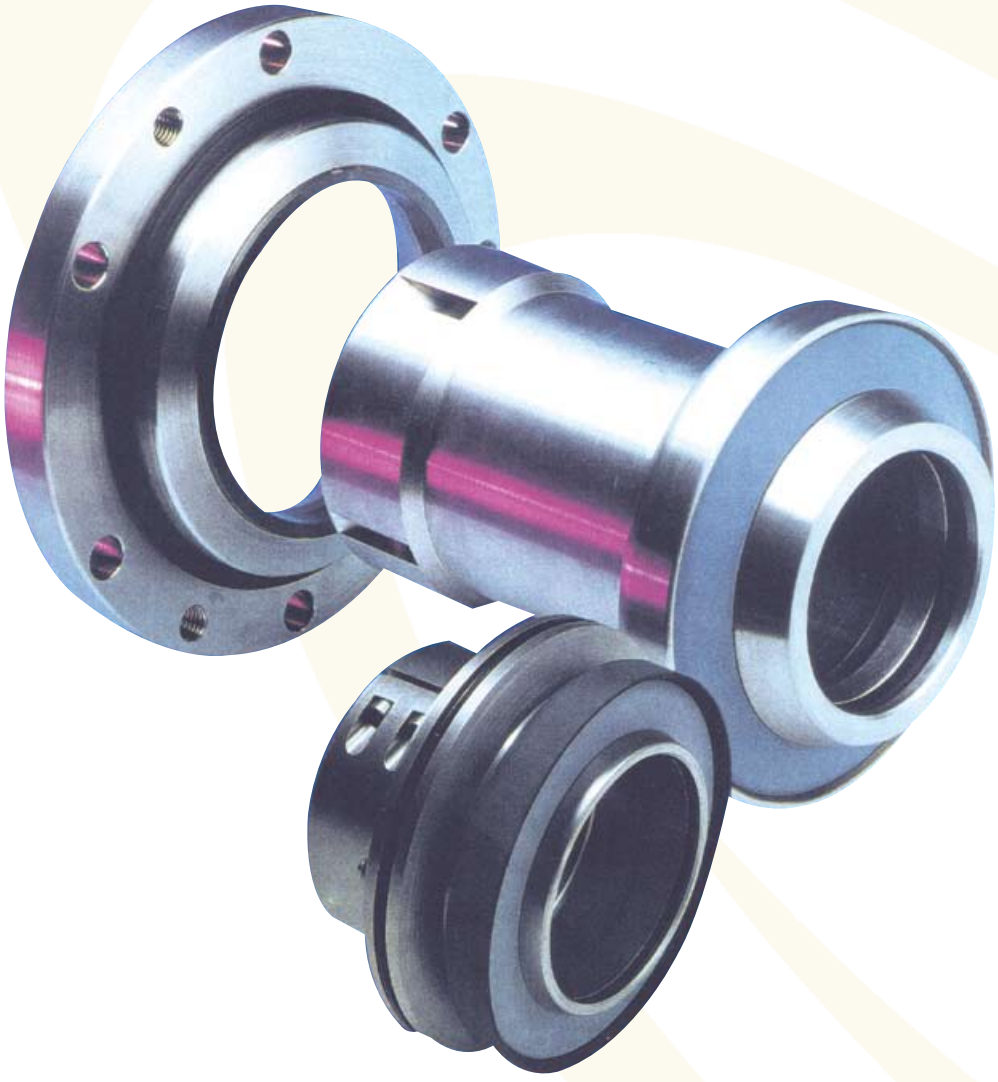
GARLOCK KLOZURE®

GPA Seal Catalog



Garlock Klozure®
HIGH-PERFORMANCE DYNAMIC SEALS
an EnPro Industries company

Alumina Processing

In the alumina production process, the bauxite and hydrated alumina in suspension are pumped over long distances by very large slurry pumps. Stuffing boxes are the most common type of barrier between the process and the atmosphere used on these pumps and other rotating equipment such as mixers and agitators. Stuffing boxes require continuous water flushing for cooling and cleaning, a very expensive process which generates costs quite often overlooked in cost analysis; further the extraneous flush water must be removed from the pumped media and environment if leaks occur. GPA® seals do not require flushing, are environmentally friendly, and reduce operating costs.

Stuffing boxes have a limited life expectancy, experiencing frequent outage and requiring continuous monitoring by maintenance personnel. Frequent leakage, splashing, and spilling of suspensions generate local pollution which can sometimes cause serious damage to pump shafts and bearings leading to premature failures. GPA® seals, after proper set up, can be operational without any monitoring for months.

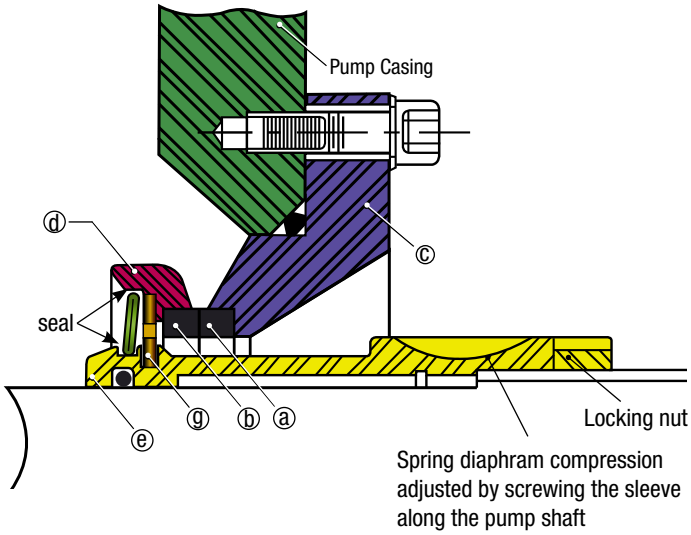
Unlike other mechanical seals, the GPA® does not clog or wear quickly. GPA® seals have acquired an unequaled reputation in alumina refineries throughout the world. The GPA® key features are a simple, sturdy, proven design and cost effectiveness.

Other Applications

Other industries faced with similar problems related to pumping abrasive, corrosive, clogging, or crystallizing fluids have successfully used GPA® seals for both slurry and liquors. Applications include Phosphoric acid for fertilizers, Cellulose, Pulp and Paper, Calcium carbonate, Coal mining, Sugar refining, Limestone for cement manufacturing, and the mining and processing of Zinc, Lead, Nickel and Gold.

GPA® seals can be adapted to almost all commercially available centrifugal pumps, mixers, agitators, drilling heads and other similar equipment. Our engineering staff is able to direct all modifications required to the standard stuffing box, and the retrofitting of equipment in the field.

Description



Operating Parameters

Temperature (Min/Max): 32-310ºF / 0-160ºC
Pressure: Up to 300 psi / 20 bar
Shaft Size: 0.788" to 7.085" / 20 to 180 mm
Solid Content: Up to 70 Oz / GAL or 500 gr/L
Shaft Speed: Up to 50 ft/sec or 15 m/sec

GPA® Seals: Simplicity and Precision

The GPA® seal is basically comprised of two components: The Fixed Ring (a) inserted in a housing (c) integral with the pump body. The Rotating Seal Sleeve Assembly (RSSAl consisting of a rotating ring) (b) inserted in a housing (d). Special drive rings (g) force the rotating housing to rotate integral to the seal sleeve (e). The spring diaphragm or membrane (f) connecting the rotating ring to the sleeve has three key functions:

- Acts as a static seal between the seal sleeve and the rotating housing
- Ensures consistent load between the fixed and rotating rings
- Aligns the housing to ensure that the rotation is perfectly parallel to the shaft and perpendicular to the shaft axis

As shown on the diagram, there is adequate clearance between the outside of the seal sleeve and the inside of the rotating housing to prevent any risks of clogging of the membrane and damage by loose crystals. A water flush port can be added on all seal types if desired.

Figure 1

The GPA® was the first mechanical seal specifically designed to handle highly abrasive slurries. GPA® seals are very forgiving because of their simple design. There are currently two options available:

Threaded type, where the sleeve is threaded on one end, allowing the compression on the spring diaphragm to be adjusted precisely by moving it along the mating thread on the shaft or shaft sleeve. The threaded type allows for some fine tuning in the field. (Figure 1)

Cartridge type, which is preset at the factory and can be installed without further adjustment. It does not require special machining of the shaft or shaft sleeve for installation. The ease of installation of the cartridge type seal makes it ideal for the first time user. As your maintenance personnel become familiar with the operation of the GPA® seal, the threaded type should be considered. (Figure 2)

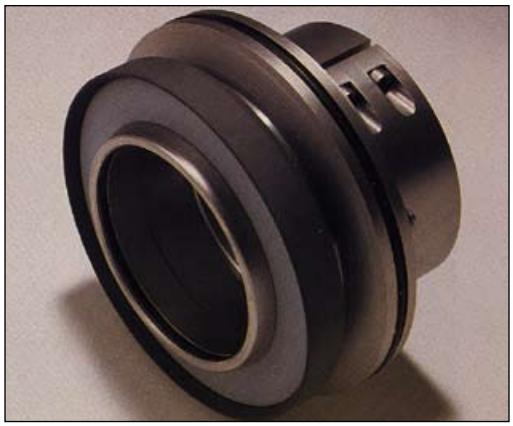


Figure 2

Materials

Depending on the process and the fluid to be pumped, the Garlock Klozure engineering staff will assist you in selecting the best materials for the following key components:

ROTATING and FIXED RING INSERTS (seal faces):

- U5: Tungsten carbide with Cobalt
- U6: Tungsten carbide with Nickel
- U8: Silicon Carbide
- C4: Siliconized Graphite

These inserts are thermally fit directly into the rings providing a strong mechanical bond between the housings and the insert, a definite advantage in case of cavitation or temporary overheating.

O-RINGS:

- B: Buna
- E: Ethylene polypropylene
- V: Viton
- N: Neoprene

These are the most common elastomers used on the GPA®; other static seal material can be utilized upon request.

MEMBRANE:

- N: Neoprene
- M5: PTFE coated
- P1: Therban® (HNBR)
- E: Ethylene polypropylene

Membrane systems are constantly being developed and tested in our laboratory to optimize the sealing and loading characteristics of the GPA®.

SLEEVES:

- D: Carbon Steel
- E: Chrome Steel
- G: 316 L Stainless steel
- T: Cr-Ni-Mo-Cu steel for phosphoric service

Any other machinable metallic materials are available upon request.

COATINGS:

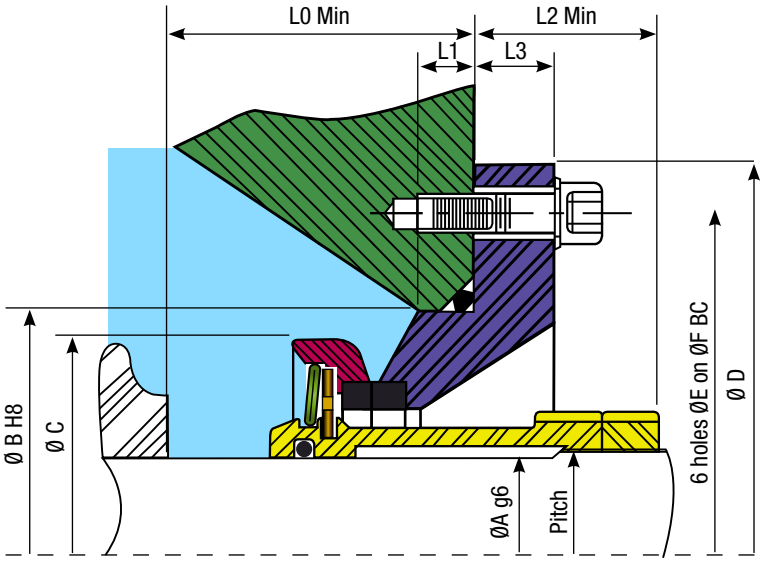
- W: Chromic oxide
- X: Nickel

All metallic surfaces exposed to the media can be hard surfaced to provide better abrasion resistance. A wide variety of coatings are available upon request.

GPA® seals are used in the most demanding environments. A selection of specific applications is listed in the table below.

Applications	Parameters	GPA Types	Pump Manufacturers
ALLUMINA REFINERIES Bayer Process Slurry-Liquor	Temp.: up to 284ºF/140ºC P: up to 150psi/10 bar	GPA/GPAC GPAD	Allis Chalmers Bharat Pumps Canada Pumps Denver Sala Dresser Jeumont Schneider Dresser Worthington Fraser Chalmers GIW- Hazleton Goulds Pumps Ingersoll Rand-Kestner Krogh Pump - KSN - LICAR Morris - Schabaver Sulzer - Weise - Warman Int'l
Alumina liquor	Up to 500g/1 Solid contents	US U5 ENDW US U5 E M5 FW	
Phosphoric acid P205 Gypsum and phosphate	Temp.: up to 176ºF/80ºC P.: up to 87psi/6 bar Solid contents: 300g/l	GPA - GPAC GPACP U8 U8 VM5TX	Dresser JS Ensival
Pulp - Liquors	Temp.: up to 176ºF/80ºC P.: up to 87psi/6 bar	GPA U5 U5 ENDW	Schabaver Moret
Calcium carbonate	Room Temperature P.: up to 87psi/6 bar	GPA U5 U5 E M5 FW	Dresser JS Sala Pumps
Pulverized Coal	P.: up to 87psi/6 bar Air N: 30rpm	GPACP GPEC	Hasler
Water and Coal	P.: up to 87psi/6 bar N: 180rpm	GPA/GPAC U5 U5 E M5 FW	Warman Fapmo
Ore Treatment	Abrasive and corrosive solutions (H_2SO_4)	GPACP U8 U8 V M5 TX	Dresser JS
Sand/Mud Silica Slurries	Room Temperature P.: up to 87psi/6 bar Solid contents: 100 to 600 g/l	GPA GPAC U5 U5 ENDW	Essa Mico Schabaver Neyrtec Moineau PCM Linatex Sihi
Painting - Pigments	Room Temp P.: up to 87psi/6 bar	U5 U8 E M5 G	Netzsch Bornemann
Natural Gas Treatment	Room Temp P.: up to 87psi/6 bar (sulfur)	GPA/GPAC U5 U5 ENDW U8 U8 E M5 GW	Schabaver Sihi
Sugar Industry	Temp.: up to 194ºF/90ºC P: up to 87psi/6 bar Solid contents: up to 300g/l	GPA/GPCA/GPACP U5 U5 E N GW	Schabaver Toyo
Industrial Powders	Environmental dry or humid P.: 43psi/3 bar Temp.: less than 212ºF/100ºC	GPACP U5 U5 E M5 G	Mixer Guedu

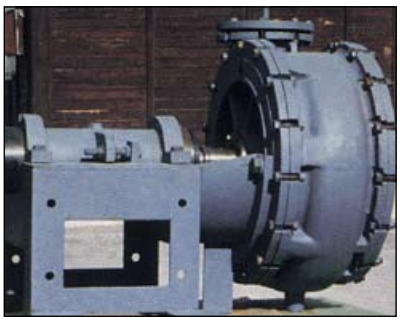
GPA Threaded Type — Style 03 Stationery Ring



Style 03 is one of the most popular designs on the market. The fixed ring is installed on the drive side. The characteristic table below lists standard sizes. Special sizes are available upon request.

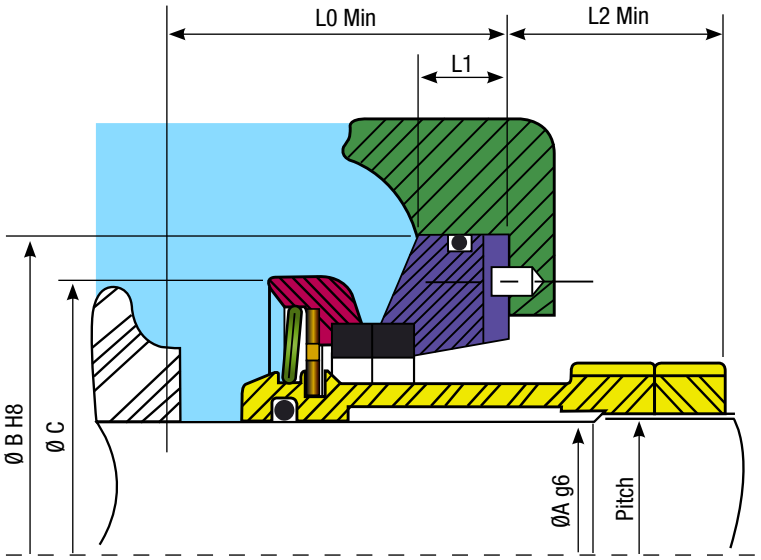
Model	A		B		C		D		E		F	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	.787-1.260	20-32	2.992	76	2.835	72	4.882	124	.433	11	4.173	106
72x82	1.300-2.008	33-51	4.252	108	3.898	99	6.614	168	.512	13	5.827	148
103x113	2.047-3.071	52-78	5.512	140	5.315	135	7.835	199	.512	13	7.087	180
132x144	3.110-4.252	79-108	7.283	185	6.693	170	9.449	240	.512	13	8.661	220
160x178	4.291-5.394	109-137	8.268	210	8.189	208	11.417	290	.512	13	10.236	260
211x229	5.433-7.087	138-180	11.024	280	10.394	264	14.567	370	.669	17	12.992	330

Model	L0		L1		L2		L3		Deflection		Pitch	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	1.909	48.5	.512	13	1.260	32	.472	12	.059	1.5	.039-.059	1-1.5
72x82	2.402	61	.591	15	1.496	38	.709	18	.079	2	.059	1.5
103x113	2.402	61	.591	15	1.535	39	.748	19	.079	2	.079	2
132x144	2.441	62	.630	16	1.575	40	.787	20	.079	2	.079	2
160x178	2.835	72	.866	22	1.575	40	.787	20	.079	2	.079	2
211x229	3.661	93	.984	25	1.654	42	.866	22	.098	2.5	.079-.118	2-3



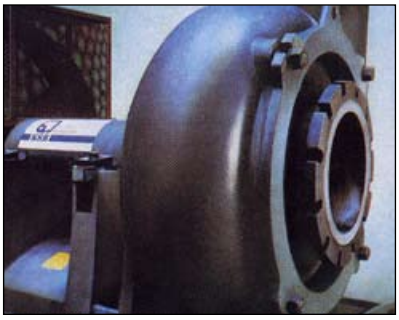
Final sealing performance test at 85psi, 6 bar.
Schabaver pump, Pechiney Aluminum, France.

GPA Threaded Type — Style 13 Stationery Ring



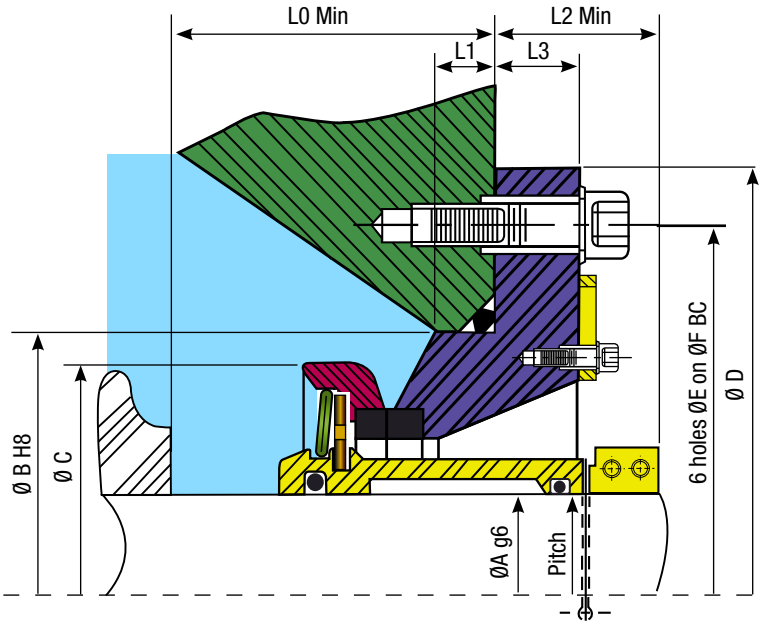
Style 13 available only in the threaded version is very easy to install. The fixed ring is mounted on the impeller side. The characteristic table below lists standard sizes. Special sizes are available upon request.

Model	A		B		C		L0		L1		L2		Deflection		Pitch	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	.787-1.260	20-32	2.992	76	2.835	72	1.988	50.5	.591	15	1.594	40.5	.059	1.5	.039-.059	1-1.5
72x82	1.300-2.008	33-51	4.252	108	3.898	99	2.402	61	.591	15	1.890	48	.079	2	.059	1.5
103x113	2.047-3.071	52-78	5.512	140	5.315	135	2.480	63	.669	17	2.244	57	.079	2	.079	2
132x144	3.110-4.252	79-108	7.283	185	6.693	170	2.638	67	.709	18	2.283	58	.079	2	.079	2
160x178	4.291-5.394	109-137	8.268	210	8.189	208	3.386	86	1.339	34	2.362	60	.079	2	.079	2
211x229	5.433-7.087	138-180	11.024	280	10.394	264	4.134	105	1.575	40	2.441	62	.098	2.5	.079-.118	2-3



GPA® threaded type installed on a KSB pump, alumina plant, Greece

GPAC Cartridge Type — Style 03C Stationery Ring



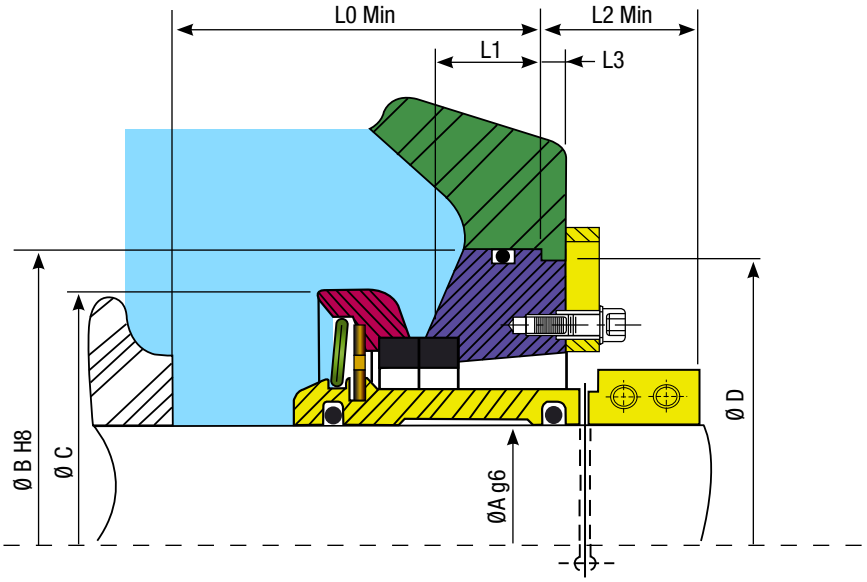
Style 03C is a cartridge seal with the fixed ring installed on the drive side. These seals are preset at the factory. The characteristic table below lists standard sizes. Specific sizes are available upon request.

Model	A		B		C		D		E		F	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	.787-1.260	20-32	2.992	76	2.835	72	4.882	124	.433	11	4.173	106
72x82	1.300-2.008	33-51	4.252	108	3.898	99	6.614	168	.512	13	5.827	148
103x113	2.047-3.071	52-78	5.512	140	5.315	135	7.835	199	.512	13	7.087	180
132x144	3.110-4.252	79-108	7.283	185	6.693	170	9.449	240	.512	13	8.661	220
160x178	4.291-5.394	109-137	8.268	210	8.189	208	11.417	290	.512	13	10.236	260
211x229	5.433-7.087	138-180	11.024	280	10.394	264	14.567	370	.669	17	12.992	330

Model	L0		L1		L2		L3	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	1.909	48.5	.512	13	1.260	32	.472	12
72x82	2.402	61	.591	15	1.496	38	.709	18
103x113	2.402	61	.591	15	1.535	39	.748	19
132x144	2.441	62	.630	16	1.575	40	.787	20
160x178	2.835	72	.866	22	1.575	40	.787	20
211x229	3.661	93	.984	25	1.654	42	.866	22

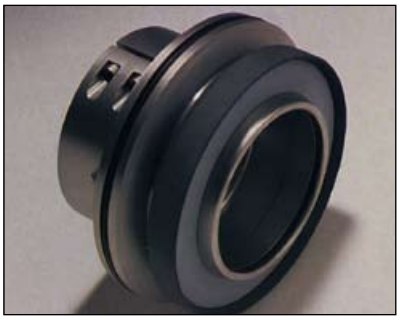
Installation of a GPAC 03C on a Warman pump, mud treatment plant, Belgium.

GPAC Cartridge Type — Style 43C Stationery Ring



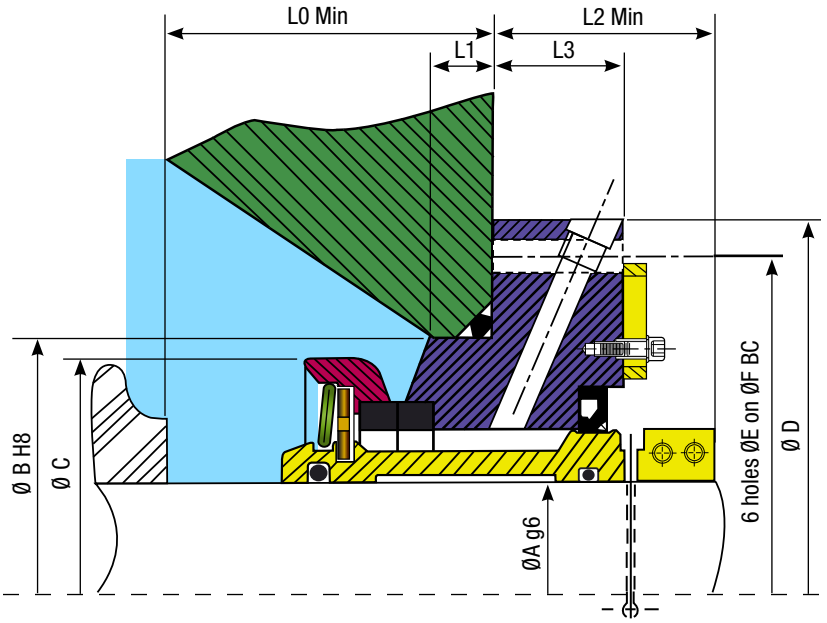
Style 43C is a cartridge seal with the fixed ring on the impeller side. These seals are preset at the factory. The characteristic table below lists standard sizes. Specific sizes are available upon request.

Model	A		B		C		D		L0		L1		L2		L3	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	.787-1.260	20-32	2.992	76	2.835	72	2.677	68	1.988	50.5	.591	15	.984	25	.157	4
72x82	1.300-2.008	33-51	4.252	108	3.898	99	4.016	102	2.402	61	.591	15	1.083	27.5	.236	6
103x113	2.047-3.071	52-78	5.512	140	5.315	135	5.157	131	2.480	63	.669	17	1.181	30	.236	6
132x144	3.110-4.252	79-108	7.283	185	6.693	170	6.969	177	2.638	67	.709	18	1.299	33	.236	6
160x178	4.291-5.394	109-137	8.268	210	8.189	208	7.953	202	3.386	86	1.339	34	1.969	50	.236	6
211x229	5.433-7.087	138-180	11.024	280	10.394	264	10.433	265	4.134	105	1.575	40	2.362	60	.315	8



Worthington M pump on a high capacity decanting unit, Alcan, Canada

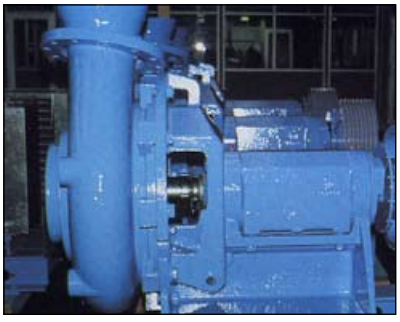
GPACP Protected Cartridge Type — Style 03CP Stationery Ring



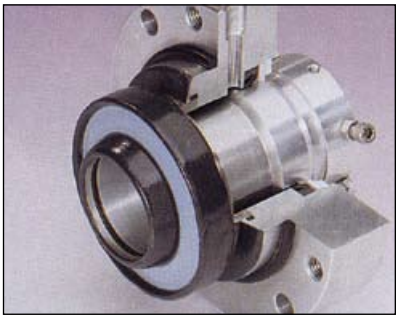
Style 03CP is a protected cartridge with the fixed ring installed on the drive side. This design is recommended for aggressive fluids; a lip seal is mounted in the fixed ring. Grease or flush water is used as barrier media.

Model	A		B		C		D		E		F	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	.787-1.260	20-32	2.992	76	2.835	72	4.882	124	.433	11	4.173	106
72x82	1.300-2.008	33-51	4.252	108	3.898	99	6.614	168	.512	13	5.827	148
103x113	2.047-3.071	52-78	5.512	140	5.315	135	7.835	199	.512	13	7.087	180
132x144	3.110-4.252	79-108	7.283	185	6.693	170	9.449	240	.512	13	8.661	220
160x178	4.291-5.394	109-137	8.268	210	8.189	208	11.417	290	.512	13	10.236	260
211x229	5.433-7.087	138-180	11.024	280	10.394	264	14.567	370	.669	17	12.992	330

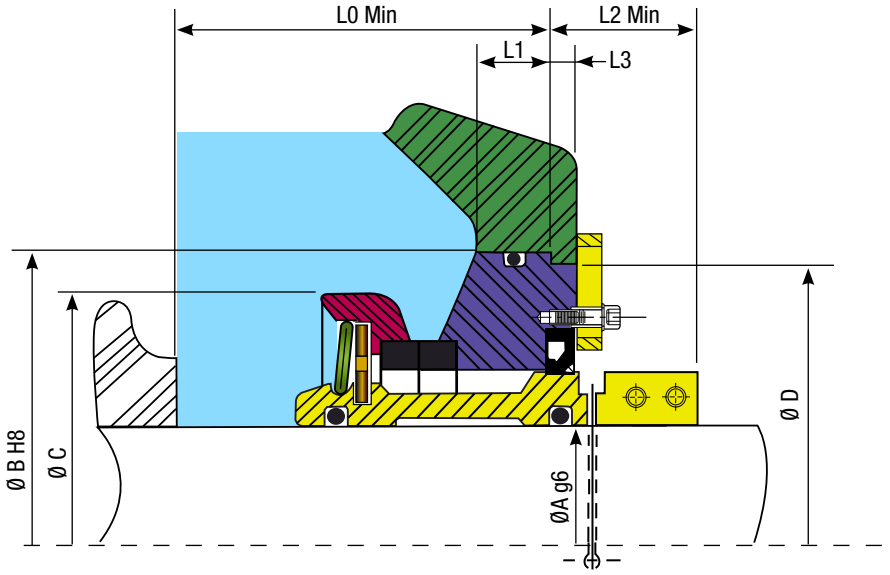
Model	L0		L1		L2		L3	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	1.909	48.5	.512	13	2.421	61.5	1.181	30
72x82	2.402	61	.591	15	2.756	70	1.378	35
103x113	2.402	61	.591	15	3.189	81	1.575	40
132x144	2.441	62	.630	16	3.346	85	1.575	40
160x178	2.835	72	.866	22	3.543	90	1.575	40
211x229	3.661	93	.984	25	3.661	93	1.654	42



Jeumont Schneider pump used in the manufacturing of fertilizers. GPACP 03 resistant to phosphoric acid, France

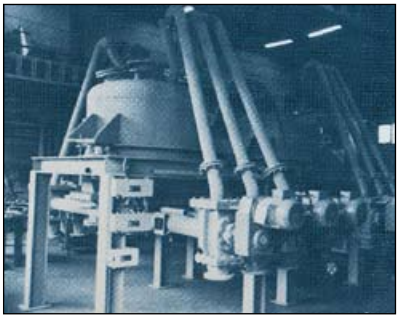


GPAC Cartridge Type — Style 43CP Stationery Ring

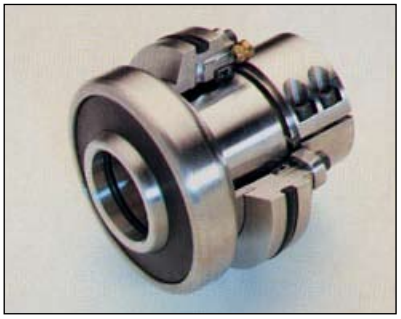


Style 43CP has a protected cartridge with the fixed ring on the impeller side. This design prevents dry friction and leakage of corrosive fluids. A lip seal is mounted in the fixed ring. Grease or flush water is used as barrier media.

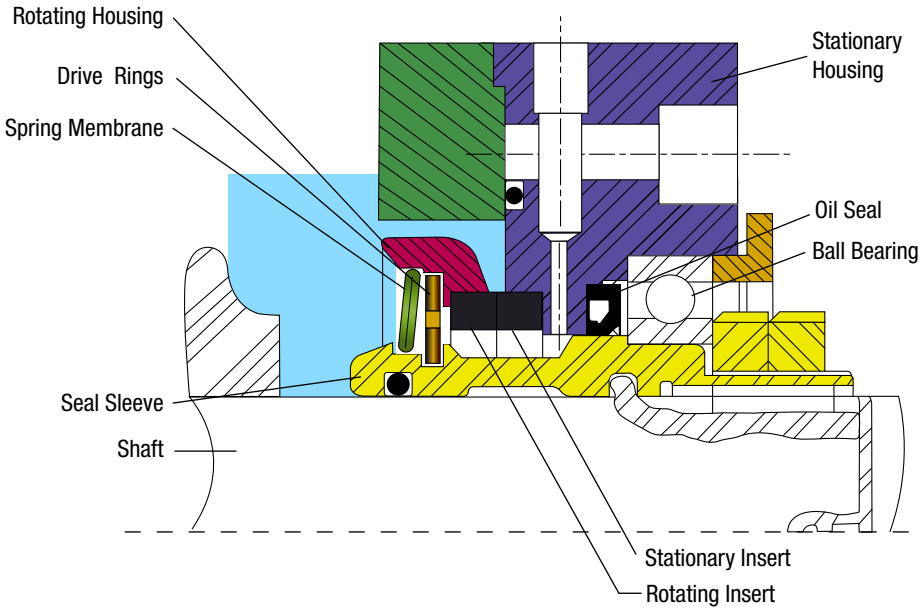
Model	A		B		C		D		L0		L1		L2		L3	
	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
47x55	.787-1.260	20-32	2.992	76	2.835	72	2.677	68	1.988	50.5	.591	15	.984	25	.157	4
72x82	1.300-2.008	33-51	4.252	108	3.898	99	4.016	102	2.402	61	.591	15	1.083	27.5	.236	6
103x113	2.047-3.071	52-78	5.512	140	5.315	135	5.157	131	2.480	63	.669	17	1.181	30	.236	6
132x144	3.110-4.252	79-108	7.283	185	6.693	170	6.969	177	2.638	67	.709	18	1.299	33	.236	6
160x178	4.291-5.394	109-137	8.268	210	8.189	208	7.953	202	3.386	86	1.339	34	1.969	50	.236	6
211x229	5.433-7.087	138-180	11.024	280	10.394	264	10.433	265	4.134	105	1.575	40	2.362	60	.315	8

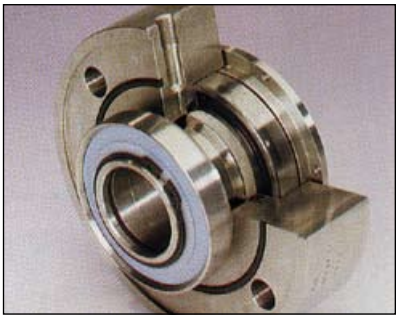


Hasler blast furnaces, GPACP 43 equips the screw-feeder conveyor systems handling granular coal at 85psi. Lorraine basin, France



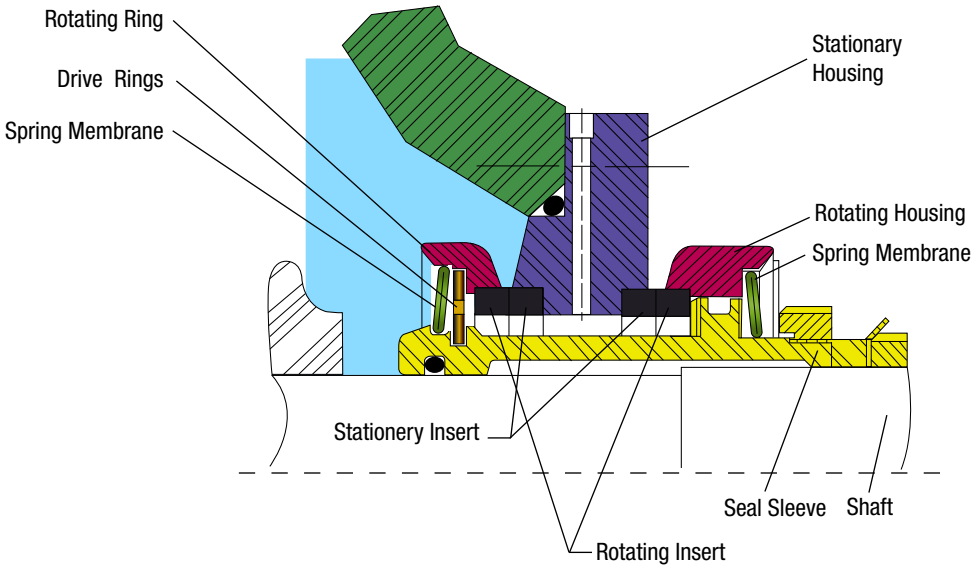
GPEC®

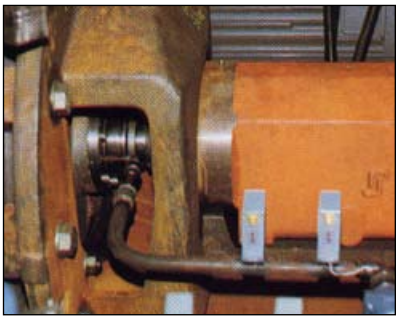




The GPEC is a cartridge type seal which has a built in ball bearing system. This provides excellent centering of the seal, since the bearing is very close to the friction surfaces.

GPAD Double-Seal

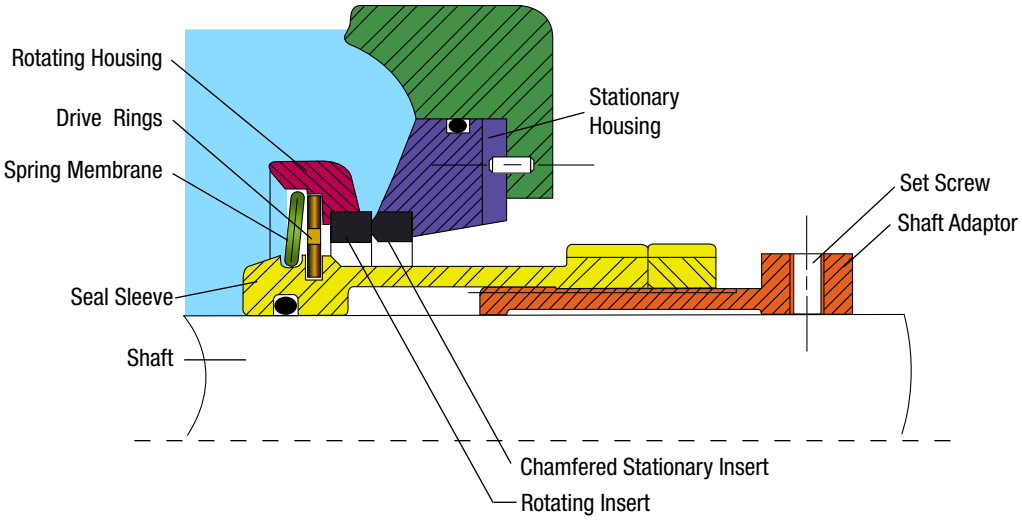




Multistage pumping of alumina slurries, Ingersoll-Dresser and SIHI-Schabaver pumps, India.

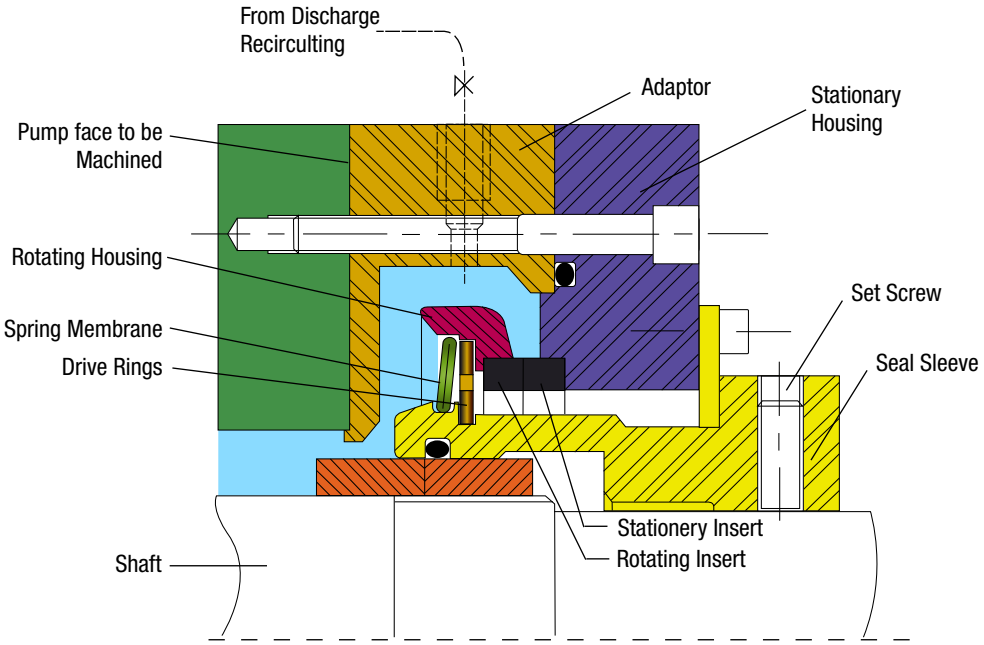
The GPAD is a double seal arrangement used on multistage pumping stations, allowing a smooth transfer of pressure between the pumps.

Chamfered Face GPA®

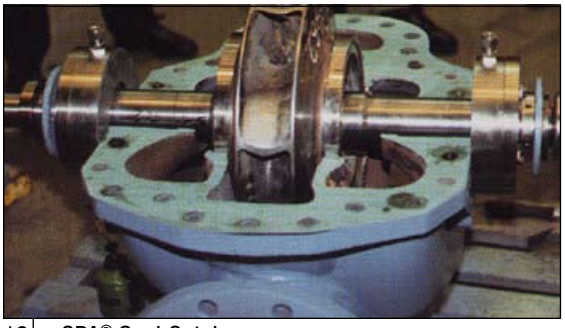


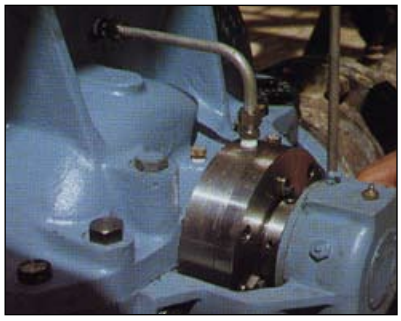
Chamfered face GPA® seal. This specific design has reduced seal face contact area resulting in lower breakout torque. Popular in latex paint manufacturing. Operating conditions are 100ºF / 40ºC, up to a 1000 rpm, pressure 30psi / 2.5bar.

External GPA



GPA® cartridge type, this specific design can be mounted outside of the pump body, in this particular case, operating at 200ºF / 95ºC, 1400 rpm, Suction pressure 25 PSI / 1.8 bar, discharge pressure 90 PSI / 6 bar. The seals replace the packing rings without modifications to the pump.





Double bearing external set up on 10LR pumps, Alumina processing, green liquor, Australia.

General Instructions:

- Check and adjust the pump shaft to impeller housing clearance according to the pump manufacturer's specifications
- Verify all elastomer O-rings are installed and properly lubricated with the enclosed lubricant
- The use of an anti seize compound (enclosed) on all threaded components is advised
- Check the bore to shaft alignment with an indicator. The maximum tolerances are: Bore Shaft misalignment: 0.016" TIR Perpendicularity: 0.004" TIR

GPA Style 03 Specific:

- Remove the impeller from the pump shaft
- Remove the impeller housing and place the fixed ring over the pump shaft
- Replace the impeller housing and attach the fixed ring to the outside of the housing

GPA Style 13 Specific:

- Remove the impeller from the pump shaft
- Place the fixed ring over the pump shaft
- Attach the fixed ring to the inside of the impeller housing

GPA General Instructions:

- Install the Rotating Seal Sleeve Assembly (RSSA) on the shaft (or shaft sleeve) prior to installing the impeller
- Place the RSSA on the threaded shaft leaving a 0.120" 0.160" clearance between the sealing faces

Adjustment for CPA Seals (Style 03 and 13):

Check the mechanical seal faces to insure that they are clean and free of any nicks or burrs. Tighten until the seal faces contact. Rotate the RSSA approximately 2 turns and fill the pump cavity with water. Slowly loosen the RSSA until small beads of water appear. Retighten the RSSA 1.5 turns. Lock the RSSA onto the shaft sleeve with the locking nut.

GPAC Style 03C Specific:

- Remove the impeller from the pump shaft
- Remove the impeller housing allowing full access to the pump shaft
- Place the GPAC assembly over the pump shaft
- Replace the impeller housing and attach the GPAC assembly to the outside of the housing

GPAC Style 43C Specific:

- Remove the impeller from the pump shaft
- Place the GPAC assembly over the pump shaft
- Attach the GPAC assembly to the inside of the impeller housing

GPAC General Instructions:

- Attach the GPAC assembly to the pump shaft with two clamp screws
- Remove the compression bars, placing the GPAC seal in the proper operating position. The GPAC seal is preset and requires no adjustment.

In all cases, to verify proper installation, pressurize the pump cavity with water (40-45 psi). After filling, rotate the pump shaft by hand. Proper installation allows a small amount of water to seep from the seal faces. This leak should disappear after a few days of operation.

FOR MORE INFORMATION,
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