



PLUMMER BLOCK INSTALLATION GUIDE



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1. PREPARATION

Gather the necessary parts and tools. Consult NSK or qualified personnel for a list of tools needed for assembly. Read through all instructions before beginning the installation. There is a picture of a bearing assembly set into the housing base in Figure 1 on page 5 that can help clarify the instructions.


Warning: To ensure that the drive shaft is not unexpectedly started (if the shaft is connected to a power source) turn off and lockout the power source before proceeding. Failure to observe these precautions could result in bodily injury.

PREPARING THE SHAFT

Clean shaft and all bearing components thoroughly (eliminate any irregularities or burrs on the shaft). Check basic dimensions to ensure adapters and shaft diameters are correct. A tapered bore bearing is mounted on a tapered adapter or a tapered shaft. A straight bore bearing is mounted directly onto the shaft.

PREPARING THE HOUSING

Consider numbering or marking matching caps and bases if many are being assembled. Caps and bases of split pillow blocks are NOT interchangeable. Each cap and base must be assembled with its mating part in the orientation in which it was removed. Most applications require one fixed bearing and one float bearing per shaft. The fixed bearing requires a fixing (locating) ring to be installed next to the bearing helping to lock it into position. The float bearing does not require the fixing (locating) ring. If thrust loads are involved, it is generally better to choose the bearing with the heaviest radial loading to be the fixed bearing because spherical bearings subject to thrust loads require a radial load as well to operate properly. To verify the proper bearing position along the shaft, consult the equipment



manufacturer. Also, some housings have lube drain holes at the base of the housing. Note the location, if any, to ensure the housing is positioned to allow access, if needed, for the application. Remove any paint and burrs from the cap and base at the housing split and thoroughly clean the housing and bearing area. If the housing base contains a vertical hole at the bottom of the seal groove, check to ensure the hole and groove are free of foreign matter. Set lower halves of housings on a base and lightly oil the bearing seats. Prepare the cap in a similar manner, maintaining the orientation of cap and base. Alignment dowel pins in the base will help re-orient the caps to the base. Place these parts in a clean area.

Caution: Consideration should be given to any inboard seal that will be used. If the housing style uses metal labyrinth seal rings which are solid (not split), they will need to be positioned or located on the shaft prior to the bearing being positioned and tightened onto the shaft. An example of this style of seal ring is shown in Figure 1 on page 5.

MOUNTING THE ADAPTER SLEEVE

If an adapter sleeve is to be used, it must now be mounted. Remove any oil from the shaft to prevent transfer of oil to the bore of the adapter sleeve. Position the adapter sleeve on the shaft with the threads outboard to the approximate location with respect to the required bearing centerline. A light coating of oil may be applied to the outside diameter surface of the sleeve to make bearing mounting and removal easier.

2. PRECAUTIONS WHEN MOUNTING BEARINGS

PACKING OF A NEW BEARING

New bearings are packed with an anticorrosive agent because if a bearing were to rust it would not rotate properly. As for their dimensional accuracy, bearings are manufactured precisely in units of 0.001 mm (micrometer). As a result, even powdery dust becomes a great obstacle to bearing operation. Therefore, do not unpack bearings until it is necessary.

CONFIRMATION OF BEARING NUMBER

Before using a new bearing, confirm that its bearing number (Brg. No.), which consists of the basic number, appearance symbol and clearance symbol, matches or is equivalent to that of the bearing being removed from the equipment. Here is a confirmation example using 23226CAMKE4C3:

BASIC NUMBER

(Bearing Series Number + Bearing Bore Number)

The bearing series number is the first three digits, 232.

The bearing bore number is the fourth and fifth digits, 26.

APPEARANCE SYMBOL

The symbol consists of the following characters:

CAMKE4 where,

- CAM: Indicates the cage style of the bearing. CAM is a one piece brass cage with a guide ring.
- K: Indicates that the bearing has a tapered bore with a 1/12 taper (K30 indicates that the bearing has a tapered bore with a 1/30 taper).
- E4: Indicates that an oil groove and oil holes are provided on the outside of the outer ring.

CLEARANCE SYMBOL

The clearance symbol consists of two characters, in this case C3. The symbol represents the bearing clearance alone and indicates the geometrical or real clearance. The geometrical clearance may change depending on the shaft and housing fitting, temperature difference, or its operational condition, after mounting.

Confirm that the basic number, appearance symbol, and clearance symbol of the new bearing are identical or equivalent to that of the bearing that is being replaced.

PREPARING TO MOUNT THE BEARING

Prior to the start of the bearing mounting process, examine the steps involved in the mounting method by reading the rest of this installation guide, referring to any technical drawings that may be useful, and checking the jigs and tools necessary for mounting. Depending on the work, preparation of a special jig may be necessary, so a preliminary examination must be done.

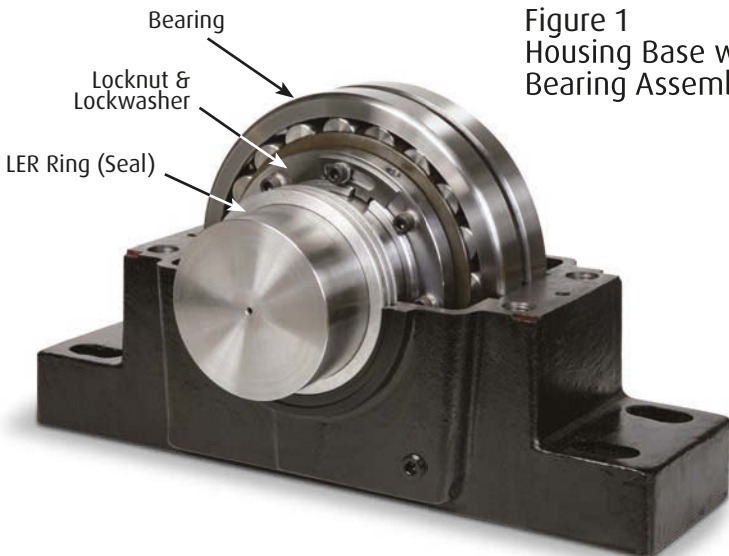


Figure 1
Housing Base with
Bearing Assembly

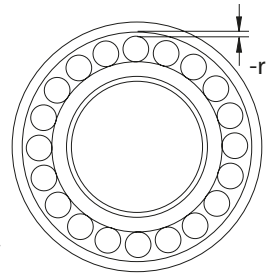
3. MOUNTING THE BEARING(S)


MEASURING INTERNAL CLEARANCE

When mounting a bearing, the measurement of radial internal clearance within the bearing is a most important task. When handling the bearing and measuring the internal clearance, it is wise to wear thin rubber gloves (if the bearing is touched by a bare hand, the touched area may rust.)

MEASUREMENT OF MANUFACTURED BEARING CLEARANCE

Prior to mounting, measure the radial internal clearance of a bearing, set the bearing standing upright (vertically) on a flat surface while holding its outer ring with one hand. While paying close attention not to incline the inner and outer rings, stabilize the rollers by rotating the inner ring to the right and left about 1/2 to 1 turn. Adjust the rollers until one randomly chosen roller of either double row is positioned exactly at the top. Now the internal clearance is measured with a feeler gauge by starting with a thin size and increasing the thickness until it no longer passes between the rollers and the inside of the outer ring. Insert the feeler gauge between rollers of two rows which have a roller positioned exactly at the top of the bearing and outer ring. For cage styles with staggered roller spacing, position rollers in both rows as close to the top as possible. Now measure the internal clearance (Δr). A little inward pressure by hand on the top roller will help the feeler gauge to pass over the roller and between the outer race. The feeler gauge must pass over the top of the roller for an accurate measurement. You might find a slight sawing action needed to get the feeler to pass. Do not roll the bearing roller to measure the clearance. As rollers become heavier with size, this will assist in making the initial clearance measurement. Record this clearance.





Note: For bearings with an outer diameter greater than 200mm, please consult NSK on how to properly measure the internal clearance.

TEMPERATURE EQUILIBRIUM WHEN TAKING MEASUREMENTS

To ensure accurate measurement of the bearing internal clearance and other dimensions, the temperature of the measuring instrument and the components to be measured must be the same. Pay special attention to this if a bearing has been mounted using an oil heating tank or bearing induction heater, and measure the internal clearance only after the bearing has completely cooled down. Even a bearing that has just come out of a warehouse may have a high temperature, so it is important to check the temperature any time you are going to take measurements.

MOUNTING A BEARING WITH A TAPERED BORE

Bearings with a tapered bore are always mounted with an interference fit on the shaft or with adapter sleeve. The reduction in radial internal clearance or the axial displacement of the inner ring on its tapered seating is used as a measure of the degree of interference. With spherical roller bearings it is generally preferable to measure the reduction in clearance (beginning clearance minus the final mounted clearance). These clearances can be measured simply using feeler gauges as described in earlier sections of this manual. Only in cases where the bearings are small, or where space is cramped, is the axial displacement to be preferred as a measure of the interference. Feeler gauges having blades with a thickness of 0.03 mm (or 0.001 inches) should be used to measure the clearance before, during and after bearing mounting. The clearance should always be measured between the outer ring and an unloaded roller. Before making clearance measurements, the bearing should be rotated a few times to ensure that the rollers assume their correct positions. During the measurement, the roller at the measuring point is lightly pressed against the guide ring between the two roller rows. The measured radial internal clearance must be the same for both rows of rollers.


3. MOUNTING THE BEARING(S) (CONT)

Guideline values for the reduction of radial internal clearance are listed in Table 1 (page 10) for spherical roller bearings with tapered bore. If these recommendations are followed, the degree of interference will be adequate. The minimum clearance reduction values should generally be used for bearings, which before mounting have an initial radial internal clearance close to the lower limit (see Table 1).

Heavy loads, high speeds, and/or appreciable temperature differences expected between inner and outer rings necessitate a comparatively large final internal clearance. In such cases bearings with a radial internal clearance greater than normal (C3 or C4) should be used.

MOUNTING PROCEDURE FOR TAPERED BORE BEARING

It is important to first measure the clearance in the bearing. Proper mounting requires you to measure the beginning and mounted clearance to ensure enough running clearance is allowed. To measure the unmounted radial internal clearance in the bearing, insert progressively larger feeler blades over the full length of the roller between the most vertical unloaded roller and the outer ring sphere as described in earlier sections of this manual. This is made easier by pressing the top roller gently inward toward the center of the bearing (when the bearing is setting vertically, not on a shaft, but on a table or the ground). Gently slide the feeler gauge across the top of the roller (a gentle sawing type action will help you). Record the measurement of the largest size blade that will slide through. This is the unmounted radial internal clearance (a bearing resting on the shaft will have the internal clearance at top of the bottom roller). You should be able to slide the feeler gauge under the bearing, i.e. between the roller and the outer ring. See Table 1 for clearance guidelines. Again, slight inward pressure by hand on the roller will help you take an accurate clearance measurement.



Place the bearing on the adapter sleeve, starting with the large bore of the inner ring to match the taper of the adapter. Use the adapter nut (without the lock washer to avoid damaging it during tightening) to snug the bearing onto the adapter. Position the bearing to the proper axial position on the shaft (the lock washer will be installed after the bearing is mounted by loosening and then removing the nut and inserting the lock washer later). Apply the locknut with the chamfered face toward the bearing. Use a lubricant on the face of the locknut where it contacts the inner ring face of the bearing to make easier mounting for large sizes. Large size bearings will require a heavy duty impact spanner wrench and a sledge hammer to obtain the required reduction in radial internal clearance. A Hydraulic Nut or Jack-up Nut can be purchased from NSK to make the mounting of large bearings much easier. Do not attempt to tighten the locknut with hammer and drift. The locknut will be damaged and chips can enter the bearing. In large sizes it will be more difficult to tighten the locknut far enough with a spanner wrench.

For large sizes (8 inch shaft sizes and larger) oval point screws drilled and tapped through the face of the nut that will contact just the inner ring of the bearing, will make installation (bearing drive-up) of large units much easier. In such cases 8 to 12 oval point screws (1/2-13 UNC threads) evenly spaced may be added and progressively tighten each screw evenly in a clockwise manner. Tighten each screw to the same torque before increasing a higher torque as this will assure an even tightening. Proceed in this manner, being sure to measure the clearance often, until the proper radial internal clearance is achieved. To measure the mounted clearance of a bearing, rotate the rollers of the bearing left and right until a randomly chosen roller from each row is exactly at the bottom of the bearing. For cage styles with staggered roller spacing, position rollers in both rows as close to the bottom as possible. Carefully insert the feeler gauge between

3. MOUNTING THE BEARING(S) (CONT)

the bottom rollers and the outer raceway and use a gentle sawing motion to slip the largest possible tab through by starting with a thin tab and using progressively thicker tabs. The thickest tab that will slip through between the rollers and the raceway is the mounted radial internal clearance (ΔrS). If grease is to be used as the bearing lubricant, hand pack the bearing with grease before installing the lockwasher and locknut.

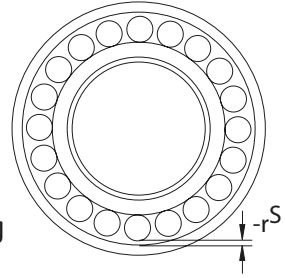


Table 1 Radial Internal Clearance Dimensions

Unit: inch

Nominal Bore Diameter (mm)		Reduction in Radial Clearance		Minimum Permissible Residual Clearance after Mounting		
from	to (incl.)	min	max	CN	C3	C4
31	40	0.0010	0.0012	0.0004	.0010	.0014
41	50	0.0012	0.0014	0.0006	.0012	.0018
51	65	0.0012	0.0014	0.0010	.0014	.0024
66	80	0.0016	0.0018	0.0012	.0016	.0030
81	100	0.0018	0.0022	0.0014	.0020	.0033
101	120	0.0020	0.0024	0.0018	.0026	.0043
121	140	0.0024	0.0028	0.0022	.0031	.0051
141	160	0.0026	0.0031	0.0024	.0039	.0059
161	180	0.0028	0.0035	0.0028	.0043	.0067
181	200	0.0031	0.0039	0.0028	.0043	.0075
201	225	0.0035	0.0043	0.0031	.0051	.0083
226	250	0.0039	0.0047	0.0035	.0055	.0091
251	280	0.0043	0.0055	0.0039	.0059	.0098
281	315	0.0047	0.0059	0.0043	.0063	.0110
316	355	0.0055	0.0067	0.0047	.0071	.0118
356	400	0.0059	0.0075	0.0051	.0079	.0130
401	450	0.0067	0.0083	0.0055	.0087	.0142
451	500	0.0075	0.0094	0.0063	.0094	.0154
501	560	0.0083	0.0106	0.0067	.0106	.0161
561	630	0.0091	0.0118	0.0079	.0122	.0181
631	710	0.0102	0.0130	0.0087	.0130	.0205
711	800	0.0110	0.0146	0.0094	.0154	.0232
801	900	0.0122	0.0161	0.0110	.0169	.0260
901	1000	0.0134	0.0181	0.0122	.0185	.0287

Note: These values are for any mounting method other than using a hydraulic nut. If you plan to use a hydraulic nut for mounting, please consult NSK.

MOUNTING A BEARING WITH A CYLINDRICAL (STRAIGHT) BORE

A bearing with cylindrical (straight) bore ordinarily does not require as tight of fit to the shaft as tapered bore bearings. Expand the inner ring by warming in an oil bath or bearing induction heater, which can be purchased from NSK. Several hundred degrees Fahrenheit will likely be necessary to expand the bore adequately to provide assembly clearance. To assist, the shaft may be cooled. The inner ring of the bearing is secured to the shaft as the ring cools to the same temperature. The typical shaft interference or shrink fit is 0.0005" inch per inch of shaft diameter fit. Clearance in the bearing should be measured before and after installation to ensure you have adequate internal clearance. Table 1 (page 10) can be used as a guide. Consult the equipment manufacturer or NSK for shaft tolerances and shaft fit guide lines. If grease is to be used as the bearing lubricant, hand pack the bearing with grease before installing the lockwasher and locknut.

INSTALLING LOCKWASHER AND LOCKNUT

After tightening the bearing to the appropriate internal clearance, loosen and remove the locknut (remove mounting screws also if any were used), and install the lockwasher between the nut and bearing. Position the single inner tab of lockwasher toward the face of the bearing and in the slot of the adapter sleeve. The outer tabs must face the nut chamfer. Retighten the locknut until tight. (Do NOT drive bearing further up the taper, as this will reduce the radial internal clearance previously secured). Check to make sure the radial internal clearance has not changed. Find the lockwasher tab that is nearest a locknut slot. If a slot is slightly past a tab, don't loosen the nut, but tighten it slightly to meet a washer tab, then use a drift or blunt chisel to bend that tab down into the slot of the nut, thus locking the nut in position and keeping the bearing tight.

4. PLACING ASSEMBLY INTO PLUMMER BLOCK HOUSING

SETTING “FIXED” BEARING AND SHAFT INTO HOUSING

Note: There must be only one “fixed” bearing per shaft. The other bearing(s) must be “float” bearings to permit shaft expansion.

Place shaft with bearings into lower halves of housings, carefully guiding seals into the seal grooves and being certain that the bearing outer rings sit squarely in the pillow block bearing seats. If felt type seals are used — typically standard in many metric blocks — oil soak seals prior to inserting them in the seal grooves, and trim length to fit.

The fixing rings, also known as locating rings, stabilizing rings, or stab rings, must be installed next. To verify the number of fixing rings that should be used, measure the width of the bearing seat inside the housing, as well as the width of the bearing and the width of a fixing ring. Subtract the width of the bearing from the width of the bearing seat, and divide the result by the width of a fixing ring. The final result will be the number of fixing rings that must be used to hold the bearing in place. In some cases only one fixing ring will be used while in others two or more may be used. Move shaft with bearing (or block) axially so that the fixing ring(s) can be inserted between the “fixed” bearing outer ring and housing shoulder on the locknut side of the bearing where practical. The fixing ring(s) may be installed on either side of the bearing or on both sides if multiple rings are used. One assembly can be seen in Figure 1 on page 5. Slotted base hold-down bolt holes can be used to adjust the housing location slightly. Check and align bearing with shaft. Bolt the fixed housing securely in place.

SETTING “FLOAT” BEARING(S) AND SHAFT INTO HOUSING

The bearing in the float housing can now be centered within the housing seat. Center any other float bearings that are on the same shaft in the housing seat in a similar manner. This will allow the bearing and shaft to expand or contract if required due to thermal growth and changes of the equipment. (See Lubrication section before tightening the cap bolts and tightening the base bolts). The labyrinth seals (if solid ring type) must be installed before cap and base are tightened together. For seal installation apply a generous coating of grease to the labyrinth grooves of the seal as well as those in the housing. Lock all housings down.

LUBRICATION

If grease is used as a lubricant, it should be applied before the upper housing half is secured and in accordance with the lubrication notes given in the “Lubrication” section, see Tables 2 and 3. Hand pack the grease between rollers and rotate the bearing at least one full turn to spread the grease around. For oil bath lubrication, fill to the middle of the lowest roller, and consult equipment manufacturer or NSK as to oil type and other lubrication requirements.

Caution: In the higher speed ranges of operation, too much grease will cause overheating. The amount of grease that the bearing will take for a particular high speed application can only be determined by experience. Excess grease in the bearing may causes overheating, therefore it may be necessary to remove the grease fitting or plug to permit the excess grease to escape. When establishing a re-lubrication schedule, note that small amounts of grease at frequent intervals is preferable to a large quantity at infrequent intervals. For normal applications, use a No. 2 Lithium base grease or equivalent. See Table 2.

4. PLACING ASSEMBLY INTO PLUMMER BLOCK HOUSING (CONT)

A second Lubrication Guide (Table 3) is also provided, listing re-lubrication intervals by bearing temperatures and conditions. A slight show of purged grease at the bearing seals is normal and also helps keep contaminants out.

Table 2 Lubrication Guide by Bearing Speed

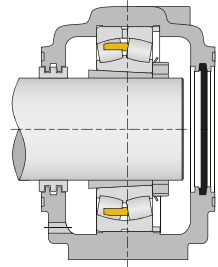
Hours Run per Day	Lubrication period in weeks						
	1 - 250 RPM	250 - 500 RPM	500 - 750 RPM	750 - 1000 RPM	1000 - 1500 RPM	1500 - 2000 RPM	2000 - 3000 RPM
8	12	12	10	7	5	4	3
16	12	7	5	4	2	2	1
24	10	5	3	2	1	1	1

Table 3 Lubrication Guide by Bearing Temps and Conditions

Operating Conditions	Bearing Temperatures	Grease Interval
CLEAN	32°F - 120°F	6 - 10 months
	120°F - 150°F	1 - 3 months
	150°F - 200°F	1 - 4 weeks
DIRTY	32°F - 150°F	1 - 4 weeks
	150°F - 200°F	daily to 1 week
MOISTURE	32°F - 200°F	daily to 1 week

INSERTING THE END COVERS

Before installing the housing cap, when the housing assembly requires an end cover, it must be inserted into the groove on the base of the outboard side of the housing, as seen in the figure to the right. Ensure that the cover is fully inserted into the groove to create a good seal on the end.



INSTALLING THE HOUSING CAP

The bearing seat in the upper half of the housing, called the cap, should be checked for burrs, thoroughly cleaned, lightly oiled and placed over the bearing. Especially with oil lubrication, the use of a sealing compound such as Permatex 2 at the split surfaces is helpful. Sealing compound must be applied sparingly. Wipe a thin film near the outer edges. Excessive amounts are forced not only out, but also in between the housing bore and bearing O.D. and this can pinch an outer ring or make a “free” bearing actually “held.” Dowel pins align cap and base of housing. Do NOT force the housing cap and base together, and always check for matched parts.

Note: Caps and bases of pillow blocks are NOT interchangeable. Each cap and base must be assembled with its mating part. Lockwashers (if provided) and cap bolts are then applied and tightened to complete the assembly. If shimming is required, only shims which cover the full mounting surface of the pillow block base are recommended.

The Plummer Block assembly is now complete. If you have any problems or questions please contact NSK using the contact information listed on the back cover of this manual.

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