223/0.225	0.265	0.350
7	0.242/0.244	0.292/0.294	0.350	0.517
8	0.363/0.365	0.449/0.451	0.517	0.690
9	0.484/0.486	0.602/0.604	0.690	0.910

The larger gland height (H) for dynamic applications reduces breakout and dynamic friction. Smaller gland height for static applications improves sealing reliability.

Face Seals—Internal Pressure



S SEALS



US* SEALS

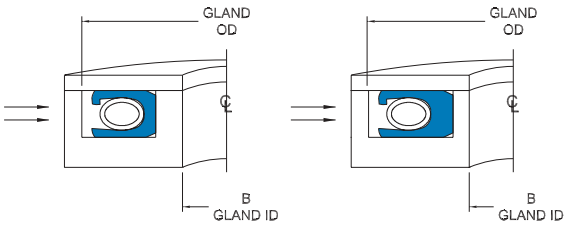
*Extended Heel

SIZE No.	A Gland OD	Gland ID	
		S Seals	US Seals
1/16-Inch (0.062) Nominal Cross Section Cross Section Code 0			
	+0.001 -0.000	Max	Max
(0.312)	0.312	0.102	
(0.375)	0.375	0.165	
(0.437)	0.437	0.227	0.141
(0.500)	0.500	0.290	0.204
(0.625)	0.625	0.415	0.329
3/32-Inch (0.094) Nominal Cross Section Cross Section Code 4			
	+0.001 -0.000	Max	Max
(0.875)	0.875	0.565	0.501
(1.000)	1.000	0.690	0.626
(1.125)	1.125	0.815	0.751
(1.250)	1.250	0.940	0.876
(1.500)	1.500	1.190	1.126
	+0.002 -0.000	Max	Max
(1.750)	1.750	1.440	1.376
(2.000)	2.000	1.690	1.626
(2.250)	2.250	1.940	1.876
1/8-Inch (0.125) Nominal Cross Section Cross Section Code 5			
	+0.001 -0.000	Max	Max
(1.125)	1.125	0.749	0.595
(1.250)	1.250	0.874	0.720
(1.375)	1.375	0.999	0.845
(1.500)	1.500	1.124	0.970
(1.625)	1.625	1.249	1.095
	+0.002 -0.000	Max	Max
(1.750)	1.750	1.374	1.220
(2.000)	2.000	1.624	1.470
(2.250)	2.250	1.874	1.720
(2.500)	2.500	2.124	1.970

SIZE No.	A Gland OD	Gland ID	
		S Seals	US Seals
3/16-Inch (0.187) Nominal Cross Section Cross Section Code 6			
	+0.003 -0.000	Max	Max
(3.000)	3.000	2.470	2.300
(3.250)	3.250	2.720	2.550
(3.500)	3.500	2.970	2.800
(3.750)	3.750	3.220	3.050
	+0.004 -0.000	Max	Max
(4.000)	4.000	3.470	3.300
(4.250)	4.250	3.720	3.550
(4.500)	4.500	3.970	3.800
1/4-Inch (0.250) Nominal Cross Section Cross Section Code 7			
	+0.004 -0.000	Max	Max
(4.000)	4.000	3.300	2.966
(4.250)	4.250	3.550	3.216
(4.500)	4.500	3.800	3.466
(4.750)	4.750	4.050	3.716
(5.000)	5.000	4.300	3.966
	+0.005 -0.000	Max	Max
(5.250)	5.250	4.550	4.216
(5.500)	5.500	4.800	4.466
(5.750)	5.750	5.050	4.716
(6.000)	6.000	5.300	4.966
3/8-Inch (0.375) Nominal Cross Section Cross Section Code 8			
	+0.015 -0.000	Max	Max
(6.500)	6.500	5.466	5.120
(7.000)	7.000	5.966	5.620
(7.500)	7.500	6.466	6.120
(8.000)	8.000	6.966	6.620
1/2-Inch (0.500) Nominal Cross Section Cross Section Code 9			
	+0.015 -0.000	Max	Max
(12.500)	12.500	11.120	10.680
(14.000)	14.000	12.620	12.180
(15.000)	15.000	13.620	13.180
(17.000)	17.000	15.620	15.180

Because of space limitations, only the most common sizes are shown. Other sizes up to 78 inches are available. Contact our Technical Sales department for more information.

Face Seals—External Pressure



IS SEALS UIS SEALS

SIZE No.	B Gland ID	Gland OD	
		IS Seals	UIS Seals
1/16-Inch (0.062) Nominal Cross Section Cross Section Code 0			
	+0.000 -0.001	Max	Max
(0.187)	0.187	0.397	0.483
(0.250)	0.250	0.460	0.546
(0.375)	0.375	0.585	0.671
(0.500)	0.500	0.710	0.796
(0.750)	0.750	0.960	1.046
3/32-Inch (0.094) Nominal Cross Section Cross Section Code 4			
	+0.000 -0.001	Max	Max
(0.625)	0.625	0.935	0.999
(0.750)	0.750	1.060	1.124
(1.000)	1.000	1.310	1.374
(1.250)	1.250	1.560	1.624
(1.500)	1.500	1.810	1.874
	+0.000 -0.002	Max	Max
(1.750)	1.750	2.060	2.124
(2.000)	2.000	2.310	2.374
(2.250)	2.500	2.810	2.874
1/8-Inch (0.125) Nominal Cross Section Cross Section Code 5			
	+0.000 -0.001	Max	Max
(1.125)	1.125	1.501	1.655
(1.250)	1.250	1.626	1.780
(1.375)	1.375	1.751	1.905
(1.500)	1.500	1.876	2.030
(1.625)	1.625	2.001	2.155
	+0.000 -0.002	Max	Max
(1.750)	1.750	2.126	2.280
(2.000)	2.000	2.376	2.530
(2.250)	2.250	2.626	2.780
(2.500)	2.500	2.876	3.030

SIZE No.	B Gland ID	Gland OD	
		IS Seals	UIS Seals
3/16-Inch (0.187) Nominal Cross Section Cross Section Code 6			
	+0.000 -0.003	Max	Max
(3.000)	3.000	3.530	3.700
(3.250)	3.250	3.780	3.950
(3.500)	3.500	4.030	4.200
(3.750)	3.750	4.280	4.450
	+0.000 -0.004	Max	Max
(4.000)	4.000	4.530	4.700
(4.250)	4.250	4.780	4.950
(4.500)	4.500	5.030	5.200
1/4-Inch (0.250) Nominal Cross Section Cross Section Code 7			
	+0.000 -0.004	Max	Max
(4.000)	4.000	4.700	5.034
(4.250)	4.250	4.950	5.284
(4.500)	4.500	5.200	5.534
(4.750)	4.750	5.450	5.784
(5.000)	5.000	5.700	6.034
	+0.000 -0.005	Max	Max
(5.250)	5.250	5.950	6.284
(5.500)	5.500	6.200	6.534
(5.750)	5.750	6.450	6.784
(6.000)	6.000	6.700	7.034
3/8-Inch (0.375) Nominal Cross Section Cross Section Code 8			
	+0.000 -0.010	Max	Max
(6.500)	6.500	7.534	7.880
(7.000)	7.000	8.034	8.380
(7.500)	7.500	8.534	8.880
(8.000)	8.000	9.034	9.380
1/2-Inch (0.500) Nominal Cross Section Cross Section Code 9			
	+0.000 -0.010	Max	Max
(12.500)	12.500	13.880	14.320
(14.000)	14.000	15.380	15.820
(15.000)	15.000	16.380	16.820
(17.000)	17.000	18.380	18.820

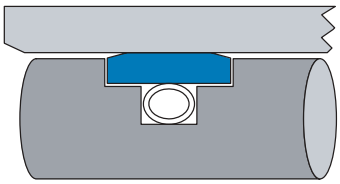
Because of space limitations, only the most common sizes are shown. Other sizes up to 78 inches are available. Contact our Technical Sales department for more information.

BAL SEAL GUIDE RINGS

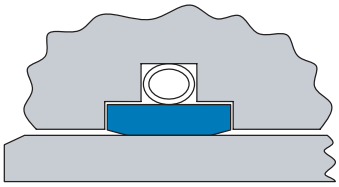
Bal Seal Guide Rings Give Piston Support

Bal Seal spring-energized guide rings used with Bal Seal fluid seals help prevent metal-to-metal contact and provide piston guidance and support. Bal Seal guide rings differ from conventional wear rings in one major respect: Our unique canted-coil spring supports the weight of the piston or rod evenly around the circumference and compensates for wear.

Selection between light, medium, and heavy spring forces tailor the guide ring for a suitable mix of friction and piston support. Provide our technical sales staff with your application details, so we can propose the optimum ring material and spring force combination. Contact the Technical Sales department for more information.



PW GUIDE RING
PISTON MOUNTED

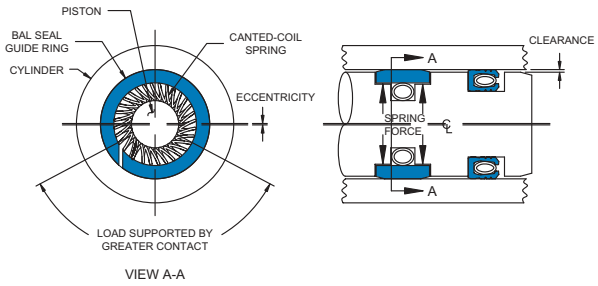


HW GUIDE RING
HOUSING MOUNTED

PISTON SUPPORT

Bal Seal Guide Rings vs. Conventional Wear Rings

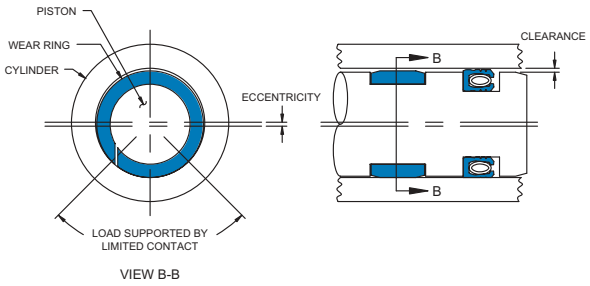
FEATURES OF BAL SEAL GUIDE RING



VIEW A-A

- Supports piston weight
- Reduces bearing load
- Reduces cylinder scoring
- Minimizes side loading
- Compensates for wear

LIMITATIONS OF CONVENTIONAL WEAR RING

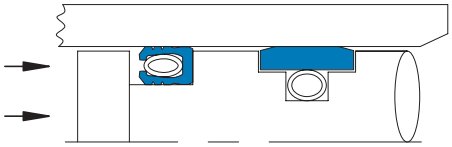


VIEW B-B

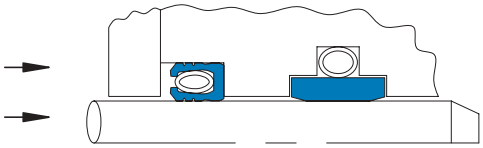
- Overcome by weight of piston
- Increases stress
- Allows metal-to-metal contact
- Succumbs to side loading
- Accelerates wear

IMPROVED SEAL PERFORMANCE

Bal Seal Guide Rings Improve Seal Performance

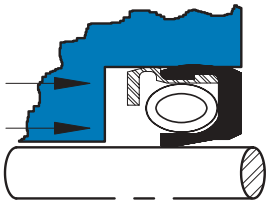


PISTON MOUNTED PW GUIDE RING
WITH A LOW FRICTION BAL SEAL



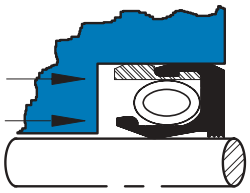
HOUSING MOUNTED HW GUIDE RING
WITH A LOW FRICTION BAL SEAL

Customized solutions to suit your application

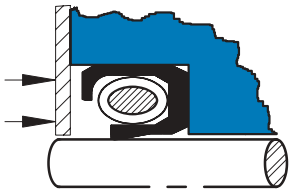


Low Pressure with Good Sealing Ability

Viscous Fluids at Low Speeds

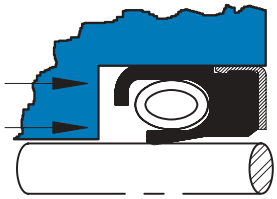


Medium Pressure, Dust Exclusion



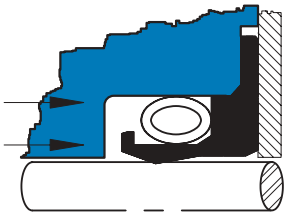
Good Sealing Ability with Low Dead Volume

Bi-directional at Low Pressure

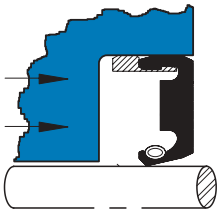


Higher Uncaptivated Pressures than KS-series.

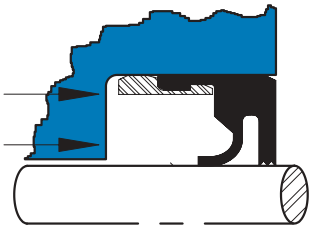
High Pressures



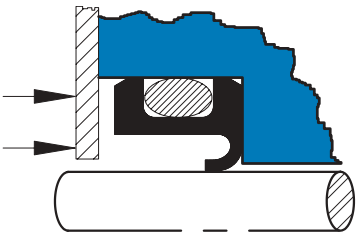
Cryogenic, Very Low Pressure



Large Cross Section, Medium Pressure and Medium Speed

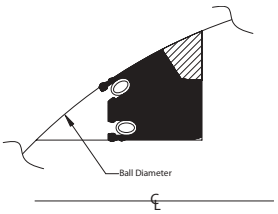


Low Pressure, Dust Exclusion

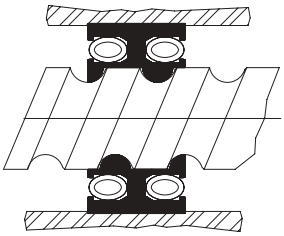


Low Speed, Low Pressure

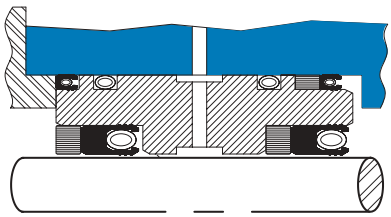
Bi-directional, Low Pressure



Ball Valve Seal



Ball Screw Seal



Bearing-Seal Package

Typical Applications

Bal Seal is used for:

- Critical Applications
- Extreme Conditions
- High Performance and Reliability

Typical Applications:

- Flow Controls
- Fluid Dispensing
- HPLC Plunger Pumps
- Medical/Dental Equipment
- Aircraft Controls
- Oil and Gas Equipment
- Semiconductor Equipment
- Food Processing
- Chemical Processing
- High Performance Engines
- Motion Control
- Factory Automation
- Machine Tools

  And More

DM-5 Rotary Bal Seal

DM-5m Metric Rotary Bal Seal

DM-7 BalContact Springs

Current carrying contact elements

DM-8 BalShield EMI Gaskets

For EMI/RFI shielding and grounding

Technical Reports and Product Flyers

To receive copies of these brochures call 1-800-366-1006 or download them at www.balseal.com

IMPORTANT INFORMATION

CLEANING: Customer/End User is advised that Bal Seal products may require cleaning and/or sterilization prior to usage, depending on the application. (LE-110B)

WARNING: It is essential the end-user run evaluation testing under actual service conditions with a sufficient safety factor to determine if the proposed, supplied, or purchased, Bal Seal products are suitable for the intended purpose.

Welded springs have an increased probability of breaking or failing at or adjacent to the weld as opposed to other areas of the spring. This probability is increased further if the spring is used in an application involving extension of the spring. Temperature affects the properties (i.e., tensile, elongation, etc.) of the spring. Failure of Bal Seal Engineering Company, Inc. products can cause equipment failure, property damage, personal injury, and/or death. Equipment containing Bal Seal products must be designed to provide for the safe handling of any eventuality that may result from a partial or total failure of said Bal Seal products. Bal Seal products must be tested with a sufficient safety factor after installation. A program of regular maintenance and inspection must be performed. The User, through its own analysis and testing, is solely responsible for making the final selection of the products and for assuring that all performance, safety and warning requirements of the application are met (LE-110A)

DISCLAIMER OF ALL WARRANTIES: The implied warranties of merchantability and fitness for a particular purpose and all warranties, implied or expressed, are excluded and shall not be implied to Bal Seal.

All statements, technical information, and recommendations herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed. All such statements, technical information and recommendations shall not be the basis of any bargain with Bal Seal or any seller and do not constitute a warranty that the goods will conform to any statements, technical information, or recommendations. The use of any such statement, information or recommendation is solely for the purposes of identification or illustration and is not to be construed as a warranty that any goods will conform to such statements, information, or recommendations. No affirmation of fact or promise made by Bal Seal or any seller will constitute a warranty that any goods will conform to the affirmation of promise.

Before using any product, User shall determine the suitability of the product for its intended use and User assumes all risk and liability whatsoever in connection therewith. No one, including company representatives, wholesalers, distributors, salespersons, or employees of Bal Seal is authorized to make any warranty or representation and no customer or user may rely on any warranty or representation. Bal Seal reserves the right to make any changes without notice in our products and in the information and contents of this document/brochure. Such information can include, but is not limited to, dimensional data, force, torque, materials, pressures, temperatures, surface finishes, surface speed, etc.

Nothing contained herein or in any of our literature shall be considered a license or recommendation to use any process or to manufacture or to use any product in conflict with existing or future patents, covering any product or material or its use.

The buyer shall hold and save the company, its officers, agents, and employees, harmless from liability of any nature or kind for or on account of the use, sales or lease of any patented or unpatented invention, article, or appliance, furnished or used hereunder. (LE-52)

LIMITATION OF LIABILITY/REMEDIES: It is agreed that the liability of the seller and Bal Seal, whether as a result of breach of any warranty, if any warranty in fact be found to exist, negligence, other tort, breach of contract or otherwise shall be limited to replacing the non-conforming Bal Seal product or any part thereof, or, at seller's option, to the repayment to the buyer of the purchase price paid by buyer in respect of which damages are claimed upon return to the seller, freight prepaid, of the non-conforming product or part thereof. It is expressly agreed that buyer's remedy, as stated above, shall be exclusive and that seller shall not be liable in tort or in contract for any other damages, direct, indirect or consequential. Any claims must be in writing and within 28 days of shipment of goods to receive consideration. (LE-52)

PATENTS: The items described in this catalog include products which are the subject of the following issued United States patents 5,979,904; 5,984,316; 5,994,856; 6,050,572; 6,161,838; 6,264,205 and others as well as foreign patents or products where patents are pending." (LE-88g)

ISO 9001

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