TYPE E APPLICATION GUIDE

At Moline, our goal is to provide you with the most reliable products, helpful service, and expert support. We work to make our application guides clear and easy to understand. But if you have further questions, please contact us. 800.242.4633

LUBRICATION - VARIOUS OPERATIONS

Normal Operation

Your Moline bearing has been greased at the factory and is ready to install and run. When establishing a re-lubrication schedule, note that a small amount of grease at frequent intervals is preferable to a large amount of grease at infrequent intervals. Table 1 below is a general guide for Lubrication. It should be noted that certain conditions may require a change of lubricating periods as dictated by experience.

High Speed Operation

At higher operating speeds, 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 the grease fitting and run for 10 minutes. This will allow excess grease to escape. Then wipe off excess grease and replace the grease fitting.

Operating Temperatures

Normal temperature may range from "cool or warm to the touch" up to a point of "too hot to touch for more than a few seconds," depending on the bearing size, speed and surrounding conditions. Abnormally high bearing temperature may indicate faulty lubrication practices and/or misalignment. 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 is noisy, usually indicates too little grease.

Special Operating Conditions

Refer acid, chemical, extreme or other special operating conditions to the factory.

LUBRICATION INSTRUCTIONS

All Moline bearings are factory lubricated with No. 2 consistency lithium base grease that is suitable for most normal applications. Many ordinary cup greases will disintegrate at speeds far below those at which Moline bearings will operate successfully if proper grease is used. Relubricate with lithium base grease or a grease that is compatible with original lubricant and suitable for roller bearing service. It should be noted that when re-lubricating, adding a small amount of grease on a frequent basis is preferable to a large amount of grease infrequently. In unusual cases consult the factory or a reputable grease supplier.

Storage or Special Shutdown

If equipment will be idle for some time, before shutting down, add grease to the bearing, rotating the sleeve to distribute grease. If possible, cover the bearing to protect from dust and other contaminants. This will ensure protection of the bearing, particularly when exposed to severe environmental conditions. After lengthy storage, add a small amount of fresh grease before running.

TABLE 1 - LUBRICATION CHART

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

Read Operations and Lubrication sections above before establishing lubrication schedule.

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After choosing the best bearing, make sure you specify the optimal grease for the application. We use premium Timken™ All Purpose lithium grease to assemble our bearings.
Moline Bearing has access to many of the differing Lubricants on the market today. If you have special or specific performance requirements from the lubricant used for your application, please contact us with the details and we will be glad to accommodate your request.

RADIAL/THRUST LOAD RATINGS

Moline Type E bearings have the capacity to carry heavy radial, thrust, and combined radial/thrust loads. The maximum recommended load which can be applied is limited by various components in the system, such as the bearing, housing, shaft, shaft attachment, speed and life requirements as listed in this catalog.

Select a bearing from the Type E Radial Load Ratings selection chart in pages 48-51 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 required for the majority of applications and provides for occasional average shock loads. (Equivalent Radial Load = P). L10 Hours of Life is the life that may be expected from at least 90% of a given group of bearings operating under identical conditions.

For L10 Hours of Life other than those listed in the Type E Radial Load Ratings selection chart in pages 48-51, multiply the Equivalent radial load by one of the following factors:

For 50,000 L10 Hours of Life use the factor of 1.16; 80,000 - 1.34. Then select a bearing from the bold face (30000) L10 ratings only in the selection chart having a rating equal to or greater than this value.

Heavy Service

For heavy shock loads, frequent shock loads or severe vibrations, add up to 50% (according to severity of conditions) to the Equivalent Radial Load to obtain a modified radial load.

Thrust load values shown in the table below are recommended as a guide for normal applications that will give adequate L10 life. Where substantial radial load is also present, it is advisable to calculate the L10 life to assure it meets the requirements. The effectiveness of the shaft attachment to carry thrust load depends on proper tightening of the set screws, shaft tolerance, and shaft deflections. Therefore, it is advisable to use auxiliary thrust carrying devices such as shaft shoulder, snap ring, or a thrust collar to locate the bearing under heavier thrust loads or where extreme reliability is desired.

RPM RANGE	20–200	201–2000	OVER 2000
Recommended Thrust Load	C90/4	C90/8	C90/12

The shaft tolerances recommended in Table 2 on page 44 are adequate under normal radial, thrust, and combination radial/thrust load applications. The radial load is limited by the attachment to the shaft (see table on following page 43). Since the allowable load, especially at low speed, is very large, the shaft should be checked to assure adequate shaft strength.

The magnitude and direction of both the thrust and radial load must be taken into account when selecting a housing. When pillow blocks are utilized, heavy loads should be directed through the base. Where a 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.

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

$$L_{10} = \left(\frac{C_{90}}{P}\right)^{10/3} \times \frac{1{,}500{,}000}{RPM}$$

Where:
L_{10} = Life, hours
C_{90} = Dynamic Capacity, lbs. (page 43)
P = Equivalent Radial Load, lbs.

When the load on a two row roller bearing is solely a radial load with no thrust (axial) load, the load is shared equally by both rows of rollers and the equivalent load is the same as the actual load. However, when a thrust (axial) load is applied, the loading on the two rows is shared unequally depending on the ratio of thrust to radial load. The use of the X (radial factor) and Y (thrust) factor from the table on page 43. convert the actual applied thrust and radial loads to equivalent radial load which has the same effect on the life of a bearing as a radial load of this magnitude.

$$P = XFR + YFA$$

Where:
P = Equivalent radial load, lbs.
FR = Radial load, lbs.—
(see page 37 for allowable slip fit maximum)
FA = Thrust (axial) load, lbs.
e = Thrust load to radial load factor (page 43)
X = Radial load factor (page 43)
Y = Thrust load factor (page 43)

To find X and Y, first calculate FA/FR and compare to e. Determine X and Y from the Thrust Factors and Seal Speeds chart on page 43. Light Thrust FA/FR less than or equal to e or heavy thrust FA/FR greater than e.

Substitute all known values into the equivalent radial load equation. The equivalent radial load (P) thus determined can be used in the L_{10} life formula or compared to the allowable equivalent radial load rating desired in the expanded rating table to select a bearing.

If the calculated value of P is less than FR then use P = FR.

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Type E Thrust Factors and Seal Speeds

SHAFT SIZE	e	LIGHT THRUST IF FA/FR≤E		HEAVY THRUST IF FA/FR≥E		LOAD RATING		SEAL SPEED LIMITS		MAXIMUM SLIP FIT RADIAL LOAD FR**
		X	Y	X	Y	DYNAMIC C_{90}* LBS.	STATIC C_0 LBS.	CONTACT RPM	LABYRINTH RPM	
1 - 1 1/4 25mm	.49	.87	1.77	.70	2.14	3810	15760	3800	4490	3100
1 3/8 - 1 7/16 35mm	.46	.87	1.89	.70	2.28	6100	26000	3200	3820	5000
1 1/2 - 1 11/16 40mm	.44	.87	1.96	.70	2.37	7860	33000	2800	3320	6400
1 3/4 - 2 45mm 50mm	.33	.87	2.64	.70	3.18	10300	43000	2650	3050	8400
2 3/16 55mm	.36	.87	2.38	.70	2.87	10900	48200	2300	2730	8900
2 1/4 - 2 1/2 60mm 65mm	.40	.87	2.17	.70	2.63	11600	54000	2100	2420	9500
2 11/16 - 3 70mm 75mm	.46	.87	1.87	.70	2.26	12300	61200	1965	2060	10000
3 3/16 - 3 1/2 80mm 85mm 90mm	.50	.87	1.71	.70	2.07	19600	108600	1640	1640	16000
3 15/16 - 4 100mm	.49	.87	1.77	.70	2.14	26900	154000	1530	1530	22000
4 7/16 - 4 1/2 110mm 115mm	.53	.87	1.63	.70	1.97	33000	188400	1360	1360	27000
4 15/16 - 5 125mm	.47	.87	1.83	.70	2.21	45500	266000	1200	1200	35000
5 7/16 - 6 130mm 135mm 140mm 150mm	.54	.87	1.76	.70	2.12	41500	354000	915	915	42400
6 7/16 - 7 160mm 170mm 180mm	.54	.87	1.61	.70	1.95	70500	574000	750	790	72000

* C90—Dynamic capacity based on a rated life of 90 million revolutions or 3,000 hours at 500 RPM.

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

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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.

TABLE 2 - SHAFT SIZING

SHAFT DIAMETER	SHAFT TOLERANCES
1 – 1½ 35mm	Plus .0000" to minus .0005" Plus .0000" to minus .013mm
1⅝ – 4 40mm – 100mm	Plus .0000" to minus .0010" Plus .0000" to minus .025mm
4 7/16 – 6 110mm – 140mm	Plus .0000" to minus .0015" Plus .0000" to minus .038mm
6 7/16 – 7 160mm – 180mm	Plus .0000" to minus .0020" Plus .0000" to minus .051mm

For best results, clean the shaft and bore of the bearing. The shaft should be straight, free of burrs and nicks, and the correct size, Table 2. Lubricate the 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 housings or seals. Bolt the unit to the support, using shims where necessary to align bearing. Use shims that cover across the entire housing base.

Determine the final shaft position and hand tighten set screws firmly onto shaft. If possible, rotate the shaft slowly under load. If there is any strain, or vibration, it could be due to incorrect alignment, a bent shaft or bent supports. Tighten set screws alternately in small increments to the torque value listed Table 3. To ensure full locking of the inner race to the shaft, after 24 hours of operation the set screws should be retightened.

TABLE 3 - SET SCREW TORQUE

SHAFT SIZE IN	SHAFT SIZE MM	SET SCREW SIZE UNC	TORQUE (IN - LBS)
1	25	¼ – 20	80
1 3/16 - 1 ¼	-----	5/16 – 18	165
1 ⅜ - 1 7/16	35	5/16 – 18	165
1 ½ - 1 11/16	40	5/16 – 18	165
1 ¾ - 2	45 - 50	⅜ – 16	290
2 3/16	55	⅜ – 16	290
2 ¼ - 2 ½	60 - 65	⅜ – 16	290
2 11/16 - 3	70 - 75	½ – 13	620
3 3/16 - 3 ½	80 - 90	½ – 13	620
3 15/16 - 4	100	⅝ – 11	1325
4 7/16 - 4 ½	110 - 115	⅝ – 11	1325
4 15/16 - 5	125	⅝ – 11	1325
5 7/16 - 6	130 - 150	¾ – 10	2150
6 7/16 - 7	160 - 180	¾ – 10	2150

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