

TIMKEN®

Torrington®



Vibrating Mechanism Bearings

Vibrating equipment represents some of the most demanding applications for anti-friction roller bearings. This type of equipment includes screens, vibrating finishing mills, and vibrating compactors. Operating modes result in high radial and impact loads not regularly encountered with other machinery. The environment is often punishing, with high rotational speeds leading to high temperatures. This, together with misalignment, contributes to severe conditions for roller bearings.

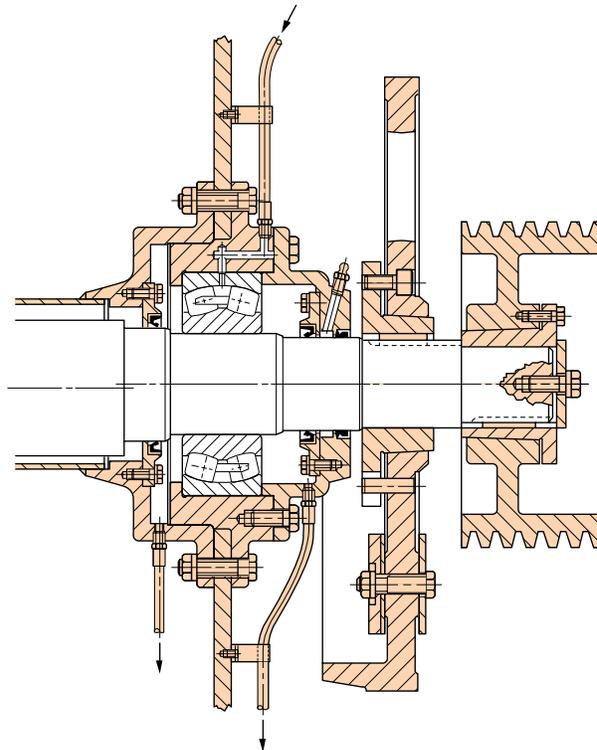


SPHERICAL ROLLER BEARINGS

The self-aligning roller bearing is able to compensate for the misalignment present in vibrating mechanisms. Timken manufactures its bearings from the finest quality steels to the highest manufacturing standards.

New surface finishing techniques, along with an open-ended, fully machined bronze cage, ensures a smooth running bearing. Through developments of surface contour measurements and the matching of components, we can offer greater reliability and cooler operation. The Torrington® spherical roller bearing is ideally suited for vibrating mechanisms.

VIBRATING MECHANISM TYPES



Single Shaft – Two Bearing – Circulating Oil Lubrication

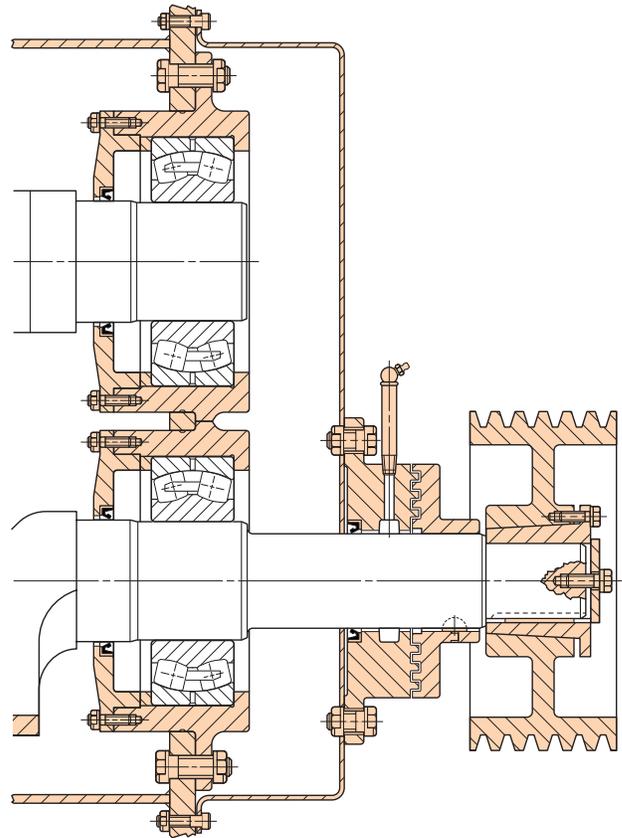
Single shaft units are designed with an eccentric portion to provide the throw with one bearing at each end of the shaft. The bearing at the drive end of the shaft is allowed to float and the other is fixed.

This unit is shown with a circulating oil system. It is used where speeds are excessive. The oil not only provides lubrication for the bearings but also acts as a coolant.

Double Shaft – Four Bearing – Splash Oil Lubrication

This design features two counter-rotating eccentric shafts geared synchronously. Bearings at the geared end of the shafts (not shown) are fixed to provide location. Those at the drive end are allowed to float to compensate for shaft expansion and contraction.

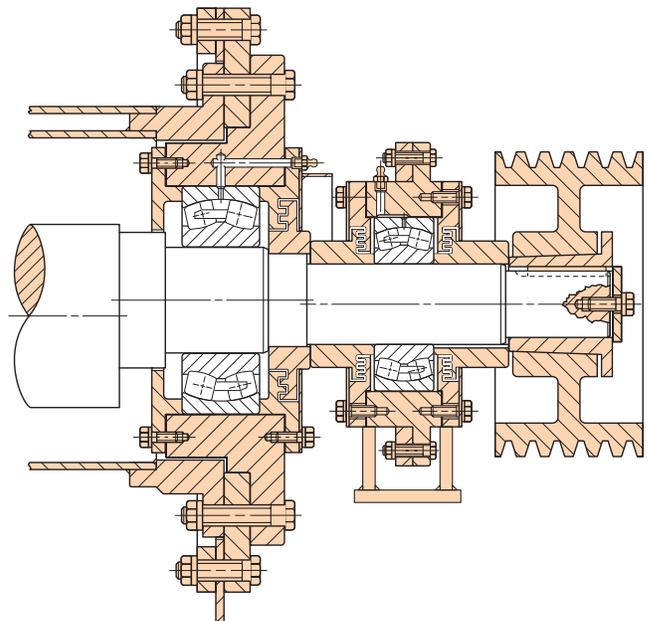
The vibrating movement agitates the oil to supply the bearings. The oil level can be easily checked with a sight gage.



Single Shaft – Four Bearing – Grease Lubrication

This design uses four bearings on a single shaft. The two inboard bearings are eccentric to the outer bearings. Outer bearings are mounted to the frame and the inboard bearings are mounted to the screen bed providing a positive throw to the screen. Counterweights are normally used to counteract the forces of the screen bed, thereby reducing the load on the outer bearings.

Grease is normally acceptable when the speeds are moderate.



Lubrication

There are two basic types of lubricants-greases and oils that are used in anti-friction bearings. The successful selection and application of these lubricating fluids in bearings, depends on the physical and chemical properties of the lubricant as they pertain to the bearing, its application operating parameters, installation and environmental conditions. Manufacturers of vibrating equipment have utilized four main types of lubrication systems. They are grease - manual or automatic feed, oil splash and circulating oil. Oil mist and drip feed systems have also been used, but to a lesser extent. Each system has its own advantages. For both grease and oil, the viscosity of the base oil should be

the main consideration in selecting the proper lubricant. As a general rule, it is recommended that a lubricant which can maintain a minimum viscosity of 105SUS (21,8 cSt) at the bearing operating temperature be utilized, to insure adequate lubrication of the bearing. With the improved analytical tools that exist today, we are now able to more accurately predict the required viscosity for each application, based on the actual bearing, load & speed conditions. This type of analysis allows us to optimize the lubricant, to insure proper lubrication of the bearing while minimizing the system generated heat. For a more comprehensive lubrication analysis, contact your local Timken sales engineer.

GREASE SYSTEMS

Grease consists of a base oil plus a thickener and assorted additives. The base oil in the grease should be a good grade oxidation resistant mineral oil. Synthetic base oils are also available, but quite expensive, and in most cases are not necessary. The use of a synthetic grease might be considered when high loads and speed result in operating temperatures of 200-250° F.

Some thickeners used in grease are soaps of calcium, sodium, or lithium. Calcium soaps should not be used unless they contain anticorrosive additives. Sodium or lithium based greases are good where moisture condensation can be a problem. To raise the operating temperature of the grease, complexing agents are normally added to the thickeners. For vibrating mechanisms, extreme pressure and anticorrosive additives are recommended. In certain cases, molybdenum disulfide (MoS₂) has been added as an extreme pressure additive. Depending on the grade of MoS₂ used, abnormal wear of races and rollers can occur. Therefore, we do not recommend the use of greases that contain MoS₂.

Manufacturers will design grease lubrication systems because it simplifies sealing, making it the most economical choice. In addition, the grease acts as an additional barrier against contamination. However, grease is not suitable for all applications due to its inability to operate at higher speeds.

Under normal operating conditions, in ambient summer temperatures NLGI Grade 2 greases are specified. At lower operating temperatures a Grade 1 or even a Grade 0 may be specified. At higher ambient temperatures a Grade 3 grease is required.

Greases are also sometimes used to fill the gap in the labyrinth seals of oil lubricated mechanisms. NLGI Grade 3 grease with calcium soaps and anticorrosive additives are best suited here. Care should be taken to not over grease the bearing, which will result in excessive operating temperatures, due to churning. For vibrating mechanisms the initial fill quantities should be 50% in the bearing, while the free space in the housing should be 30 - 50% full.

The mixing of grease should be avoided as much as possible. The different types of thickeners are not always compatible. There are also cases when even two compatible grease when mixed together result in a grease having less than desirable properties. When mixing greases consult with your lubricant supplier.

OIL LUBRICATION

Oil Lubrication allows the bearing to operate at higher speeds, dissipates heat quicker, improved control of lubricant quantity, use of a filtration system to remove contaminate and moisture.

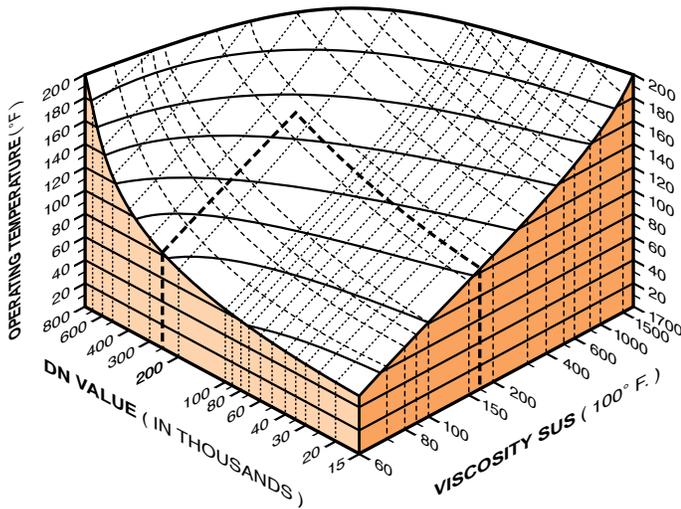
Similar to grease, there are numerous additives available to enhance the properties of oils. There are extreme pressure agents, pour point depressants, wear preventatives, anti-foaming and antioxidants. All of these additives are recommended for vibrating mechanisms.

Oil lubrication can be applied by several methods, splash and circulating oil being the most common. Splash systems are most popular and normally provide adequate lubrication in most cases. In high speed & load applications where the heat generated cannot be dissipated by a splash system, circulating systems are used. Circulating oil not only carries away heat, but also any contaminate that may have entered the bearing. Oil coolers may also be added for additional heat extraction.

Selection of an oil is based upon the viscosity required to generate the proper film thickness at the bearing operating temperature. For vibrating mechanisms an ISO 220 grade is normally used during the spring, summer and fall (Ambient > 50°F), and ISO 150 grade during winter operation (Ambient < 50°F), Lower grades maybe required in extreme cold conditions. For exact viscosity requirements for a specific application, a detailed EHL analysis is required.

For greater detail on grease, oil or lubrication systems, please refer to Timken Lubrication Guide – Order No. 5733.

Oil Viscosity Selection Chart



Internal Clearance

Radial internal clearance before installation – Bearings with cylindrical bore –

BORE DIA. (millimeters)		RADIAL INTERNAL CLEARANCE (inches)	
Over	Incl.	C4	
		Min.	Max.
30	40	.0024	.0032
40	50	.0030	.0039
50	65	.0035	.0047
65	80	.0043	.0057
80	100	.0053	.0071
100	120	.0063	.0083
120	140	.0075	.0094
140	160	.0087	.0110
160	180	.0094	.0122
180	200	.0102	.0134

Note: C4 Clearance is most common in bearings used in vibrating equipment

Typical Torrington® Vibrating Equipment Bearing Modifications

- W20** = Outer ring with standard lube holes
- W22** = Outer ring with reduced O.D. tolerance
- W33** = Outer ring with standard lubrication holes and machined lubrication groove in center of O.D. This feature is standard unless otherwise specified.
- W40I** = Inner ring made of carburizing grade steel
- W47** = Inner ring with oversize bore
- W49** = Outer ring with oversized O.D.
- W50** = Tapped holes in face of inner ring.
- W64I** = Inner ring only made of premium quality carburizing grade steel
- W88** = Inner ring with reduced bore tolerance
- W98** = Inner ring with undersize bore
- W800** = Combines W88 & W22 features & the upper 2/3 of the specified clearance.
- W810** = Combines W33, W50, W98 and W22.

Standard screen bearings are:
 223XX YM W33 W800 C4
 233XX YM W33 W800 C4

YM = One piece roller riding machined bronze cage.
YMB = One piece land riding machined bronze cage.

Bearing Damage Diagnosis

Knowing and understanding typical bearing failures can lead to longer bearing life. Pictured below are some typical examples.

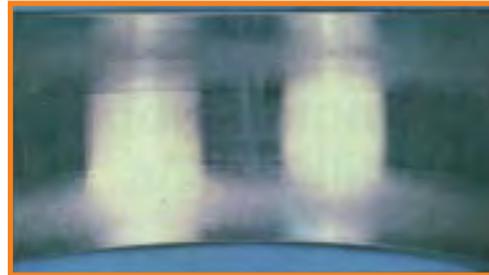
CORROSION

Everybody is familiar with red rust when steel is exposed to moisture. However, there is another form of corrosion which occurs when moisture reacts with decomposed lubricant to form an acid. The black pitting appearance shown is the result.



ABRASIVE WEAR

Abrasive wear is one of the most common types of failures associated with vibrating applications because of the environment in which they operate. Typical abrasive wear is frosty gray in appearance. More frequent lubrication cycles will help purge the contaminants out. Persistent contamination problems could be caused by a faulty seal or improper venting.



FRETTING, FRETTING CORROSION, FRICTION OXIDATION

This is normally observed on the O.D. or bore of the bearing. This results from an improper fit between the bearing and the shaft or housing. The red and black rust which is associated with this type of damage must be totally removed from the bearing area since it is quite abrasive and will damage the bearings and seals. The shaft and housing diameters should be checked and compared to those listed for the bearing to minimize the amount of fretting.



LUBE FAILURE

Lubrication breakdown, improper viscosity or low lubricant level often results in fine grain spalling as shown.



Recommended Fitting Practice

Vibrating Mechanism Type

1. Single shaft-two bearing: Shaft s4** (loose fit) / Housing P6* (tight fit)
2. Double shaft - four bearing: Shaft s4 (loose fit) / Housing P6 (tight fit)

3. Single shaft - four bearing:
Main bearing - Shaft m6 (tight fit) / Housing H7 (loose fit)
Eccentric Bearings - Shaft s4 (loose fit) / Housing P6 (tight fit)

* P6 is an ABMA designation

**s4 is a Timken designation

Bearing Number	Nominal Dimensions						Fitting Practice			
	Bore		O.D.		Width		Shaft O.D. s4 Fit	Housing Bore P6 Fit	Shaft O.D. m6 Fit	Housing Bore H7 Fit
	mm.	in.	mm.	in.	mm.	in.	in. Max. Min.	in. Min. Max.	in. Max. Min.	in. Min. Max.
22308	40	1.5748	90	3.5433	33	1.2992	1.5739 1.5735	3.5411 3.5420	1.5758 1.5752	3.5433 3.5447
22309	45	1.7717	100	3.9370	36	1.4173	1.7708 1.7704	3.9348 3.9357	1.7727 1.7721	3.9370 3.9384
22310	50	1.9685	110	4.3307	40	1.5748	1.9676 1.9672	4.3285 4.3294	1.9695 1.9689	4.3307 4.3321
22311	55	2.1654	120	4.7244	43	1.6929	2.1644 2.1640	4.7222 4.7231	2.1666 2.1659	4.7244 4.7258
22312	60	2.3622	130	5.1181	46	1.8110	2.3612 2.3608	5.1156 5.1166	2.3634 2.3627	5.1181 5.1197
22313	65	2.5591	140	5.5118	48	1.8898	2.5581 2.5577	5.5093 5.5103	2.5603 2.5596	5.5118 5.5134
22314	70	2.7559	150	5.9055	51	2.0079	2.7549 2.7545	5.9030 5.9040	2.7571 2.7564	5.9055 5.9071
22315	75	2.9528	160	6.2992	55	2.1654	2.9518 2.9514	6.2967 6.2977	2.9540 2.9533	6.2992 6.3008
22316	80	3.1496	170	6.6929	58	2.2835	3.1486 3.1482	6.6904 6.6914	3.1508 3.1501	6.6929 6.6945
22317	85	3.3465	180	7.0866	60	2.3622	3.3452 3.3448	7.0841 7.0851	3.3479 3.3470	7.0866 7.0882
22318	90	3.5433	190	7.4803	64	2.5197	3.5420	7.4775	3.5447	7.4803
23318	90	3.5433	190	7.4803	73	2.8740	3.5416	7.4787	3.5438	7.4821
22319	95	3.7402	200	7.8740	67	2.6378	3.7389 3.7385	7.8712 7.8724	3.7416 3.7407	7.8740 7.8758
22320	100	3.9370	215	8.4646	73	2.8740	3.9357 3.9353	8.4618 8.4630	3.9384 3.9375	8.4646 8.4664
22322	110	4.3307	240	9.4488	80	3.1496	4.3294	9.4460	4.3321	9.4488
23322	110	4.3307	240	9.4488	92.1	3.6260	4.3290	9.4472	4.3312	9.4506
22324	120	4.7244	260	10.2362	86	3.3858	4.7231	10.2331	4.7258	10.2362
23324	120	4.7244	260	10.2362	106	4.1732	4.7227	10.2343	4.7249	10.2382
22326	130	5.1181	280	11.0236	93	3.6614	5.1165	11.0205	5.1197	11.0236
23326	130	5.1181	280	11.0236	112	4.4094	5.1160	11.0217	5.1187	11.0256
22328	140	5.5118	300	11.8110	102	4.0157	5.5102	11.8079	5.5134	11.8110
23328	140	5.5118	300	11.8110	118	4.6457	5.5097	11.8091	5.5124	11.8130
22330	150	5.9055	320	12.5984	108	4.2520	5.9039	12.5949	5.9071	12.5984
23330	150	5.9055	320	12.5984	128	5.0394	5.9034	12.5963	5.9061	12.6006
22332	160	6.2992	340	13.3858	114	4.4882	6.2976	13.3823	6.3008	13.3858
23332	160	6.2992	340	13.3858	136	5.3543	6.2971	13.3837	6.2998	13.3880
22334	170	6.6929	360	14.1732	120	4.7244	6.6913 6.6908	14.1697 14.1711	6.6945 6.6935	14.1732 14.1754
22336	180	7.0866	380	14.9606	126	4.9606	7.0850 7.0845	14.9571 14.9585	7.0882 7.0872	14.9606 14.9628
22338	190	7.4803	400	15.7480	132	5.1969	7.4784	15.7445	7.4821	15.7480
23338	190	7.4803	400	15.7480	155	6.1024	7.4778	15.7459	7.4809	15.7502
22340	200	7.8740	420	16.5354	138	5.4331	7.8721	16.5316	7.8758	16.5354
23340	200	7.8740	420	16.5354	165	6.4961	7.8715	16.5332	7.8746	16.5379

NOTE: The 233 series bearings are about 15 to 20% wider than the 223 series and have about 15 to 22% more capacity. Many screens using the 223 series can also use the 233 series.

For your nearest Timken sales representative, call (800) 223-1954.
Outside the U.S. and Canada, call (330) 438-3000.

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