Mounted Ball Bearings

Product Overview

PTI offers the widest assortment of housings and ball bearing inserts in the industry. We have cataloged the more popular combinations, but others are available. So if you cannot find exactly what you want, let us know. We stock finished components as well as assemblies, so nearly every combination is possible.

Shaft Attachment

Typically mounted Ball Bearings attach to the shaft with set screws, eccentric locking collars, a tapered adapter or a clamping lock collar. PTI stocks all four types. The various inserts fit into any housing type.

Gold and Silver Series

PTI offers two brands of inserts in Set Screw and Eccentric Lock Mount The Gold Series is a popular European Brand and uses a nylon type cage for higher speeds. The Silver Series is a PTI Brand and available in all 4 mounting types. See insert section for dimensions.

UC Gold UC Silver

The choice allows 2 price points. A wide range of inserts are available. Wide Inner Ring, Narrow Inner Ring, Set Screw and Eccentric Collar Lock, Adapter Mount, Concentric Clamping collar type, stainless and cylindrical OD types. So, you have choices!

Housing Types

PTI stocks over 400 housing types and sizes including popular European Metric, Pacific Metric and American Standard configurations. Stainless and thermoplastic housings are stock as well. Custom housings are also possible.

Wide Assortment of Types

Pillow Blocks

Four Bolt Flange and Cartridge Types

Mounted Ball Bearings

Product Overview Cont.

3-Bolt Flange Units

Corrosion Resistant All Stainless Steel

2-Bolt Flange Units

Thermoplastic Housings and Stainless Bearing Inserts

Take-ups, Hanger and Swivel Flange Units

Gold and Silver Insert Series, Wide and Narrow Inner Rings, Set Screw, Eccentric Collar and Adapter Locking Types.

Ball Bearing Selection Criteria

Load

There are basically two types of bearing loads: Radial and Thrust. For proper selection, the value of these loads must be determined. Service factors for applications can vary from uniform, light or heavy shock loads. The service factor for uniform loads is 1.0, for light shock loads use 2.0 and for heavy shock use 3.0 times the load.

Speed

When selecting bearings, the maximum speed published is intended as a guide. It is also generally assumed in life calculations that heavy loads are not applied at the maximum speeds, but rather light loads at high speeds and heavier loads at lower speeds. Heavy loads and high speeds will increase bearing operating temperatures which can effect the lubricant, seals and the cages or retainers. Bearing speeds are limited primarily by tolerance grade of bearing ball and raceway, lubricant, ambient conditions, retainer design, and type of bearing seal.

Brand

PTI Silver Series Ball Bearing Mounted Units have steel cages. The bearings are grease lubricated and have a steel slinger with a lip seal on each side of the bearing. Triple lip seals are also available. PTI Brand = Silver Series.

PTI Gold Series Ball Bearing Mounted Units have a molded nylon cage. The bearings are grease lubricated and typically have a lip seal between 2 pieces of zinc plated steel. The limiting speeds are listed on the Ball Bearing pages. Our gold series is a popular European brand and marked as such.

Life

The L_{10} Life is the expected life of a bearing based on normal conditions. Factors involving temperatures and ambient conditions, i.e. chemical, moisture and maintenance intervals are not factored into the basic formula. However they must be considered or factored into your selection criteria. To determine the L_{10} hours of life for ball bearing use the following:

$$L_{10} = (C/P)^3 \times 16667/rpm$$

where: L_{10} = Life hours. **C =** Dynamic capacity (lb).
P = Equivalent Radial load. When **P** is a radial load only, then **P** = the actual radial load. If there is a thrust and radial load acting on the bearing, then these loads must be converted into an equivalent load. The equivalent load formula is:

$$P = (X \times F_R) + (Y \times F_A)$$

where **P** = equivalent load (lb). See table A, where:
F_R = radial load (lb), F_A = thrust axial load (lb), **e** = thrust load to radial load factor (see table A), **X** = radial load factor (table A), **Y** = thrust factor (table A), **Co** = basic static rating. The first step is to find **X** and **Y**. Calculate F_A/C_O to determine **e**. Then calculate F_A/F_R and compare to **e** to determine the **X** and **Y** factors to use from table A. Next substitute all known values into $P = (X \times F_R) + (Y \times F_A)$ equation. Then put the value of **P** into the L_{10} life formula to determine the life hours of the bearing. Rpm is the shaft speed in revolutions per minute.

Table A

$\frac{F_A}{C_O}$	e	Radial/Thrust Factors			
		If F_A/F_R is equal to or less than e		If F_A/F_R is greater than e	
		$F_A/F_R \le e$		$F_A/F_R > e$	
		X	Y	X	Y
.014	.19	1	0	.56	2.30
.021	.21	1	0	.56	2.15
.028	.22	1	0	.56	1.99
.042	.24	1	0	.56	1.85
.056	.26	1	0	.56	1.71
.070	.27	1	0	.56	1.63
.084	.28	1	0	.56	1.55
.110	.30	1	0	.56	1.45
.170	.34	1	0	.56	1.31
.280	.38	1	0	.56	1.15
.420	.42	1	0	.56	1.04
.560	.44	1	0	.56	1.00

Misalignment

There are two types of misalignment: **Static**, which refers usually to a bearing alignment in a housing and **Dynamic**, which is usually a misalignment that can be handled within the bearing while operating. Aligned bearings run smoother, cooler, and quieter than misaligned units. Consequently, misaligned bearings will run hotter than aligned units. Cooler running bearings will operate longer than hot running bearings. Single Row ball bearings in housings will generally handle +/- 2% static misalignment but only slight dynamic misalignment. Spherical Roller bearings, as a comparison, can handle larger dynamic mislignments.

Temperature / Lubrication

Bearings that operate at higher temperatures may also experience a reduced life. There are no specific simple formulas to predict this, but a good understanding and experience of the application will help maximize bearing life. PTI Stainless Steel bearing inserts are lubricated with Mobil FM222 H1 Food Grade grease. A slight showing of grease purging from the seal area is optimal. When re-lubricating, small amounts of grease at frequent intervials is more desirable then large quanities infrequently. Re-lube while the bearing is rotating if possible. The normal operating temperatures for these bearings are 10°F to 200°F in a clean environment. Higher or lower operating temperatures will require the use of a special lube. Higher ambient temperatures require lube with special features and the bearing races should also be specially heat treated or "normalized" to improve their resistance to warping. Also, special seals, internal clearance and frequent lubrication (possibly daily) may be necessary. A bearing required to operate above 250° F will need to be de-rated in capacity. Load de-rated factors can be provided for elevated temperatures. Special seals, lubricant, internal clearances can also be provided.

Other Conditions

Determine if a standard cast iron housing and the standard bearing will withstand the operating environment. Thermoplastic, Stainless Steel and Nickel plated housings along with Stainless Steel bearing inserts for wash down applications are also available. Consult PTI for other needs or requirements.

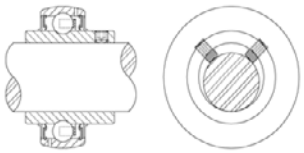
Mounted Ball Bearings - Shaft Locking Methods

.....4 Choices, each with a purpose.....all available at PTI.

There are 4 standard methods to lock Mounted Ball Bearings to the shaft. Each method has its advantages. The following will review the basics of these 4 mounting choices to help determine which method would be best for the application. The general installed dimension for each unit is basically the same with a minor difference in length thru the bore. Depending on application need, one method may yield a better operating result. PTI stocks each of these options in the standard inch and metric bore sizes and can assist in product selection.

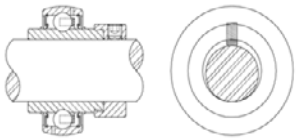
1. Set Screw Locking-UC Insert

Set Screw Locking is one of the most popular and the least cost of the 4 attachment methods. This type is simple to install and two set screws tighten the bearing to the shaft. The clearance fit of bearing on the shaft, makes installation simple and quick. They are typically used for low to medium speed applications. The set screws will eventually create a small burr on the shaft making removal a little more difficult. As the bearing works, it may require that the set screws be re-tightened periodically. Set screws are usually knurled or a cup point design which helps keep them tight. Due to the clearance fit, some fretting can occur between the shaft and the bore of the bearing. This can make removal a little more difficult over time. Dimpling the shaft or adding a flat where the set screw bears against the shaft, makes removal easier. The smaller the clearance between the bearing and the shaft, the smoother the bearing will operate resulting in less vibration and generally helping to extend bearing life. The above sketch is exaggerated to illustrate the clearance between the shaft and the bearing inner ring.



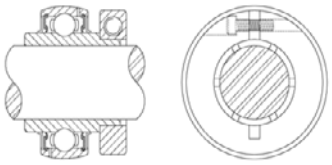
2. Eccentric Collar Locking-HC Insert

The eccentric locking collar is also a popular method of mounting a ball bearing to the shaft. The bearing inner ring has an eccentric groove and a mating groove is machined into the collar. Commonly a drift pin and hammer are used to tighten the collar against the mating eccentric of the inner ring, locking the bearing to the shaft. Generally the locking collar is tightened with the direction of shaft rotation. For reversing loads, it is best to use another locking method as torque reversals could loosen the collar. One set screw in the collar keeps the collar in position on the mating eccentrics. This is still a clearance fit of bearing to the shaft. Some shaft fretting, or rubbing of parts will likely occur over time. A burr raised on the shaft during the tightening of the set screw may slightly hinder removal. A flat on the shaft helps to minimize this. The eccentric collar is also an economical method and popular in all of the various housing types including pillow blocks, flanges, tapped bases, take-ups and more. The above view of the shaft is also exaggerated for clarity.



3. Concentric Locking Clamp Collar-CL Insert

The concentric locking method allows the bearing inner ring to fit concentrically to the shaft. This is still a clearance fit of bearing inner ring to the shaft, therefore, easy to install and will not loosen after proper initial tightening. These units are more expensive than comparably sized set screw or eccentric locking methods due to the additional collar and slotted inner race. As the cap screw in the split locking collar is tightened, the collar compresses the spline zone of the inner ring to grip or squeeze the shaft. Loosening the concentric collar will loosen the unit and removal is easy. The load rating for all units being compared are basically the same. As expected, they run smoother due to an improved concentric fit onto the shaft. Reduced fretting between the shaft and bore of the bearings is also a benefit due to the concentric clamping of the shaft.



4. Adapter Mount Locking-UK & GSH Insert

The adapter locking method provides the most concentric locking fit of the 4 types simulating the direct mounting of bearing to the shaft. The adapter mounting allows highest speed with the least amount of residual vibration. It is also typically higher in cost as compared to the set screw or eccentric locking types primarily due to the additional components. Due to the improved (near ideal) shaft fit, no fretting occurs between components when they are properly tightened. Hence, the bearing can ultimately be removed without any damage to the shaft, allowing shaft re-use. A tang on the locking washer is bent into a slot on the locknut to insure a positive lock, even during reversing loads. Two adapter mount versions are available. The GSH insert allows interchange with the same shaft and housing footprint as any of the three other mounting methods. While the UK insert can be considered a medium duty robust bearing unit and requires one housing size larger. When either unit is used in a flange type housing, the adapter type may require shims between the flange and the mounting frame. The bearing will shift approx 1/16" during mounting as the bearing is pushed up the tapered sleeve.