Kingsbury Pivoted Shoe Journal Bearings

Kingsbury, Inc.

THE TRADEMARK OF BEARING QUALITY SINCE 1912

CATALOG PJ

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The precision choice for tough applications

Properly selected bearings are crucial to the performance of rotating equipment. Conversely, the cost and inconvenience of a poorly selected bearing can be catastrophic. The purpose of this catalog is to provide both the designer and the user of rotating equipment with a handy guide to the proper selection of Kingsbury pivoted-shoe journal bearings, as well as an overview of where they are best applied.

Why pivoted shoe journal bearings?

As rotating machinery has evolved, many types of bearings have come and gone. Today, rotational speeds and power density levels continue to increase, along with the complexity of the machinery. The dynamic characteristics of such complex machines depend heavily on the journal bearings.

The simplistic plain journal bearing, inherently unstable at light loads, can experience self-excited subsynchronous vibration during operation—a phenomenon known as oil whirl. While some bore profile modifications have been successful at raising the stability threshold when new, a fixed geometry bearing is susceptible to damage from misalignment, unbalance, wear, or shock loading.

The inherent design characteristics of a pivoted shoe journal bearing, on the other hand, eliminate all concerns about oil film instability. At the same time, the mechanical design of a pivoted shoe journal bearing provides excellent resistance to shock and unbalanced loading while allowing continued operation during conditions of misalignment or wear.

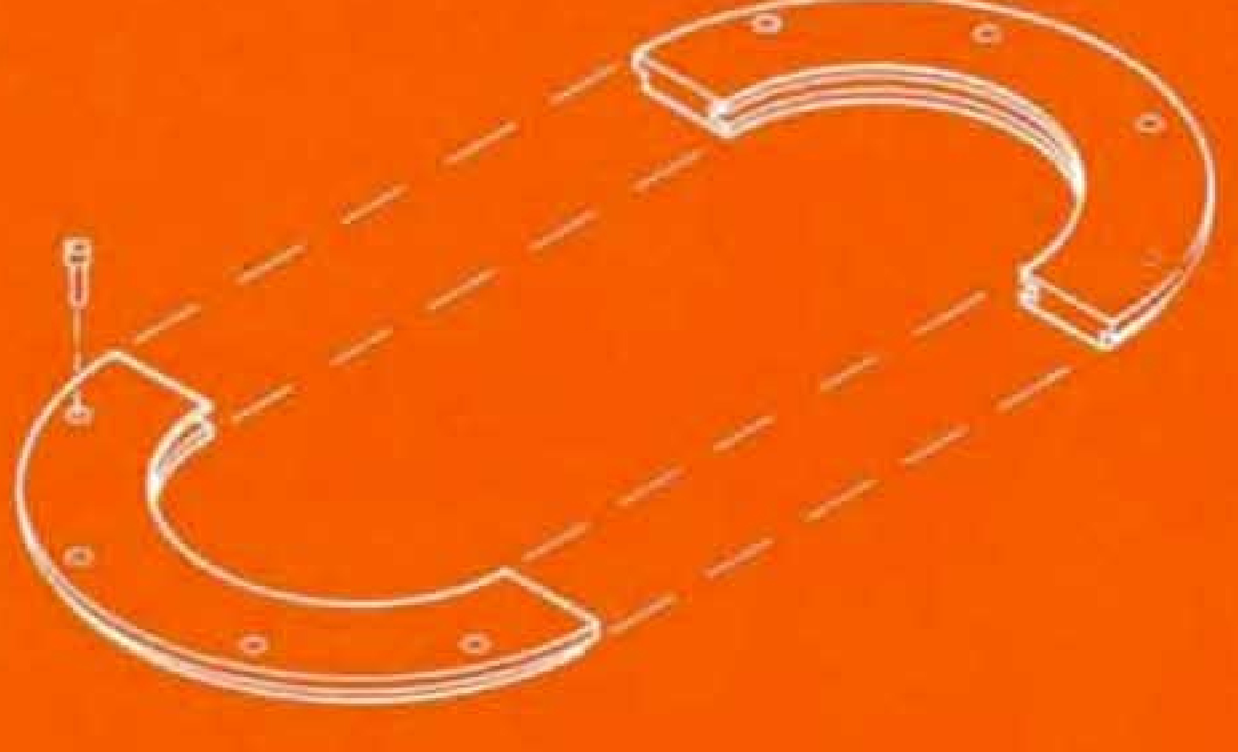
Why Kingsbury pivoted shoe journal bearings?

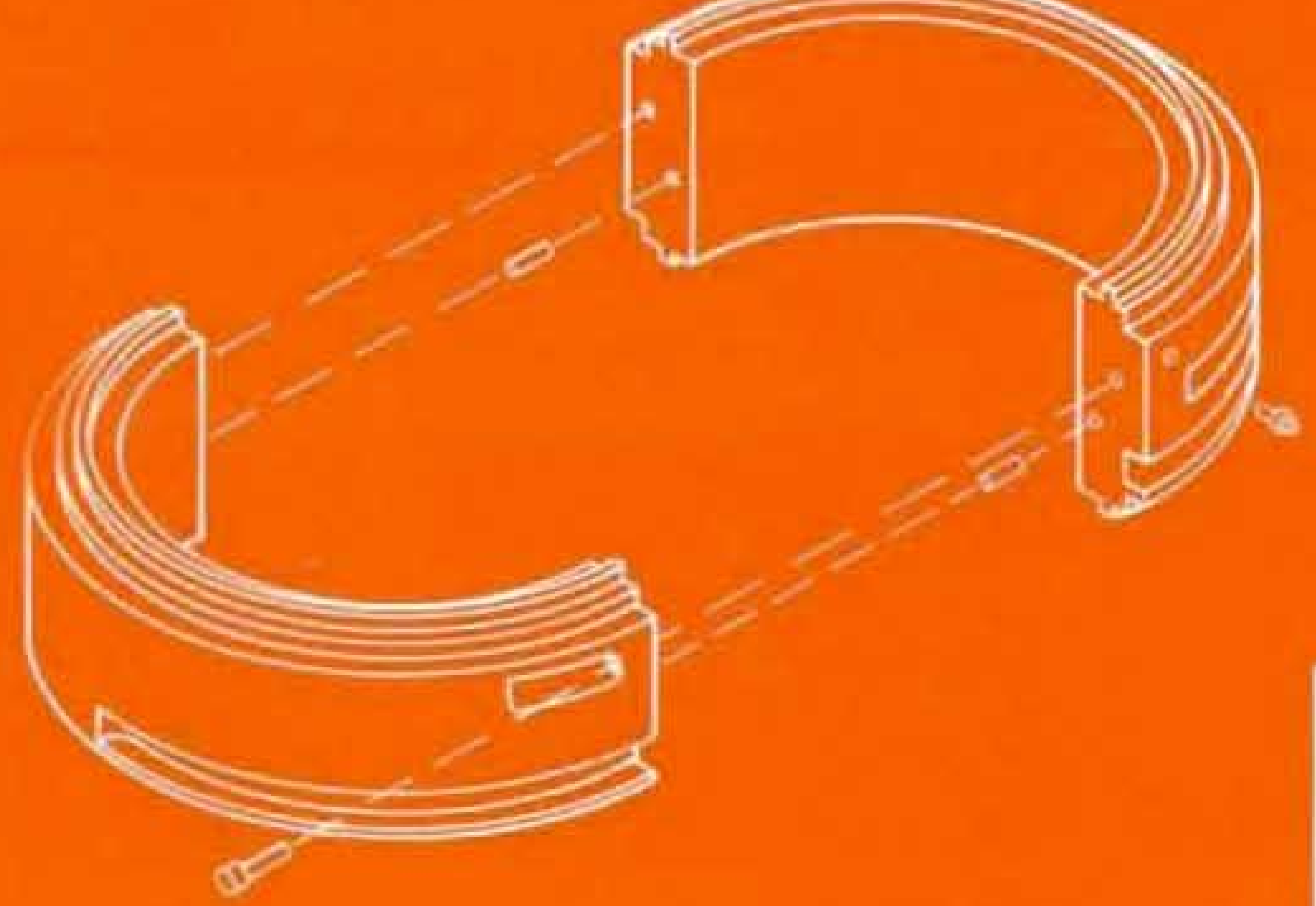
Since 1912, Kingsbury has designed, developed, and manufactured fluid-film bearings. Our engineers have studied their performance in thousands of applications, and have meticulously refined the designs to increase performance, enhance operating stability, and extend operating life. The resultant pivoted shoe journal bearings represent the state of the art in their class, offering you a complete choice of journal bearing configurations.

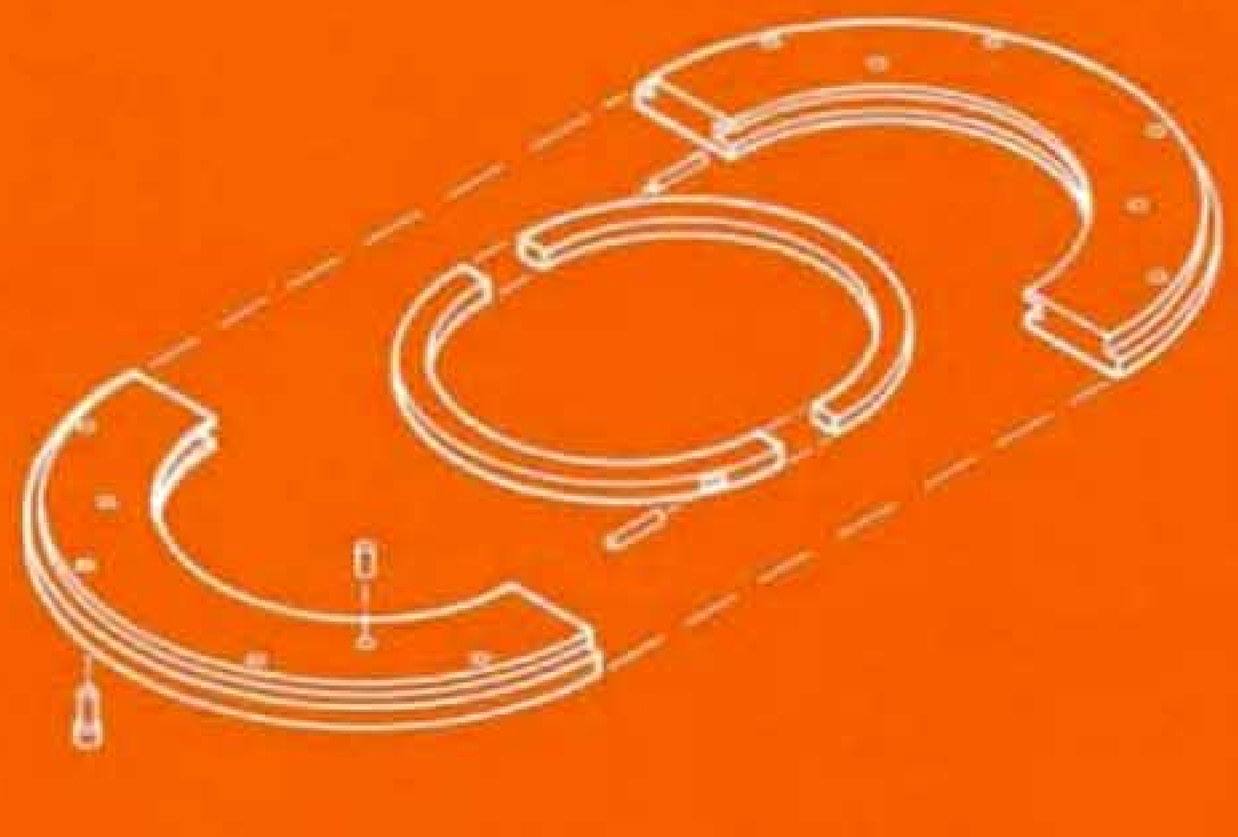
You can specify Kingsbury pivoted shoe journal bearings in either standard inch sizes or in metric sizes, with journal length-to-diameter ratios of 0.4, 0.7, or 1.0, with various end plate configurations, suitable for nominal shaft diameters from 2" to 12" (50mm to 300mm).

Load capacities in this catalog range up to 50,000 lb, (11,240N), and operating speeds to 50,000RPM. Complete instrumentation is available, including proximity sensors to measure axial and radial shaft position, and thermocouples or resistance temperature detectors (RTD's) to measure shoe temperature.

Our LEG™ pivoted shoe journal bearing with exclusive Leading Edge Groove directed lubrication can help reduce the size of the lubricating system, as well as reduce power loss and operating temperatures at high speeds.








Kingsbury manufacturing precision makes the difference.

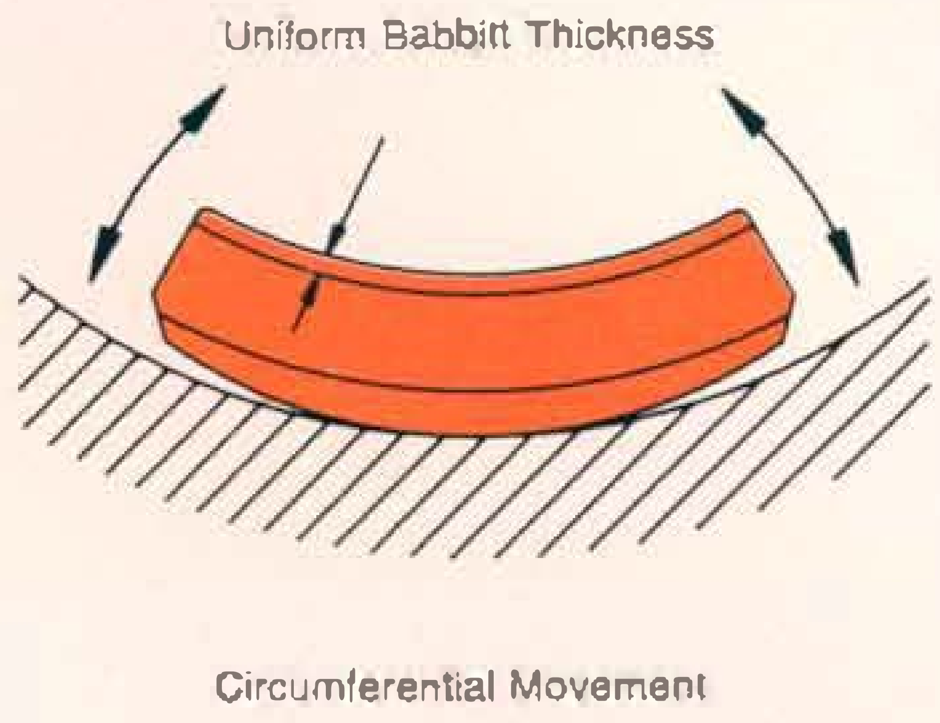
Each standard pivoted shoe journal bearing consists of five journal shoes supported in a precisely machined aligning ring. The shoes are held axially and circumferentially by shoe retaining plates.

The aligning ring, manufactured from heat treated 4100 class alloy steel, is axially split to allow easy assembly of the bearing around the shaft. Both halves are doweled for positive realignment and secured with socket head cap screws, while a hardened steel dowel on the cylindrical outside diameter prevents rotation of the bearing assembly in the housing.

An oil distribution annulus is machined into the outside of the aligning ring, and feed holes direct cool oil from the distribution annulus to the spaces between adjacent journal shoes. Custom designed aligning rings with flanges or adjustment pads to suit special requirements can be provided on a special order basis.

Each journal shoe is manufactured from heat treated 4100 class alloy steel. High-tin babbitt, per Federal Spec QQ-T-390 Grade 2 (ASTM B-23 Gr 2), is centrifugally cast, metallurgically bonded, then precisely machined to create the bearing surface. Proprietary manufacturing processes provide a uniform babbitt thickness across each journal shoe, while tight design tolerances permit interchangeability of shoes, both within a single bearing and between different bearings of the same size. (Each shoe is etched with its actual dimensions.)

The back of each journal shoe is contoured in two directions. This double radius design allows each shoe to adjust itself to the hydrodynamic forces generated by the rotating shaft, even under conditions of axial misalignment. The combination of hardened alloy steel and moderate Hertzian stresses allows the standard Kingsbury pivoted shoe journal bearing to be used in high shock load applications.



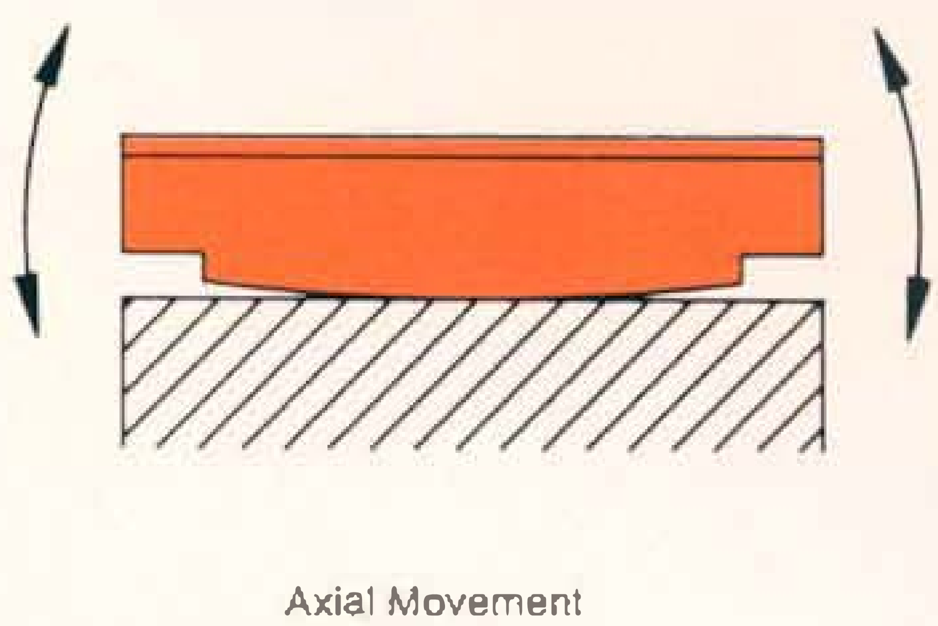


Figure 4-1: Double Radius Shoe Construction

The shoe retaining plates are manufactured from tempered aluminum plate. They are axially split and precision bored to regulate oil discharge from the bearing assembly. Locating pins at the ends of each journal shoe match corresponding holes in the retaining plates to provide accurate circumferential positioning, and to retain shoes when the bearing assembly is split for installation or inspection. The standard retaining plates can be replaced to provide special seal provisions or thrust faces. See Optional Features, page9.

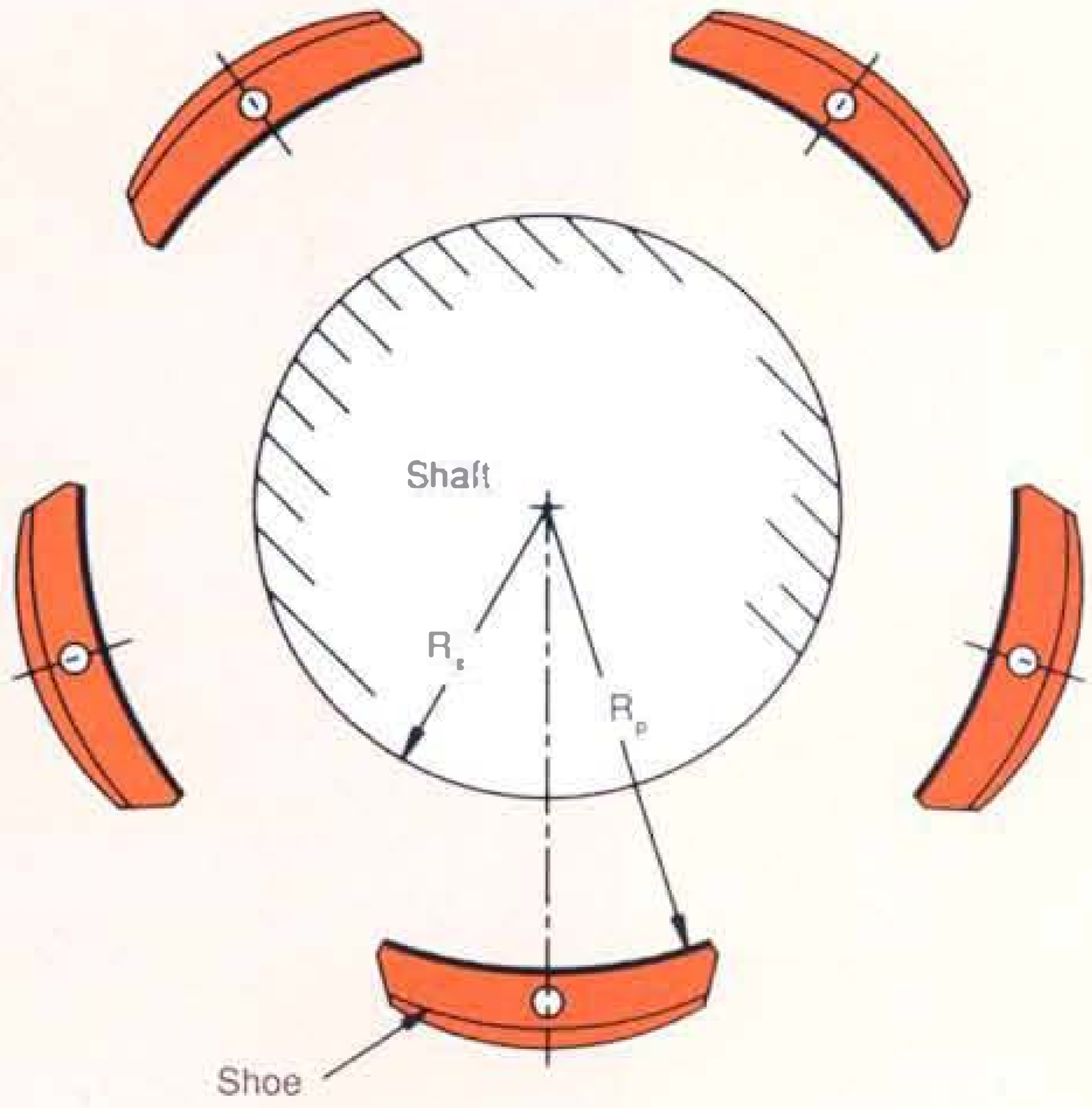
Clearance and preload.

Bearing clearance and preload are defined by relations between the shaft, shoe and bearing radii (see Fig. 5-1). In Kingsbury's pivoted shoe journal bearings, the babbitted shoes are precisely machined to curvature R_p. Installation in the aligning ring moves the shoes radially inward to assembled radius R_b. The difference between radius R_b and shaft radius R_s is the bearing's assembled radial clearance C_b. The assembled clearance allows space for thermal expansion, shoe tilt, and oil films. It also affects the quantity of oil flowing through the film, which removes heat generated by shear.

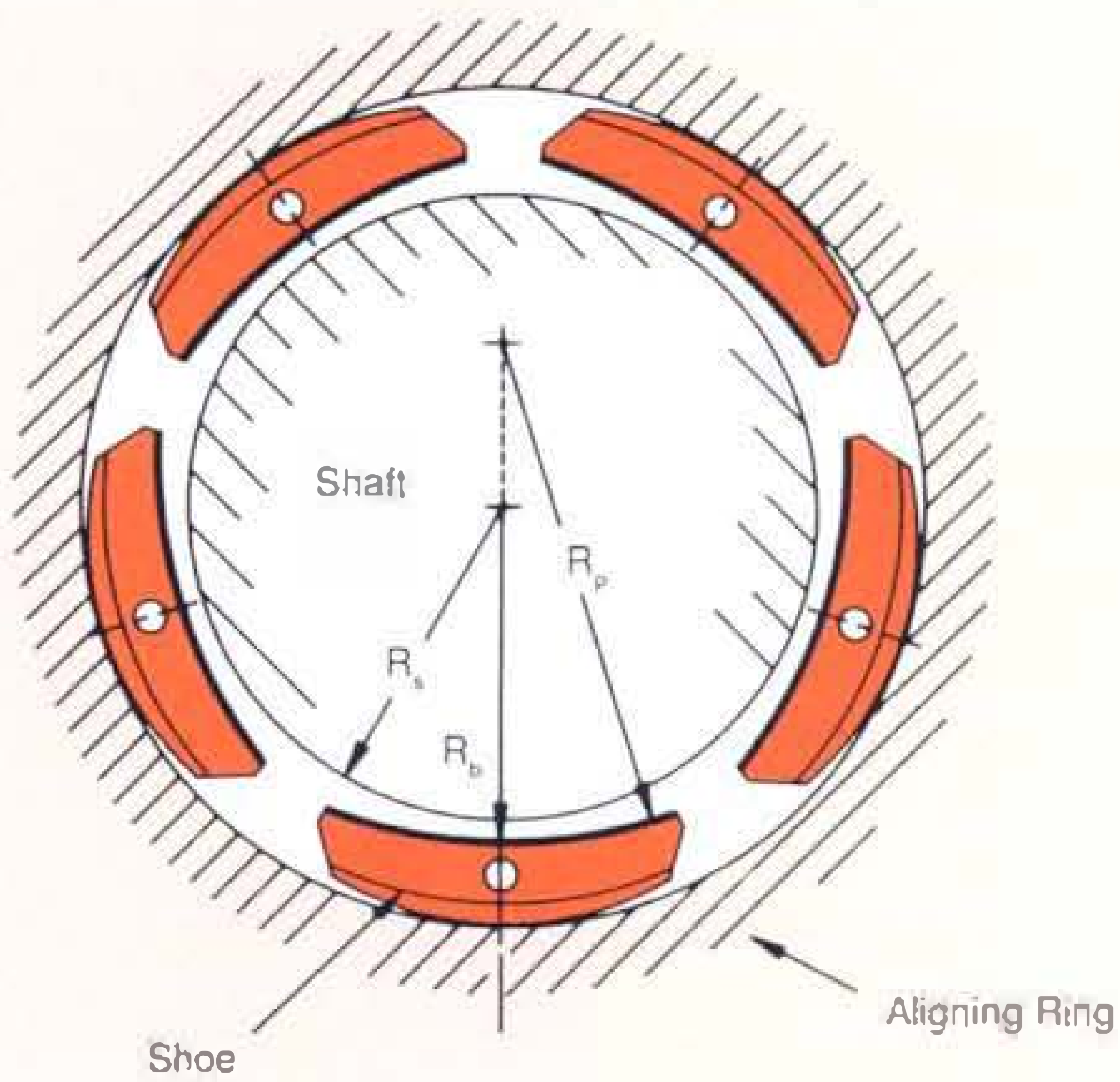
The inward relocation of the shoes from concentric positions preloads the bearing. The mathematical expression for preload defines a relationship between the surface curvatures and the assembled clearance. Kingsbury's standard pivoted shoe journal bearings are manufactured to provide a positive preload. This increases bearing stiffness by reducing the assembled clearance, C_b. The positive preload profile provides a larger clearance at the leading edge of the shoe, protecting against failure due to oil starvation. This assures that a converging oil wedge is always present to develop hydrodynamic forces.

Both the assembled clearance and the preload affect the operating characteristics of the bearing, such as power loss, oil and shoe temperatures, film thickness, dynamic stiffness, and damping coefficients. This catalog provides data for bearing selection based on standard values. Since the bearings are part of the machine's dynamic system, assembled clearance and preload can be tailored to suit your specific application.

Please do not hesitate to contact our engineers for additional information.



Pivoting Shoes as Machined



Pivoting Shoes as Assembled

R_s = Shaft radius
R_p = Shoe machined curvature
R_b = Bearing assembled radius

C_p = Shoe machined clearance = $R_p - R_s$
C_b = Bearing assembled clearance = $R_b - R_s$

$$\text{Preload} = 1 - (C_b/C_p)$$

Figure 5-1: Bearing Preload

Reference Codes

Kingsbury pivoted shoe journal bearings are identified and ordered using a six part reference code. The reference code identifies the bearing style, nominal shaft diameter, nominal journal shoe length, installation type, load vector orientation, and optional features.

Bearing style

PJ–English
MJ–metric
(consult factory for sizes)

Nominal shaft diameter, A

(standard size range 2.00" to 12.00")

Nominal shoe length, B

(Std. B/A ratios are 0.4, 0.7 or 1.0)

PJ 02.50 01.75 P S (FS)

Installation type

P—Pin located
F—Flange located
B—Bolted flange located

Load vector orientation

S—Load on single shoe
D—Load between two shoes

Optional features

(see page 9)
FS—Floating seals
MT—Instrumentation
PP—Proximity probes
HL—High pressure lift
TF—Flat land thrust face
TT—Taper land thrust face
TS—Thrust shoes

Installation Type

Three standard mounting configurations can be selected from this catalog.

Installation Code P: Pin Located.

This is the most widely used mounting configuration. In this design, a hardened steel dowel protrudes from the aligning ring. Once this dowel is located in a hole or slot in the bearing housing, it holds the bearing both axially and circumferentially.

Installation Code F: Flange Located.

In this design, a hardened steel dowel is used to prevent rotation of the bearing in the housing. The shoe retaining plates extend beyond the aligning ring to locate the bearing axially.

Installation Code B: Bolted Flange Located.

This design is most commonly used for assembly when the housing is not split. One of the shoe retaining plates is extended to locate the bearing axially. Holes are provided in the flange so that the bearing can be secured to the housing.

Load Vector Orientation

The standard 5-shoe journal bearing can be oriented in either of two positions. The position is determined by the location of the housing's pin slot for installation codes P and F, or by the housing's bolt pattern for installation code B.

With the load shared between two shoes, the bearing can support greater radial loads. This is accompanied by a larger static shaft drop. With the load supported on a single shoe, static shaft drop is minimized. This configuration provides for a higher vertical stiffness than the load between shoes orientation.

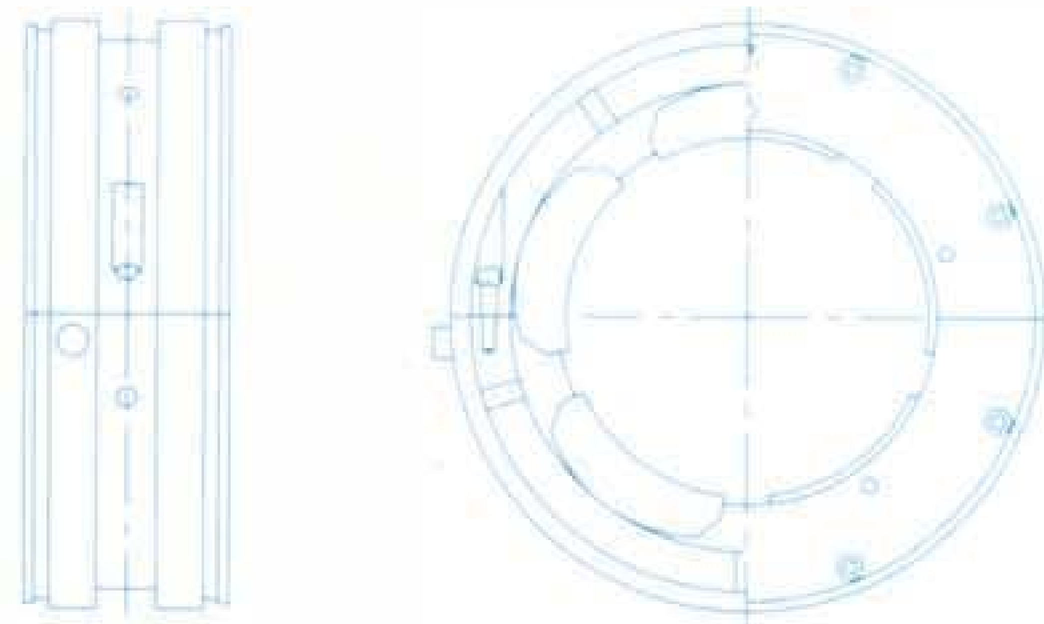


Figure 7-1: Pin Located Bearing (Code P)

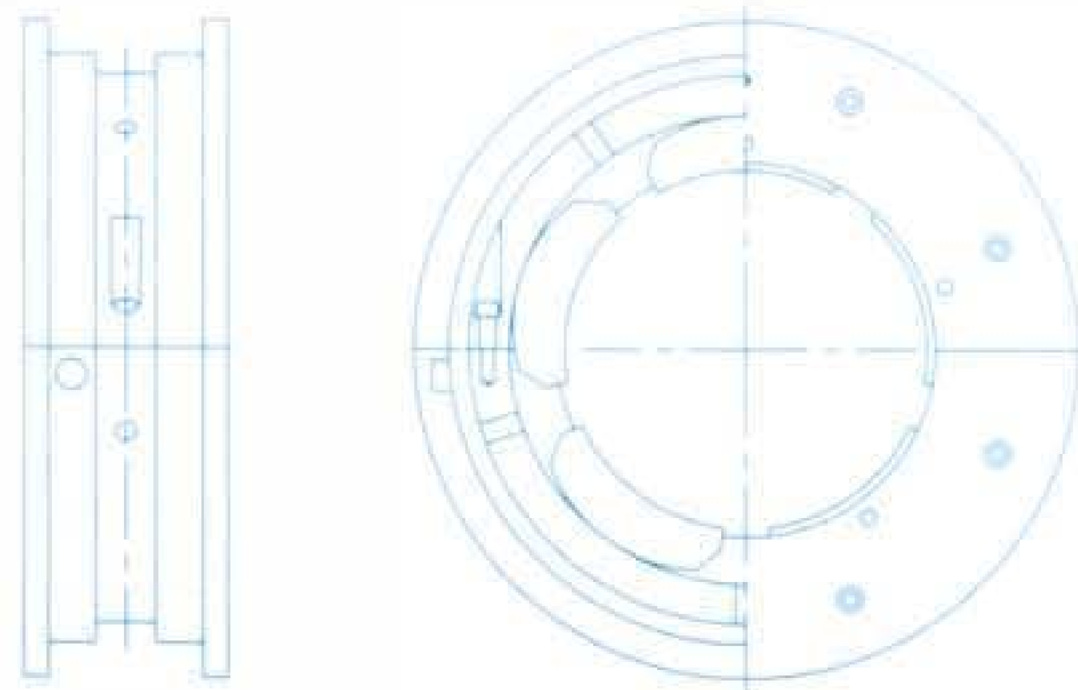


Figure 7-2: Flange Located Bearing (Code F)

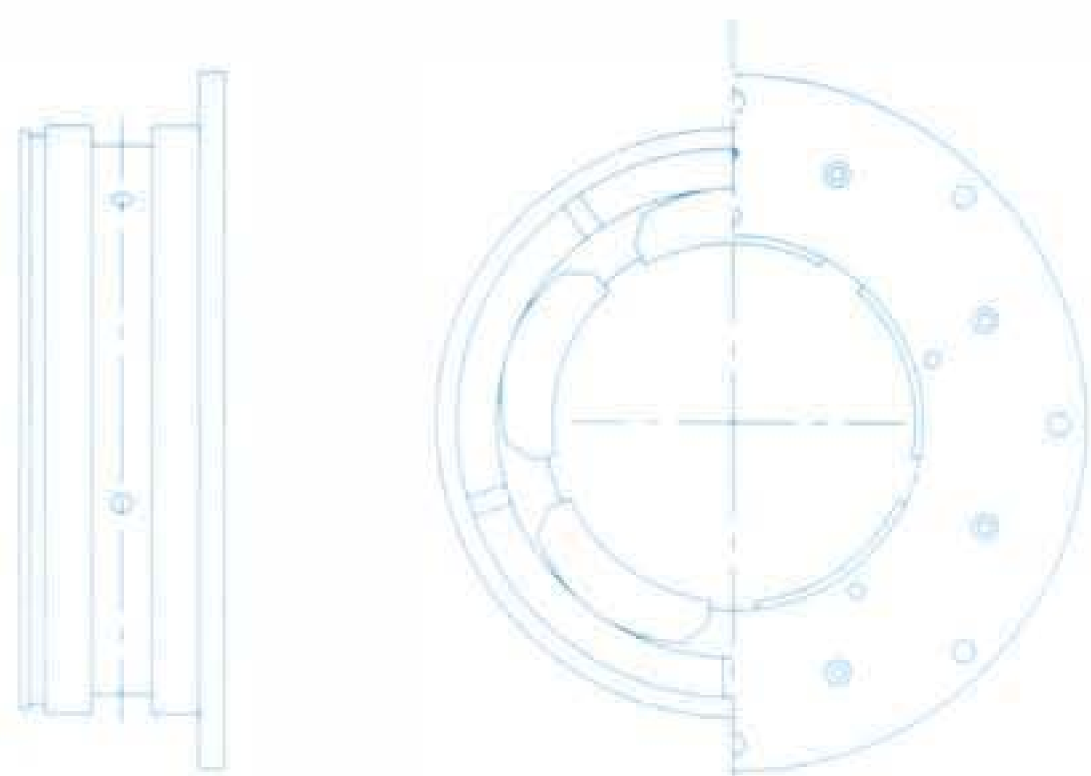


Figure 7-3: Bolted Flange Located Bearing (Code B)

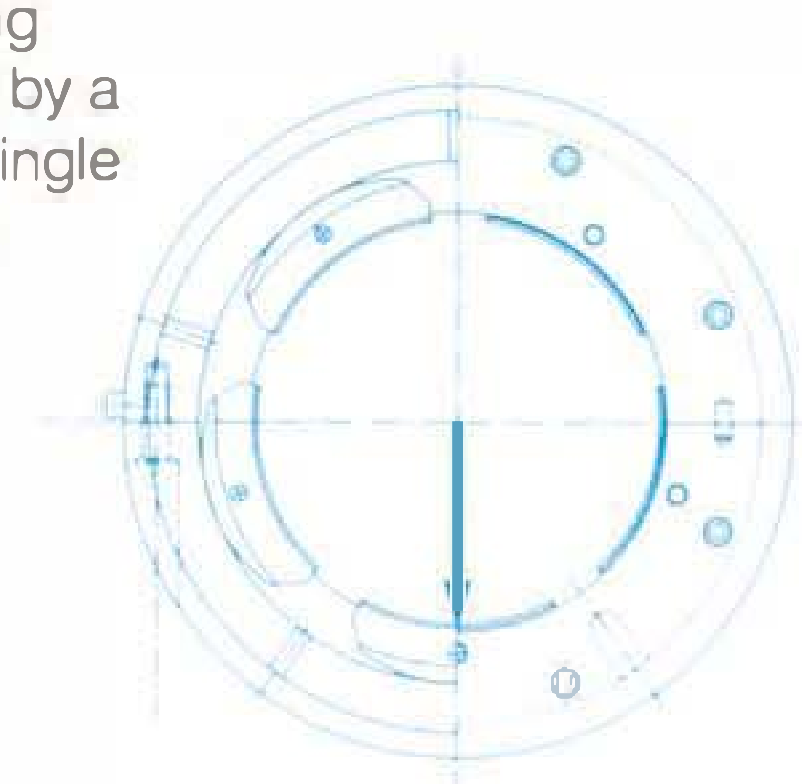


Figure 7-4: Load on One Shoe (Code S)

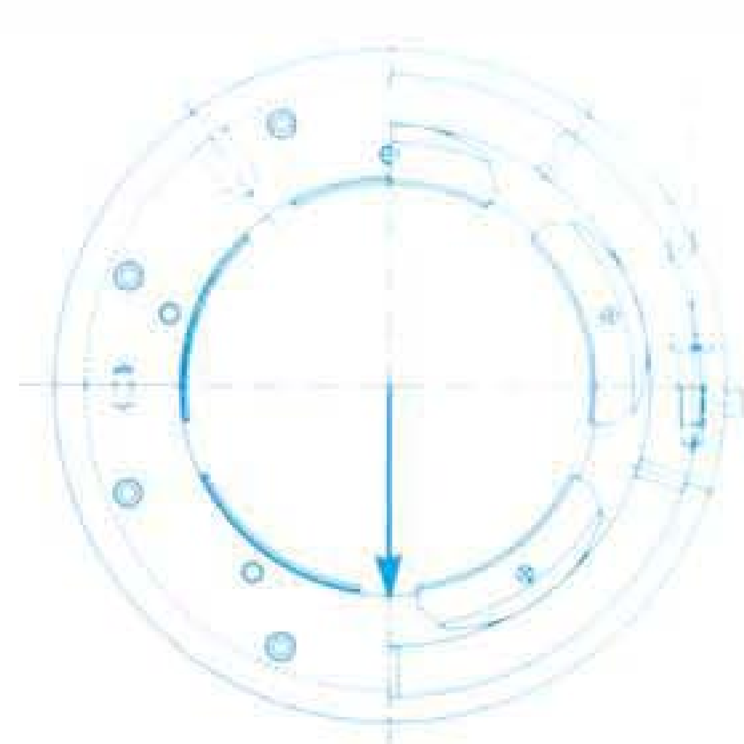


Figure 7-5: Load on Two Shoes (Code D)

Reference Codes

Kingsbury pivoted shoe journal bearings are identified and ordered using a six part reference code. The reference code identifies the bearing style, nominal shaft diameter, nominal journal shoe length, installation type, load vector orientation, and optional features.

Bearing style

PJ–English
MJ–metric
(consult factory for sizes)

Nominal shaft diameter, A

(standard size range 2.00" to 12.00")

Nominal shoe length, B

(Std. B/A ratios are 0.4, 0.7 or 1.0)

PJ 02.50 01.75 P S (FS)

Installation type

P—Pin located
F—Flange located
B—Bolted flange located

Load vector orientation

S—Load on single shoe
D—Load between two shoes

Optional features

(see page 9)
FS—Floating seals
MT—Instrumentation
PP—Proximity probes
HL—High pressure lift
TF—Flat land thrust face
TT—Taper land thrust face
TS—Thrust shoes

Optional Features.

Floating seals, Code FS

When oil flow out of the bearing along the shaft has to be controlled, floating seal rings are recommended. Both shoe retaining plates are fitted with floating seal rings (Fig. 9-1).

Instrumentation, Code MT

Journal shoes are instrumented with thermocouples or RTD's to monitor bearing temperatures. The type of instrumentation required and sensing position (shoe center or trailing edge) should be indicated (Fig. 9-2). Specify both on the "Inquiries" form, page 29.

Proximity Probes, Code PP

Customer furnished proximity probes are mounted radially on special shoe retaining plates. The probes are mounted 90° apart for monitoring shaft position or orbit (Fig. 9-3).

High Pressure Lift, Code HL

Shoes are modified for the injection of high pressure oil to establish an oil film at start-up or during very low speed operation (Fig. 9-4). Kingsbury can also supply high pressure lift systems if required (see Catalog W).

Thrust Capability

Thrust bearing capability can be incorporated in a pivoted shoe journal bearing with suitable shoe retaining plate modifications (photo, page 11).

Code TF

Thrust face with flat land, babbitted bumper incorporated into one or both of the shoe retaining plates (Fig. 11-1).

Code TT

Same as flat face bumper except with taper land design to handle higher axial loads (Fig. 11-1).

Code TS

Thrust shoes (NE style bearing) mounted on one or both shoe retaining plates (Fig. 11-2). For more information, refer to page 11.

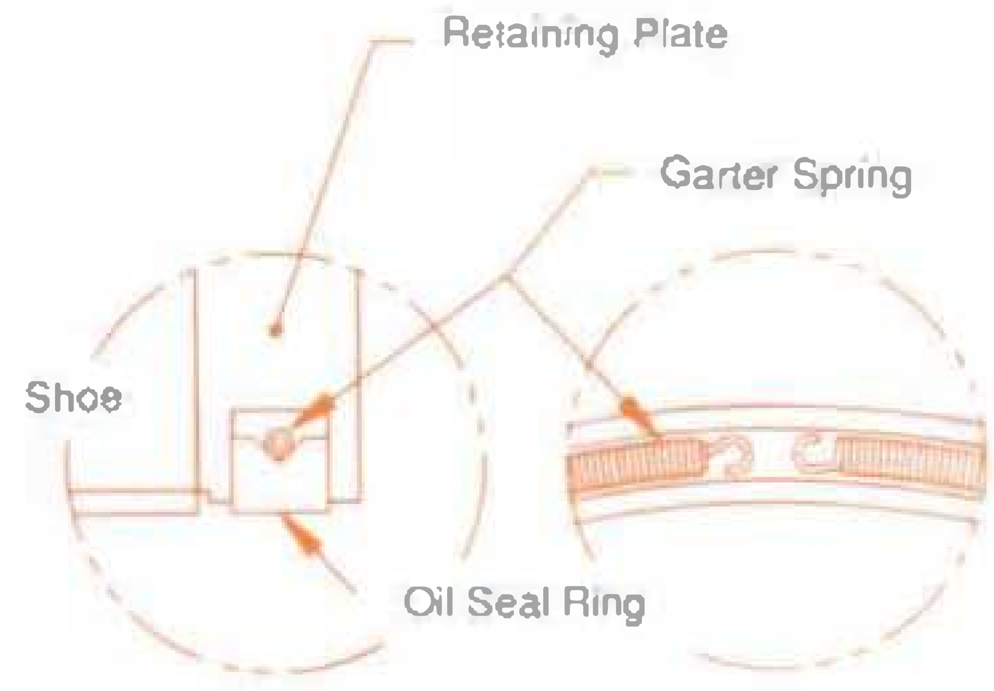


Figure 9-1: Floating Seals (Code FS)

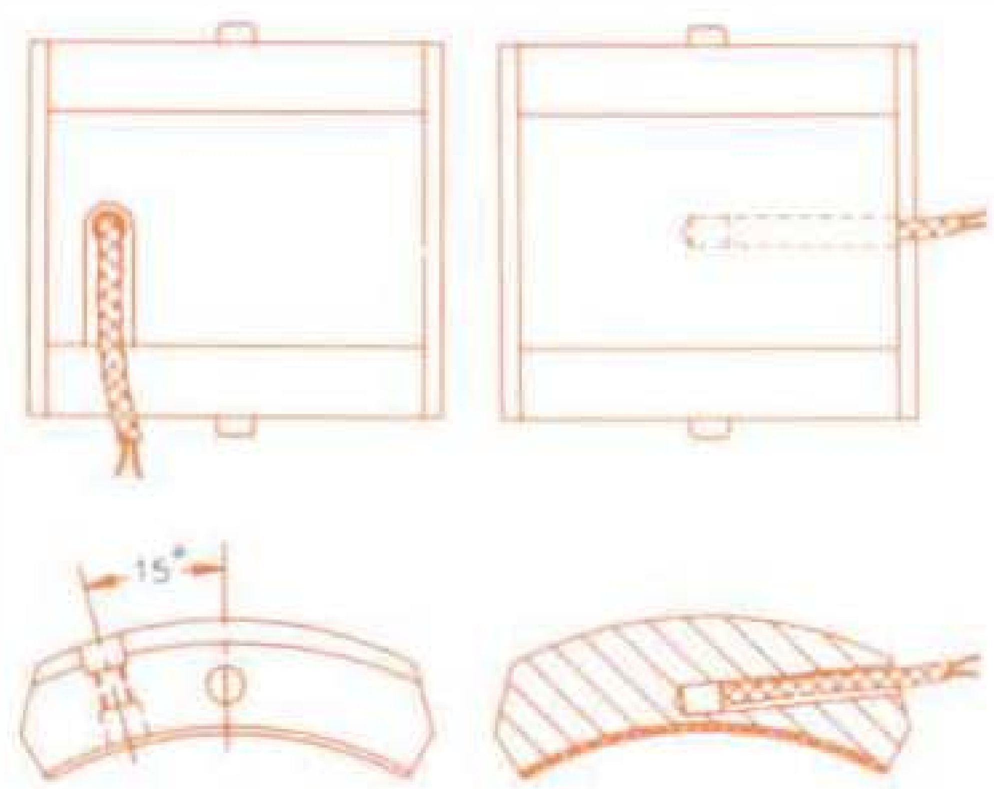


Figure 9-2: Instrumentation Locations

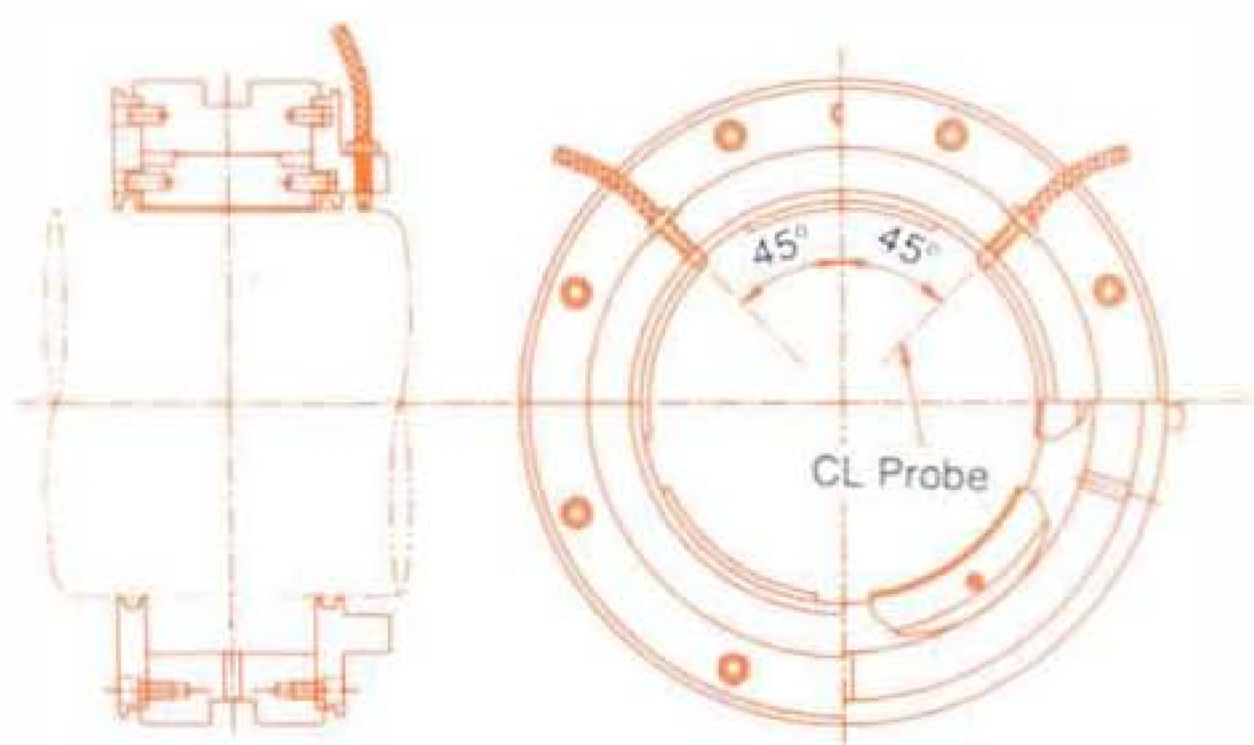


Figure 9-3: Proximity Probes (Code PP)

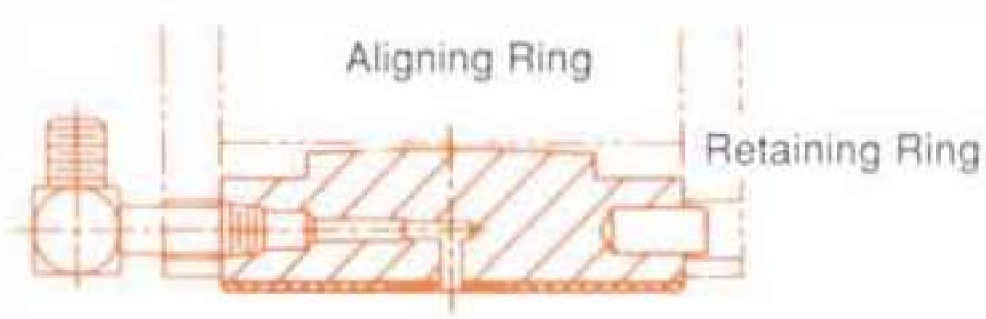


Figure 9-4: High Pressure Lift (Code HL)

Design Customization.

This catalog documents the popular, standard bearing selections. However, should your application require special consideration, Kingsbury can supply custom bearings to satisfy individual requirements. Please contact our Engineering Department during your preliminary design stages so we can assist in providing a bearing particularly suited for your equipment.

Bearing size and B/A ratio.

In addition to the standard bearings shown in this catalog, Kingsbury has supplied bearings with various B/A ratios and for shaft diameters from 1.25" to 56." An appropriate bearing can be designed to accommodate special applications with envelope restrictions and unusual load characteristics.

Shoe backing material.

Standard shoe backing material is heat treated alloy steel. Under certain operating conditions, steel shoes can yield unacceptably high temperatures. In such cases, a chrome-copper material can be substituted.

Chrome-copper has an excellent thermal conductivity, which makes it very effective in removing heat from the babbitt. This property allows significant reductions in temperature for applications where steel backed shoes run too hot; e.g., high speed, high load. Chrome-copper is also used to keep temperatures low in applications where specifications place limits on shoe temperatures.

Other materials are available for high ambient or inlet oil temperatures.

Inlet orifice.

Oil flows for standard bearings are intended to be controlled by an orifice in the supply line to the bearing. If required, individual orifices can be provided in the radial feed holes of the bearing.

LEG™ bearing.

Pivoted shoe journal bearings are available with Kingsbury's exclusive, patented leading edge groove shoes to reduce the volume of oil required, yielding more efficient operation.

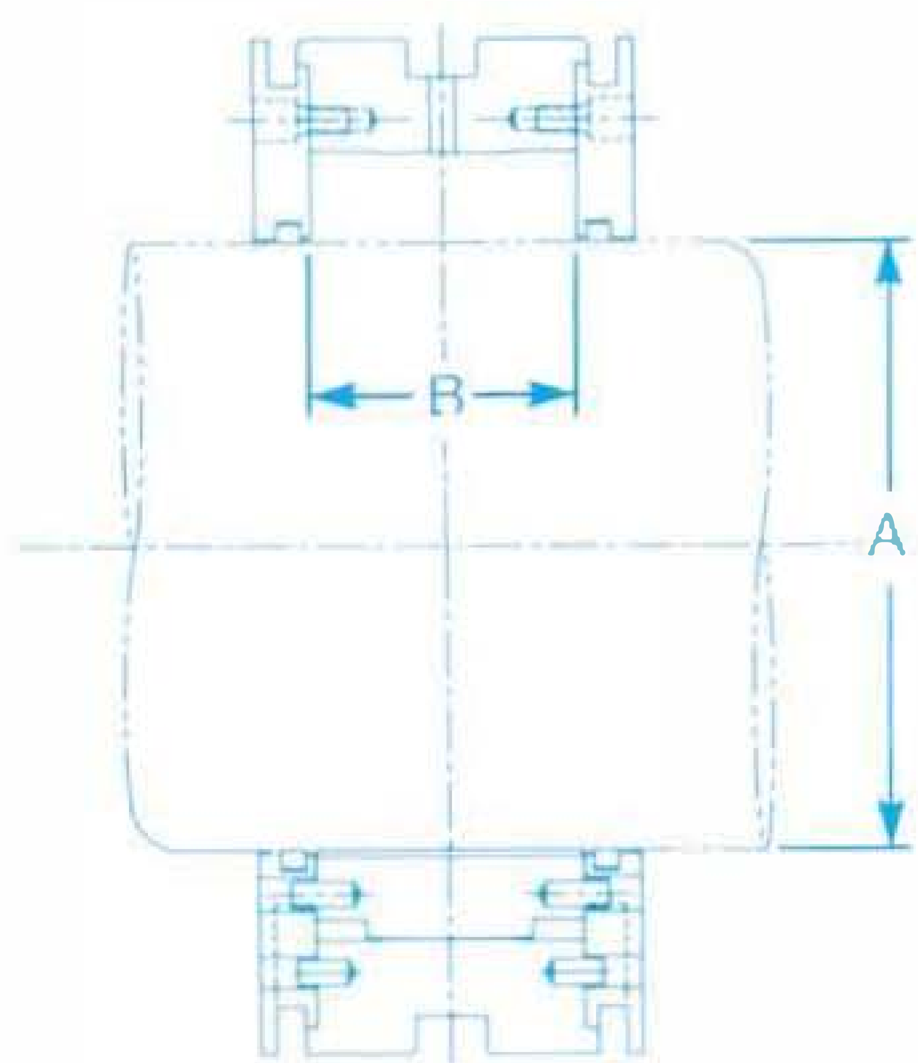


Figure 10-1: B/A Ratio

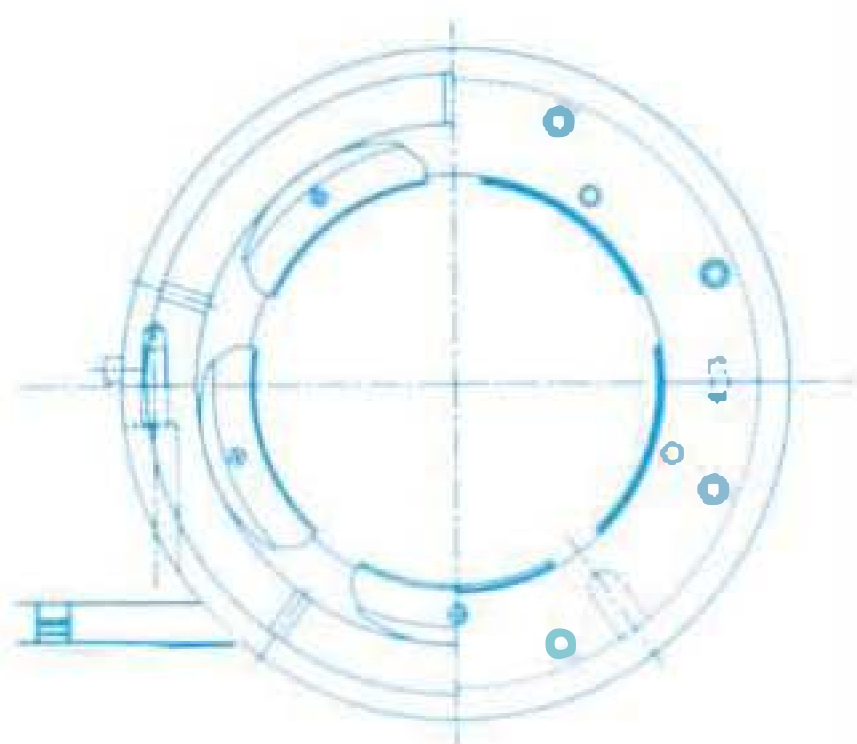


Figure 10-2: Orificed Supply Line

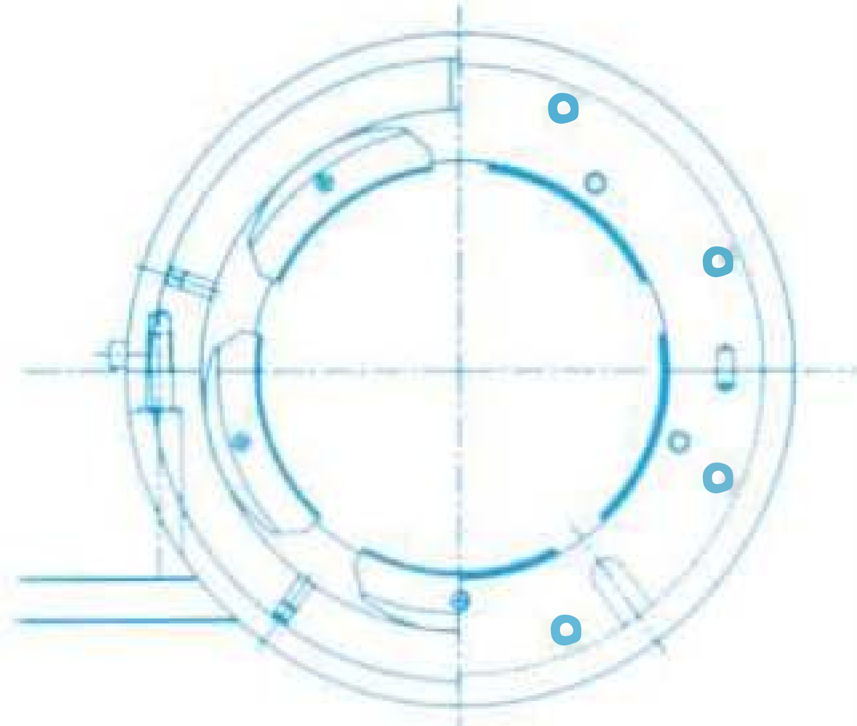


Figure 10-3: Orificed Feed Holes

Journal bearings with thrust capabilities.

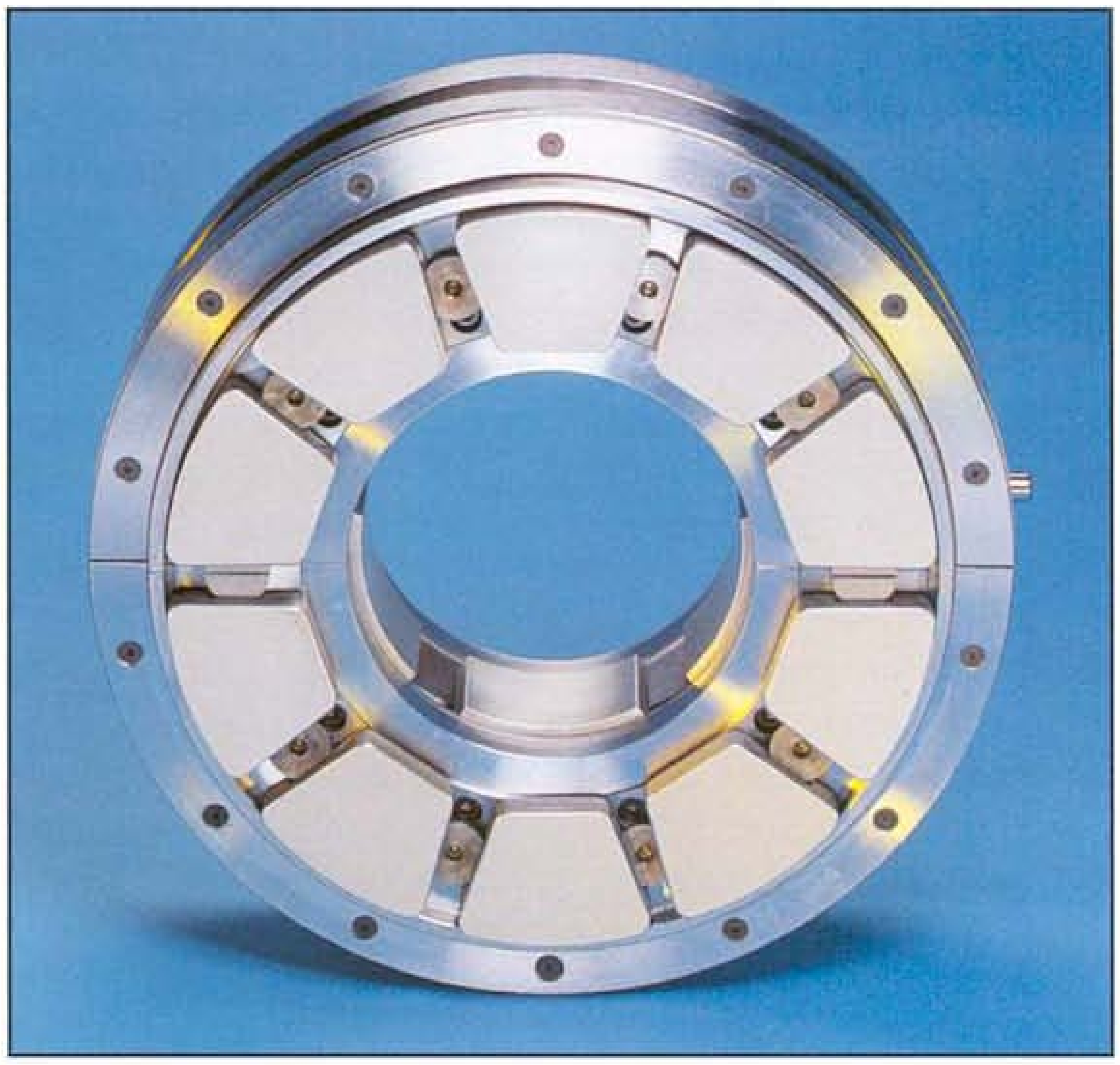
Kingsbury, Inc. specializes in packaging thrust and journal bearings to meet the needs of original equipment manufacturers. We can add thrust capacity to our standard pivoted shoe journal bearings simply by removing the standard shoe retaining plates and replacing them with either flat or taper land thrust plates.

You can order flat land thrust plates by specifying optional feature "TF," and taper land thrust plates by specifying optional feature "TT." Flat thrust faces can carry loads up to 80 psi; taper land thrust faces can carry loads up to 250psi.

If greater thrust capacities are needed, a special aligning ring, optional feature "TS," has been developed to hold thrust shoes. Tilting or pivoted-shoe thrust bearings can be used on either or both ends of the aligning ring.

For further information on Kingsbury's non-equalizing thrust bearings, see catalog NE. Our standard equalizing bearings can also be mounted on one or both ends of the aligning ring. For performance data, we refer you to catalog EQH.

The thrust capabilities for pivoted shoe journal bearings are tailored to meet your special requirements. If you order this type of bearing, we recommend consultation with our Engineering Department.



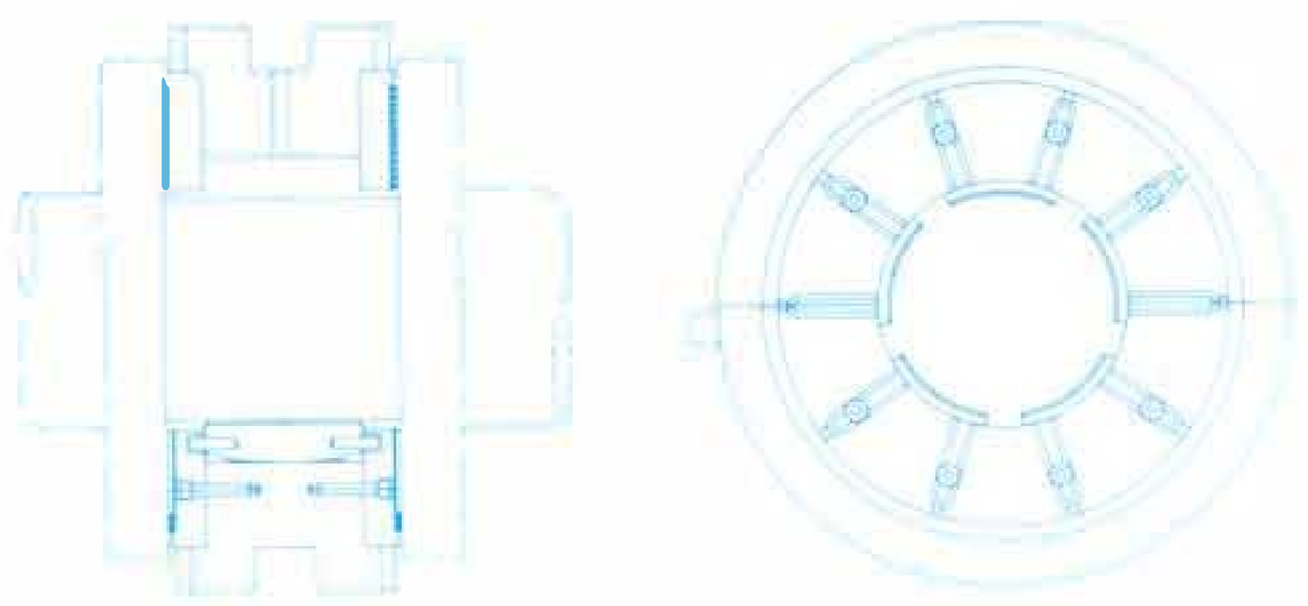


Figure 11-1: Thrust Face with Flat Land (Code TF) or Taper Land (Code TT)

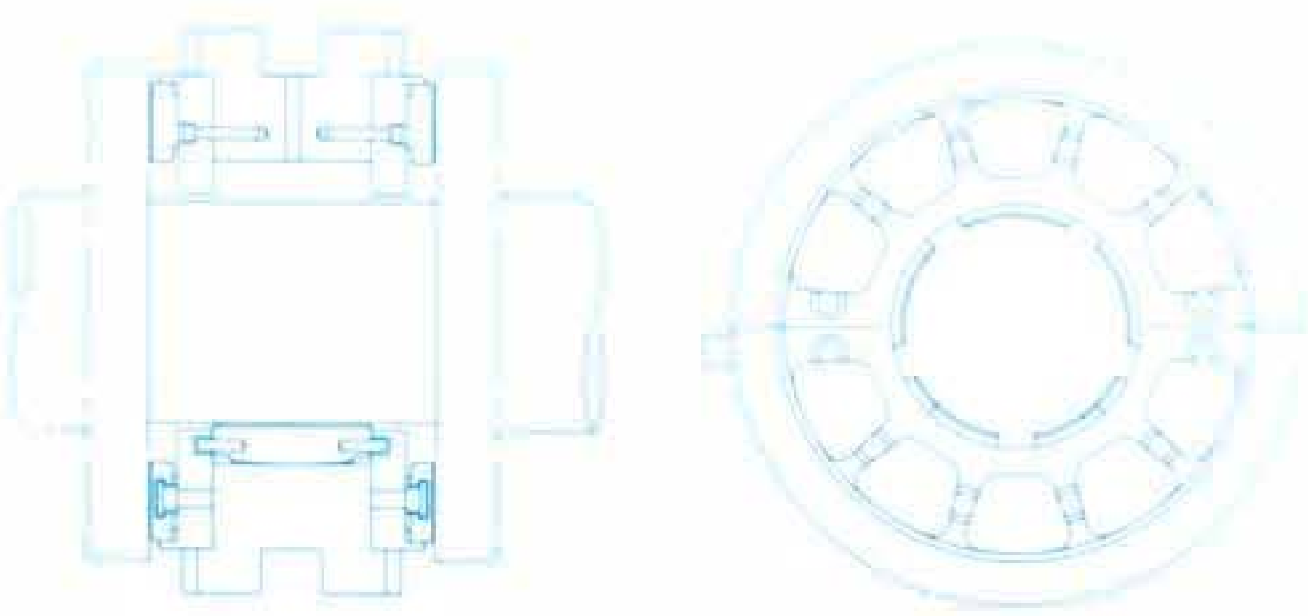


Figure 11-2: Thrust Shoes (Code TS)

Bearing parameters affecting system dynamics.

The standard bearing configurations listed in this catalog were selected to provide good overall bearing operation and performance. Because bearing selection is also an integral part of the total system dynamics, variations from the standards are sometimes required. The following are design parameters that can be selected to optimize the bearing characteristics. Bearing stiffness and damping coefficients are available from our Engineering Department upon request. Please contact us for more specific information on the application of these special designs.

Number of shoes.

The five-shoe bearing was selected as standard because of the wide range of applications suited to this design. Four shoe bearings are another popular design (see discussion on page 13). The number of shoes is often selected to obtain required dynamic performance.

In certain cases, selection is based on shoe proportions. On units with short axial lengths, more than five shoes may be required. Bearings with as many as ten or more shoes have been supplied for special applications.

Bearing orientation.

Bearing orientation should be considered for machines with varying load magnitude and direction. For these classes of machines, both the number of shoes and bearing orientation can be selected to obtain the best combination to handle the loads (Fig. 12-1).

Clearance and preload.

Clearance and preload were defined on page 5. Kingsbury's standard average preload value is 0.25. If required, clearance and preload other than standard can be provided to refine bearing operation and overall system dynamics.

B/A ratio.

The B/A ratio is another method used to change the dynamic characteristics of the bearing. By increasing or decreasing the diameter "A" and/or axial length "B," bearing stiffness and damping can be altered to achieve the desired response.

Offset pivots.

Standard bearings are supplied with a centrally located shoe pivot suitable for bi-rotational equipment (Fig. 12-2). For applications with one direction of rotation, the pivot can be offset (Fig. 12-3). The offset provides a better oil film wedge and yields lower shoe temperatures.

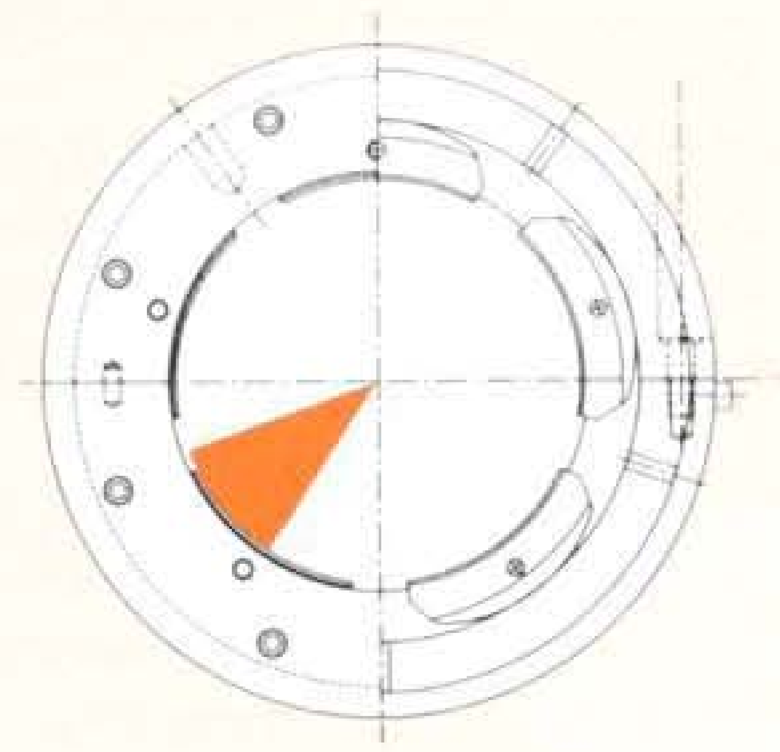


Figure 12-1: Bearing orientation modified to suit variable load.

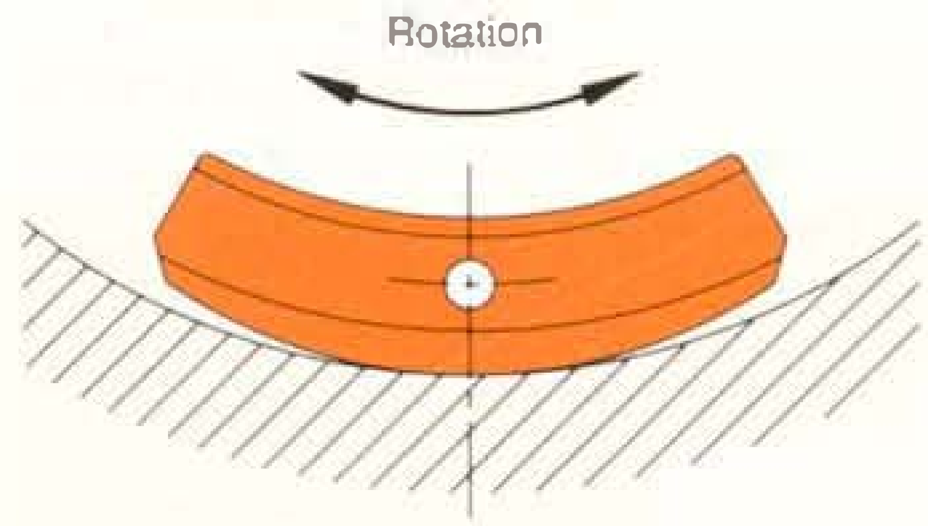


Figure 12-2: Shoe with standard central pivot.

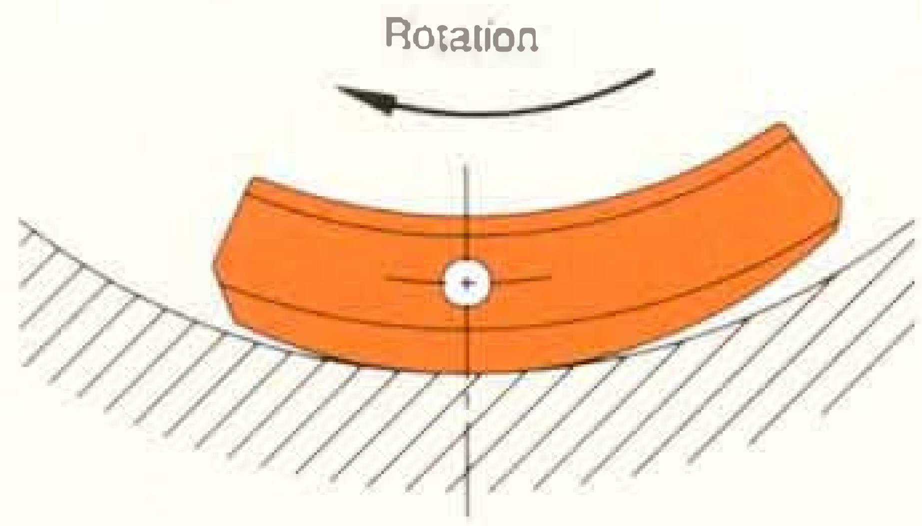
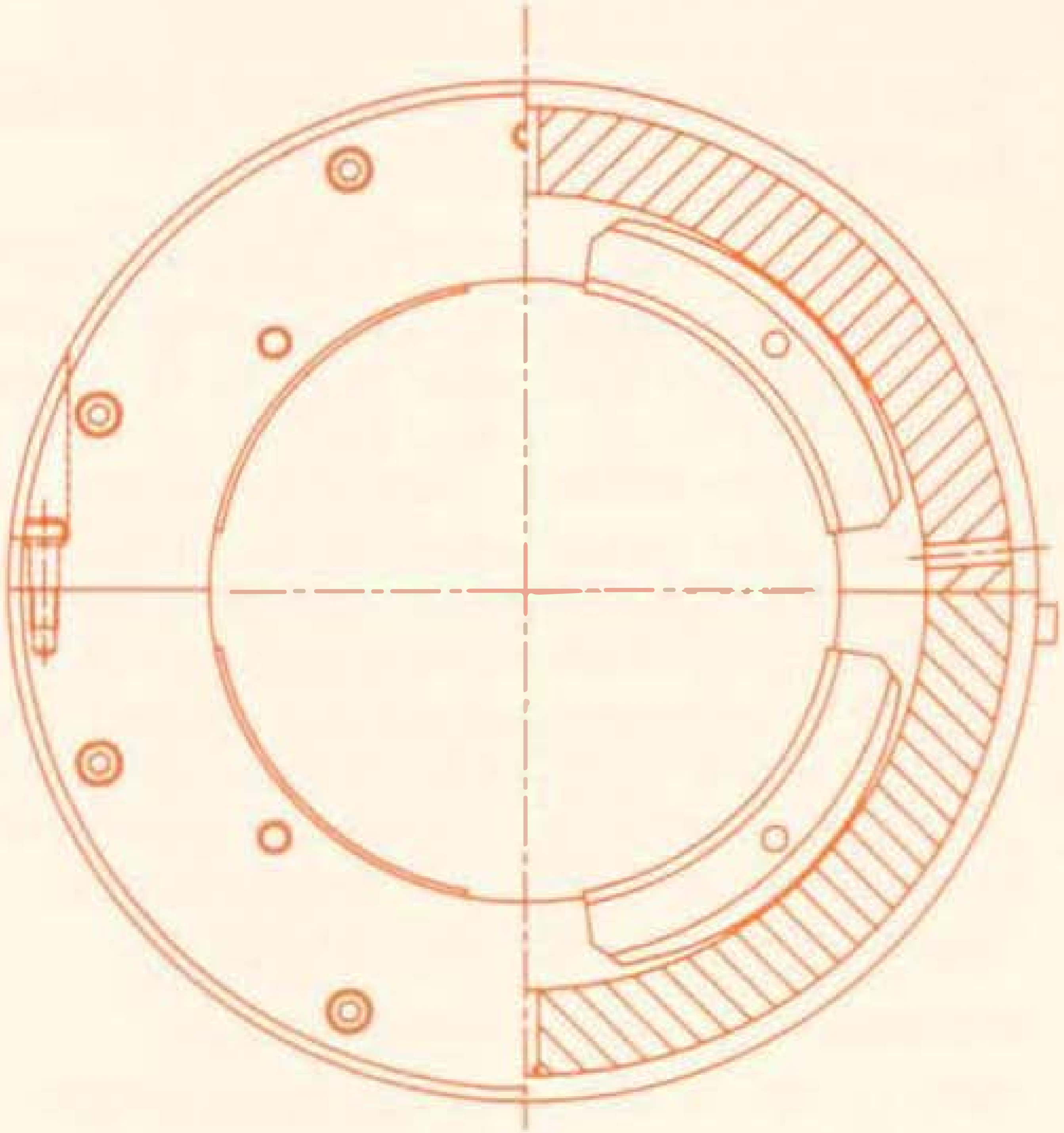


Figure 12-3: Shoe with optional offset pivot.



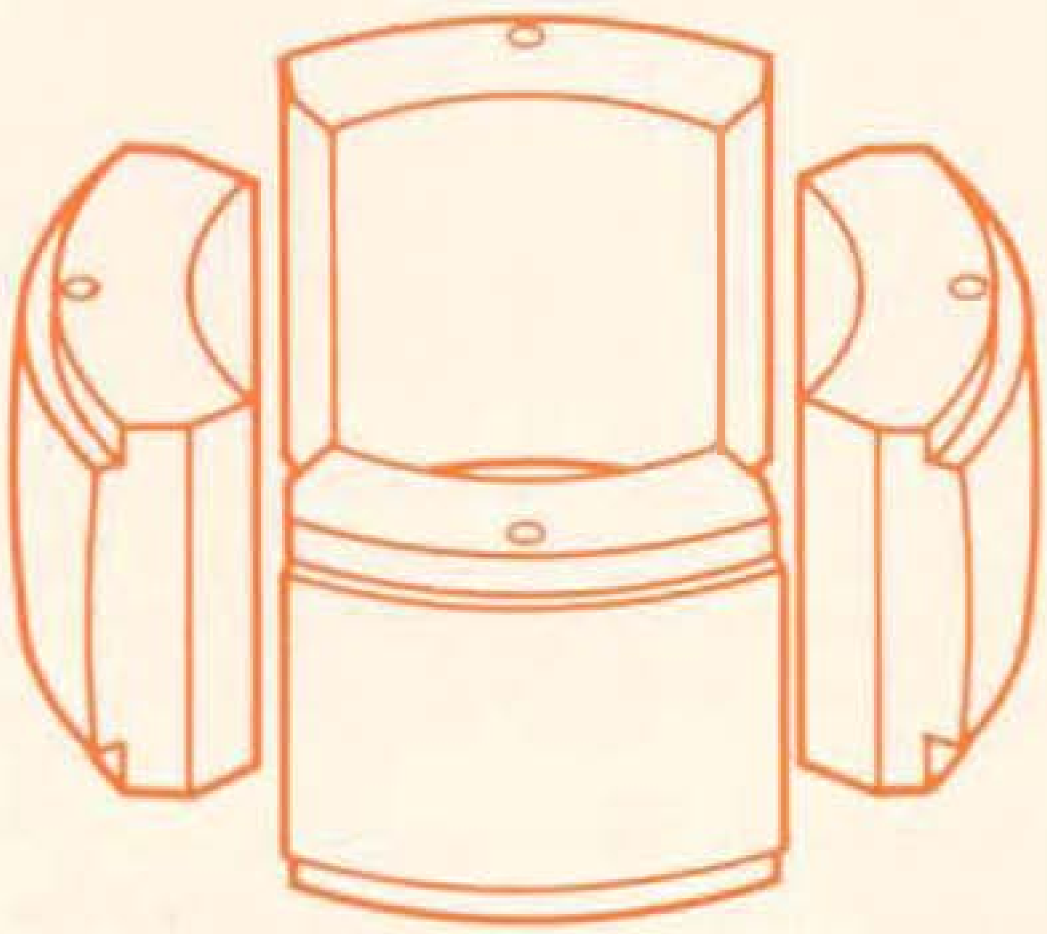


Figure 13-1: Typical Four-Shoe Journal Bearing

Kingsbury's Pivoted 4-Shoe Journal Bearings

Because of its asymmetrical geometry, a 5-shoe journal bearing's vertical stiffness exceeds its horizontal stiffness. At low loads, preload can be introduced in Kingsbury's pivoted shoe journal bearings to increase stiffness. If horizontal stiffness requirements are high, a pivoted 4-shoe journal bearing provides a horizontal stiffness equal to the vertical stiffness.

Four-shoe bearings will virtually eliminate the potential of an elliptical orbit. In fact, with a preload factor of approximately 0.50, the bearing will constrain the shaft to a relatively small circular orbit. Because 4-shoe journal bearing shoes have a longer arc than those in the 5-shoe bearing, they also generate a thicker oil film, which will improve bearing damping characteristics.

As with the 5-shoe bearing, the 4-shoe bearing is available in installation codes P, F, and B. For light loads, a B/A ratio of 0.4 is recommended. If the bearing must carry heavier loads, however, we recommend a B/A ratio of 0.6. Kingsbury 4-shoe journal bearings can be supplied for all envelope dimensions shown in this catalog and various optional features can also be ordered. Consult our Engineering Department for details.

Reference Codes

Kingsbury pivoted shoe journal bearings are identified and ordered using a six part reference code. The reference code identifies the bearing style, nominal shaft diameter, nominal journal shoe length, installation type, load vector orientation, and optional features.

Bearing style
PJ–English
MJ–metric
(consult factory for sizes)

Nominal shaft diameter, A
(standard size range 2.00" to 12.00")

Nominal shoe length, B
(Std. B/A ratios are 0.4, 0.7 or 1.0)

PJ 02.50 01.75 P S (FS)

Installation type
P—Pin located
F—Flange located
B—Bolted flange located

Load vector orientation
S—Load on single shoe
D—Load between two shoes

Optional features
(see page 9)
FS—Floating seals
MT—Instrumentation
PP—Proximity probes
HL—High pressure lift
TF—Flat land thrust face
TT—Taper land thrust face
TS—Thrust shoes

Size Selection for Standard 5-Shoe Bearings.

To select the proper bearing size, determine the shaft diameter, the required load, and the operating speed. With these parameters noted, enter Table 15-1 or 15-2 with nominal shaft diameter. Select the combination of journal shoe length (i.e. B/A ratio) and load vector type (load on one shoe [S] or between two shoes [D]) that provide adequate load capacity for the application. After selecting journal length and load vector, go to pages 16 through 21, and use the appropriate curves to determine power loss and required oil flow. If you find that your application involves bearing operation outside the nominal range shown in these curves, consult Kingsbury's Engineering Department to make final bearing selection.

Oil Grade

Bearing capacity and power loss values are based on oil grade ISO VG32, supplied at an inlet temperature of 120°F (48.9°C). The recommended oil flow is based on an oil outlet temperature of 150°F (65.6°C), and assumes standard Kingsbury preload and clearances.

For power loss, oil flow, and bearing capacity using oil grades and operating temperatures other than those given above, or using preload and clearances different from standard, contact Kingsbury's Engineering Department.

Dimensions

Once you've selected the proper bearing size, you can use the dimension tables that correspond to the selected B/A ratio to determine bearing dimensions and housing requirements (see Tables 22-1 through 27-1, pages 22–27).

A note about metric dimensions: For metric applications, bearings are manufactured to match standard nominal metric shaft diameters, as shown in the first column of Tables 23-1, 25-1 and 27-1 (+0.0000, -0.0127mm). All other bearing dimensions are obtained by converting from the corresponding English units in the adjacent table.

Table 15-1: Rated Load for Pivoted Shoe Journal Bearings—English Units

Nominal Shaft Diameter, inches	Length/Diameter (B/A) Ratio					
	B/A = 0.4		B/A = 0.7		B/A = 1.0	
	Load, lb_f on One Shoe	Load, lb_f on Two Shoes	Load, lb_f on One Shoe	Load, lb_f on Two Shoes	Load, lb_f on One Shoe	Load, lb_f on Two Shoes
2.00	340	540	590	950	840	1,400
2.50	540	870	860	1,400	1,300	2,100
3.00	790	1,300	1,300	2,100	1,900	3,000
3.50	1,100	1,800	1,700	2,800	2,600	4,200
4.00	1,300	2,200	2,300	3,700	3,400	5,400
4.50	1,700	2,800	2,900	4,600	4,200	6,900
5.00	2,200	3,500	3,600	5,800	5,200	8,500
5.50	2,500	4,000	4,300	7,000	6,300	10,300
6.00	3,000	4,900	5,200	8,300	7,500	12,200
7.00	4,000	6,500	7,100	11,400	10,300	16,600
8.00	5,400	8,700	9,000	14,600	13,400	21,700
9.00	6,900	11,100	11,500	18,600	17,000	27,400
10.00	8,400	13,500	14,200	23,000	20,900	33,900
11.00	10,300	16,600	17,300	28,000	25,300	41,000
12.00	12,000	19,500	20,900	33,900	30,200	48,800

Table 15-2: Rated Load for Pivoted Shoe Journal Bearings—Metric Conversions

Nominal Shaft Diameter, mm	Length/Diameter (B/A) Ratio					
	B/A = 0.4		B/A = 0.7		B/A = 1.0	
	Load, newtons, on One Shoe	Load, newtons on Two Shoes	Load, newtons on One Shoe	Load, newtons on Two Shoes	Load, newtons on One Shoe	Load, newtons on Two Shoes
50	1,500	2,400	2,600	4,200	3,700	6,000
60	2,400	3,900	3,800	6,200	5,800	9,400
75	3,500	5,700	5,900	9,500	8,400	14,000
90	4,800	7,800	7,600	12,000	11,000	19,000
100	6,000	9,600	10,000	16,000	15,000	24,000
115	7,700	12,000	13,000	21,000	19,000	31,000
125	9,600	16,000	16,000	26,000	23,000	38,000
140	11,000	18,000	19,000	31,000	28,000	46,000
150	13,000	22,000	23,000	37,000	34,000	54,000
175	18,000	29,000	31,000	51,000	46,000	74,000
200	24,000	39,000	40,000	65,000	60,000	97,000
225	31,000	50,000	51,000	83,000	76,000	122,000
250	37,000	60,000	63,000	103,000	93,000	151,000
280	46,000	74,000	77,000	124,000	113,000	182,000
300	54,000	87,000	93,000	151,000	134,000	217,000

Power Loss/Oil Flow

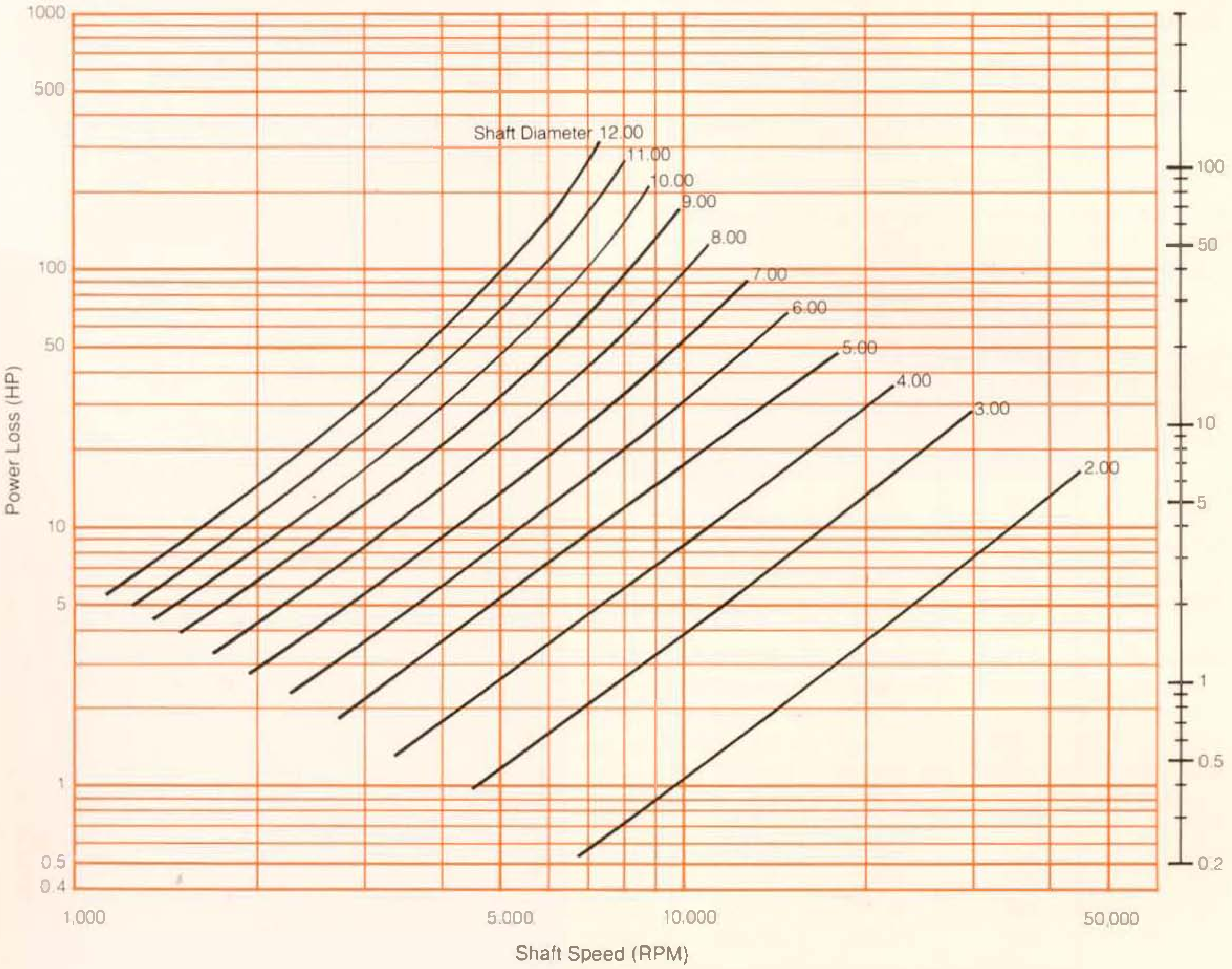
B/A = 0.4 Load on One Shoe

Values are based on the following conditions:

Oil inlet temperature = 120°F (48.9°C)
Oil outlet temperature = 150°F (65.6°C)
Clearance = 0.0015in./in.
Preload = 0.25

To convert HP loss to KW, multiply HP by 0.7457
To convert oil flow to LPM, multiply GPM by 3.79

Table 16-1: Power Loss and Oil Flow vs. Shaft Speed, Load on One Shoe, B/A = 0.4

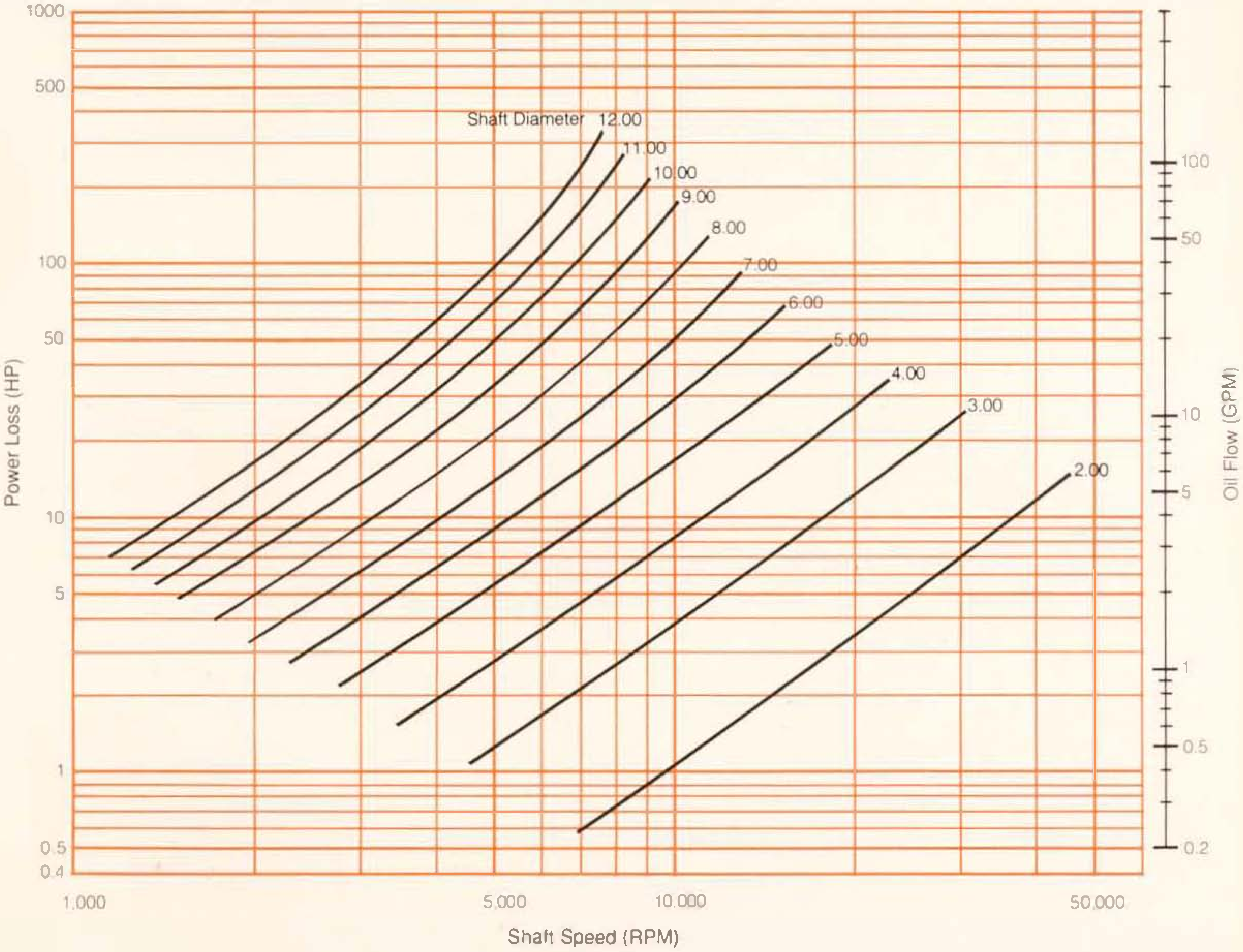


B/A = 0.4
Load on
Two Shoes

Values are based on the following conditions:
Oil inlet temperature = 120°F (48.9°C)
Oil outlet temperature = 150°F (65.6°C)
Clearance = 0.0015in./in.
Preload = 0.25

To convert HP loss to KW, multiply HP by 0.7457
To convert oil flow to LPM, multiply GPM by 3.79

Table 17-1: Power Loss and Oil Flow vs. Shaft Speed, Load on Two Shoes, B/A = 0.4



Power Loss/Oil Flow

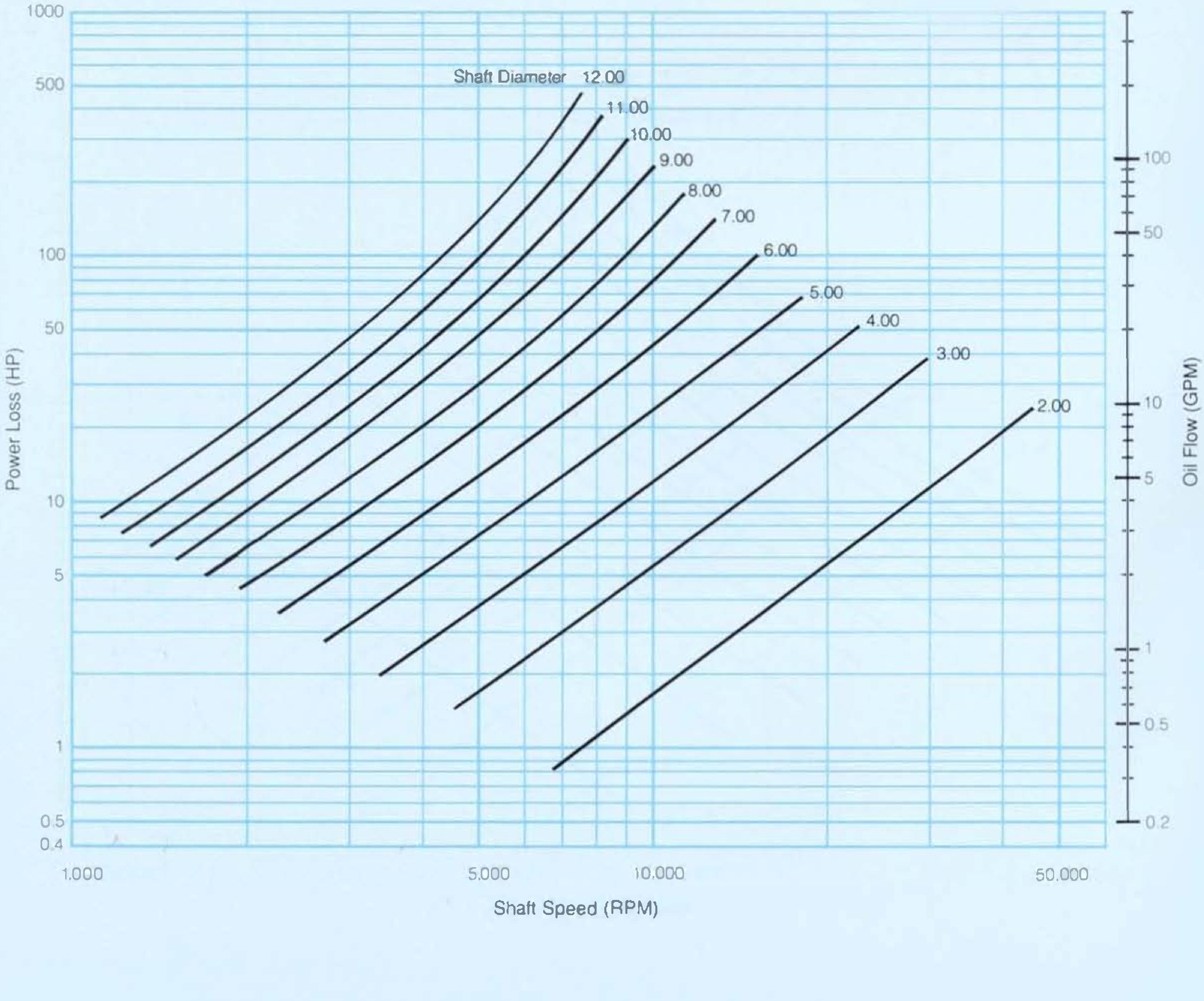
B/A = 0.7 Load on One Shoe

Values are based on the following conditions:

Oil inlet temperature = 120°F (48.9°C)
Oil outlet temperature = 150°F (65.6°C)
Clearance = 0.0015in./in.
Preload = 0.25

To convert HP loss to KW, multiply HP by 0.7457
To convert oil flow to LPM, multiply GPM by 3.79

Table 18-1: Power Loss and Oil Flow vs. Shaft Speed, Load on One Shoe, B/A = 0.7



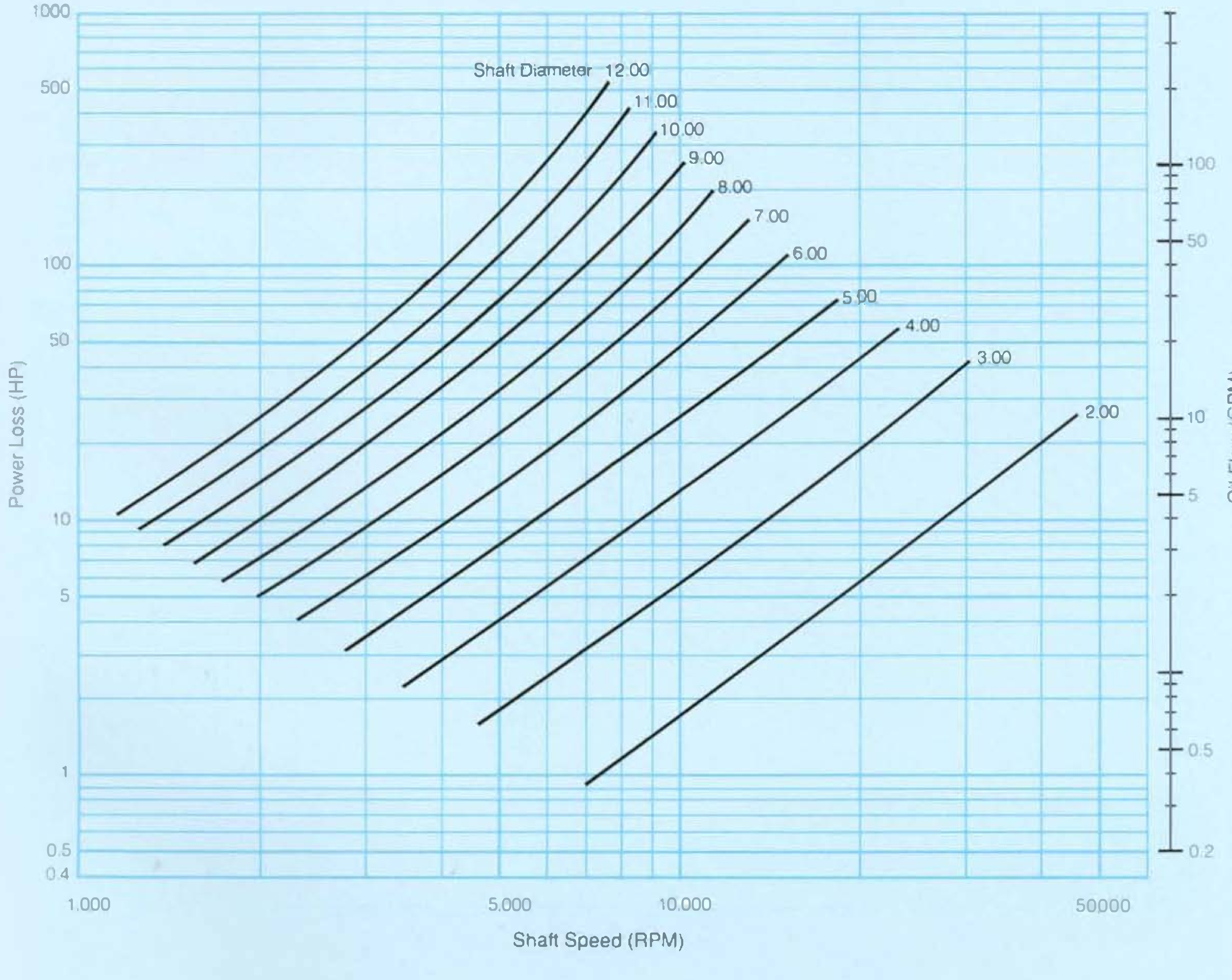
B/A = 0.7
Load on Two Shoes

Values are based on the following conditions:

Oil inlet temperature = 120°F (48.9°C)
Oil outlet temperature = 150°F (65.6°C)
Clearance = 0.0015in./in.
Preload = 0.25

To convert HP loss to KW, multiply HP by 0.7457
To convert oil flow to LPM, multiply GPM by 3.79

Table 19-1: Power Loss and Oil Flow vs. Shaft Speed, Load on Two Shoes, B/A = 0.7



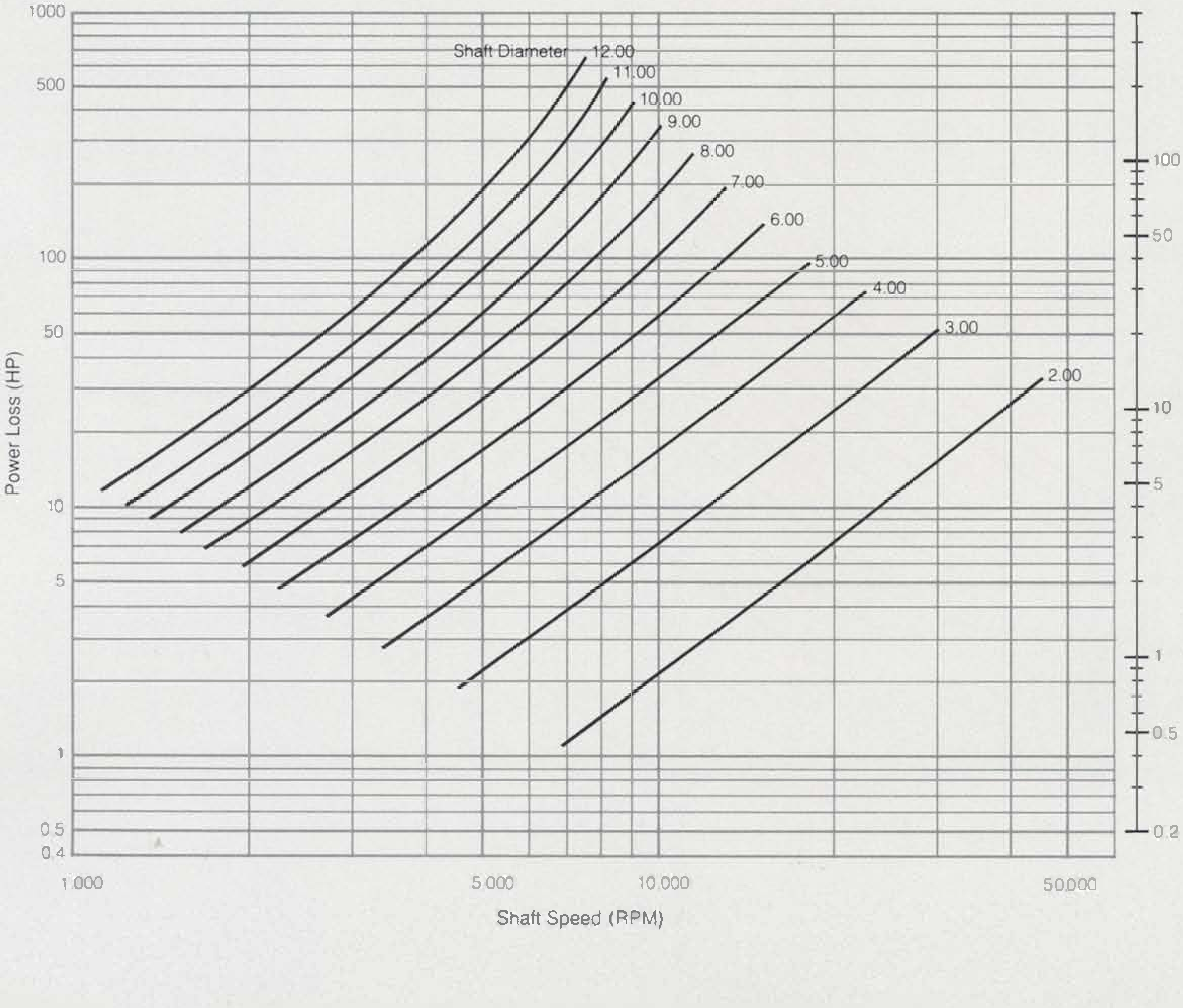
Power Loss/Oil Flow

B/A = 1.0
Load on
One Shoe

Values are based on the following conditions:
- Oil inlet temperature = 120°F (48.9°C)
- Oil outlet temperature = 150°F (65.6°C)
- Clearance = 0.0015in./in.
- Preload = 0.25

To convert HP loss to KW, multiply HP by 0.7457
To convert oil flow to LPM, multiply GPM by 3.79

Table 20-1: Power Loss and Oil Flow vs. Shaft Speed, Load on One Shoe, B/A = 1.0

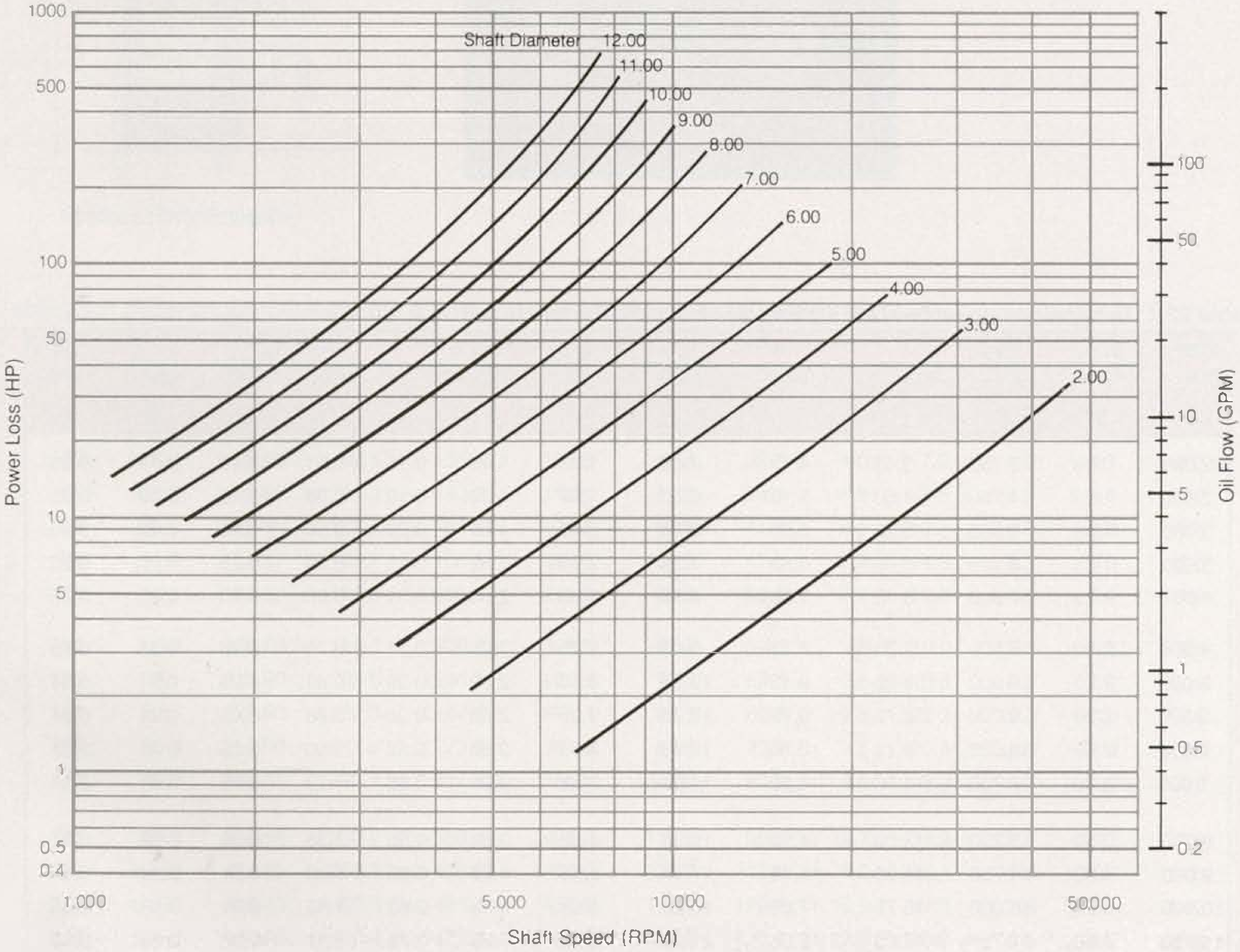


B/A = 1.0
Load on
Two Shoes

Values are based on the following conditions:
- Oil inlet temperature = 120°F (48.9°C)
- Oil outlet temperature = 150°F (65.6°C)
- Clearance = 0.0015in./in.
- Preload = 0.25

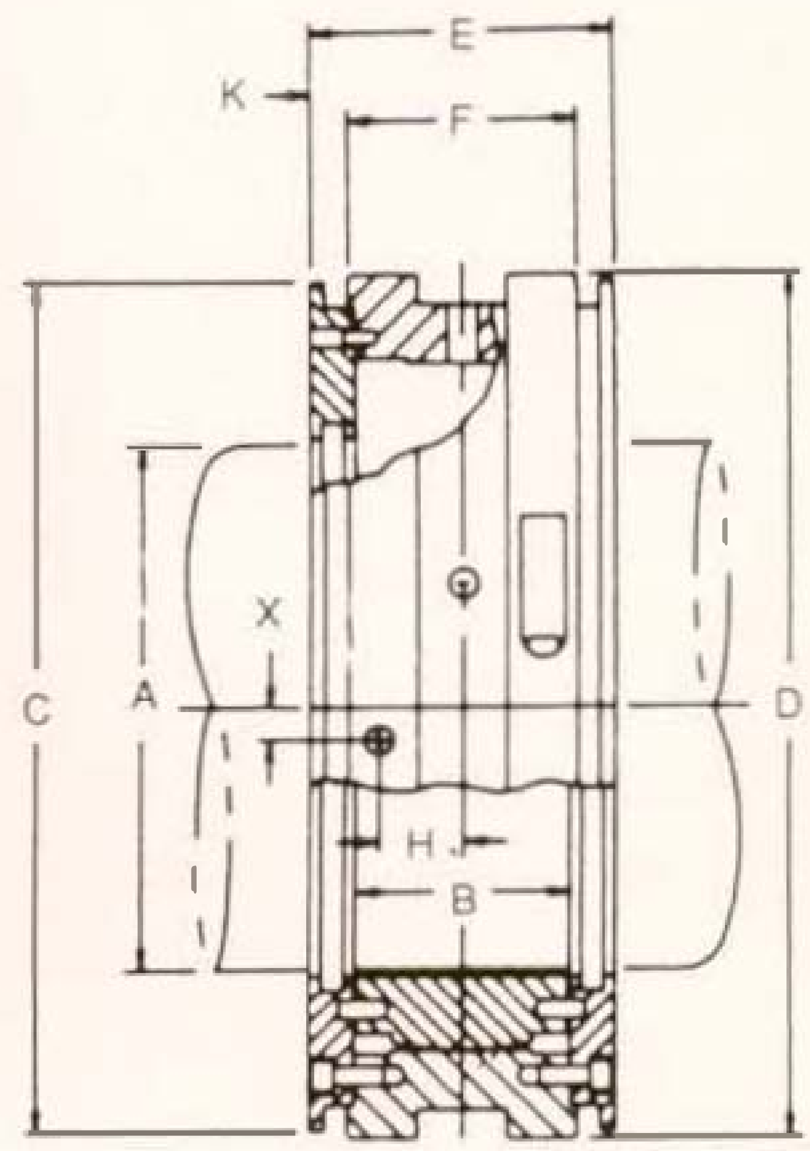
To convert HP loss to KW, multiply HP by 0.7457
To convert oil flow to LPM, multiply GPM by 3.79

Table 21-1: Power Loss and Oil Flow vs. Shaft Speed, Load on Two Shoes, B/A = 1.0



Dimensions

B/A = 0.4
English Units (inches)



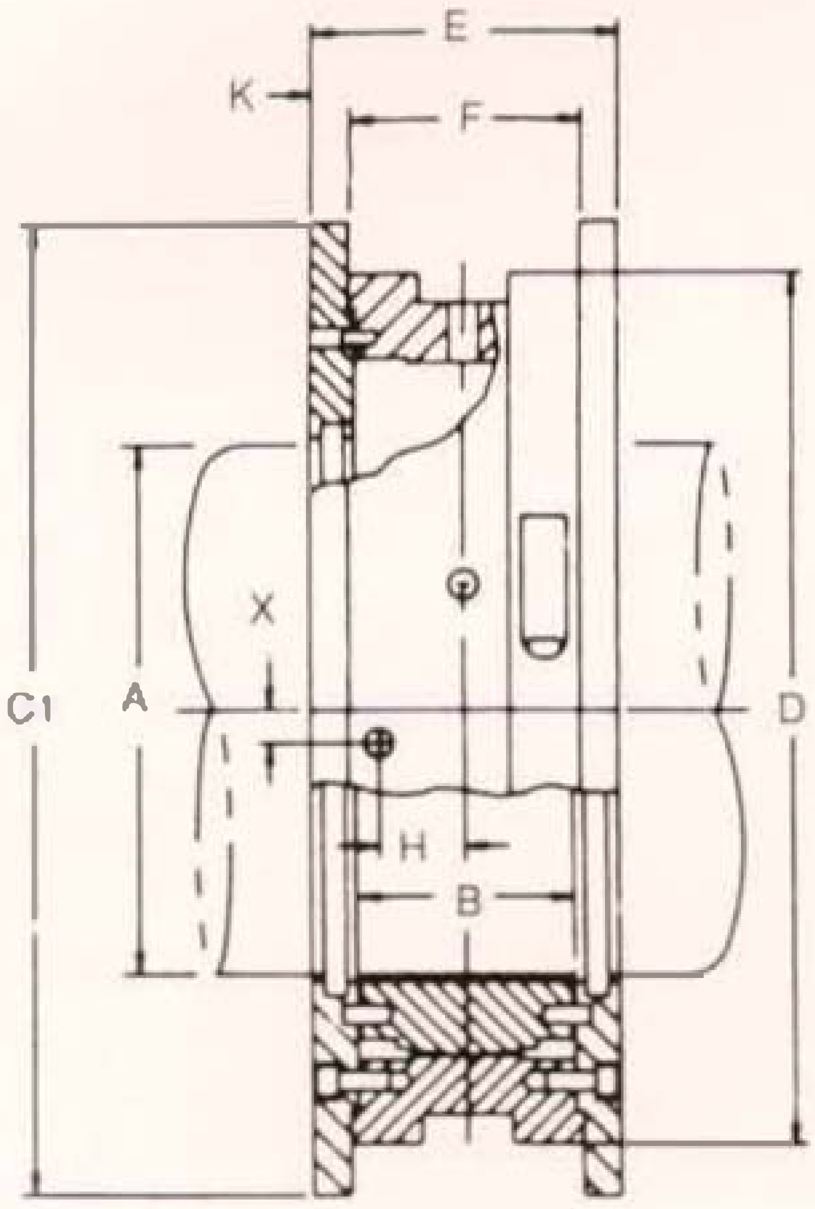
Code P: Pin Located

Table 22-1: Dimensions (in inches) for Pivoted Shoe Journal Bearings with B/A = 0.4

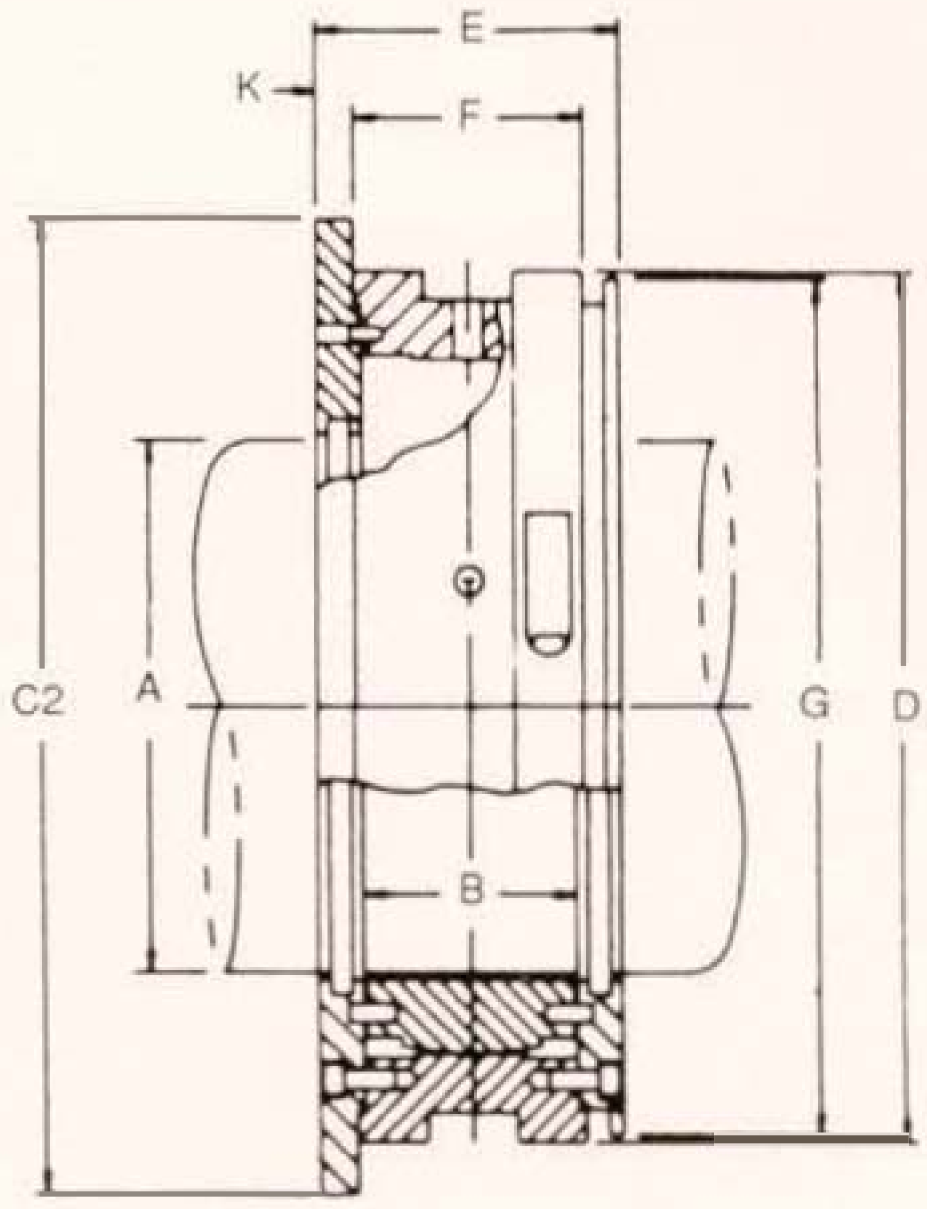
Shaft Dia.	Shoe Width	Hsg. Bore	Endplate O.D.			Overall Width	Seat Width	Locating Pin				Plate Proj.
			Code P	Code F	Code B			Dia.	Loc.	Proj.	Loc.	
A	B	D	C	C1	C2	E	F	G	H	J	X	K
2.000	0.88	3.750	3.63	4.13	4.88	1.63	1.13	0.16	0.31	0.19	0.17	0.25
2.500	1.13	4.750	4.50	5.13	6.00	1.88	1.38	0.19	0.38	0.19	0.19	0.25
3.000	1.38	5.500	5.25	6.00	6.75	2.13	1.63	0.25	0.50	0.25	0.22	0.25
3.500	1.63	6.125	5.88	6.63	7.38	2.38	1.88	0.25	0.56	0.25	0.22	0.25
4.000	1.75	7.000	6.75	7.50	8.50	2.50	2.00	0.31	0.63	0.25	0.25	0.25
4.500	2.00	7.500	7.25	8.13	9.00	2.75	2.25	0.31	0.75	0.25	0.25	0.25
5.000	2.25	8.500	8.25	9.13	10.25	3.13	2.50	0.38	0.81	0.25	0.31	0.31
5.500	2.38	9.000	8.75	9.75	10.75	3.25	2.63	0.38	0.88	0.25	0.31	0.31
6.000	2.63	10.000	9.75	10.75	12.00	3.50	2.88	0.38	1.00	0.25	0.31	0.31
7.000	3.00	11.750	11.50	12.50	14.00	3.88	3.25	0.38	1.19	0.25	0.31	0.31
8.000	3.50	13.250	13.00	14.13	15.88	4.50	3.88	0.50	1.38	0.25	0.38	0.31
9.000	4.00	14.750	14.50	15.75	17.75	5.50	4.38	0.63	1.50	0.31	0.44	0.56
10.000	4.38	16.000	15.75	17.00	19.25	5.88	4.75	0.63	1.63	0.31	0.44	0.56
11.000	4.88	17.750	17.25	18.88	21.25	6.88	5.25	0.75	1.81	0.38	0.56	0.81
12.000	5.25	19.000	18.50	20.25	22.50	7.25	5.63	0.75	2.00	0.38	0.56	0.81

Note: All dimensions should be confirmed by a certified drawing.
Tolerance for shaft: +0.0000/-0.0005.
Tolerance for hsg. bore: +0.001/-0.000

B/A = 0.4
Metric Conversion
(mm)



Code F: Flange Located



Code B: Bolted Flange

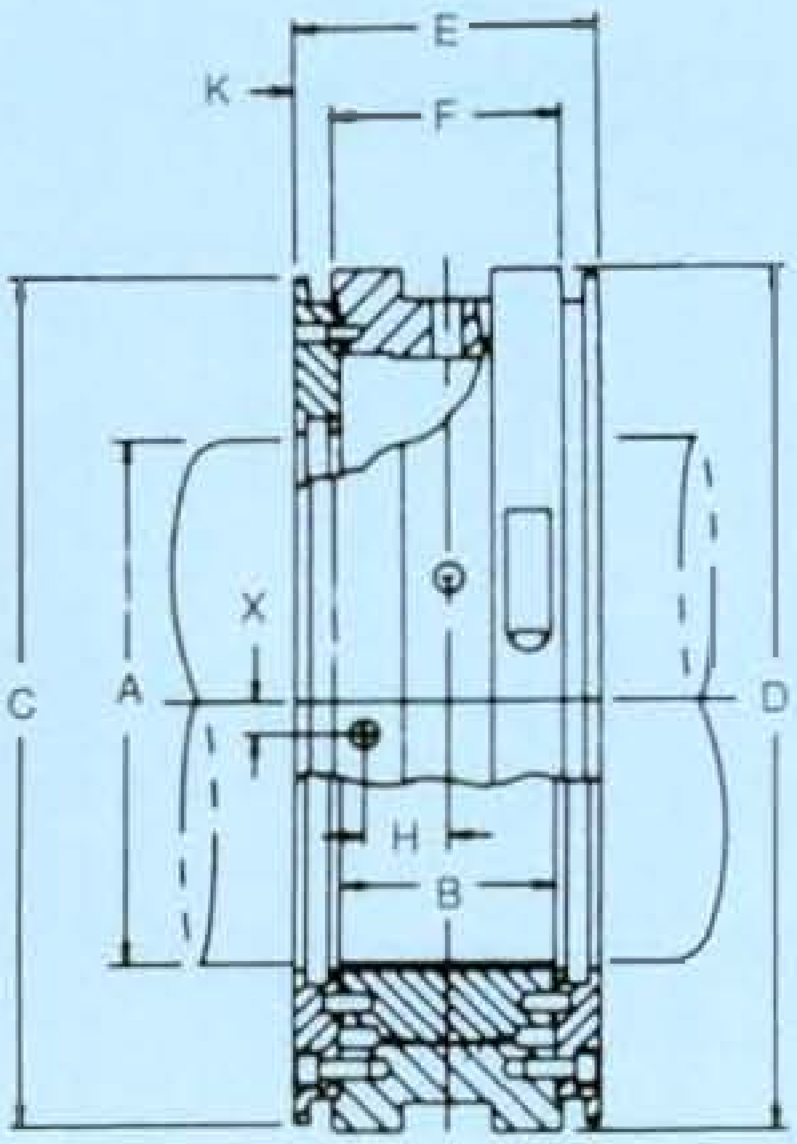
Table 23-1: Dimensions (converted to mm) for Pivoted Shoe Journal Bearings with B/A = 0.4

Shaft Dia.	Shoe Width	Hsg. Bore	Endplate O.D.			Overall Width	Seat Width	Locating Pin				Plate Proj.
			Code P	Code F	Code B			Dia.	Loc.	Proj.	Loc.	
A	B	D	C	C1	C2	E	F	G	H	J	X	K
50	22.4	95.25	92.1	104.8	123.8	41.4	28.7	4.0	7.9	4.8	4.3	6.3
60	28.7	120.65	114.3	130.2	152.4	47.8	35.1	4.8	9.5	4.8	4.8	6.3
75	35.1	139.70	133.3	152.4	171.5	54.1	41.4	6.3	12.7	6.3	5.6	6.3
90	41.4	155.57	149.2	168.3	187.3	60.5	47.8	6.3	14.3	6.3	5.6	6.3
100	44.5	177.80	171.4	190.5	215.9	63.5	50.8	7.9	15.9	6.3	6.3	6.3
115	50.8	190.50	184.1	206.4	228.6	69.8	57.1	7.9	19.0	6.3	6.3	6.3
125	57.1	215.90	209.6	231.8	260.4	79.5	63.5	9.5	20.6	6.3	7.9	7.9
140	60.5	228.60	222.3	247.6	273.1	82.5	66.8	9.5	22.2	6.3	7.9	7.9
150	66.8	254.00	247.6	273.0	304.8	88.9	73.2	9.5	25.4	6.3	7.9	7.9
175	76.2	298.45	292.1	317.5	355.6	98.6	82.5	9.5	30.2	6.3	7.9	7.9
200	88.9	336.55	330.2	358.8	403.2	114.3	98.6	12.7	34.9	6.3	9.7	7.9
225	101.6	374.65	368.3	400.0	450.9	139.7	111.3	15.9	38.1	7.9	11.2	14.3
250	111.3	406.40	400.0	431.8	488.9	149.4	120.7	15.9	41.3	7.9	11.2	14.3
280	124.0	450.85	438.1	479.4	539.8	174.8	133.3	19.0	46.0	9.5	14.2	20.6
300	133.3	482.60	469.9	514.3	571.5	184.1	143.0	19.0	50.8	9.5	14.2	20.6

Note: All dimensions should be confirmed by a certified drawing.
Tolerance for shaft: +0.0000/-0.0127.
Tolerance for hsg. bore: +0.025/-0.000

Dimensions

B/A = 0.7 English Units (inches)



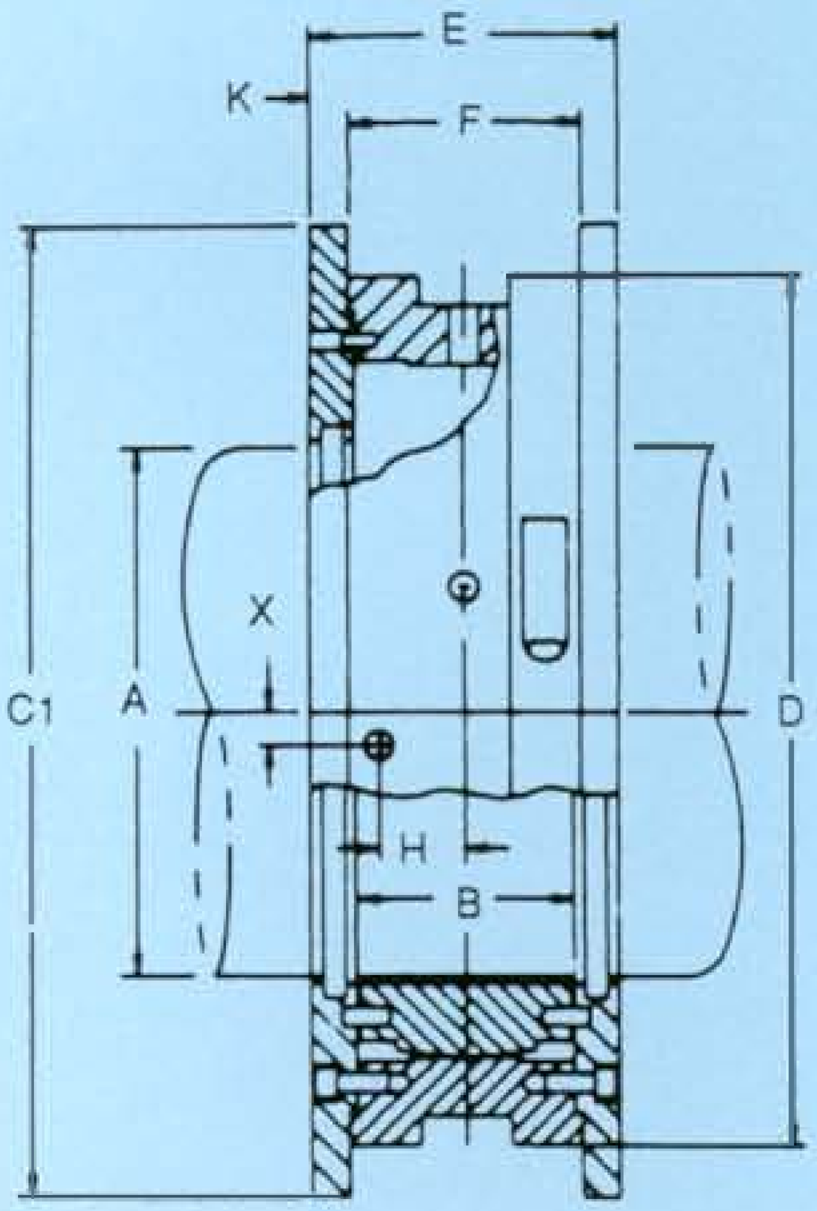
Code P: Pin Located

Table 24-1: Dimensions (in inches) for Pivoted Shoe Journal Bearings with B/A = 0.7

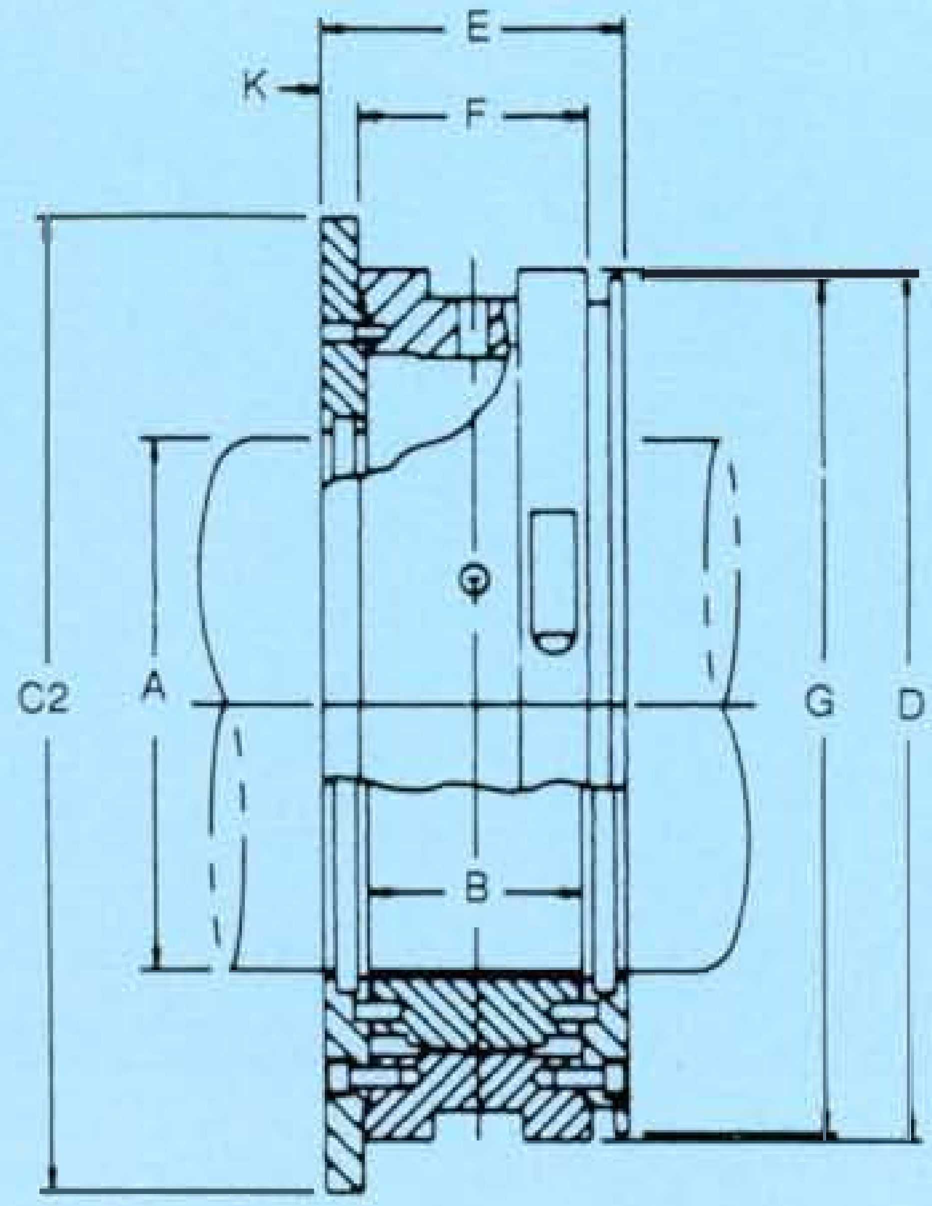
Shaft Dia.	Shoe Width	Hsg. Bore	Endplate O.D. Code P	Endplate O.D. Code F	Endplate O.D. Code B	Overall Width	Seat Width	Locating Pin Dia.	Locating Pin Loc.	Locating Pin Proj.	Locating Pin Loc.	Plate Proj.
A	B	D	C	C1	C2	E	F	G	H	J	X	K
2.000	1.50	3.750	3.63	4.13	4.88	2.25	1.75	0.16	0.31	0.19	0.17	0.25
2.500	1.75	4.750	4.50	5.13	6.00	2.50	2.00	0.19	0.38	0.19	0.19	0.25
3.000	2.25	5.500	5.25	6.00	6.75	3.00	2.50	0.25	0.50	0.25	0.22	0.25
3.500	2.50	6.125	5.88	6.63	7.38	3.25	2.75	0.25	0.56	0.25	0.22	0.25
4.000	2.88	7.000	6.75	7.50	8.50	3.63	3.13	0.31	0.63	0.25	0.25	0.25
4.500	3.25	7.500	7.25	8.13	9.00	4.00	3.50	0.31	0.75	0.25	0.25	0.25
5.000	3.63	8.500	8.25	9.13	10.25	4.50	3.88	0.38	0.81	0.25	0.31	0.31
5.500	4.00	9.000	8.75	9.75	10.75	4.88	4.25	0.38	0.88	0.25	0.31	0.31
6.000	4.38	10.000	9.75	10.75	12.00	5.25	4.63	0.38	1.00	0.25	0.31	0.31
7.000	5.13	11.750	11.50	12.50	14.00	6.00	5.38	0.38	1.19	0.25	0.31	0.31
8.000	5.75	13.250	13.00	14.13	15.88	6.75	6.13	0.50	1.38	0.25	0.38	0.31
9.000	6.50	14.750	14.50	15.75	17.75	8.00	6.88	0.63	1.50	0.31	0.44	0.56
10.000	7.25	16.000	15.75	17.00	19.25	8.75	7.63	0.63	1.63	0.31	0.44	0.56
11.000	8.00	17.750	17.25	18.88	21.25	10.00	8.38	0.75	1.81	0.38	0.56	0.81
12.000	8.88	19.000	18.50	20.25	22.50	10.88	9.25	0.75	2.00	0.38	0.56	0.81

Note: All dimensions should be confirmed by a certified drawing.
Tolerance for shaft: +0.0000/-0.0005.
Tolerance for hsg. bore: +0.001/-0.000

B/A = 0.7 Metric Conversion (mm)



Code F: Flange Located



Code B: Bolted Flange

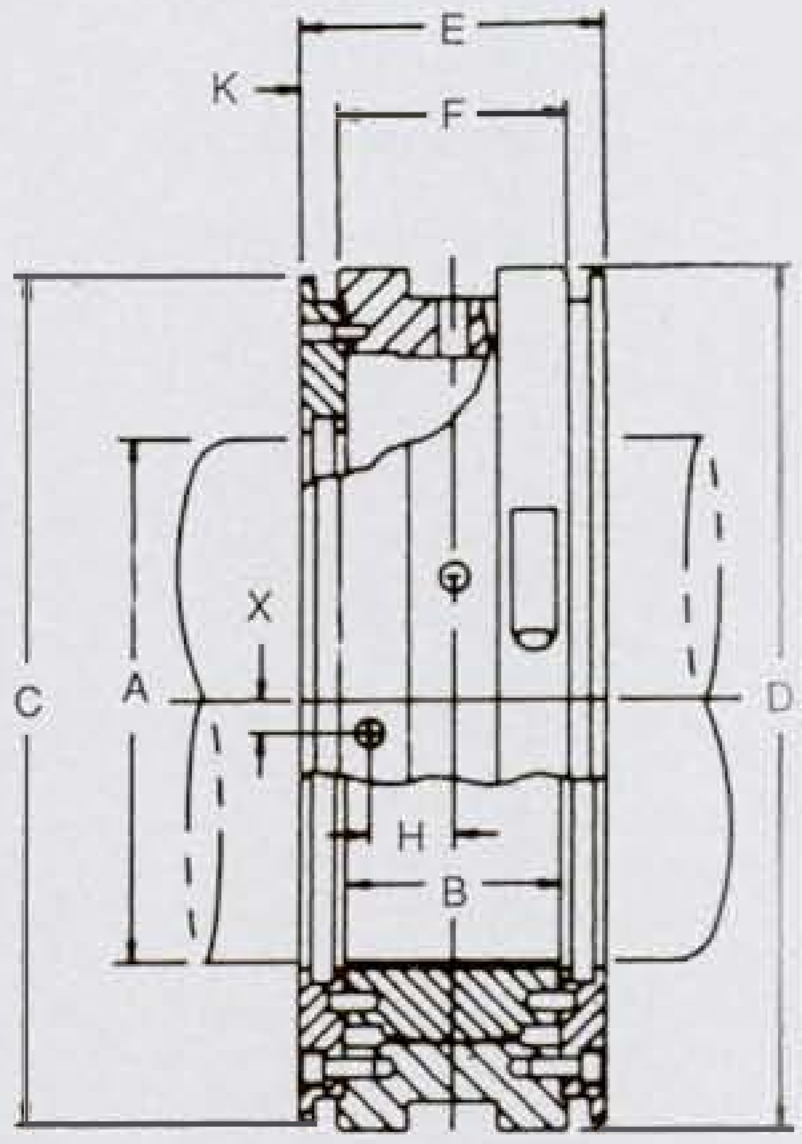
Table 25-1: Dimensions (converted to mm) for Pivoted Shoe Journal Bearings with B/A = 0.7

Shaft Dia.	Shoe Width	Hsg. Bore	Endplate O.D. Code P	Endplate O.D. Code F	Endplate O.D. Code B	Overall Width	Seat Width	Locating Pin Dia.	Locating Pin Loc.	Locating Pin Proj.	Locating Pin Loc.	Plate Proj.
A	B	D	C	C1	C2	E	F	G	H	J	X	K
50	38.1	95.25	92.1	104.8	123.8	57.1	44.5	4.0	7.9	4.8	4.3	6.3
60	44.5	120.65	114.3	130.2	152.4	63.5	50.8	4.8	9.5	4.8	4.8	6.3
75	57.1	139.70	133.3	152.4	171.5	76.2	63.5	6.3	12.7	6.3	5.6	6.3
90	63.5	155.57	149.2	168.3	187.3	82.5	69.8	6.3	14.3	6.3	5.6	6.3
100	73.0	177.80	171.4	190.5	215.9	92.1	79.4	7.9	15.9	6.3	6.3	6.3
115	82.5	190.50	184.1	206.4	228.6	101.6	88.9	7.9	19.0	6.3	6.3	6.3
125	92.1	215.90	209.6	231.8	260.4	114.3	98.4	9.5	20.6	6.3	7.9	7.9
140	101.6	228.60	222.3	247.6	273.1	123.8	107.9	9.5	22.2	6.3	7.9	7.9
150	111.1	254.00	247.6	273.0	304.8	133.3	117.5	9.5	25.4	6.3	7.9	7.9
175	130.2	298.45	292.1	317.5	355.6	152.4	136.5	9.5	30.2	6.3	7.9	7.9
200	146.1	336.55	330.2	358.8	403.2	171.4	155.6	12.7	34.9	6.3	9.7	7.9
225	165.1	374.65	368.3	400.0	450.9	203.2	174.6	15.9	38.1	7.9	11.2	14.3
250	184.1	406.40	400.0	431.8	488.9	222.3	193.7	15.9	41.3	7.9	11.2	14.3
280	203.2	450.85	438.1	479.4	539.8	254.0	212.7	19.0	46.0	9.5	14.2	20.6
300	225.4	482.60	469.9	514.3	571.5	276.2	234.9	19.0	50.8	9.5	14.2	20.6

Note: All dimensions should be confirmed by a certifed drawing.
Tolerance for shaft: +0.0000/-0.0127.
Tolerance for hsg. bore: +0.025/-0.000

Dimensions

B/A = 1.0 English Units (inches)



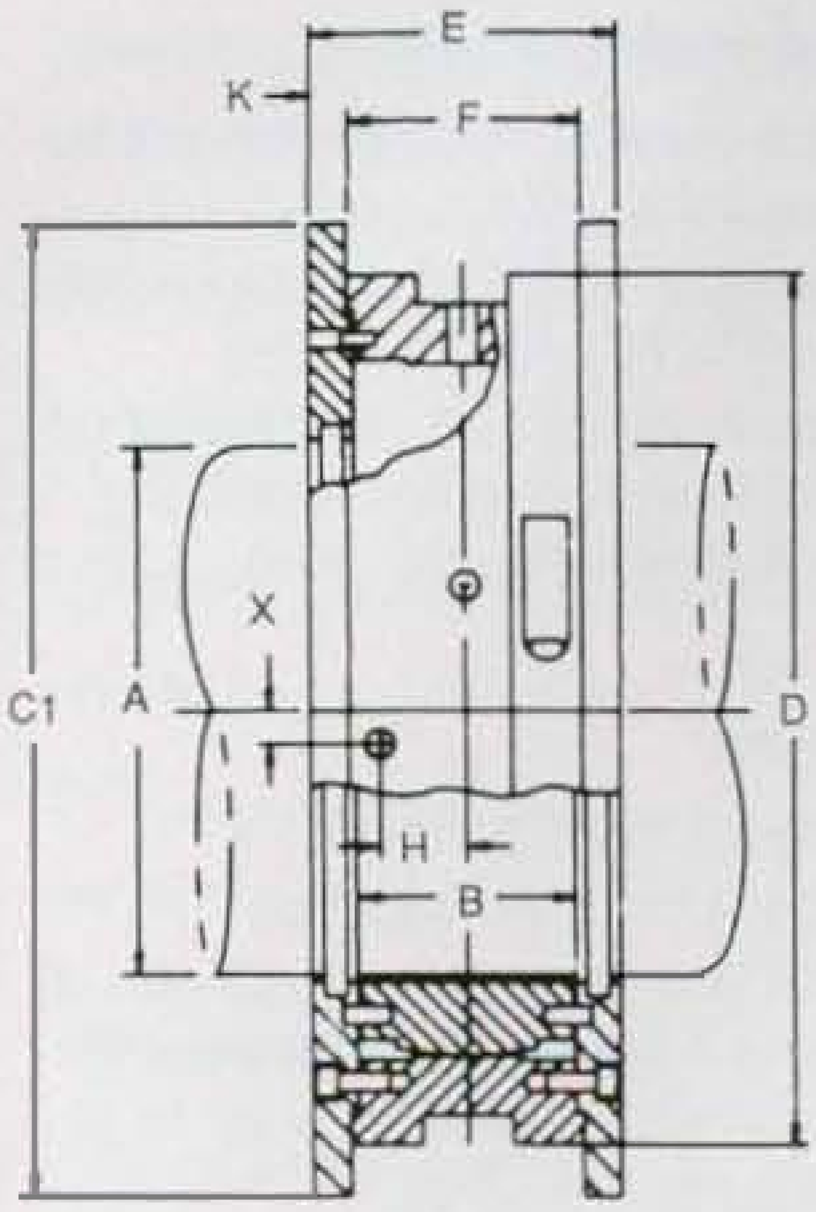
Code P: Pin Located

Table 26-1: Dimensions (in inches) for Pivoted Shoe Journal Bearings with B/A = 1.0

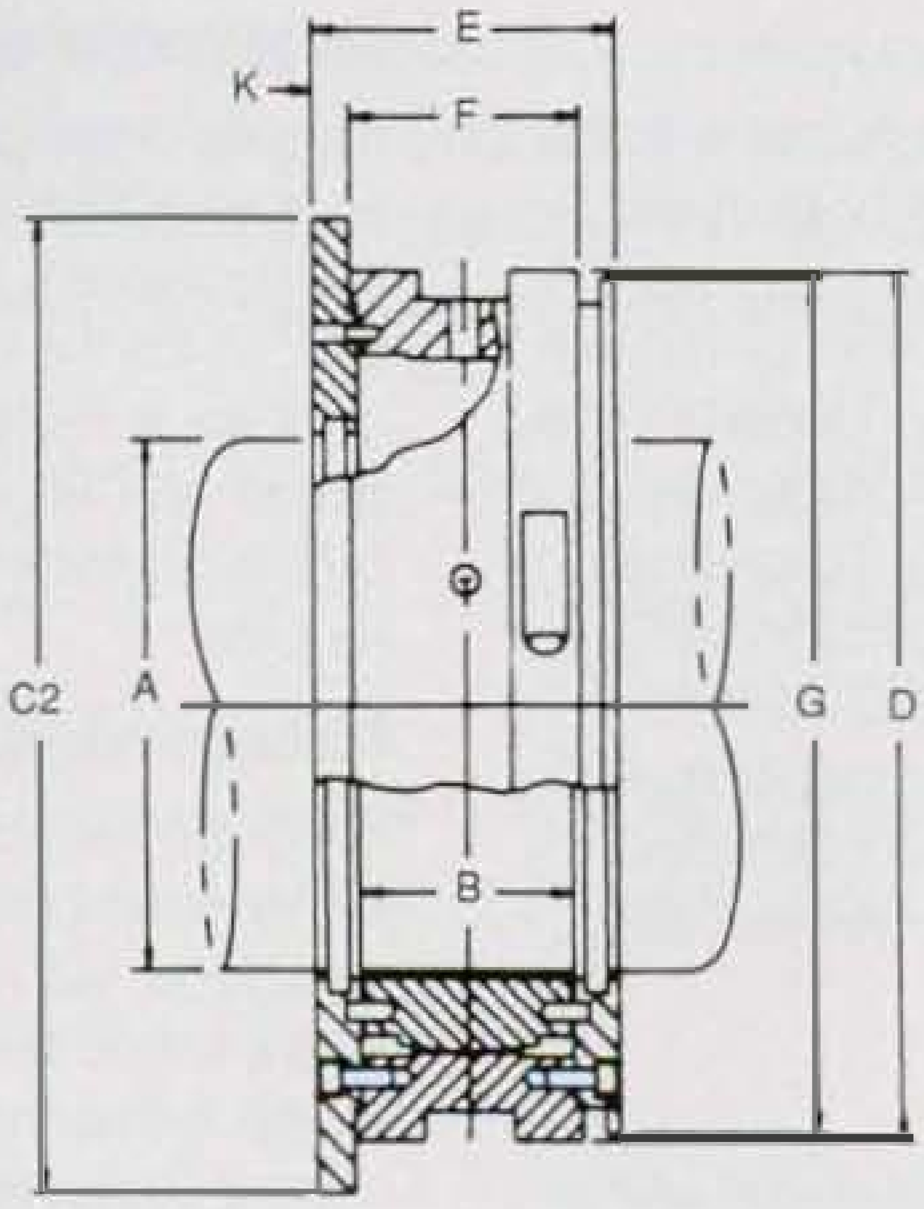
Shaft Dia.	Shoe Width	Hsg. Bore	Endplate O.D.			Overall Width	Seat Width	Locating Pin				Plate Proj.
			Code P	Code F	Code B			Dia.	Loc.	Proj.	Loc.	
A	B	D	C	C1	C2	E	F	G	H	J	X	K
2.000	2.00	3.750	3.63	4.13	4.88	2.75	2.25	0.16	0.31	0.19	0.17	0.25
2.500	2.50	4.750	4.50	5.13	6.00	3.25	2.75	0.19	0.38	0.19	0.19	0.25
3.000	3.00	5.500	5.25	6.00	6.75	3.75	3.25	0.25	0.50	0.25	0.22	0.25
3.500	3.50	6.125	5.88	6.63	7.38	4.25	3.75	0.25	0.56	0.25	0.22	0.25
4.000	4.00	7.000	6.75	7.50	8.50	4.75	4.25	0.31	0.63	0.25	0.25	0.25
4.500	4.50	7.500	7.25	8.13	9.00	5.25	4.75	0.31	0.75	0.25	0.25	0.25
5.000	5.00	8.500	8.25	9.13	10.25	5.88	5.25	0.38	0.81	0.25	0.31	0.31
5.500	5.50	9.000	8.75	9.75	10.75	6.38	5.75	0.38	0.88	0.25	0.31	0.31
6.000	6.00	10.000	9.75	10.75	12.00	6.88	6.25	0.38	1.00	0.25	0.31	0.31
7.000	7.00	11.750	11.50	12.50	14.00	7.88	7.25	0.38	1.19	0.25	0.31	0.31
8.000	8.00	13.250	13.00	14.13	15.88	9.00	8.38	0.50	1.38	0.25	0.38	0.31
9.000	9.00	14.750	14.50	15.75	17.75	10.50	9.38	0.63	1.50	0.31	0.44	0.56
10.000	10.00	16.000	15.75	17.00	19.25	11.50	10.38	0.63	1.63	0.31	0.44	0.56
11.000	11.00	17.750	17.25	18.88	21.25	13.00	11.38	0.75	1.81	0.38	0.56	0.81
12.000	12.00	19.000	18.50	20.25	22.50	14.00	12.38	0.75	2.00	0.38	0.56	0.81

Note: All dimensions should be confirmed by a certified drawing.
Tolerance for shaft: +0.0000/-00005.
Tolerance for hsg. bore: +0.001/-0.000

B/A = 1.0
Metric Conversion
(mm)



Code F: Flange Located



Code B: Bolted Flange

Table 27-1: Dimensions (converted to mm) for Pivoted Shoe Journal Bearings with B/A = 1.0

Shaft Dia.	Shoe Width	Hsg. Bore	Endplate O.D.			Overall Width	Seat Width	Locating Pin				Plate Proj.
			Code P	Code F	Code B			Dia.	Loc.	Proj.	Loc.	
A	B	D	C	C1	C2	E	F	G	H	J	X	K
50	50.8	95.25	92.1	104.8	123.8	69.8	57.1	4.0	7.9	4.8	4.3	6.3
60	63.5	120.65	114.3	130.2	152.4	82.5	69.8	4.8	9.5	4.8	4.8	6.3
75	76.2	139.70	133.3	152.4	175.1	95.3	82.5	6.3	12.7	6.3	5.6	6.3
90	88.9	155.57	149.2	168.3	187.3	107.9	95.3	6.3	14.3	6.3	5.6	6.3
100	101.6	177.80	171.4	190.5	215.9	120.7	107.9	7.9	15.9	6.3	6.3	6.3
115	114.3	190.50	184.1	206.4	228.6	133.3	120.7	7.9	19.0	6.3	6.3	6.3
125	127.0	215.90	209.6	231.8	260.4	149.2	133.3	9.5	20.6	6.3	7.9	7.9
140	139.7	228.60	222.3	247.6	273.1	161.9	146.1	9.5	22.2	6.3	7.9	7.9
150	152.4	254.00	247.6	273.0	304.8	174.6	158.8	9.5	25.4	6.3	7.9	7.9
175	177.8	298.45	292.1	317.5	355.6	200.0	184.1	9.5	30.2	6.3	7.9	7.9
200	203.2	336.55	330.2	358.8	403.2	228.6	212.7	12.7	34.9	6.3	9.7	7.9
225	228.6	374.65	368.3	400.0	450.9	266.7	238.1	15.9	38.1	7.9	11.2	14.3
250	254.0	406.40	400.0	431.8	488.9	292.1	263.5	15.9	41.3	7.9	11.2	14.3
280	279.4	450.85	438.1	479.4	539.8	330.2	288.9	19.0	46.0	9.5	14.2	20.6
300	304.8	482.60	469.9	514.3	571.5	355.6	314.3	19.0	50.8	9.5	14.2	20.6

Note: All dimensions should be confirmed by a certified drawing.
Tolerance for shaft: +0.0000/-0.0127.
Tolerance for hsg. bore: +0.025/-0.000

General Information

Quality assurance.

Kingsbury's quality assurance program, particularly in the field of close-tolerance manufacture, meets or exceeds the requirements of industry.

Our quality assurance program is approved for nuclear applications and military applications by the United States government. We have resident government inspection and we manufacture in accordance with Quality Assurance Specification MIL-Q-9858, Inspection Specification MIL-I-45208, and Calibration Specification MIL-STD-45662.

These standards, along with coordinate measurement equipment driven by the most sophisticated computer programs, assure that Kingsbury bearings represent the highest quality in bearing manufacture.

Lube oil.

All of the information in this catalog is based on the use of ISO VG32 oil (150SSU @ 100°F) with a recommended supply temperature of 120°F (50°C). While you can use lubricants having other viscosities with Kingsbury pivoted shoe journal bearings, rated loads and performance data will vary with lubricant type and supply temperature.

The normal supply pressure at the bearing is approximately one bar (14psig). The aligning ring feed holes are sized to accommodate the largest oil flow required for bearing operation. We recommend that the bearing supply line be orificed to achieve proper oil pressure and flow, and that the supply line include an oil filter no larger than 20 microns, since bearing longevity is dependent on the cleanliness of the oil.

Field service.

Kingsbury's staff of experienced field service engineers are available to supervise installation of new bearings, help with adjustments or modifications to existing bearings, and to troubleshoot rotor dynamic problems. Our field service engineers are expertly trained and must have more than ten years of experience in the fluid film bearing industry before they are allowed to supervise field applications.

Our field service engineers can make minor repairs in the field, or supervise parts repairs at machine shops in your area. In addition, they are supported by Kingsbury's complete staff of fluid film bearing designers and manufacturing craftsmen in our factories in Philadelphia, PA and Oshkosh, WI.

Installation and operating instructions.

Kingsbury will supply installation and operation manuals for your application, upon request. With various preload configurations, and an odd number of shoes, it is extremely difficult for the OEM or end user to measure bearing clearance. For your convenience, Kingsbury has published pamphlet CM, which illustrates techniques for measuring bearing clearance. This pamphlet is available upon request.

Recommended spare parts.

Although Kingsbury, Inc. carries a large inventory of replacement parts, in order to minimize emergency downtime, we recommend that you carry at least one set of spare shoes and one set of seal rings (where applicable) for each bearing size installed. Kingsbury will quickly fill all of your other replacement parts requirements.

Manufacturing capabilities.

Kingsbury's state-of-the-art manufacturing facilities in Philadelphia, PA and Oshkosh, WI supply the world's marketplace. With highly specialized CAD/CAM systems and computer numerically controlled machine tools, we have manufactured journal bearings as small as one inch in diameter, and larger than four feet in diameter, as well as thrust bearings up to 10 feet in diameter. Our advanced computer systems and experienced workforce allow Kingsbury to meet delivery schedules and provide consistent, high quality bearings.

Special designs and retrofits.

At Kingsbury, we've designed, refined and raised the state of the art of fluid film bearings for over 75 years, but we aren't complacent. We will carry our tradition of design excellence into the 21st century with continued refinement of our leading edge groove (LEG) bearings and development of a complete family of magnetic bearings.

We can also design and manufacture special bearings of all types, whether for retrofit in upgraded machines or for new machines. In either case, you can be sure the bearings will combine convenient packaging with the highest performance and most advanced technology.

For details, please consult our Applications Engineering department. They'll gladly discuss your particular bearing needs.

Inquiries

When ordering pivoted shoe journal bearings, we recommend that you submit the anticipated operating conditions so that we can confirm the suitability of your bearing selection. Our Engineering Department will furnish all of the bearing performance data you require. Please specify your requirements. Feel free to photocopy this page and fax it to (215) 824-4999, or mail it to: Application Engineering, Kingsbury Inc., 10385 Drummond Road, Philadelphia, PA 19154, USA.

YOUR NAME ______________________ TITLE ______________

COMPANY ______________________

ADDRESS ______________________

CITY ______________________ STATE ________ ZIP ______________

PHONE (______) ______________________ FAX (______) ______________________

APPLICATION DATA

TYPE OF APPLICATION: ______________________

BEARING REFERENCE CODE: ______________________

SHAFT DIAMETER: ______________________ INCHES ☐ VERTICAL ☐ HORIZONTAL

SHAFT SPEED, RPM: NORMAL ______________ MAX. ______________ MIN. ______________

RADIAL LOAD: NORMAL ______________ LB_F MAX. ______________ LB_F

DIRECTION ______________________ ON ☐ ONE SHOE ☐ TWO SHOES

THRUST LOAD: NORMAL ______________ LB_F MAX. ______________ LB_F

LUBRICANT TYPE/GRADE: ______________________ VISCOSITY ______________ SSU

LUBRICANT INLET TEMPERATURE: ______________ °F AND PRESSURE: ______________ PSIG

INSTRUMENTATION: ☐ YES ☐ NO

☐ ACCOMMODATION FOR PROXIMITY PROBES

☐ THERMOCOUPLES AT ☐ SHOE CENTER OR ☐ TRAILING EDGE

☐ RESISTANCE TEMPERATURE DETECTORS (RTD'S) AT ☐ SHOE CENTER OR ☐ TRAILING EDGE

STYLE OF CASE: ______________________

LEAD MATERIAL: ______________________

LEAD LENGTH: ______________________

DO MILITARY OR INDUSTRIAL SPECIFICATIONS APPLY? ☐ YES ☐ NO

IF SO, PLEASE LIST: ______________________

SPECIAL FEATURES (CHARACTERISTICS OF THE APPLICATIONS THAT MAY REQUIRE BEARING MODIFICATIONS). PLEASE

LIST: ______________________

____

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Represented by:

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