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HIGH TEMP BEARINGS

SAF BEARING INSTRUCTION MANUAL

Instruction Manual for Split Block Bearing Units | HTB Corporation

Instruction Manual for Spilt Block Bearing Units Including SAF, SDAF, FSAF Series Housings

Installation

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

1. Clean shaft and all bearing components thoroughly. Check basic dimensions to insure adapters and shaft diameters are correct. A tapered bore bearing is mounted on a tapered adapter or a tapered shaft. A cylindrical bore bearing is direct mounted onto the shaft.

SAF Bearing Assembly

2. Preparing the Housings and Seals for Assembly.
NOTE: Housing cap and base must remain as a set.

Consideration should be given to any inboard seal types, see standard SAF seal types at end of the document.

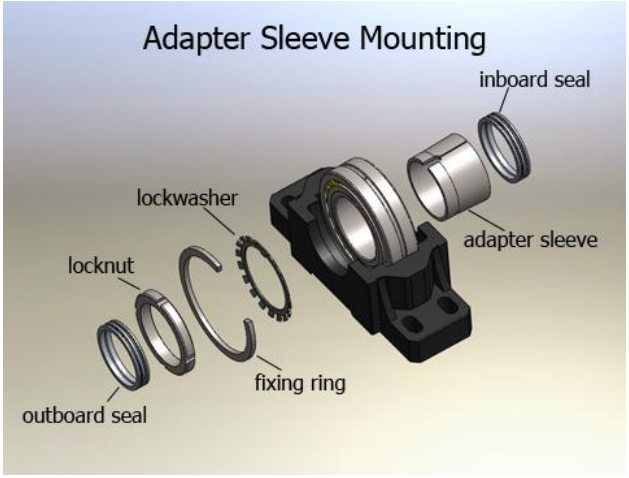
Metal seal rings which are not split will need to be positioned or located on the shaft prior to the bearing being positioned and tightened onto the shaft. *Lightly grease or oil the shaft and bore of inboard seal to protect both the shaft, seal and any related rubber seals, then carefully slide the inboard seal onto the shaft, but clear of the bearing area.*

Consider numbering or matching marking caps and bases if many are being assembled. Most applications require one fixed bearing and one expansion bearing per shaft. The fixed bearing requires a fixing ring to be installed next to the bearing helping to lock it into position. The expansion bearing does not require the fixing ring. If thrust loads are involved, it is generally better to choose the bearing with the heaviest radial loading to be the fixed bearing. Spherical bearings subject to thrust loads, require a radial load to operate properly. To verify the proper bearing position along the shaft, consult the equipment manufacturer.

Some housing have oil drain holes at the base of the housing. Note the location, if any, position the housing to allow access for future maintenance .Check the housing and remove any paint and burrs from the cap and base at the housing split and thoroughly clean the housing and bearing area. Insure mounting surface is flat. If the housing base contains a drain hole at the bottom of the seal grooves, check to insure the hole and or seal grooves are free of foreign matter. Set lower half of the housing on base and lightly oil the bearing seats. Prepare the cap in a similar manner, maintaining the orientation of cap and base. Place these parts in a clean area.

3. Mounting Bearing onto Shaft
NOTE: Inboard seal must be positioned on the shaft prior to bearing mounting.

Adapter Sleeve Mounting (for tapered bore bearings)
Remove oil or grease from the shaft where adapter sleeve will set. Position the adapter sleeve on the shaft with the thread outboard as shown to approximate location with respect to required bearing centerline. Light oil applied to the sleeve threads and tapered sleeve surface results in easier bearing mounting, excess on sleeve must be wiped off.



4A. Mounting Spherical Roller Bearings with Tapered Bores
Bearings with a tapered bore are always mounted with an interface fit on the shaft. 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 radial pre-loading. With spherical roller bearings it is generally preferable to measure the clearance reduction (beginning radial clearance less the final mounted clearance). This clearance can be measured by feeler gauges. 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 measuring, the bearing should be rotated a few times to ensure that the rollers assume their correct and normal 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.

Guideline values for the reduction of radial internal clearance are listed in Table 1 for spherical roller bearings with tapered bore. If these recommendations are followed, the degree of interference (fit to shaft) 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.

Heavy loads, high speeds 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.

Procedure: It is important to first measure the clearance in the bearing. Proper mounting requires measurement before, during and after mounting of the bearing to insure adequate running clearance is allowed. To measure the un-mounted internal radial clearance in the bearing, insert progressively larger feeler blades over the full length of the roller 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 gage across the top of the roller (a gentle sawing type action will help the feeler gage to pass). Record the measurement of the largest size blade that will slide through. This is the un-mounted radial internal clearance.

(*A bearing resting on the shaft will have the internal clearance at top of the lower most rollers. Slide the feeler gauge under the lowest roller, i.e. between the roller and the outer ring. Lift the roller slightly to help the feeler gage to pass when measuring clearance in this manner. See Table 1 for clearance guidelines.)*

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 the washer during tightening) to snug the bearing onto the adapter. Position the bearing to the proper axial position on the shaft. (The lock washer should be only installed ***after*** the bearing is fully tightened. The nut can then be removed and washer re-inserted, then the nut re tightened. 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 SLEDGE HAMMER TO OBTAIN THE REQUIRED REDUCTION IN RADIAL INTERNAL CLEARANCE. A HYDRAULIC NUT CAN BE PURCHASED TO MAKE MOUNTING OF LARGE SIZE BEARINGS EASIER. It is not advised to use a 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. An option

for large sizes (8" shaft sizes and larger) oval point screws may be incorporated into the face of the nut that will contact just the inner ring of the bearing. This 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 (drilled an tapped in the nut to contact the bearing inner ring) and allows to progressively tighten each screw evenly to the same torque before increasing a higher torque as this will assure an even tightening. Proceed in a clockwise manner, being sure to measure the clearance periodically, until the proper radial internal clearance is achieved. Once proper internal clearance is met, go to step 5.

4B. Mounting Self-Aligning Ball Bearings

Mount the bearing on the adapter sleeve, starting with the large bore of the inner ring to match the taper of the adapter. With the bearing hand tight on the adapter, locate bearings to the proper axial position on the shaft. (DO NOT use the lock washer during initial tightening because drive-up procedure may damage lock washer. Install washer after tightening.)

Position the locknut with chamfered face toward the bearing after lubricating the face of the locknut next to the bearing. Hand-tighten the nut with a spanner wrench until the adapter sleeve can neither be moved axially, nor rotated on the shaft. Then with a hammer, drive the spanner wrench until the locknut has been turned 90° or ¼ turn on the adapter sleeve.

CAUTION: A bearing that is not properly tightened will lead to the inner ring of the bearing turning on the adapter sleeve and/or the adapter sleeve turning on the shaft. To insure that the nut is not excessively tight, make certain the outer ring of the bearing rotates freely after installation. When mounting a normal fit bearing, swiveling the outer ring will result in a slight drag. If the bearing is a C3 fit, the outer ring will swivel freely.

4C. Mounting Spherical Roller Bearings with Cylindrical Bores

A bearing with cylindrical bore ordinarily does not require as tight of fit to the shaft as taper bore units. Expand the inner ring by warming in an oil bath or other suitable safe means. Several hundred degrees °F 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 bearing and shaft become the same temperature.

NOTE: The typical shaft interference or shrink fit is 0.0005" inch per inch of shaft diameter. Clearance in the bearing should be measured before and after installation to insure you have adequate internal clearance. Table 1 and 2 can be used as a guide. Consult the bearing manufacturer for shaft tolerances and shaft fit guide lines.

5. Locknut and Lockwasher

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 certain radial internal clearance has not changed.) Find the lockwasher tang that is nearest a locknut slot and bend into the nut slot. If a slot is slightly past the tang, do not loosen the nut, but tighten the nut slightly to meet a washer tang. This will lock the nut in position to keep the bearing tight.

6. Seals & Fixing Rings Installation, Assembling the Bearing into Housing Base

Place shaft with mounted bearings into the lower half of housing, carefully guiding seals into the seal grooves and being certain that the bearing outer rings sit squarely in the pillow block bearing seats. For grease lubricated bearing units, apply a generous amount of grease in the housing seal grooves. If felt type seals are used, oil soak the seals prior to inserting them in the seal grooves, trim length to fit. Move shaft with bearing (or block) axially so that the fixing ring can be inserted between the "fixed" bearing outer ring and housing shoulder on the locknut side of the bearing where practical. The Fixing Ring may be installed on either side of the bearing.

NOTE: SOME BLOCKS INCLUDE TWO FIXING RINGS, TO FILL THE AXIAL HOUSING SPACE FOR THE BEARING. THE FIXED BEARING SHOULD HAVE ALL THE AXIAL HOUSING SPACE FILLED.

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.

The expansion bearing unit must be centered within the housing seat. This will allow the bearing to expand or contract axially if required to accommodate potential thermal growth changes of the equipment/shaft. Lock all housings down.

NOTE: THERE MUST BE ONLY ONE "FIXED" BEARING PER SHAFT. OTHER BEARING OR BEARINGS MUST BE "EXPANSION" TYPES TO ALLOW SHAFT EXPANSION.

7. 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 1 & 2. Hand pack the bearing between rollers. For oil lubrication, fill to middle of lowest roller. Proper oil and grease selection is dependent on operating load, speed and environmental conditions, consult with your bearing representative to determine the proper lubrication.

8. Installing Housing Cap (Upper Half)

The bearing seat in the upper half of the housing (cap) should be checked for burrs, thoroughly cleaned, lightly oiled and placed over the bearing. Especially with oil lubrication, use of a liquid gasket compound such as Permatex at the split surfaces is required to prevent oil seepage. Sealing compound must be applied sparingly. Wipe a thin film near the outer edges. Excessive amounts may be forced between the housing bore and bearing O.D. and this can pinch an outer ring or make a "free" bearing act as a "fixed" bearing.

Dowel pins align cap and base of housing, Do not force the housing cap and base together. Check for matched parts.

CAUTION: 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 inserted and tightened to complete the assembly. If shimming is required, only shims which cover the full mounting surface of the pillow block are recommended.

Bearing Radial Pre-Load Data

Bearings with a tapered bore require a tighter fit on the shaft than bearings with cylindrical bore. The inner ring of the bearing is secured by forcing it up the tapered shaft or sleeve, or by driving a tapered sleeve between the bearing and the shaft. An inner ring secured in this way, expands and gives a decrease in bearing radial internal clearance, which indicates the amount of interference attained.

If a ball bearing is mounted on an adapter sleeve, the sleeve nut should be tightened but not so much that the outer ring is prevented from turning easily. Refer to the assembly instructions for adapter mounted ball bearings for proper mounting procedure.

Table 1: Recommendation for Driving a Spherical Roller Bearing on a Tapered Seat

Dimension in mm

Bore Diameter d (mm)		Reduction in Radial Internal Clearance		Minimum Permissible Final Clearance After Mounting Bearings with Clearance		
Over	Incl.	Min	Max	Normal	C3	C4
30	40	0.020	0.025	0.015	0.025	0.040
40	50	0.025	0.030	0.020	0.030	0.050
50	65	0.030	0.040	0.025	0.035	0.055
65	80	0.040	0.050	0.025	0.040	0.070
80	100	0.045	0.060	0.035	0.050	0.080
100	120	0.050	0.070	0.050	0.065	0.100
120	140	0.065	0.090	0.055	0.080	0.110
140	160	0.075	0.100	0.055	0.090	0.130
160	180	0.080	0.110	0.060	0.100	0.150
180	200	0.090	0.130	0.070	0.100	0.160
200	225	0.100	0.140	0.080	0.120	0.180
225	250	0.110	0.150	0.090	0.130	0.200
250	280	0.120	0.170	0.100	0.140	0.220
280	315	0.130	0.190	0.110	0.150	0.240
315	355	0.150	0.210	0.120	0.170	0.260
355	400	0.170	0.230	0.130	0.190	0.290
400	450	0.200	0.260	0.130	0.200	0.310

Grease Lubrication

The bearing must be lubricated by the customer prior to operation. When establishing a re-lubrication schedule, small amounts of grease at frequent intervals are preferable to a large quantity at infrequent intervals. For normal applications use NLGI No. 2 High quality Lithium grease with appropriate oil base stock kinematic viscosity per Table 2. Use of the lubricant selection chart also applies to oil bath lubricated bearings.

High Speed Operation – At higher speeds, 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. If excess grease in the bearing causes overheating, it will be necessary to remove the grease fitting or plug to permit the excess grease to escape.

A second Lubrication Guide (See Table 4) is also provided by bearing temperatures and conditions. Re-lube periods are better determined by experience. A slight show of purged grease at the bearing seals is normal and also helps keep contaminants out.

For new bearings:

- 100% pack the bearing races
- 33%-50% housing pack with grease for 50-500 RPM range, excessive packing will overheat the bearing due to grease churning
- For high speed or very clean environments, grease fill may be reduced to 33% housing pack
- Up to 100% housing packing is OK at less than 20 RPMS or very contaminated environments
- Rub grease on the interior housing walls and if using labyrinth seals fill the seal grooves to improve sealing.

For most application you should be able to add grease about 5 times until you have filled the housing, this is best done while the bearing is rotating. After approximately 5 applications, clean out the housing. Disassemble and flush until clean, be sure to push new grease through all of the lubrication holes to make sure all of the old grease is out.

Lubrication frequency is based on the installed conditions, very dirty or extreme environments will require high service rates to maintain the roller bearings.

Table 2: Oil/Grease base stock lubricant selection

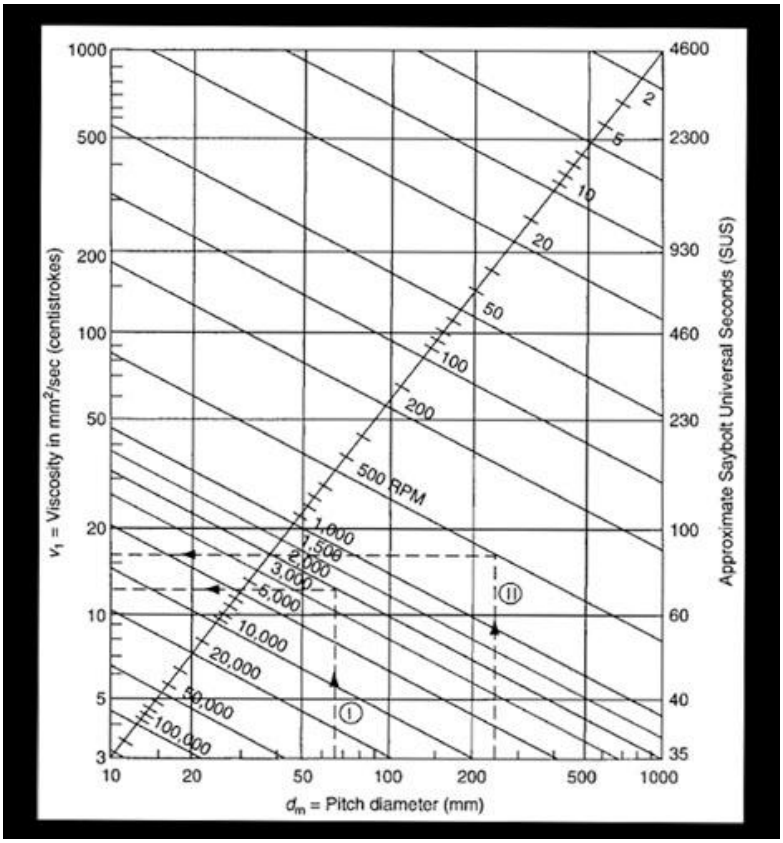


Table 3: Lubrication guide by bearing speed suggested lubrication period in weeks

	RPM						
Hours Run/Day	1 to 250	250 to 500	500 to 750	750 to 1000	1000 to 1500	1500 to 2000	2000 to 3000
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 4: Lubrication guide by bearing temperatures & 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

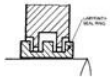
Standard SAF Seals

SAF bearings feature labyrinth (LER & PER) and Taconite (TER) contact seal options. For LER & PER addtional external contact lip seals can be mounted the housing to further enhance sealing. The standard options will service the majority of installations, high performance seals can be produced to ensure maximum reliability. LER, PER and TER seals each have their own advantages, **Table 5** outlines the primary factors in seal selection.

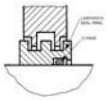
SAF Seal Types

LER Seal TER Seal PER Seal

SAF Basic Seal Types:



LER Seal (Labyrinth Seal): All purpose Non-contact seal, best for non-expansion applications. Standard practice is to fill the seal grooves with compatible grease to that of the bearing. This improves sealing, aids in contaminate trapping and reduces incidental contact wear.



PER Seal (Labyrinth Seal): Non-contact seal, for expansion applications. This seal features an O-ring on the seal internal diameter that allows it to float on the shaft if a thrust load is applied. Standard practice is to fill the seal grooves with compatible grease to that of the bearing. This improves sealing, aids in contaminate trapping and reduces incidental contact wear.

Standard LER and PER seals are effective against typical industrial contamination, but should not be used to resist driven contamination or liquids unless an outboard contact seal is applied or an enhance version is utilized. When using oil bath lubrication LER/PER seals are prone to oil seepage from the housing, this can be minimized but will generally always occur.

TER Seal (Taconite Seal): Contact seal, for expansion applications and or improved sealing. This seal features an outer lip seal and an internal felt seal. The cavity between the two seals is filled with grease to lubricate the lip seal and enhance contaminate trapping. Because it is a contact seal, it can be used in expansion applications. Best practice is to soak felt in compatible oil and fill space between felt and outer lip seal with compatible grease.

Standard TER seals are effective in heavily contaminated environments. It uses a series of contact seals to prevent contamination from entering the housing with the added benefit that it also helps hold lubrication in, leading to very little seepage. TER seals are limited to moderate shaft speeds, increase the bearing length footprint, are subject to wear and increase the friction torque of the bearing system.

Table 5: Seal style comparison

	Lip Seal	Clearance Seal
Max. P (Mpa)	0.1-4	leakage dependent
Max. V (m/s)	20	no limitation
Max. T (^{0}C)	150	no limitation
Min. T (^{0}C)	-70	no limitation
Leakage Rating	≤1	≤1000
Power Loss Rating	1-2	≈0
Life (hours)	5000	≥10000
Reliability	good	excellent
Maintenance	none	none