

Sealing Solutions for Reciprocating and Static Applications

- Low Friction
- Chemical Compatibility
- Vacuum to High Pressure
- Extreme Temperatures
- Engineered for
High Performance



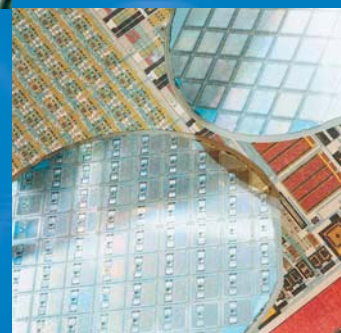
Bal Seals are used for:

- Critical Applications
- Extreme Conditions
- High Performance and Reliability
- Chemical Compatibility
- Harsh Environments
- Low Friction



Typical Applications:

- Piston Pumps
- Flow Controls
- Fluid Dispensing Equipment
- HPLC Plunger Pumps
- Medical/Dental Equipment
- Aerospace Components
- Oil and Gas Handling Equipment
- Semiconductor Processing Equipment
- Food Processing Equipment
- Chemical Processing Equipment
- High Performance Engines
- Motion Control Devices
- Linear Actuators
- Machine Tools
- HVAC
- And More . . .



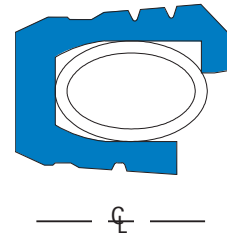
SHORTENED DYNAMIC LIP

Series 13 for Housing Mounting

Series 14 for Piston Mounting

Features short dynamic sealing lip. This feature improves overall seal performance by providing:

- Improved sealing ability
- Better wiping
- Reduced friction
- Reduced heat build-up for longer life

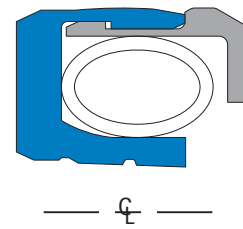


METAL RETAINING RING

Series KS13

A self-retaining seal with metal-to-metal contact between housing material and metal locking ring.

- Easy installation
- Suitable for high and low temperatures
- Greater thermal stability

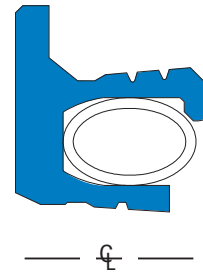


FLANGED SEAL

Series R13

Reduces seal shuttling and provides secondary sealing on the flange.

- Ideally suited for cryogenic applications
- Long term sealing applications

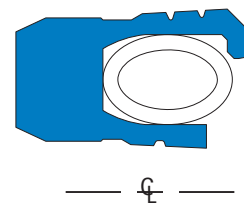


HIGH PRESSURE SEAL

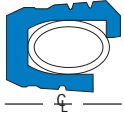
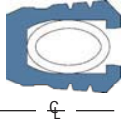
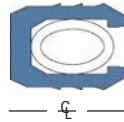

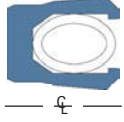
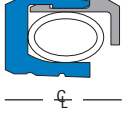


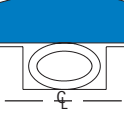

Series U13, U14, U15, U10

High pressure reciprocating service.

- Excellent sealing ability
- Extended heel zone for increased seal strength
- Longer seal life with better resistance to extrusion
- Improved stability/performance at high temperatures and high pressures



Reciprocating/Static Canted Coil Spring Energized Seals

Seal Design	Series	Features/Application	Pressure Limit (km/cm ²)	Cross Section Range (mm)	Inside Diameter Range (mm)
	13* 14	Wiping, Low friction, longer life. Improved sealing ability.	211	1,00 - 12,50	2,00 - 1900,00
	15*	Symmetrical design for piston or sealing rod. Better sealing ability.	211	1,00 - 12,50	2,00 - 1900,00
	10* U10	Most economic design. General purpose.	211	1,00 - 12,50	2,00 - 1900,00
	31* 41 S31	Low friction. Limited sealing ability.	141	1,00 - 12,50	2,00 - 1900,00
	C15* C13 C14	Very small diameters. Miniature cross-sections.	211	0,50 - 2,00	.0,5 - 4,00
	KS13*	For thermal cycling and self- retaining with a metal locking ring. High and low temperatures.	211	2,00 - 12,50	4,00 - 864,00
	R13* IR14	Flange-mounted. Reduces seal movement. Low friction, longer life.	211	1,00 - 12,50	2,00 - 1900,00
	U13* U14 U15	For high pressure. Low friction.	703	1,00 - 12,50	2,00 - 1900,00
	PW* HW	Guide Ring. Better piston guidance and align- ment.	NA	1,00 - 12,50	2,00 - 1500,00+
	S2* IS2	Face seal for static sealing Slow rotary applications. Use in internal or external pressure conditions.	211 (static)	2,00 - 7,00	5,00 - 1830,00

*Bold type denotes seal design images shown on this page.

Refer to page 16 for other designs. For medium to high pressure and other special designs, contact Bal Seal Engineering for assistance.

Bal Seal Materials

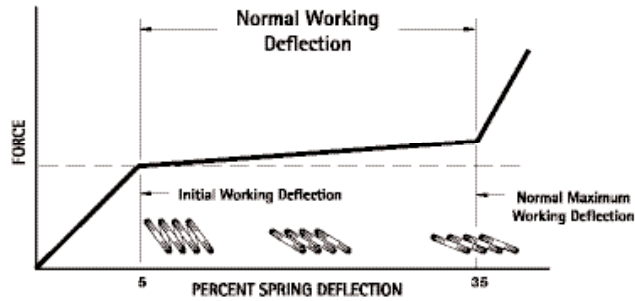
Material Code/Description	Temperature Range °C	Wear Resistance 5=Excellent 1=Fair	Pressure/Extrusion Resistance 5=Excellent 1=Fair	Chemical Compatibility*
T VIRGIN PTFE Light duty service. Lowest friction. Excellent chemical compatibility. FDA** compliant. Color: White	-268 to 232	1	1	Excellent
G GRAPHITE-FILLED PTFE Light duty service. Low friction. Very good chemical compatibility. Good wear resistance in liquids, humid conditions. Color: Black	-268 to 232	2	2	Very Good
GC GRAPHITE-CARBON-PTFE General light duty. Low friction. Very good chemical compatibility. Good wear resistance in liquids, humid conditions. Color: Black	-268 to 246	3	3	Good
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	-268 to 232	2	2	Excellent
GFPA GRAPHITE FIBER REINFORCED PTFE Moderate service conditions. Excellent performance in high temperature applications with moderate speed and pressure. Color: Black	-196 to 260	4	5	Very Good
GFPA-HT GRAPHITE FIBER REINFORCED PTFE Similar to GFPA. Provides greater stability at higher temperatures to 288°C. Color: Black	-196 to 288	4	5	Very Good
GFPMA MOS2-REINFORCED PTFE Severe dry and liquid service. Excellent wear and extrusion resistance in liquids, inert gases, vacuum. Color: Black	-196 to 260	5	5	Very Good
UPC-10 POLYETHYLENE BLEND Aqueous service. Good wear and extrusion resistance in aqueous media. For general service. FDA compliant. Color: Translucent White	-268 to 82	4 (Water Only)	5	Very Good
UPC-16 POLYETHYLENE BLEND High purity, high wear resistance in water and aqueous solutions. FDA compliant. Color: Translucent White	-268 to 82	4 (Water Only)	5	Very Good
UP-40 UHMW POLYETHYLENE Suitable for very high pressure low speed reciprocating applications such as HPLC. FDA compatible. Color: Gold	-268 to 82	5 (Water Only)	5	Very Good
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. FDA compatible. Color: Light Green	-196 to 246	5	4	Good
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. FDA compatible. Color: Brown	-196 to 246	4	4	Good
GL-20 GLASS FIBER FILLED PTFE Severe dry/vacuum service. Excellent wear and extrusion resistance, and low outgassing. Color: Off White	-196 to 246	5	5	Excellent
GLMO-4 GLASS-MOLLY FILLED PTFE For severe conditions, excellent extrusion resistance. May be abrasive to soft mating materials. Color: Black	-196 to 260	5	5	Good
P-41 A PEEK based material for high temperature service. FDA compliant. Color: Beige	-57 to 316	5	5	Good

*Request TR-60A "Chemical Compatibility Chart of Bal Seal Material"

**USA - Federal Drug Administration

BAL SPRING®

Bal Seal Engineering is the original developer of the BAL Spring®. Our patented design holds the spring force nearly constant over a wide deflection range. As wear occurs to the seal jacket, the spring continues to provide the same sealing force. Spring loads are interchangeable, enabling the customer to optimize friction, sealing and life performance.



SPRING MATERIALS

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

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

OTHER ENERGIZERS

Energizer	Code	Relative Loading	Friction	Sealing	Wear	Small Dia	High Speed	Vacuum Gas	High Pressure
	LB	Light	Low	Low	Low	Yes	E	NR	G
	MB	Medium	Moderate	Moderate	Moderate	Yes	G	F	E
	HB	High	High	High	High	No	NR	G	E
	OR (o-ring)	High	High	High	High	No	NR	E	F
	SF (elastomer filled canted coil spring)	Med/Hi	High	High	High	No	NR	E	NR

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

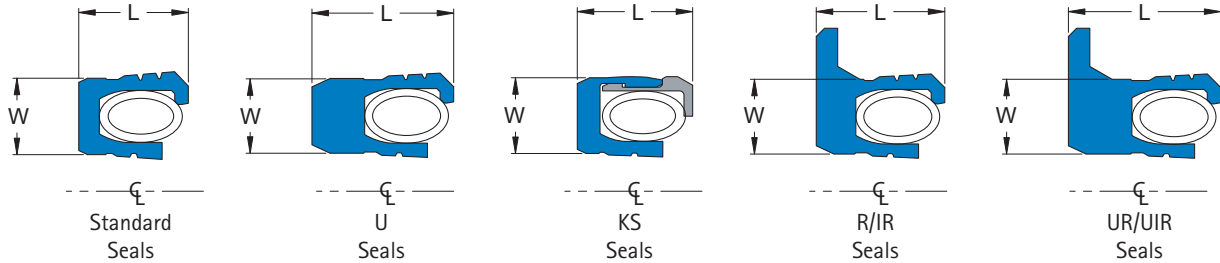
Bal Seal Part Number Information

CALL OUT: **XXX** **X** **XX** - **(ID-CS)** - **XXX** - **XXX**
STEP NO: ① ② ③ ④ ⑤ ⑥

Example: 13 4 LB-(15-2.5)-GFP-HST

<p>① Seal Design 13, 14, 15, 10, 31, 41, S31, C15, C13, C14, KS13, R13, IR14, U13, U14, U1P5, CU10, UR13 and others. Refer to Bal Seal Selection Guide page 3.</p>	<p>② Seal Cross Section 2, 1, 0, 4, 5, 6, 7, 8, and 9 Refer to Standard Cross Sections table on this page above.</p>	<p>③ Spring Force LB, MB, HB and others. Refer to page 5 for description of standard spring loads.</p>
<p>④ Size Use seal ID (metric) and seal cross section. See pages 10 and 11.</p>	<p>⑤ Seal Material T, G, GC, TA, GFPA, GFPA-HT, UPC10, UPC16, UP40, SP45, SP50, GL20, GLM04, P41 and others. Refer to Bal Seal Materials Guide on page 4.</p>	<p>⑥ Spring Material 302, 316, 316L, HST, MPN, INC, TNM, and others. Refer to page 5 for description of standard spring materials.</p>

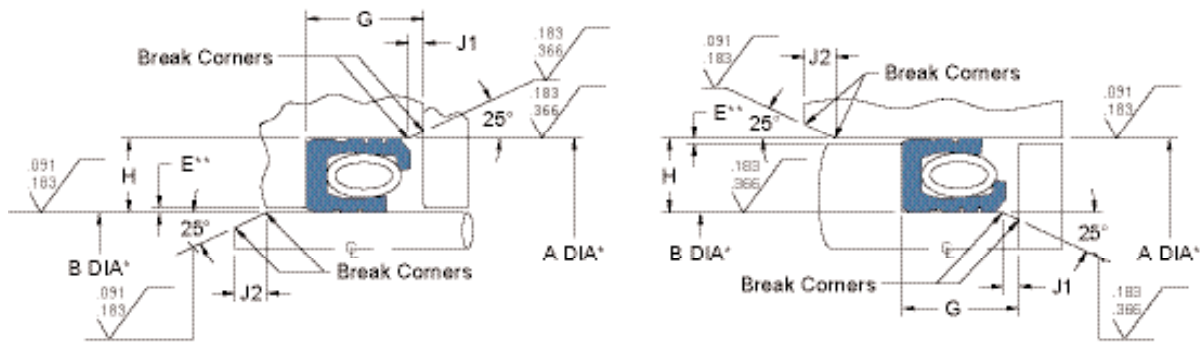
Seal Dimensions



Cross Section Code	W Nominal Cross Section	L SEAL LENGTH				
		Standard Seals	U Seals	KS Seals	R/IR Seals	UR/UIR Seals
2	0,50	0,51/0,69	1,04/1,22	NA	NA	NA
1	1,00	1,07/1,32	1,55/1,78	1,14/1,52	1,40/1,83	1,78/2,26
0	2,00	2,18/2,44	2,64/3,02	2,26/2,72	2,41/2,90	2,87/3,45
4	2,50	3,15/3,58	4,14/4,57	3,28/3,84	3,61/4,29	4,27/5,11
5	4,00	4,14/4,57	5,89/6,55	4,29/4,93	4,60/5,54	5,59/6,53
6	5,00	6,15/6,63	8,00/8,76	6,30/6,99	6,02/7,06	7,80/8,84
7	7,00	8,31/8,84	12,24/13,16	8,51/9,30	8,38/9,40	11,18/12,32
8	10,00	12,24/13,16	16,66/17,37	12,55/13,41	12,95/14,22	17,53/18,69
9	12,50	16,66/17,37	22,38/23,09	17,45/18,47	17,48/18,75	23,50/24,77

All dimensions are in millimeters.

Reciprocating/Slow Rotary—Seal Gland Dimensions

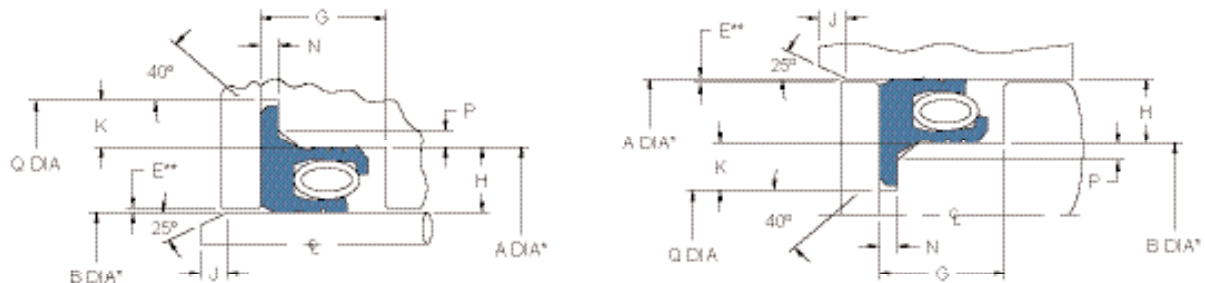


Surface Finish in μm

Cross Section Code	H Gland Height Ref.	G GLAND LENGTH		CHAMFERS LENGTH	
		Standard Seals	U Seals	J1	J2
2	0,50	0,74/0,86	1,40/1,47	0,08 \pm 0,03	
1	1,00	1,35/1,47	1,80/1,93	0,25 \pm 0,05	1,00 \pm 0,10
0	2,00	2,49/2,62	3,05/3,18	0,40 \pm 0,08	2,00 \pm 0,15
4	2,50	3,66/3,91	4,65/4,90	0,50 \pm 0,08	2,50 \pm 0,15
5	4,00	4,65/4,90	6,68/6,93	0,80 \pm 0,08	4,00 \pm 0,20
6	5,00	6,68/6,93	8,92/9,30	0,80 \pm 0,08	5,00 \pm 0,25
7	7,00	8,92/9,30	13,28/13,79	0,80 \pm 0,08	7,00 \pm 0,30
8	10,00	13,28/13,79	17,42/18,06	1,00 \pm 0,10	10,00 \pm 0,40
9	12,50	17,42/18,06	23,14/23,65	1,50 \pm 0,10	12,50 \pm 0,50

*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
		R/IR Seals	UR/UIR Seals				R/UR Seals $\pm 0,05$	IR/UIR Seals $\pm 0,05$	
1	1,00	1,91/2,41	2,34/2,84	0,30/0,33	0,30/0,43	1,22	A + 2,44	B - 2,44	1,00 \pm 0,10
0	2,00	2,97/3,48	3,51/4,01	0,30/0,33	0,43/0,58	1,73	A + 3,43	B - 3,43	2,00 \pm 0,13
4	2,50	4,34/4,85	5,16/5,66	0,48/0,51	0,71/0,89	1,80	A + 3,63	B - 3,63	2,50 \pm 0,15
5	4,00	5,59/6,10	6,58/7,09	0,66/0,69	1,02/1,24	1,96	A + 3,94	B - 3,94	4,00 \pm 0,20
6	5,00	7,11/7,62	8,92/9,42	0,79/0,81	1,45/1,70	3,12	A + 6,25	B - 6,25	5,00 \pm 0,25
7	7,00	9,52/10,03	12,42/12,93	1,12/1,14	1,75/2,03	3,89	A + 7,77	B - 7,77	7,00 \pm 0,30
8	10,00	14,35/14,86	18,82/19,33	2,24/2,29	2,03/2,34	4,88	A + 9,75	B - 9,75	10,00 \pm 0,40
9	12,00	18,87/19,38	24,89/25,40	2,24/2,28	2,34/2,62	6,10	A + 12,19	B - 12,19	12,50 \pm 0,50

*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.

All dimensions are in millimeters.

Seal Inside Diameter Graph and Suggested Shaft/Piston and Bore/Housing Tolerances

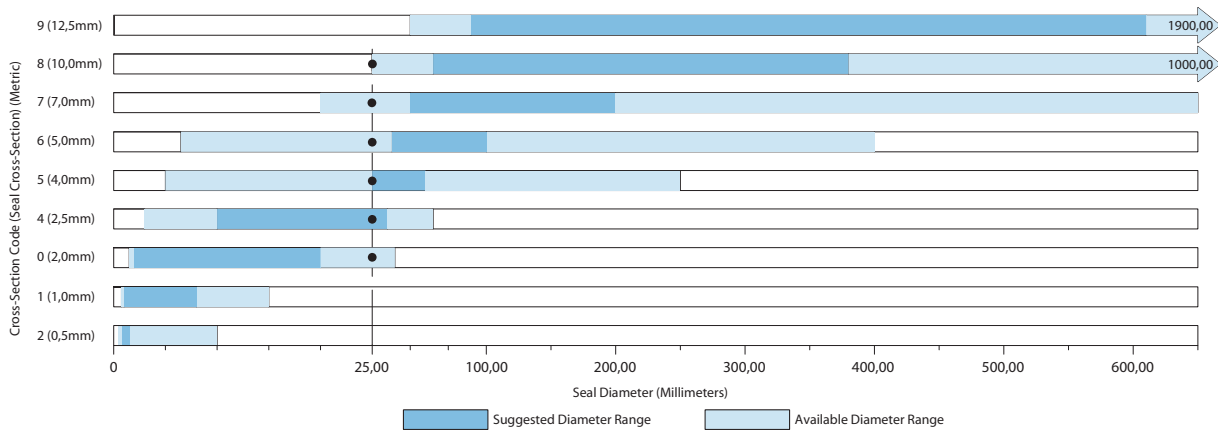
SUGGESTED STANDARD CROSS SECTIONS AND SEAL INSIDE DIAMETER CHART

Cross section range from 0,50 to 12,50 mm. Seal cross section and seal inside diameter are divided into available and suggested size ranges. Suggested sizes will generally result in better seal performance.

Cross Section Code	Nominal Cross Section	SEAL INSIDE DIAMETER SIZE RANGES			
		Available Sizes	Suggested Sizes		Available Sizes
		Min	Min	Max	Max
2	0,50	0,50	0,80	1,60	10,00
1	1,00	0,75	1,00	8,00	15,00
0	2,00	1,50	2,00	20,00	40,00
4	2,50	3,00	10,00	35,00	65,00
5	4,00	5,00	25,00	60,00	250,00
6	5,00	6,50	38,00	100,00	400,00
7	7,00	20,00	50,00	200,00	650,00
8	10,00	25,00	65,00	380,00	1000,00
9	12,50	50,00	90,00	610,00	1900,00

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 INSIDE DIAMETER AND SEAL CROSS SECTION SUGGESTIONS WITH BAL SEAL CODE



Example:

A 25,00mm seal diameter is available in cross sections 0 (2,0mm), 4 (2,5mm), 5 (4,0mm), 6 (5,0mm), 7 (7,0mm) and 8 (10,0mm)

SUGGESTED SHAFT/PISTON AND BORE/HOUSING TOLERANCES

Diameter Range	Shaft Tolerances	Housing Tolerances	Diameter Range	Shaft Tolerances	Housing Tolerances
0,50 to 5,00	+0,000 / -0,010	+0,010 / -0,000	50,01 to 100,00	+0,00 / -0,05	+0,05 / -0,00
5,01 to 25,00	+0,000 / -0,025	+0,025 / -0,000	100,01 to 150,00	+0,00 / -0,08	+0,08 / -0,00
25,01 to 50,00	+0,000 / -0,040	+0,040 / -0,000	150,01 to 400,00	+0,00 / -0,10	+0,10 / -0,00

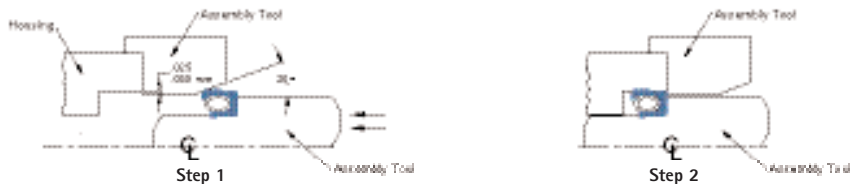
All dimensions are in millimeters.
(50-606-1)

Installation Configurations

To reduce the risk of seal damage during installation into a housing or bore without an adequate lead chamfer, we suggest using assembly tools like those shown in the illustrations. The plastic assembly tools guide the seal into the bore, and provide a suitable lead-in taper.

Collet assembly tools gradually stretch the seal over the piston and into the gland. For details on assembly procedures and limitations, request Bal Seal 6.2 literature. At the user's request, Bal Seal Engineering Company will supply dimensional information for fabricating of assembly tools for specific applications.

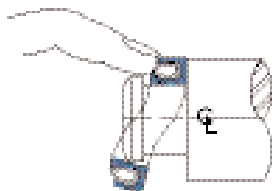
Assembly into Housing



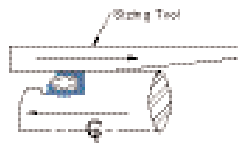
Stepped Glands, Manual Assembly



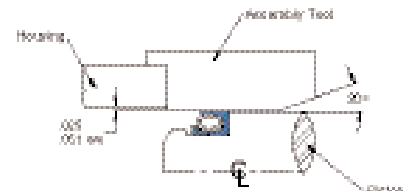
MINIMUM ID FOR MANUAL ASSEMBLY FOR 1/4H PISTON	
Cross Section Code	1/4 H
0	8,00
4	12,00
5	16,00
6	29,00



Insert large diameter seal in piston groove with fingers



Place sizing tool over the seal and leave overnight



Remove sizing tool and assemble piston into the bore

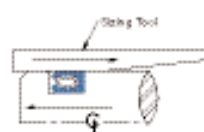
Stepped and Solid Glands, Tool Assembly



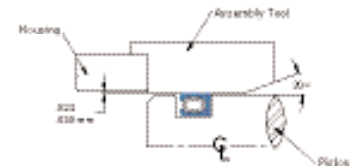
MINIMUM ID FOR TOOL ASSEMBLY FOR 1/4, 1/2 AND SOLID PISTON			
Cross Section Code	1/4 H	1/2 H	SOLID (FULL H)
0	6,00	8,00	13,00
4	8,00	10,00	16,00
5	20,00	23,00	26,00
6	25,00	32,00	39,00



Using a seal assembly adapter, push the seal into the piston gland with an assembly collet



Place sizing tool over the seal and leave overnight



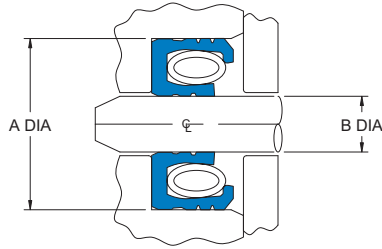
Remove sizing tool and assemble piston into the bore

Other specialized assembly methods are available. Consult our Applications Engineering Team. Request TR-6.2 "Designing and Assembly of Bal Seals into Piston Groove"

BORE/HOUSING MOUNTED

SEAL DESIGNS*

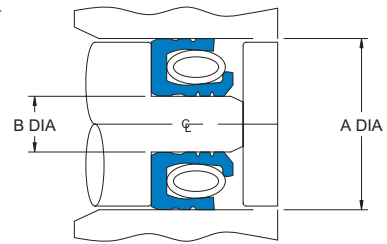
- 13 U13
- 15 U15
- 10 U10
- 31 U31
- C13 CU13
- R13 UR13
- KS13



SHAFT/PISTON MOUNTED

SEAL DESIGNS*

- 14 U14
- 15 U15
- 10 U10
- 41 U41
- OC14 OCU14
- IR14 UIR14



SIZE No.	B Diameter	A Diameter
C13, CU13 Seals Only 0,5-mm Nominal Cross Section Cross Section Code 2		
(0,5-0,5)	0,50	1,50
(0,6-0,5)	0,60	1,60
(0,7-0,5)	0,70	1,70
(0,8-0,5)	0,80	1,80
(0,9-0,5)	0,90	1,90
(1,0-0,5)	1,00	2,00
(1,5-0,5)	1,50	2,50
C13, CU13 Seals Only 1.0-mm Nominal Cross Section Cross Section Code 1		
(0,7-1)	0,70	2,70
(1,0-1)	1,00	3,00
(1,5-1)	1,50	3,50
All Seal Designs 1,0-mm Nominal Cross Section Cross Section Code 1		
(2-1)	2,00	4,00
(3-1)	3,00	5,00
(4-1)	4,00	6,00
(5-1)	5,00	7,00
(6-1)	6,00	8,00
(7-1)	7,00	9,00
(8-1)	8,00	10,00
(9-1)	9,00	11,00
(10-1)	10,00	12,00
(12-1)	12,00	14,00
(14-1)	14,00	16,00
(15-1)	15,00	17,00
C13, CU13 Seals Only 2,0-mm Nominal Cross Section Cross Section Code 0		
(1-2)	1,00	5,00
(1,5-2)	1,50	5,50
(2-2)	2,00	6,00
(2,5-2)	2,50	6,50

SIZE No.	B Diameter	A Diameter
All Seal Designs 2,0-mm Nominal Cross Section Cross Section Code 0		
(2-2)	2,00	6,00
(3-2)	3,00	7,00
(4-2)	4,00	8,00
(5-2)	5,00	9,00
(6-2)	6,00	10,00
(7-2)	7,00	11,00
(8-2)	8,00	12,00
(9-2)	9,00	13,00
(10-2)	10,00	14,00
(11-2)	11,00	15,00
(12-2)	12,00	16,00
(13-2)	13,00	17,00
(14-2)	14,00	18,00
(15-2)	15,00	19,00
(16-2)	16,00	20,00
(17-2)	17,00	21,00
(18-2)	18,00	22,00
(19-2)	19,00	23,00
(20-2)	20,00	24,00
(21-2)	21,00	25,00
(22-2)	22,00	26,00
(23-2)	23,00	27,00
(24-2)	24,00	28,00
(25-2)	25,00	29,00
(26-2)	26,00	30,00
(27-2)	27,00	31,00
(28-2)	28,00	32,00
(29-2)	29,00	33,00
(30-2)	30,00	34,00
(31-2)	31,00	35,00
(32-2)	32,00	36,00
to	to	to
(40-2)	40,00	44,00

SIZE No.	B Diameter	A Diameter
All Seal Designs 2,5-mm Nominal Cross Section Cross Section Code 4		
(3-2,5)	3,00	8,00
(4-2,5)	4,00	9,00
(6-2,5)	6,00	11,00
(8-2,5)	8,00	13,00
(10-2,5)	10,00	15,00
(12-2,5)	12,00	17,00
(14-2,5)	14,00	19,00
(16-2,5)	16,00	21,00
(18-2,5)	18,00	23,00
(20-2,5)	20,00	25,00
(22-2,5)	22,00	27,00
(24-2,5)	24,00	29,00
(26-2,5)	26,00	31,00
(28-2,5)	28,00	32,00
(30-2,5)	30,00	35,00
(32-2,5)	32,00	37,00
(34-2,5)	34,00	39,00
(36-2,5)	36,00	41,00
(38-2,5)	38,00	43,00
(40-2,5)	40,00	45,00
(42-2,5)	42,00	47,00
(44-2,5)	44,00	49,00
(46-2,5)	46,00	51,00
(48-2,5)	48,00	53,00
(50-2,5)	50,00	55,00
(52-2,5)	52,00	57,00
(54-2,5)	54,00	59,00
(56-2,5)	56,00	61,00
(58-2,5)	58,00	63,00
(60-2,5)	60,00	65,00
(62-2,5)	62,00	67,00
to	to	to
(65-2,5)	65,00	70,00

All dimensions are in millimeters.
See page 8 for suggested shaft/piston and bore/housing tolerances.
*Other seal designs are available, contact our Applications Engineering Team for more information.

Reciprocating/Slow Rotary—Common Industrial Sizes and Gland Diameters

SIZE No.	B Diameter	A Diameter
All Seal Designs 4,0-mm Nominal Cross Section Cross Section Code 5		
(5-4)	5,00	13,00
(6-4)	6,00	14,00
(8-4)	8,00	16,00
(10-4)	10,00	18,00
(12-4)	12,00	20,00
(14-4)	14,00	22,00
(16-4)	16,00	24,00
(18-4)	18,00	26,00
(20-4)	20,00	28,00
(22-4)	22,00	30,00
(24-4)	24,00	32,00
(26-4)	26,00	34,00
(28-4)	28,00	36,00
(30-4)	30,00	38,00
(32-4)	32,00	40,00
(34-4)	34,00	42,00
(36-4)	36,00	44,00
(38-4)	38,00	46,00
(40-4)	40,00	48,00
(42-4)	42,00	50,00
(44-4)	44,00	52,00
(46-4)	46,00	54,00
(48-4)	48,00	56,00
(50-4)	50,00	58,00
(52-4)	52,00	60,00
(54-4)	54,00	62,00
(56-4)	56,00	64,00
(58-4)	58,00	66,00
(60-4)	60,00	68,00
(62-4)	62,00	70,00
(64-4)	64,00	72,00
(66-4)	66,00	74,00
(68-4)	68,00	76,00
(70-4)	70,00	78,00
(72-4)	72,00	80,00
(74-4)	74,00	82,00
(76-4)	76,00	84,00
(80-4)	80,00	88,00
(100-4)	100,00	108,00
(120-4)	120,00	128,00
(140-4)	140,00	148,00
(160-4)	160,00	168,00
(180-4)	180,00	188,00
(200-4)	200,00	208,00
to	to	to
(250-4)	250,00	258,00

SIZE No.	B Diameter	A Diameter
All Seal Designs 5,0-mm Nominal Cross Section Cross Section Code 6		
(6,5-5)	6,50	16,50
(8-5)	8,00	18,00
(10-5)	10,00	20,00
(20-5)	20,00	30,00
(40-5)	40,00	50,00
(60-5)	60,00	70,00
(80-5)	80,00	90,00
(100-5)	100,00	110,00
(120-5)	120,00	130,00
(140-5)	140,00	150,00
(160-5)	160,00	170,00
(180-5)	180,00	190,00
(200-5)	200,00	210,00
(220-5)	220,00	230,00
(240-5)	240,00	250,00
(260-5)	260,00	270,00
(280-5)	280,00	290,00
(300-5)	300,00	310,00
(400-5)	400,00	410,00
All Seal Designs 7,0-mm Nominal Cross Section Cross Section Code 7		
(20-7)	20,00	34,00
(40-7)	40,00	54,00
(60-7)	60,00	74,00
(80-7)	80,00	94,00
(100-7)	100,00	114,00
(120-7)	120,00	134,00
(140-7)	140,00	154,00
(160-7)	160,00	174,00
(180-7)	180,00	194,00
(200-7)	200,00	214,00
(220-7)	220,00	234,00
(240-7)	240,00	254,00
(260-7)	260,00	274,00
(280-7)	280,00	294,00
(300-7)	300,00	314,00
(320-7)	320,00	334,00
(340-7)	340,00	354,00
(360-7)	360,00	374,00
(380-7)	380,00	394,00
(400-7)	400,00	414,00
(500-7)	500,00	514,00
(600-7)	600,00	614,00
to	to	to
(650-7)	650,00	664,00

SIZE No.	B Diameter	A Diameter
All Seal Designs 10,0-mm Nominal Cross Section Cross Section Code 8		
(25-10)	25,00	45,00
(30-10)	30,00	50,00
(40-10)	40,00	60,00
(50-10)	50,00	70,00
(60-10)	60,00	80,00
(70-10)	70,00	90,00
(80-10)	80,00	110,00
(90-10)	90,00	130,00
(100-10)	100,00	150,00
(150-10)	150,00	170,00
(200-10)	200,00	220,00
(300-10)	300,00	320,00
(400-10)	400,00	420,00
(500-10)	500,00	520,00
(600-10)	600,00	620,00
(700-10)	700,00	720,00
(800-10)	800,00	820,00
(900-10)	900,00	920,00
(1000-10)	1000,00	1020,00
All Seal Designs 12,5-mm Nominal Cross Section Cross Section Code 9		
(50-12,5)	50,00	75,00
(60-12,5)	60,00	85,00
(70-12,5)	70,00	95,00
(80-12,5)	80,00	105,00
(90-12,5)	90,00	115,00
(100-12,5)	100,00	125,00
(200-12,5)	200,00	225,00
(300-12,5)	300,00	325,00
(400-12,5)	400,00	425,00
(500-12,5)	500,00	525,00
(600-12,5)	600,00	625,00
(700-12,5)	700,00	725,00
(800-12,5)	800,00	825,00
(900-12,5)	900,00	925,00
(1000-12,5)	1000,00	1025,00
(1100-12,5)	1100,00	1125,00
(1200-12,5)	1200,00	1225,00
(1300-12,5)	1300,00	1325,00
(1400-12,5)	1400,00	1425,00
(1500-12,5)	1500,00	1525,00
(1600-12,5)	1600,00	1625,00
(1700-12,5)	1700,00	1725,00
(1800-12,5)	1800,00	1825,00
(1900-12,5)	1900,00	1925,00

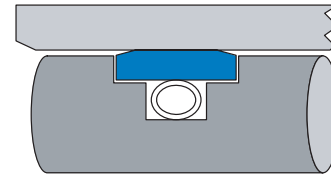
All dimensions are in millimeters.
See page 8 for suggested shaft/piston and bore/housing tolerances.
Other sizes up to 1900,00-mm are available. Contact our Applications Engineering Team for more information.

BAL SEAL GUIDE RINGS

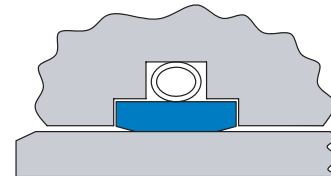
Bal Seal Guide Rings Give Piston Support

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.



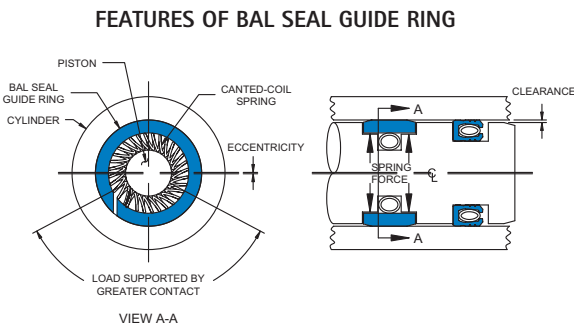
**PW GUIDE RING
PISTON MOUNTED**



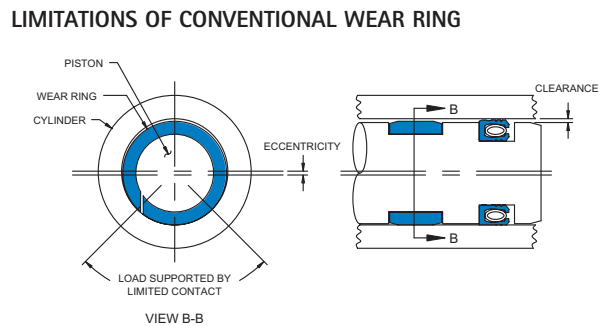
**HW GUIDE RING
HOUSING MOUNTED**

PISTON SUPPORT

Bal Seal Guide Rings vs. Conventional Wear Rings



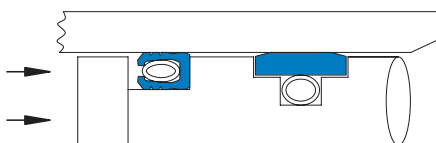
- Supports piston weight
- Reduces bearing load
- Reduces cylinder scoring
- Minimizes side loading
- Compensates for wear



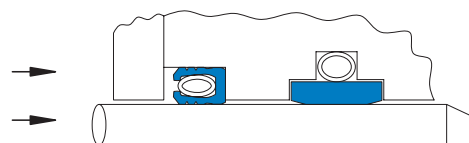
- Overcome by weight of piston
- Increases stress
- Allows metal-to-metal contact
- Succumbs to side loading
- Accelerates wear

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**

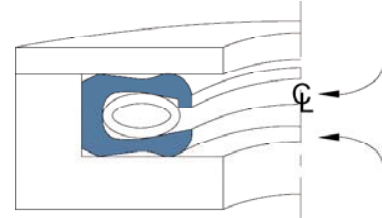
Static Seals

Bal Seal static 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.

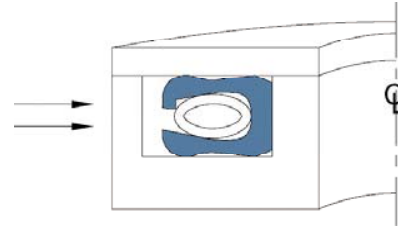
Seal Designs:
S1, S2, US1, US2



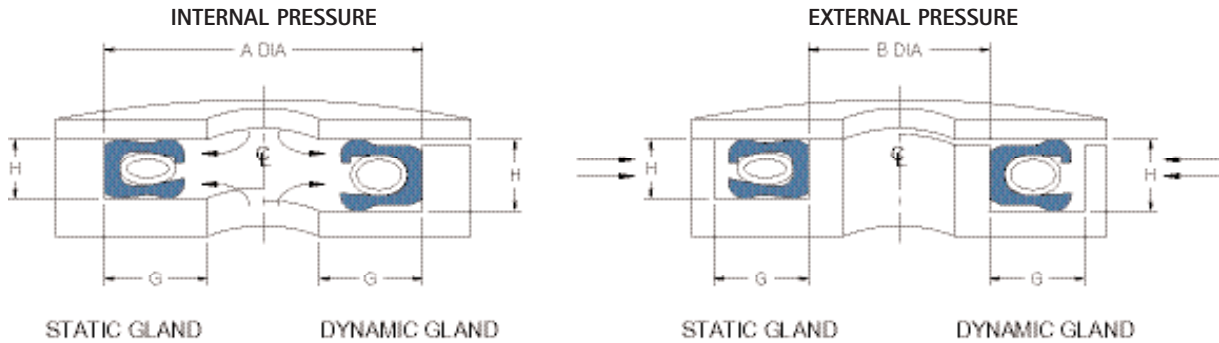
EXTERNAL PRESSURE

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, UIS1, UIS2



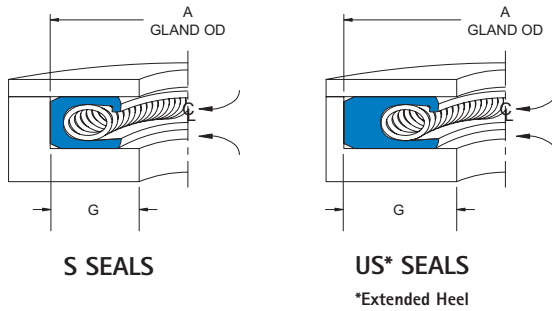
FACE SEAL GLAND DIMENSIONS



Cross Section Code	H GLAND HEIGHT		G GLAND LENGTH	
	Static Service	Dynamic Service	S/IS Seals Min.	US/UIS Seals Min.
0	1,91/1,96	2,13/2,18	2,62	3,76
4	2,39/2,44	2,92/2,97	3,76	4,75
5	3,89/3,94	4,65/4,70	4,75	6,73
6	4,93/4,98	6,33/6,38	6,73	8,92
7	6,81/6,86	8,18/8,23	8,92	13,13
8	9,22/9,27	11,89/11,94	13,13	17,78
9	12,29/12,34	15,09/15,14	17,78	23,15

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

Static Seals—Internal Pressure

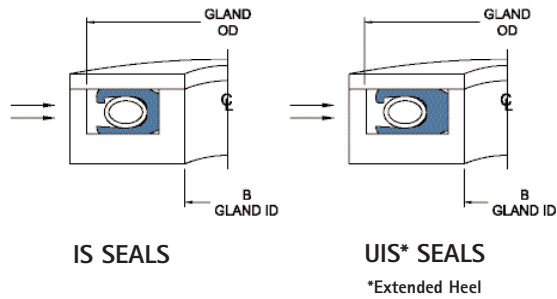


SIZE No.	A Gland OD	Gland ID	
		S Seals	US Seals
2,0-mm Nominal Cross Section Cross Section Code 0			
	+0,025 -0,000	Max	Max
(8-2)	8,00	2,66	
(9-2)	9,00	3,66	
(10-2)	10,00	4,66	
(11-2)	11,00	5,66	3,48
(12-2)	12,00	6,66	4,48
2,5-mm Nominal Cross Section Cross Section Code 4			
	+0,025 -0,000	Max	Max
(25-2,5)	25,00	17,12	15,50
(30-2,5)	30,00	22,12	20,50
(35-2,5)	35,00	27,12	25,50
(40-2,5)	40,00	32,12	30,50
	+0,040 -0,000	Max	Max
(45-2,5)	45,00	37,12	35,50
(50-2,5)	50,00	42,12	40,50
(55-2,5)	55,00	47,12	45,50
(60-2,5)	60,00	52,12	50,50
4,0-mm Nominal Cross Section Cross Section Code 5			
	+0,025 -0,000	Max	Max
(30-4)	30,00	20,44	1653
(35-4)	35,00	25,44	2153
(40-4)	40,00	30,44	2653
	+0,040 -0,000	Max	Max
(45-4)	45,00	35,44	31,53
(50-4)	50,00	40,44	36,53
(60-4)	60,00	50,44	46,53
(65-4)	65,00	55,44	51,53
(70-4)	70,00	60,44	56,53
(75-4)	75,00	65,44	61,53

SIZE No.	A Gland OD	Gland ID	
		S Seals	US Seals
5,0-mm Nominal Cross Section Cross Section Code 6			
	+0,08 -0,00	Max	Max
(80-5)	80,00	66,53	62,22
(90-5)	90,00	76,53	72,22
(95-5)	95,00	81,53	77,22
(100-5)	100,00	86,53	82,22
	+0,10 -0,00	Max	Max
(110-5)	110,00	96,53	92,22
(120-5)	120,00	106,53	102,22
(125-5)	125,00	111,53	107,22
7,0-mm Nominal Cross Section Cross Section Code 7			
	+0,10 -0,00	Max	Max
(100-7)	100,00	82,22	73,73
(110-7)	110,00	92,22	83,73
(115-7)	115,00	97,22	88,73
(120-7)	120,00	102,22	93,73
(125-7)	125,00	107,22	98,73
	+0,15 -0,00	Max	Max
(130-7)	130,00	112,22	103,73
(135-7)	135,00	117,22	108,73
(140-7)	140,00	122,22	113,73
(150-7)	150,00	132,22	123,73
10,0-mm Nominal Cross Section Cross Section Code 8			
	+0,30 -0,00	Max	Max
(175-10)	175,00	148,73	139,94
(200-10)	200,00	173,73	164,94
(300-10)	300,00	273,73	264,94
(325-10)	325,00	298,73	289,94
12,5-mm Nominal Cross Section Cross Section Code 9			
	+0,30 -0,00	Max	Max
(350-12,5)	350,00	314,94	303,77
(500-12,5)	500,00	464,94	453,77
(1000-12,5)	1000,00	964,94	953,77
(1500-12,5)	1500,00	1464,94	1453,77

All dimensions are in millimeters. Because of space limitations, only the most common sizes are shown. Other sizes up to 1900,00 mm are available. Contact our Applications Engineering Team for more information.

Static Seals—External Pressure



SIZE No.	B Gland ID	Gland OD	
		IS Seals	UIS Seals
2,0-mm Nominal Cross Section Cross Section Code 0			
	+0000 -0025	Min	Min
(5-2)	5,00	10,34	12,52
(8-2)	8,00	13,34	15,52
(10-2)	10,00	15,34	17,52
(12-2)	12,00	17,34	19,52
(14-2)	14,00	19,34	21,52
2,5-mm Nominal Cross Section Cross Section Code 4			
	+0,000 -0,025	Min	Min
(16-2,5)	16,00	23,88	25,50
(20-2,5)	20,00	27,88	29,50
(25-2,5)	25,00	32,88	34,50
(30-2,5)	30,00	37,88	39,50
(40-2,5)	40,00	47,88	49,50
	+0,000 -0,040	Min	Min
(50-2,5)	50,00	57,88	59,50
(55-2,5)	55,00	62,88	64,50
(60-2,5)	60,00	67,88	69,50
4,0-mm Nominal Cross Section Cross Section Code 5			
	+0000 -0025	Min	Min
(30-4)	3000	39,55	43,47
(35-4)	3500	44,55	48,47
(40-4)	4000	49,55	53,47
	+0000 -0040	Min	Min
(45-4)	45,00	54,55	58,47
(50-4)	50,00	59,55	63,47
(55-4)	55,00	64,55	68,47
(60-4)	60,00	69,55	78,47
(65-4)	65,00	74,55	78,47
(75-4)	75,00	84,55	88,47

SIZE No.	B Gland ID	Gland OD	
		IS Seals	UIS Seals
5,0-mm Nominal Cross Section Cross Section Code 6			
	+0,00 -0,08	Min	Min
(80-5)	80,00	93,47	97,78
(90-5)	90,00	103,47	107,78
(95-5)	95,00	108,47	112,78
(100-5)	100,00	113,47	117,78
	+0,00 -0,10	Min	Min
(110-5)	110,00	123,47	127,22
(120-5)	120,00	133,47	137,22
(125-5)	125,00	138,47	142,22
7,0-mm Nominal Cross Section Cross Section Code 7			
	+0,00 -0,10	Min	Min
(100-7)	100,00	82,78	73,27
(110-7)	110,00	92,78	83,27
(115-7)	115,00	97,78	88,27
(120-7)	120,00	102,78	93,27
(125-7)	125,00	107,78	98,27
	+0,00 -0,15	Min	Min
(130-7)	130,00	112,78	103,27
(135-7)	135,00	117,78	108,27
(140-7)	140,00	122,78	113,27
(150-7)	150,00	16778	123,27
10,0-mm Nominal Cross Section Cross Section Code 8			
	+0,30 -0,00	Min	Min
(175-10)	175,00	201,27	210,06
(200-10)	200,00	226,27	235,06
(300-10)	300,00	326,27	335,06
(500-10)	500,00	526,27	535,06
12,5-mm Nominal Cross Section Cross Section Code 9			
	+0,30 -0,00	Min	Min
(350-12,5)	350,00	385,06	396,23
(750-12,5)	750,00	785,06	796,23
(1000-12,5)	1000,00	1035,06	1046,23
(1750-12,5)	1750,00	1785,06	1453,23

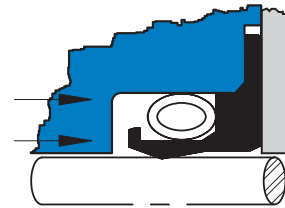
All dimensions are in millimeters.
Because of space limitations, only the most common sizes are shown. Other sizes up to 1900,00 mm are available. Contact our Applications Engineering Team for more information.



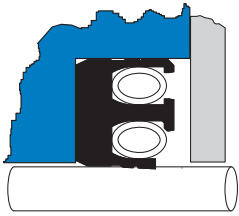
High Pressure Seal with Tapered Backup



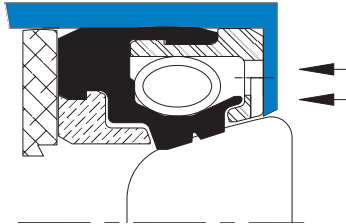
Bi-directional at Low Pressure



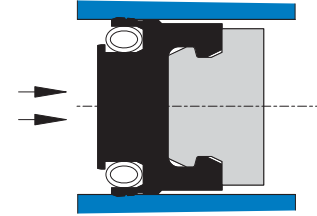
Cryogenic, Very Low Pressure



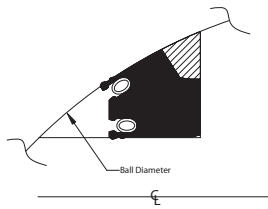
Double Spring Seal



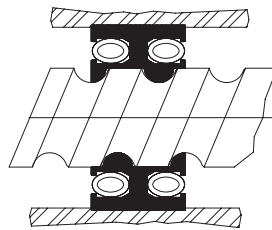
Anti-Blowout Seal



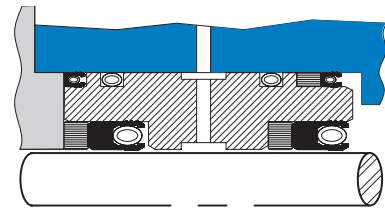
Piston Tip Seal



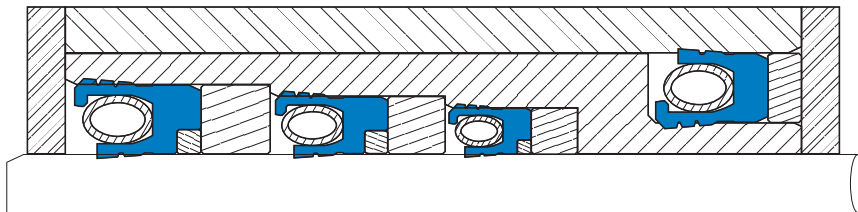
Ball Valve Seal



Ball Screw Seal

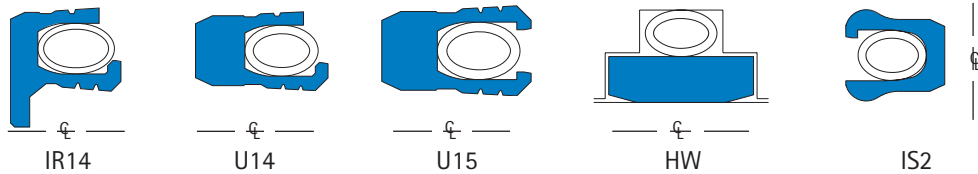
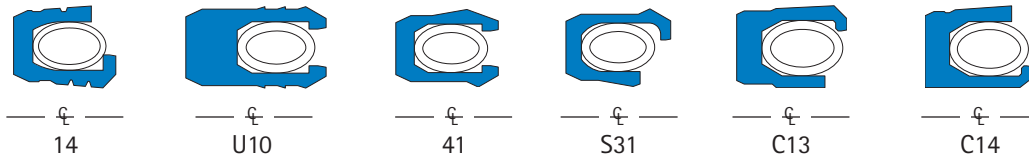


Bearing-Seal Package

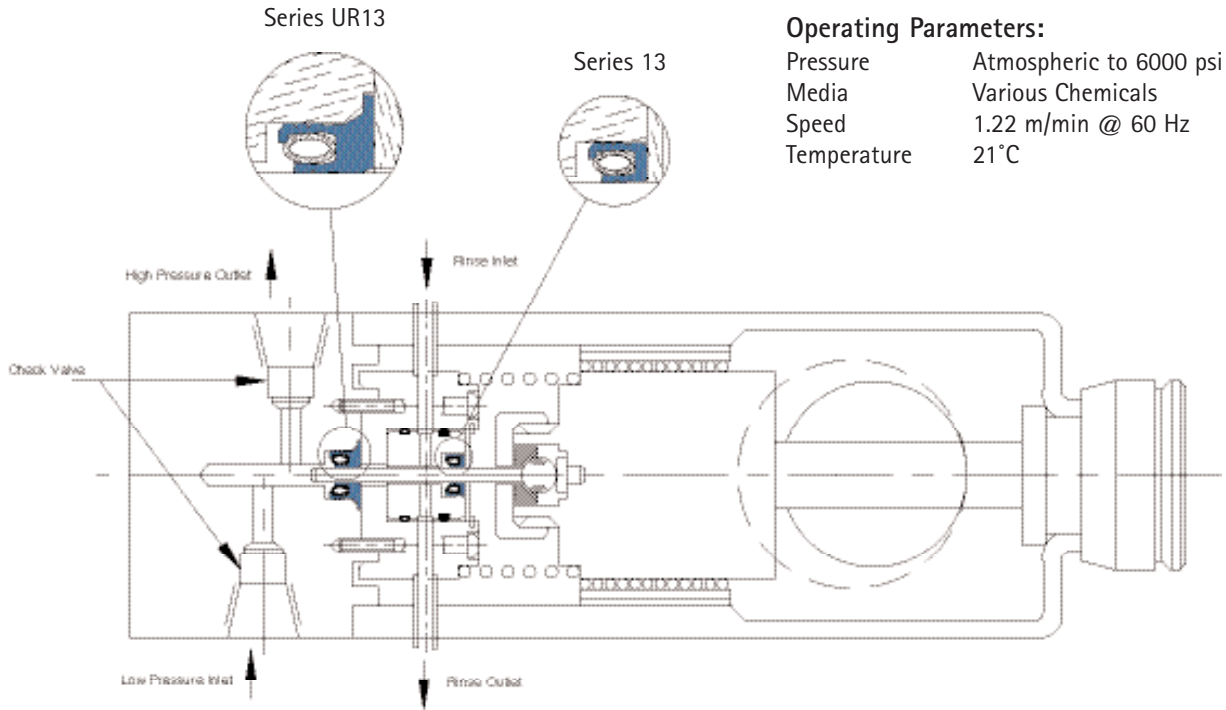


High Pressure Cartridge Assembly

Bal Seal Design Selection Guide (continued from page 3)



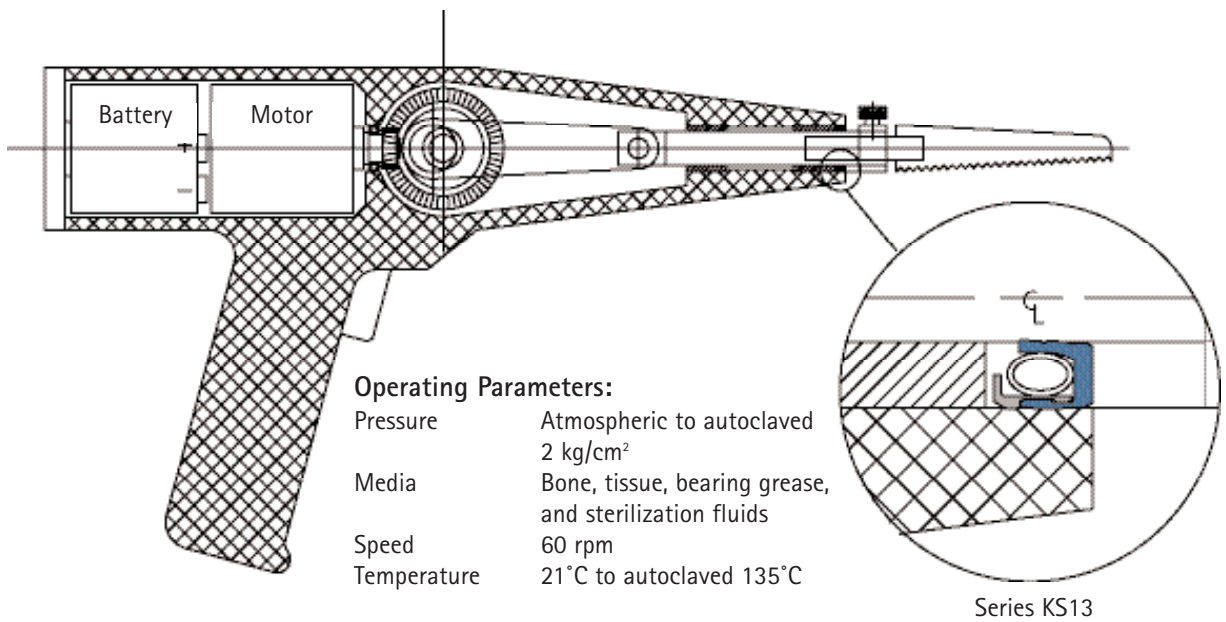
HPLC Plunger Pump



Operating Parameters:

Pressure	Atmospheric to 6000 psi
Media	Various Chemicals
Speed	1.22 m/min @ 60 Hz
Temperature	21°C

Surgical Saw



Operating Parameters:

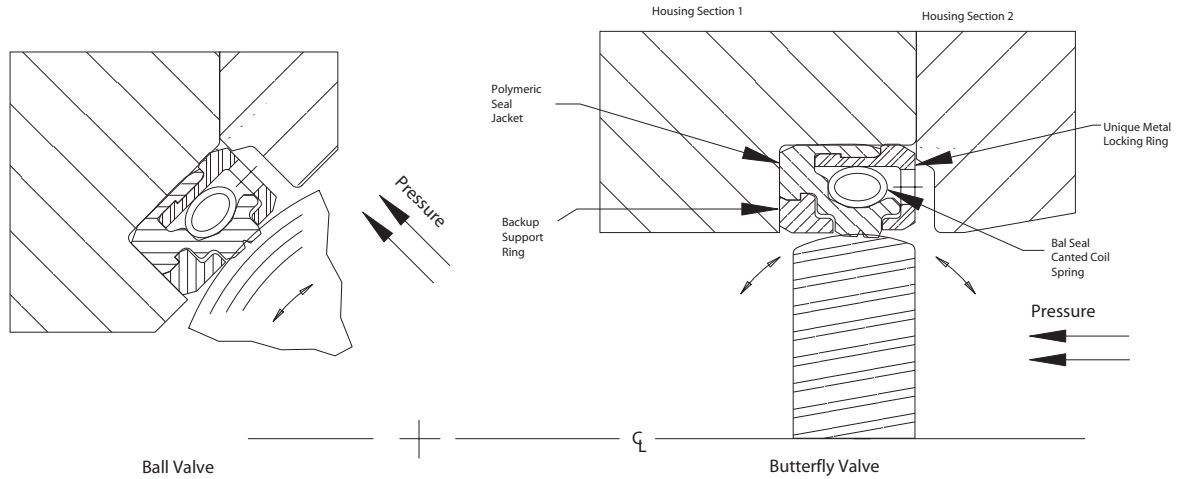
Pressure	Atmospheric to autoclaved 2 kg/cm ²
Media	Bone, tissue, bearing grease, and sterilization fluids
Speed	60 rpm
Temperature	21°C to autoclaved 135°C

Series KS13

Anti-blowout Seal Retained in a Split Housing Gland

Operating Parameters:

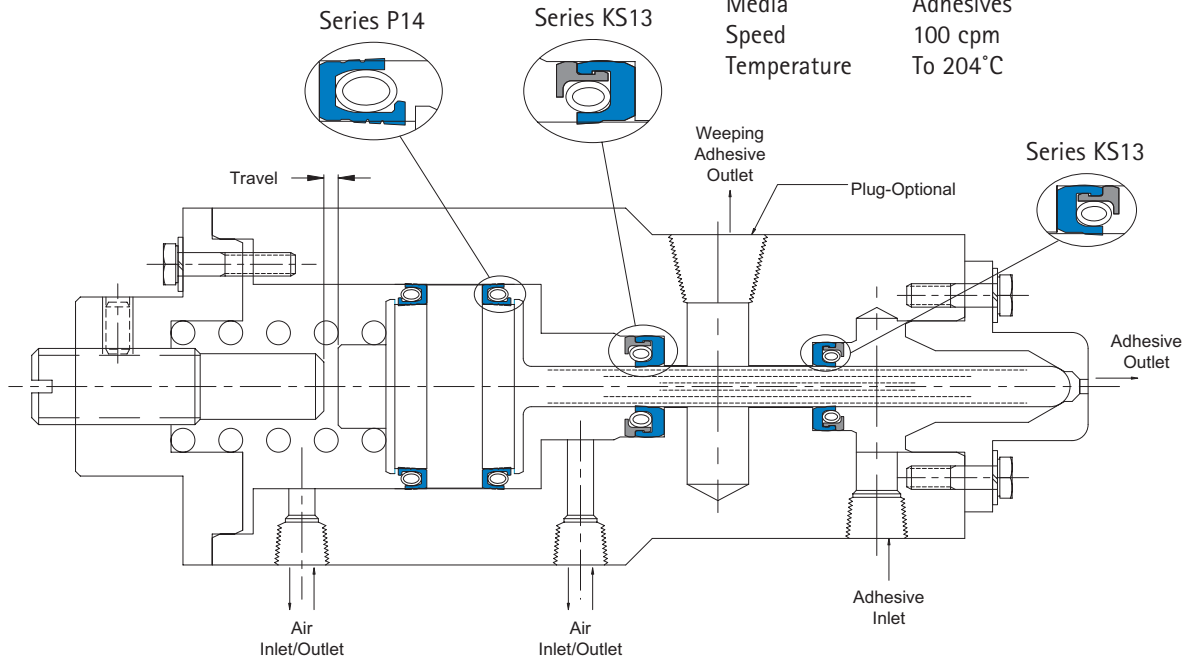
Pressure	Vacuum to 200 kg/cm ²
Media	Liquids, Gases
Service	static, linear travel, rotation
Temperature	21 to 149°C



Hot Melt Adhesive Dispensing Valves

Operating Parameters:

Pressure	To 68 kg/cm ²
Media	Adhesives
Speed	100 cpm
Temperature	To 204°C





DM-5 Rotary Bal Seal
DM-5m Metric Rotary Bal Seal



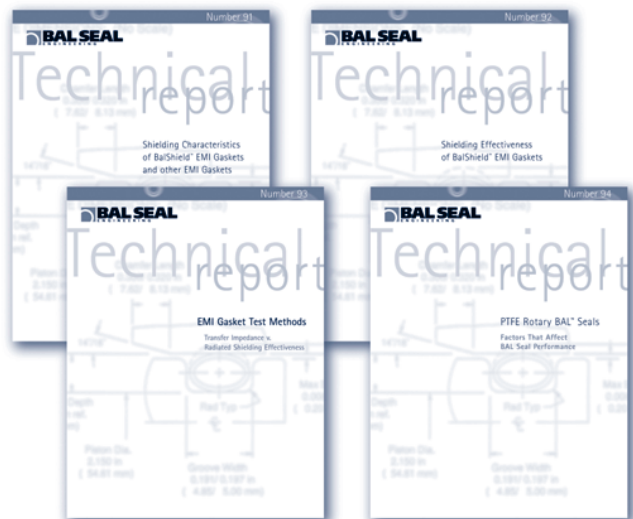
DM-7 BalContact Springs
Current carrying contact elements



DM-8 BalShield EMI Gaskets
For EMI/RFI shielding and grounding

Technical Reports and Product Flyers

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