M2000 APPLICATION GUIDE

M2000 SPHERICALS

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
1³⁄16 – 1½	Plus .0000˝ to minus .0005"
1⅝ – 4 40mm - 100mm	Plus .0000˝ to minus .0010"
4⁷⁄16 – 5 110mm - 130mm	Plus .0000˝ to minus .0015"

SHAFT SIZE		SET SCREW SIZE	TORQUE IN – LBS
IN	MM		
1³⁄16 – 2¼	40 – 55	⅜ – 24	290
2⁷⁄16 – 3½	60 – 90	½ – 20	620
3¹⁵⁄16 – 5	100 – 130	⅝ – 18	1325

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 hand tighten screws in the locking collar(s) of non-expansion bearing firmly onto the shaft, while the other bearings remain free. If possible, rotate the shaft slowly under load to properly center the rolling elements with respect to the raceways. Tighten set screws alternately in small increments to the torque value specified in Table above. To ensure full locking of the inner race to the shaft, after 24 hours of operation the setscrews should be retightened to the original torque value.
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°

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MOLINE BEARING Cº

M2000 APPLICATION GUIDE

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. Normal temperature may range from “cool to warm to the touch” up to the point of “too hot to touch for more than a few seconds,” depending on the bearing size and speed, and surrounding conditions. Unusually high temperature accompanied by excessive leakage of grease indicates too much grease. High temperature with no grease showing at the seals, particularly if the bearing seems noisy, usually indicates too little grease. Normal temperature and a slight showing of grease at the seals indicate proper lubrication.

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.

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

M2000 APPLICATION GUIDE CONTINUED

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. 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 page 65 for maximum
FR= Radial Load
X= Radial Load Factor
(page 65)
Y= Thrust Load Factor
(page 65)

To find the X and Y values, first calculate FA/FR. Then use the M2000 Thrust Factors and Seal Speeds table on the following page 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 62 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.

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MOLINE BEARING Cº

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 3/16 - 1 1/2	.28	1.0	2.4	.67	3.6	16500	73600	2800	5300	1700	2000
1 11/16 - 1 3/4 40mm 45mm	.26	1.0	2.6	.67	3.9	17300	77100	2650	4700	1600	2100
1 15/16 - 2 50mm	.24	1.0	2.8	.67	4.2	19000	84500	2400	4250	1450	2300
2 3/16 - 2 1/4 55mm	.23	1.0	2.9	.67	4.3	22400	99500	2150	3800	1300	2700
2 7/16 - 2 1/2 60mm 65mm	.24	1.0	2.8	.67	4.2	33300	148000	1800	3250	1100	4000
2 11/16 - 3 70mm 75mm	.22	1.0	3.1	.67	4.6	34600	158000	1600	2800	950	4200
3 3/16 - 3 1/2 80mm 85mm 90mm	.23	1.0	2.9	.67	4.3	56900	253000	1300	2200	800	6800
3 11/16 - 4 100mm	.24	1.0	2.8	.67	4.2	69900	311000	1200	2000	700	8400
4 7/16 - 4 1/2 110mm 115mm	.25	1.0	2.7	.67	4.1	91700	408000	1150	-----	-----	11000
4 15/16 - 5 125mm 130mm	.26	1.0	2.6	.67	3.9	123000	546000	900	-----	-----	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.
For applications that exceed the load ratings above, please contact the factory for assistance.