M2000 APPLICATION GUIDE

MOUNTING INSTRUCTIONS

It is critical to the performance of the bearing that it be mounted properly. Failure to follow proper mounting practice may result in reduced bearing life.

SHAFT DIAMETER	SHAFT TOLERANCES
1 3/16 – 1 1/2	Plus .0000″ to minus .0005″
1 5/8 – 4	Plus .0000″ to minus .0010″
4 7/16 – 4 15/16	Plus .0000″ to minus .0015″

INSTALLATION INSTRUCTIONS

Non-Expansion Bearing

1. Clean shaft and bore of bearing. The shaft should be straight, free of burrs and nicks, and the correct size.
2. Lubricate shaft and bearing bore with grease or oil to facilitate assembly. Slip bearing into position. When light press fit is required, press against the end of the inner ring of bearing. Do not strike or exert pressure on the housing or seals.
3. Bolt bearing to support, using shims where necessary to align bearing so inner ring does not rub on housing bore. Use full shims which cover across the entire housing base.
4. Determine final shaft position and tighten screws in the locking collar(s) of non-expansion bearing firmly onto the shaft, while the other bearings remain free. Rotate the shaft slowly under load, if possible, to properly center the rolling elements with respect to the raceways. Then tighten set screws in the locking collar of the remaining bearings to the recommended torque.
5. Check rotation. If there is any strain, irregular rotational torque or vibration, it could be due to incorrect alignment, bent shaft or bent supports. Installation should be rechecked and correction made where necessary.

M2000 Expansion Bearing Applications

In addition to the requirements listed above, the following additional instructions should be followed. Position the expansion bearing in the housing. For normal expansion conditions, the bearing insert should be positioned in the center of the housing. To center the insert in the housing, move the bearing to the extreme position (-.100″ on all expansion units) and mark the shaft. Then move the bearing insert in the opposite direction one-half the total expansion to center the bearing in the housing. If the maximum expansion is required, move the bearing insert to the extreme position in the housing to permit full movement in the direction of the expansion. After the expansion bearing has been positioned in the housing, tighten the set screws securely to the shaft.

Expansion Bearing

1. Same as Non-Expansion Bearing.
2. Same as Non-Expansion Bearing.
3. Same as Non-Expansion Bearing.
4. Position expansion bearing in the housing. For normal expansion conditions, the bearing insert should be positioned in the center of the housing. To center bearing insert in housing, move bearing insert to extreme position and mark shaft. Then using bearing maximums total expansion table, move bearing insert in opposite direction one-half the total expansion to center bearing in the housing. If maximum expansion is required, move bearing insert to the extreme position in the housing to permit full movement in direction of expansion. After expansion bearing has been positioned in the housing, tighten the set screws in the locking collar to the recommended torque.
5. Same as Non-Expansion Bearing.

Bearing Maximum Total Expansion

All Expansion Units have - .100″ Capacity
Misalignment Capacity = +/- 1½°

LUBRICATION INSTRUCTIONS

This bearing is factory lubricated with No. 2 consistency lithium base grease which is suitable for most applications. However, extra protection is necessary if bearing is subjected to excessive moisture, dust, or corrosive vapor. In these cases, bearing should contain as much grease as speed will permit (a full bearing with consequent slight leakage through the seal is the best protection against contaminant entry).

In extremely dirty environments, the bearing should be purged daily to flush out contaminants. For added protection, it is advisable to shroud the bearing from falling material.

High Speed Operation

At higher operating speed, too much grease may cause overheating. In these cases, the amount of lubrication can only be determined by experience. If excess grease in the bearing causes overheating, it will be necessary to remove grease fittings and run for 10 minutes. This will allow excess grease to escape. Then wipe off excess grease and replace grease fittings.

In higher speed applications, a small amount of grease at frequent intervals is preferable to a large amount at long intervals. However, the proper volume and interval of lubrication can best be determined by experience.

The following table is a general guide for normal operating conditions. However, some situations may require a change in lubricating periods as dictated by experience. If the bearing is exposed to unusual operating conditions, consult a reputable grease manufacturer.

LUBRICATION GUIDE

Read preceding paragraphs before establishing lubrication schedule.

Abnormal bearing temperatures may indicate insufficient lubrication. If the housing is too hot to touch for more than a few seconds, check the temperature by applying a thermometer at the top of the pillow block with the thermometer tip surrounded by putty.

Because the thermometer reading will be approximately 10ºF. lower than the actual bearing temperature, add ten degrees to the reading and compare to the temperature rating of your grease. If the bearing temperature reading is consistent and operating within the recommended limits of your grease, the bearing is operating satisfactorily.

If equipment will be idle for some time, before shutting down, add grease to the bearing until grease purges from the seals. This will ensure protection of the bearing, particularly when exposed to severe environmental conditions. After storage or idle period, add fresh grease to the bearing before starting.

SPECIAL OPERATING CONDITIONS

Refer acid, chemical, extreme or other special operating conditions to the Moline Bearing Company.

Moline spherical bearings have the capacity to carry substantial radial loads, thrust loads or a combined radial and thrust load. The maximum load that can be applied is limited by the various components in the system, and the life requirements listed in this catalog. The factory should be consulted on any application that exceeds the recommendations in the catalog.

Select a bearing from the M2000 load-rating chart having a radial load rating at the operating speed equal to or greater than the calculated Equivalent Radial Load for a desired L10 life. This simple method is all that is necessary for most general applications and provides for occasional shock loads.

L10 Hours of Life - Is the life that may be expected from at least 90% of a given group of bearings operated under identical conditions. The average life (L50) will be approximately five times the L10 life.

Lubrication Guide

Read preceding paragraphs before establishing lubrication schedule.

HOURS RUN PER DAY	SUGGESTED LUBRICATION PERIOD IN WEEKS							
	1 TO 250 RPM	251 TO 500 RPM	501 TO 750 RPM	751 TO 1000 RPM	1001 TO 1500 RPM	1501 TO 2000 RPM	2001 TO 2500 RPM	2501 TO 3000 RPM
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	2	2	1
24	12	5	3	2	1	1	1	1

To determine the L10 hours of life for loads and RPM's not listed, use the following equation.

$$L_{10} = \left(\frac{C}{P}\right)^{10/3} \times \frac{16667}{RPM}$$

Where: C= Dynamic Capacity (See Table below)
P= Equivalent Radial Load

If the load on a double row spherical bearing is only in a radial direction (no axial load), the Equivalent Radial Load (P) is equal to the actual radial load. In situations where the bearing load consists of radial and thrust loads, the total load must be converted into an Equivalent Radial Load by the equation:

$$P = XF_R + YF_A$$

Where:
FA = Axial (thrust) Load - See table for maximum
FR= Radial Load
X= Radial Load Factor from Table 1: Thrust Factors (page XX)
Y= Thrust Load Factor from Table 1: Thrust Factors (page XX)

To find the X and Y values, first calculate FA/FR. Then use Table 1: Thrust Factors to determine the appropriate values for X and Y. Substitute all known values into the Equivalent Radial Load equation.

For longer L10 hours other than 30,000 hours and not shown, multiply the Equivalent Radial Load by one of the following factors: for 20,000 L10 hours life, use a factor of .87; for 40,000 L10 hours of live, use 1.25; and for 80,000 L10 hours of live, use 1.38.

In applications that have heavy shock loads, frequent shock or severe vibrations, add up to 50% to the Equivalent Radial Load to obtain a modified Equivalent Radial Load. The amount of load added is relative to the severity of the application. Additional assistance can be obtained by consulting with the factory.

The shaft tolerances noted on page 58 are sufficient for normal applications. As noted in Table 1, extremely heavy radial loads may require a light to snug press fit onto the shaft.

The magnitude and direction of both the thrust and radial load must be taken into account when selecting the housing. When pillow blocks are used, heavy loads should be directed through the base. If the bearing must be used in a situation where the load pulls the housing away from the mounting base, both the hold down bolts and housing must be of adequate strength. Auxiliary load carrying devices such as shear bars are advisable for side or end loading of pillow blocks and radial loads for flange units.

M2000 Thrust Factors and Seal Speeds

SHAFT SIZE	E	LIGHT THRUST IF FA/FR≤E		HEAVY THRUST IF FA/FR≥E		DYNAMIC CAPACITY C*		SEAL SPEED LIMITS			MAXIMUM SLIP FIT RADIAL LOAD FR**
		X	Y	X	Y	LBS.	NEWTONS	STANDARD TRIPLE LIP RPM	LABYRINTH RPM	GARTER SPRING RPM	
1 7/16 - 1 1/2	.28	1.0	2.4	.67	3.6	16500	73600	2800	5300	1700	2000
1 11/16 - 1 3/4	.26	1.0	2.6	.67	3.9	17300	77100	2650	4700	1600	2100
1 15/16 - 2	.24	1.0	2.8	.67	4.2	19000	84500	2400	4250	1450	2300
2 3/16	.23	1.0	2.9	.67	4.3	22400	99500	2150	3800	1300	2700
2 7/16 - 2 1/2	.24	1.0	2.8	.67	4.2	33300	148000	1800	3250	1100	4000
2 11/16 - 3	.22	1.0	3.1	.67	4.6	34600	158000	1600	2800	950	4200
3 3/16 - 3 1/2	.23	1.0	2.9	.67	4.3	56900	253000	1300	2200	800	6800
3 11/16 - 4	.24	1.0	2.8	.67	4.2	69900	311000	1200	2000	700	8400
4 7/16 - 4 1/2	.25	1.0	2.7	.67	4.1	91700	408000	1750	---	---	11000
4 15/16	.26	1.0	2.6	.67	3.9	123000	546000	1450	---	---	14800

* Comparing Spherical to Tapered Roller Bearings—The dynamic capacity C (Spherical) and C90 (Tapered) are not the same base. To compare basic dynamic capacities, multiply C x .259 and compare to C90. To select and then compare, use the complete procedure for each bearing and then compare.

** If load exceeds maximum allowable slip fit radial load, snug to light press fit of shaft is required.

M2000 RADIAL LOAD RATINGS

NOMINAL SHAFT DIAMETER (IN)	L10 HRS LIFE	RADIAL LOAD RATINGS AT VARIOUS REVOLUTIONS PER MINUTE								
		50	100	200	500	1000	1200	1500	1800	2500
1 7/16 1 1/2	5000	7300	5930	4810	3660	2970	2780	2630	2490	2260
	10000	5930	4810	3910	2970	2410	2260	2140	2020	1830
	20000	4810	3910	3180	2410	1960	1830	1740	1640	1490
	50000	3660	2970	2410	1830	1490	1390	1320	1250	1130
	100000	2970	2410	1960	1490	1210	1130	1070	1010	919
1 11/16 1 3/4	5000	7660	6220	5050	3840	3120	2910	2760	2610	2370
	10000	6220	5050	4100	3120	2530	2370	2240	2120	1920
	20000	5050	4100	3330	2530	2060	1920	1820	1720	1560
	50000	3840	3120	2530	1920	1560	1460	1380	1310	1190
	100000	3120	2530	2060	1560	1270	1190	1120	1060	964
1 15/16 2	5000	7960	6470	5250	3990	3240	3030	2870	2720	-----
	10000	6470	5250	4270	3240	2630	2460	2330	2210	-----
	20000	5250	4270	3470	2630	2140	2000	1890	1790	-----
	50000	3990	3240	2630	2000	1620	1520	1440	1360	-----
	100000	3240	2630	2140	1620	1320	1230	1170	1110	-----
2 3/16	5000	9850	8000	6500	4940	4010	3750	3550	3360	-----
	10000	8000	6500	5280	4010	3260	3050	2880	2730	-----
	20000	6500	5280	4290	3260	2650	2470	2340	2220	-----
	50000	4940	4010	3260	2470	2010	1880	1780	1680	-----
	100000	4010	3260	2650	2010	1630	1530	1450	1370	-----
2 7/16 2 1/2	5000	14300	11600	9430	7160	5820	5440	5150	4880	-----
	10000	11600	9430	7660	5820	4730	4420	4180	3960	-----
	20000	9430	7660	6220	4730	3840	3590	3400	3220	-----
	50000	7160	5820	4730	3590	2920	2730	2580	2440	-----
	100000	5820	4730	3840	2920	2370	2210	2100	1990	-----

Note: Refer to page 61 for seal speed limits.

M2000 RADIAL LOAD RATINGS

NOMINAL SHAFT DIAMETER (IN)	L10 HRS LIFE	RADIAL LOAD RATINGS AT VARIOUS REVOLUTIONS PER MINUTE								
		50	100	200	500	1000	1200	1500	1800	2500
2 11/16 2 3/4 2 15/16 3	5000	15600	12600	10300	7800	6340	5930	5610	-----	-----
	10000	12600	10300	8340	6340	5150	4810	4560	-----	-----
	20000	10300	8340	6780	5150	4180	3910	3700	-----	-----
	50000	7800	6340	5150	3910	3180	2970	2810	-----	-----
	100000	6340	5150	4180	3180	2580	2410	2280	-----	-----
3 3/16 3 7/16 3 1/2	5000	25250	20510	16660	12660	10280	9730	-----	-----	-----
	10000	20510	16660	13530	10280	8350	7910	-----	-----	-----
	20000	16660	13530	10990	8350	6780	6420	-----	-----	-----
	50000	12660	10280	8350	6340	5150	4880	-----	-----	-----
	100000	10280	8350	6780	5150	4180	3960	-----	-----	-----
3 11/16 3 15/16 4	5000	31020	25200	20470	15550	12630	11960	-----	-----	-----
	10000	25200	20470	16620	12630	10260	9710	-----	-----	-----
	20000	20470	16620	13500	10260	8330	7890	-----	-----	-----
	50000	15550	12630	10260	7790	6330	5990	-----	-----	-----
	100000	12630	10260	8330	6330	5140	4870	-----	-----	-----
4 7/16 4 1/2	5000	40700	33050	26850	20400	16570	-----	-----	-----	-----
	10000	33050	26850	21810	16570	13460	-----	-----	-----	-----
	20000	26850	21810	17710	13460	10930	-----	-----	-----	-----
	50000	20400	16570	13460	10220	8300	-----	-----	-----	-----
	100000	16570	13460	10930	8300	6740	-----	-----	-----	-----
4 15/16	5000	54590	44340	36010	27360	22220	-----	-----	-----	-----
	10000	44340	36010	29250	22220	18050	-----	-----	-----	-----
	20000	36010	29250	23760	18050	14660	-----	-----	-----	-----
	50000	27360	22220	18050	13710	11140	-----	-----	-----	-----
	100000	22220	18050	14660	11140	9050	-----	-----	-----	-----

Note: Refer to page 61 for seal speed limits.