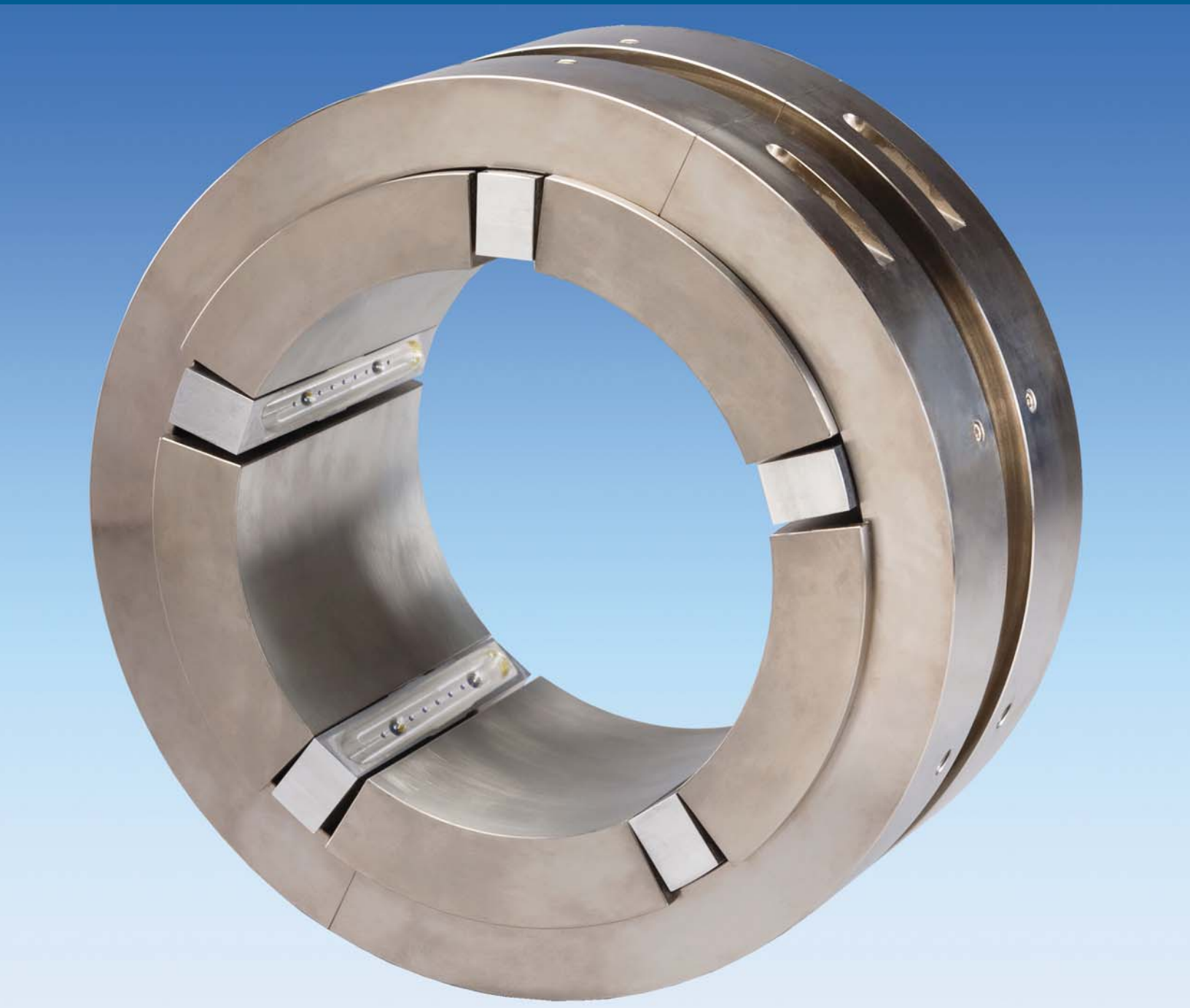
BPG® Bearings

Between Pad Groove tilting pad journal bearings



Kingsbury, Inc.®

BPG BEARING DESIGN GENERAL DESCRIPTION

Kingsbury's BPG Journal Design Delivers Exceptional Performance For High-Speed, High-Load Turbomachinery Applications.

BPG stands for "Between Pad Groove": the patented, directed lubrication journal bearing with Kingsbury's distinctive oil groove placed between the pads. Like our LEG (Leading Edge Groove) bearings, the BPG is designed to introduce cool, undiluted oil from the groove directly into the oil film. The cool oil in the wedge insulates the babbitted face from hot oil carried over by the rotating shaft. The BPG delivers significantly better performance in turbomachinery applications than flooded bearings. It requires only half the oil flow rate of a flooded bearing, resulting in a 45% drop in power losses also due to the elimination of parasitic losses. Furthermore, there is a corresponding reduction in operating temperatures, varying by 8° to 28° C, contingent on the load and shaft speed.

The BPG can be supplied with or without endplates, depending on the requirements of the particular job. If there are no concerns about oil discharge, we offer the solution without end-plates, which minimizes the axial length of the assembly and only consists of three major components: the aligning ring, the bearing pads and the oil feed grooves. If there is a need to protect sensitive items such as dry gas seals, we can readily bolt on one of two standardized end-plate designs (with or without a floating seal ring) to the journal bearing. In either case, the BPG is designed to mainly fit European envelope dimensions, making it easy to install in new or existing housings. Unlike other competing designs, the BPG's length/width ratio represents the true width, giving it a more compact envelope while increasing the load-carrying capacity.

For optimized rotordynamic behavior, BPG bearings aim for a standard preload factor of 0.35. The versatile design also boasts several options, among them a variety of lining materials (tin-based ASTM B23 Grade 2 babbitt, ECKA Tegostar 738® babbitt and thermoplastics such as PEEK); alternative pad pivot designs depending on the demands of the application (e.g. center vs. offset pivot, line vs. elliptical contact); enhancements such as anti-SSV grooves to improve rotordynamic stability.

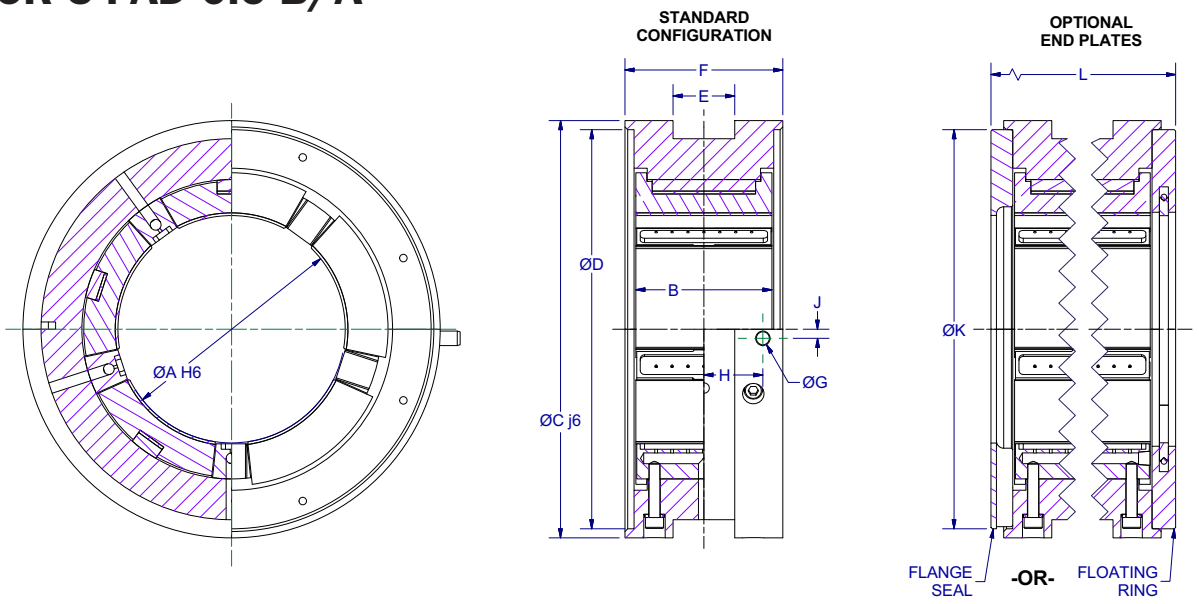
To find out how Kingsbury's BPG Journal Bearing can help improve the performance of your turbomachinery, simply give us a call or drop us an e-mail. Our contact details are conveniently listed on the back page of this brochure.

QUALITY STANDARDS:

KINGSBURY, INC.
ISO 9001-2008 Registered

BPG BEARING DIMENSIONAL DATA

4 OR 5 PAD 0.6 B/A

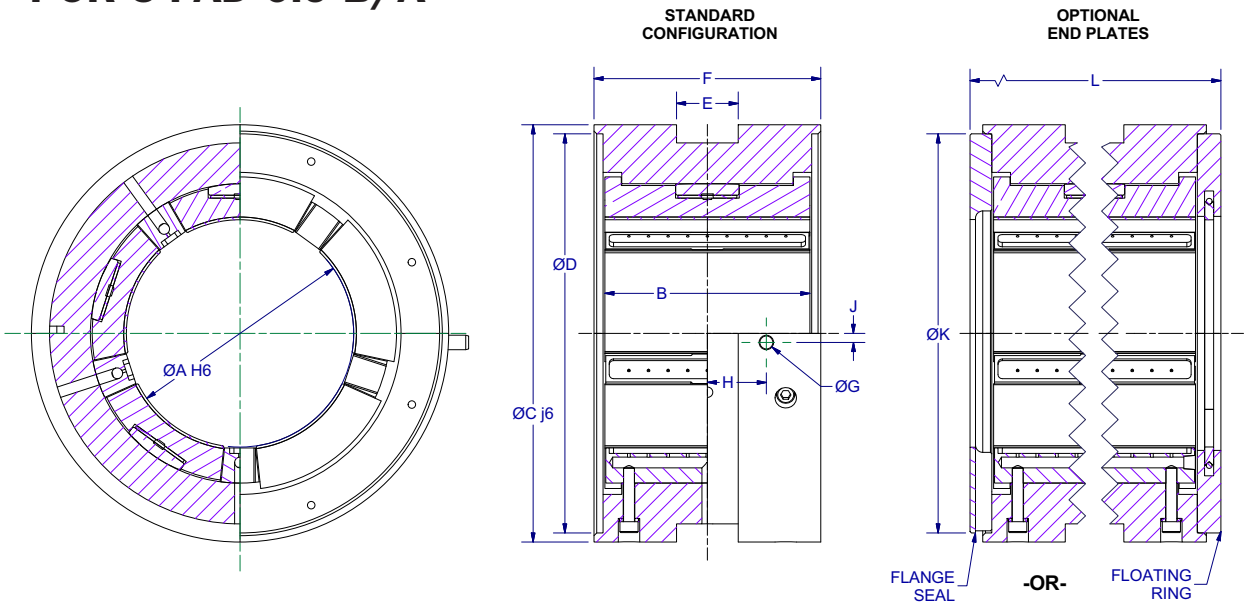


METRIC SIZES (mm)

BEARING DIAMETER	PAD WIDTH	ALIGNING RING O.D.	ENDPLATE RECESS I.D.	ANNULUS WIDTH	SEAT WIDTH	LOCATING PIN			OPTIONAL	
						DIAMETER	LOCATION	LOCATION	ENDPLATE O.D.	OVERALL WIDTH W/ ENDPLATES
A	B	C	D	E	F	G	H	J	K	L
50	30	110	102	10	41	5	14	3.5	102	49
55	33	110	102	10	44	5	14	3.5	102	52
60	36	110	102	10	47	5	14	3.5	102	57
65	39	160	150	16	54	6	21	4	150	64
70	42	160	150	16	53	6	21	4	150	63
75	45	160	150	16	56	6	21	4	150	66
80	48	160	150	16	59	6	21	4	150	69
90	54	160	150	30	65	6	21	4	150	75
100	60	200	185	32	71	6	28	4	185	85
110	66	200	185	34	77	6	28	4	185	91
125	75	230	220	34	87	8	32.5	5	220	101
140	84	230	220	35	96	8	32.5	5	220	110
160	96	280	260	35	108	8	37.5	5	260	122
180	108	315	285	42	120	8	37.5	5	285	134
200	120	350	320	42	132	8	37.5	5	320	158
225	135	425	360	45	147	10	42.5	6	360	173
250	150	475	400	50	162	10	45	6	400	188
280	168	500	450	60	180	12	54	7	450	206
300	180	515	475	65	193	12	56.5	7	475	219
315	189	580	525	65	202	12	56.5	7	525	228

BPG BEARING DIMENSIONAL DATA

4 OR 5 PAD 0.9 B/A



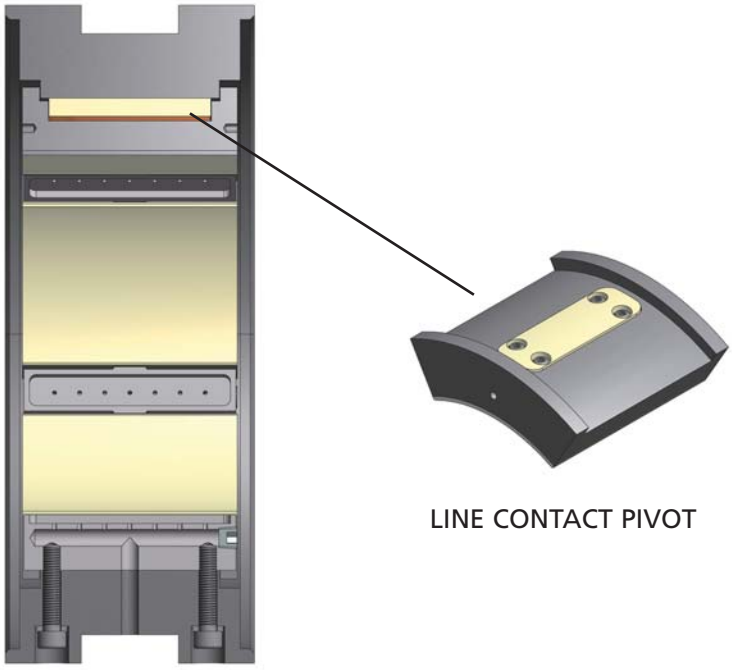
METRIC SIZES (mm)

BEARING DIAMETER	PAD WIDTH	ALIGNING RING O.D.	ENDPLATE RECESS I.D.	ANNULUS WIDTH	SEAT WIDTH	LOCATING PIN			OPTIONAL	
						DIAMETER	LOCATION	LOCATION	ENDPLATE O.D.	OVERALL WIDTH W/ ENDPLATES
A	B	C	D	E	F	G	H	J	K	L
50	45	110	102	10	56	5	14	3.5	102	64
55	50	110	102	20	61	5	14	3.5	102	69
60	54	110	102	20	65	5	14	3.5	102	75
65	59	160	150	25	70	6	21	4	150	80
70	63	160	150	30	74	6	21	4	150	84
75	68	160	150	30	79	6	21	4	150	89
80	72	160	150	30	83	6	21	4	150	93
90	81	160	150	30	92	6	21	4	150	102
100	90	200	185	32	101	6	28	4	185	115
110	99	200	185	34	110	6	28	4	185	124
125	113	230	220	34	125	8	32.5	5	220	139
140	126	230	220	35	138	8	32.5	5	220	152
160	144	280	260	35	156	8	37.5	5	260	170
180	162	315	285	42	174	8	37.5	5	285	188
200	180	350	320	42	192	8	37.5	5	320	218
225	203	425	360	45	215	10	42.5	6	360	241
250	225	475	400	50	237	10	45	6	400	263
280	252	500	450	60	264	12	54	7	450	290
300	270	515	475	65	283	12	56.5	7	475	309
315	284	580	525	65	297	12	56.5	7	525	323

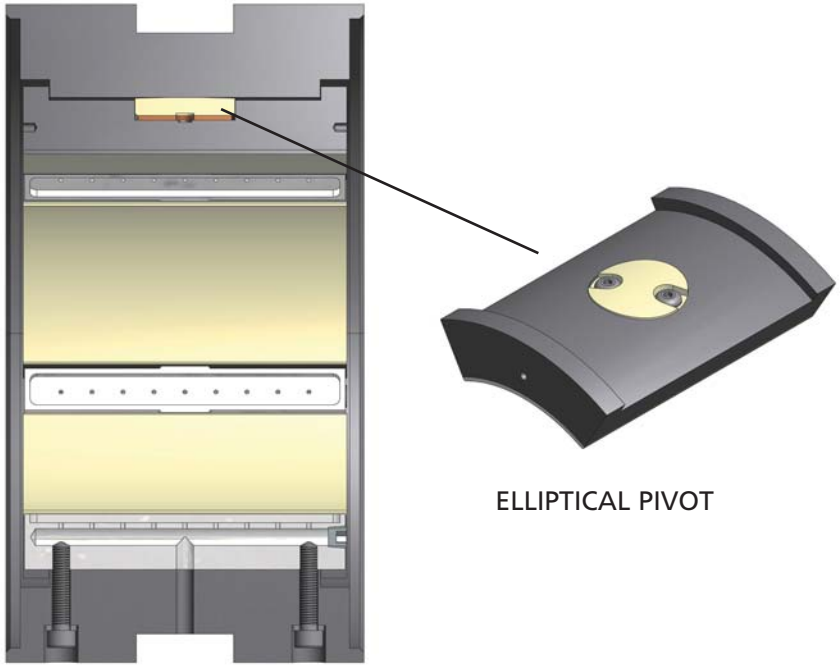
BPG PAD PIVOT STYLES

Line contact vs. elliptical contact

Line contact supports offer the benefit of high stiffness, while elliptical contact supports (also known as spherical or double radius supports) can compensate for shaft misalignment (bending or foundation deflections). Both options are available for center and offset pivot positions. We also offer the customized option of ball and socket pivots upon specific request.



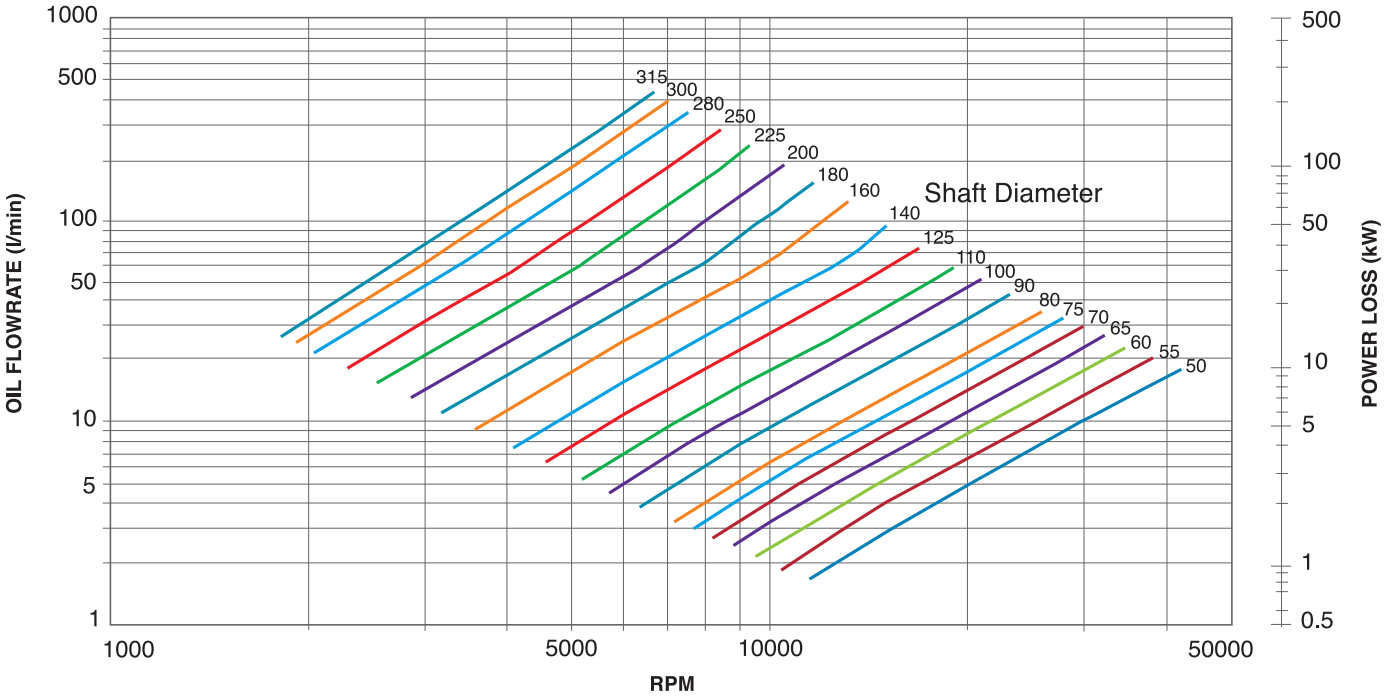
LINE CONTACT PIVOT



ELLIPTICAL PIVOT

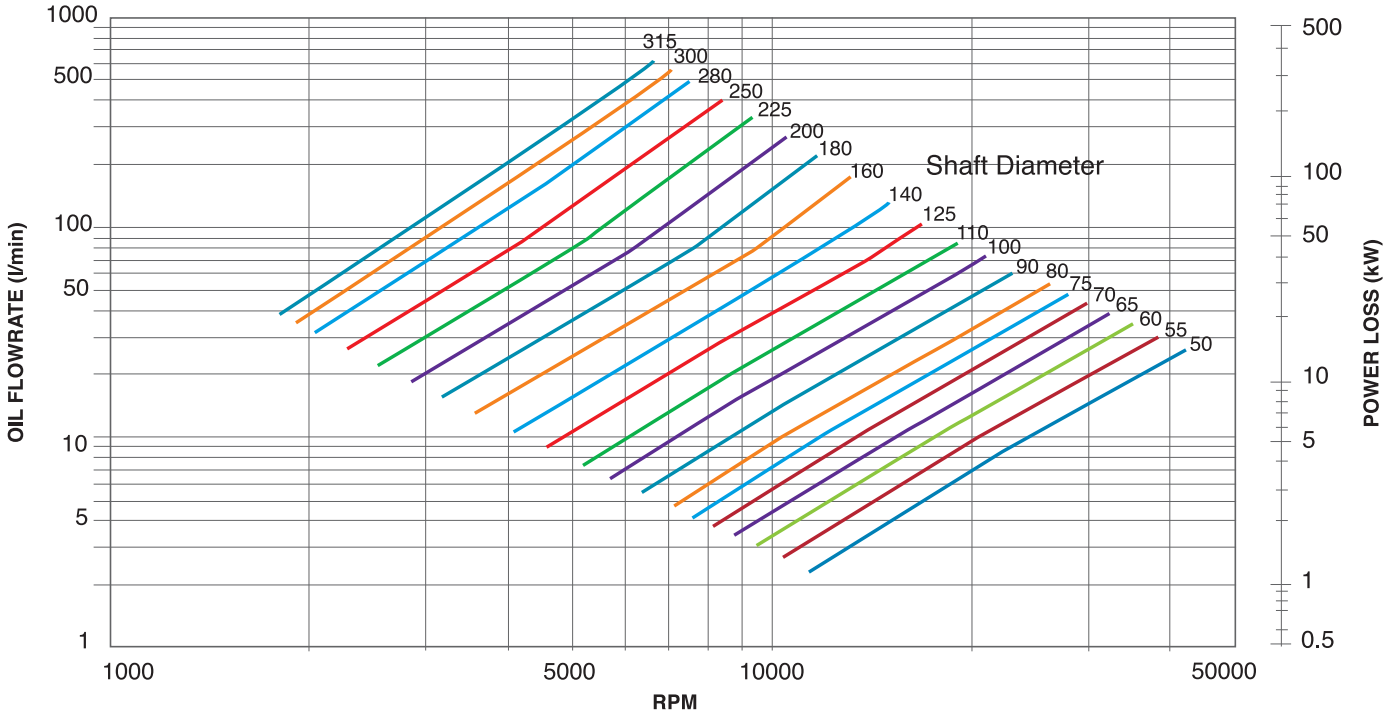
OIL FLOW RATE & POWER LOSS – 0.6 L/D

(load between pads)



OIL FLOW RATE & POWER LOSS – 0.9 L/D

(load between pads)

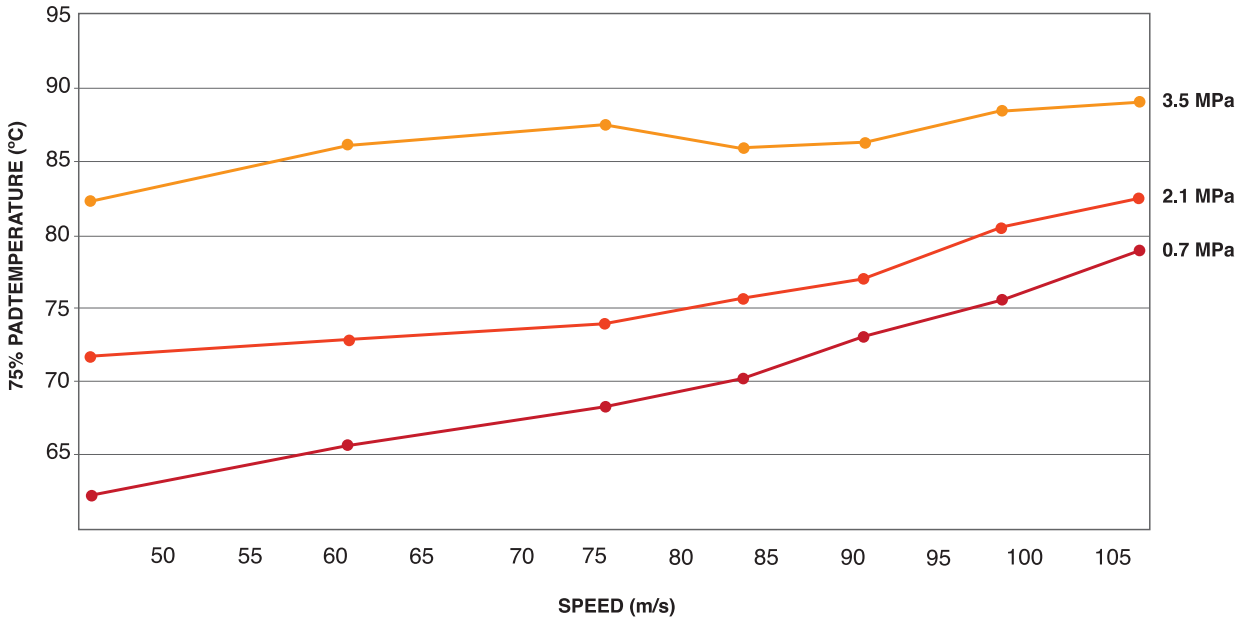


Chrome Copper Backed Pads

Oil shear at the pad surface produces heat and higher temperatures there as compared to the rest of the pad. This creates a thermal gradient in the pads and causes crowning to occur. Excess crowning leads to higher temperatures and lower load capacity. Due to its high thermal conductivity, chrome copper reduces the thermal gradient and therefore reduces crowning. It also dissipates heat from the hottest areas and distributes it more evenly into the pad.

While chrome copper pads do not always provide lower temperatures in all cases, the following is an example of what can be achieved with chrome copper pads. Shown here is test data from our new journal bearing test rig. The bearing is a 127 x 127 BPG with chrome copper pads.

OPERATING TEMPERATURES BASED ON LABORATORY DATA



Load Ratings

Kingsbury recommends maximum loads of 3.5 MPa for load-between-pads and 2.2 MPa for load-on-pad applications. In some cases, the maximum load can differ from these limits, depending on other operating factors. Please allow us to run our proprietary journal bearing calculation program to confirm the final selection. Oil film thickness, surface temperature, power loss, and oil flow will be compared against our latest standards for acceptance.

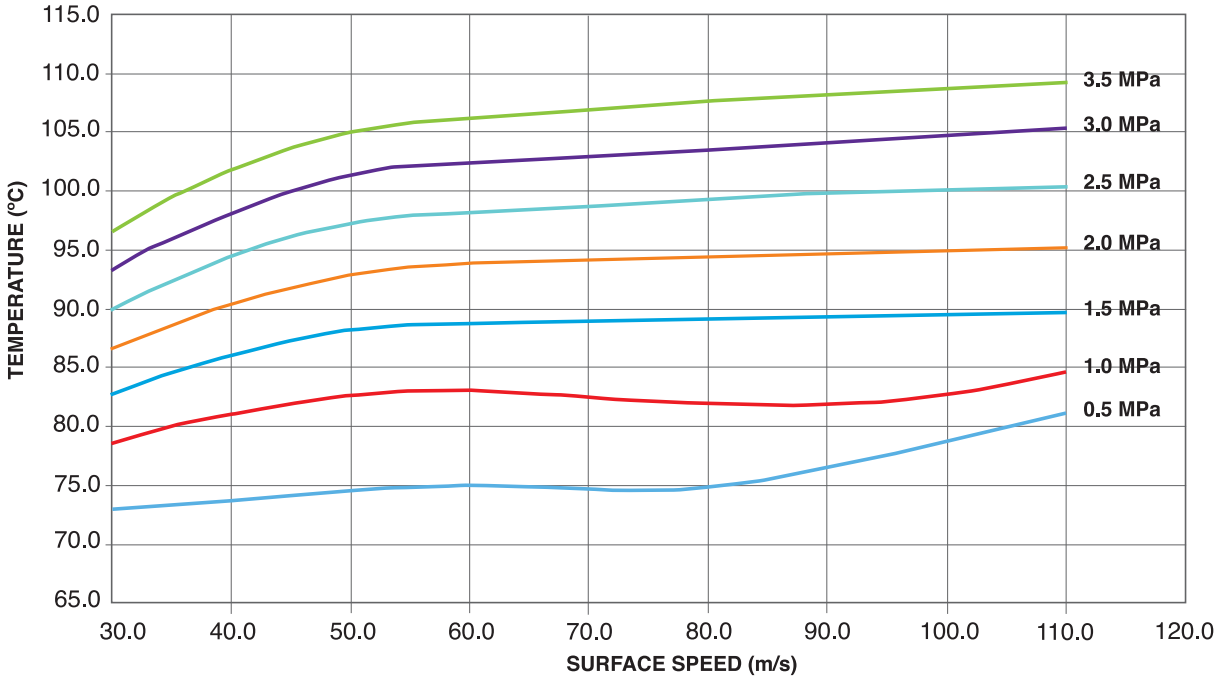
Pivot Offset

For most critical, high speed applications, offset pivots offer superior performance in terms of pad temperatures and stability. While 60% offset pivot are standard for the BPG, center pivots are also available as an option.

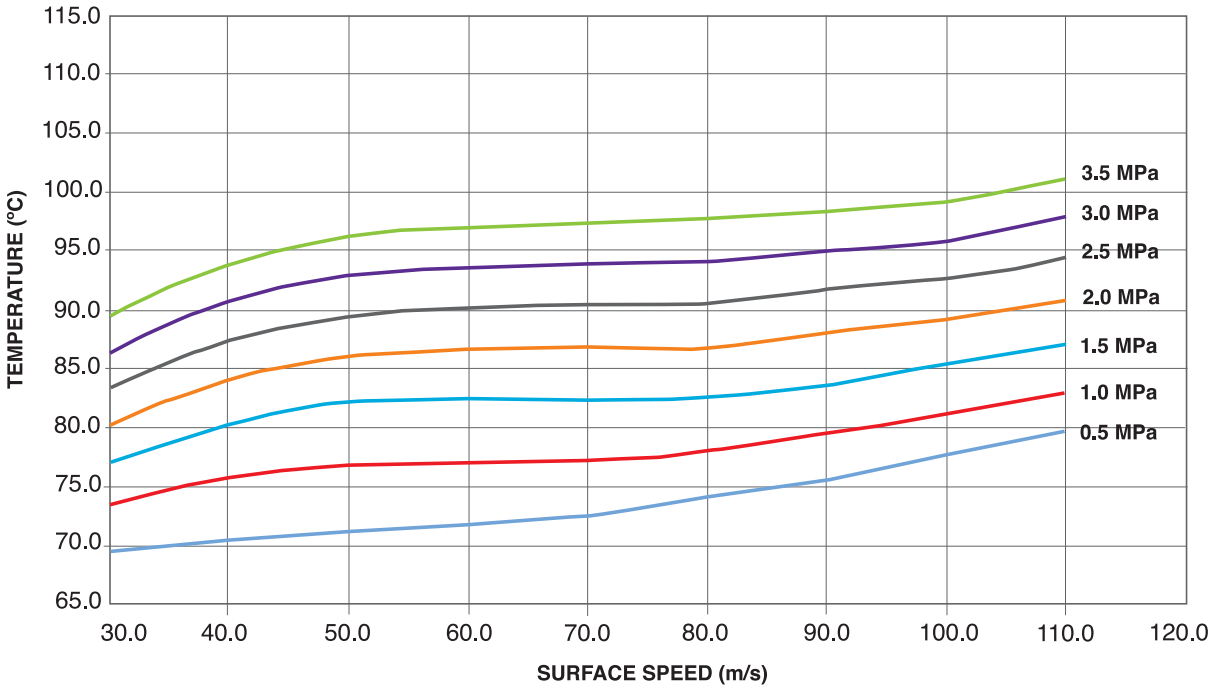
Pad Temperature Graphs

The above curves display pad temperature versus journal velocity for various load indices. Additional temperature data for center and offset pivots can be found on page 9. Values obtained from these curves are for specific operating parameters and are provided for general trends and not necessarily exact values for every application. Differences in bearing diameter, number of pads, pad length, clearance, preload, oil flow rate, oil inlet temperature, and oil viscosity all have an effect on the pad temperature. Please allow us to run our proprietary journal bearing calculation program to confirm the final pad temperature.

PAD TEMPERATURE: 50% OFFSET PIVOT



PAD TEMPERATURE: 60% OFFSET PIVOT



OPTIONS & INSTRUMENTATION

Material

BPG bearings are lined with ASTM B23 Grade 2 babbitt as our standard. Upon request, we offer alternative linings such as Tegostar 738® or thermoplastics. The pads and aligning ring materials are typically mild steel. If pad operating temperatures are elevated, we can use CrCu material as the base material to improve heat transfer and protect the lining.

Anti-Rotation Pins

Stop pins are typically located 18° from the split line but can be repositioned as necessary for a given application. Please specify your requirements when placing an order.

Hydrostatic Jacking

Hydrostatic lift or jacking is available on demand for applications where the shaft diameter exceeds 125 mm.

End-Plates

We can add standardized end-plates (with or without floating seals) if necessary to protect sensitive nearby components such as dry gas seals.

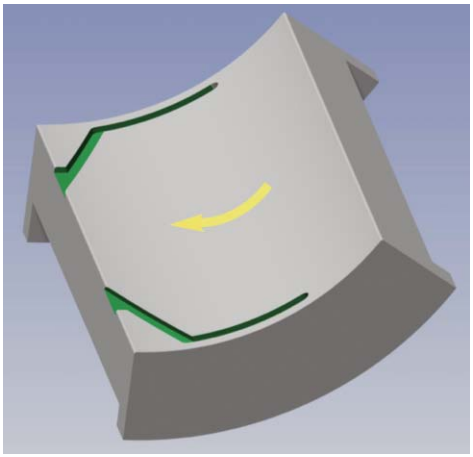
Anti-SSV Grooves

Peculiar, low-frequency, radial vibrations have been observed in various turbomachinery using tilt pad journal bearings. Unlike discrete subsynchronous spikes that often indicate a serious problem, the vibrations are indiscrete and of low frequency and amplitude. While not considered harmful, the low level shaft indications have raised concern in witness tests of critical machinery.

BPG journals bearings have proven to be less susceptible to this type of SSV than other types of bearings. Additional protection from this type of vibration can be achieved by adding Kingsbury's patented anti-SSV grooves. These groove recirculate side leakage back into the bearing and helps to eliminate SSV.

Instrumentation

Our standard temperature probe holes are Ø 3.5 mm and located in the 75/50 position (for Minco Type C sensors). Other bore sizes and locations can be accommodated on demand.



Detail of pad with anti-SSV grooves.

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Catalog BPG
Printed in USA 5/13