



# Choosing the right bearing

**The correct type must be used for each application including proper mounting and lubrication**

by Fred Fairchild

Rotating shafts are used in many types of equipment in feed mills. This can vary from a simple hand wheel shaft to open or close a gate, to high speed shafts turning pulleys or blades in a piece of equipment. No matter the purpose of the shaft, it has to be supported with some type of bearing. These bearings vary from a simple plain sleeve-type bearing to a precision ball or roller bearing.

Bearings are subjected to two forces or a combination of these forces. The first force is radial based on the forces that act perpendicular to the shaft. Examples of these are forces needed to hold a shaft in place from forces pulling perpendicular to the shaft. Keeping the hand wheel shaft in a fixed location while it is used to move the slide in a gate is one example. Another is to support the headshaft and pulley on a bucket elevator or conveyor.

The second force is thrust force created parallel to the shaft that tries to pull the shaft out of the bearing. This type of force is always present in bearings securing a vertical shaft. An example of a piece of equipment that has both forces is a screw conveyor. It requires bearings that support the radial loads of the screw flight, but also needs at least one bearing to hold back the thrust that the screw flighting creates while it moves the material along the length of the conveyor. This is done by using a combination radial and thrust bearing on one end of the screw conveyor.

A radial bearing can simply be a hole bored in a block of



All rotating shafts must be supported by some type of bearing.  
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metal to support shafts that do not continuously turn such as a shaft turned by a hand wheel or intermittent power source. As the speed increases, the bearing support may be lined with a sleeve

ity but also a high friction resistance to the turning shaft or journal.

In order to reduce the friction between the shaft and the bearing surface, metal or other types of bushings are often in-

is transmitted from the inner race to the ball and from the ball to the outer race. Since the ball is a sphere, it only contacts the inner and outer race at a very small point, which helps it spin very smoothly. But it also means that there is not very much contact area holding that load, so if the bearing is overloaded, the balls can deform or squish, ruining the bearing.

*Roller bearings are used in applications like conveyer belt rollers, where they must hold heavy radial loads.*

of different metals for intermittent or slow speed light loadings. As speeds or radial load increases, a ball or roller bearing is used to carry the radial load and minimize friction between the shaft and its mounting

#### PLAIN BEARINGS

A plain bearing, also known as a friction bearing, is the simplest type of bearing, comprising just a bearing surface and no rolling elements. Therefore the journal (i.e., the part of the shaft in contact with the bearing) slides over the bearing surface. The simplest example of a plain bearing is a shaft rotating in a hole. Plain bearings, in general, are the least expensive type of bearing. They are compact and lightweight. They have a high load-carrying capac-

serted into the bearing housing to support the shaft. These bushings are usually made of a different type of material than the shaft. Some of the most common materials are babbitt, bronze, cast iron, graphite, plastic, nylon, Teflon and even oil impregnated arguto wood bearings used in many screw conveyor interior fighting bearing hangers.

#### BALL BEARINGS

Ball bearings are probably the most common type of bearing. These bearings can handle both radial and small thrust loads and are usually found in applications where the load is relatively small, but the shaft is turning at higher speeds. The balls are enclosed in a cartridge formed by an inner and an outer enclosure called a race. The load

#### ROLLER BEARINGS

Roller bearings are used in applications like conveyer belt rollers, where they must hold heavy radial loads. In these bearings, the roller is a cylinder, so the contact between the inner and outer race is not a point but a line. This spreads the load out over a larger area, allowing the bearing to handle much greater loads than a ball bearing. However, this type of bearing is not designed to handle much thrust loading.

#### TAPERED ROLLER BEARINGS


Tapered roller bearings can support both large radial and large thrust loads. The rolls are mounted at an angle within the races so that their contact line can handle both radial and thrust loads simultaneously. This may be a single circle of


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rollers or for more radial and thrust capacity, a double circle of rollers.

### BEARING SHAFT CONNECTION

In a plain bearing application, the bearing surface is not attached to the shaft as the shaft must turn freely in the bearing. In ball and roller-type bearings, the inner and outer races are not connected to each other and the inner race is attached to the shaft. This connection is accomplished using set screw through a collar that attaches to the shaft and holds the inner race in place on the shaft. Another method often used where the collar is attached to the inner race using an eccentric fit. By turning the collar against the race, the collar is locked on to the shaft. This method is much more secure in locking the inner race to the shaft than just using set screws.

### BEARING HOUSINGS

Bearings are offered in several types of housings. The housing holds the bearing sleeve or cartridge, but may be used for several different purposes. The most common types of housings for the bearing cartridges are pillow-block and flange types.

Other types of housings include sliding housings for moving the bearing

perpendicular to the shaft for take-up applications. Bearing cartridges may be installed in other types of special housings depending on their design and use in the equipment.

### LUBRICATION

All bearings supporting a continually rotating shaft require some type of lubrication. Plain bearings often have a

*Bearing seals help keep out unwanted water and dirt, and other particulates that can be harmful to bearings.*

method of dripping or applying oil directly on to the turning shaft. Bearings that use ball or rollers require that the bearing be run in oil or grease.

The purpose of bearing lubrication is to prevent direct metallic contact between the various rolling and sliding elements. This is accomplished through the formation of a thin oil (or grease) film on the contact surfaces. However, for ball and rolling bearings, lubrication has additional advantages: reduction of friction and wear, dissipa-

tion of friction heat, prolonged bearing life, prevention of rust and protection against harmful elements. In order to exhibit these effects, a lubrication method that matches service conditions must be used. In addition to this, a quality lubricant must be selected, the proper amount of lubricant must be used and the bearing must be designed to prevent foreign matter from getting in or lubricant from leaking out.

### BEARING SEALS

Bearings may be either sealed where the lubrication is added and then permanently sealed or they are built to be re-lubricated. Bearing seals have two purposes: to keep debris out and lubricant in. The different seal types trade sealing ability for performance. Bearing seals help enhance performance of the bearing as well as increase the life expectancy.

Bearing seals help keep out unwanted water and dirt and other particulates that can be harmful to the bearings. Seals also help keep in the lubrication, be it grease or oil, to maximize efficiency. Depending on the type, application, and material of the bearing, there can be a different choices of the seal used.

Seals and shields are both used to keep contaminants out of a bearing. In order

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of effectiveness, the enclosures that are offered are as follows: metal shields, rubber non-contact seals, Teflon non-contact seals and rubber contact seals. Not surprisingly, as the sealing performance is increased, the torque required

to turn the bearing will also increase due to the increased friction caused by the seal/shield. The application's condition and life requirements are important to know to determine the best shield or seal choice.

**More bearings have been damaged and ruined by overlubrication than any other reason. Bearings should be lubricated according to the manufacturer's recommendations and instructions.**

tion due to temperature variations, and at different rates. Axial shaft expansion can be an issue in machines where there are temperature changes between the shaft and the bearing mounts. One bearing should serve as an anchor bearing to hold the shaft lengthwise. All other bearings should permit the shaft to move freely lengthwise. Most bearings are available as fixed or expansion type. The anchor bearing must be a fixed bearing, but all others attached to the same shaft should be expansion type bearings. On long shafts, the anchor bearing should preferably be located near the center of the shaft to keep the expansion of the two ends to a minimum.

In summary, the proper type of bearing must be chosen for each application including proper mounting and lubrication. Every bearing manufacturer has available specific data and information on the selection, application, installation

and maintenance of their products.

More bearings have been damaged and ruined by over lubrication than any other reason. Bearings should be lubricated according to the manufacturer's recommendations and instructions. A sure sign that a bearing is being over lubricated is when grease oozes through the seal around the shaft.

If you are not sure if the bearing has enough lubrication, I would suggest removing the grease fitting (zerk) and run the bearing long enough to achieve normal operating conditions.

If too much lubrication is in the bearing, it will be excreted through the lubrication opening. Once the excretion is finished, stop the machine, replace the zerk, and put the machine back into operation. **WG**

**INSTALLATION**

Not only is choosing the correct bearing for the application important, equally important is the proper installation of a bearing. Each bearing must be carefully installed and aligned on the shaft to avoid damage to the bearing or seals.

Often the shaft and the base on which the bearing housings are mounted are subject to linear expansion or contrac-

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