International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 5, Issue 2
February 2018

Different Approaches for Supporting Loads of Rotating Parts of Machine

Pritesh Khatwani,
M.Tech.Scholar,
VIT University, Vellore, Tamilnadu, India

ABSTRACT: *Rotating parts are very widely used as a part of mechanical systems for its paramount functions in different industries to perform a large number of operations. Unexpected and instantaneous interruption in performing the main function of rotating part, i.e. transmission of rotating movement very often caused catastrophic failures of particular parts or complete mechanical systems mainly due to inertial forces& are also responsible for catastrophic failure. Various approaches were used for supporting loads of rotating parts of machine.Vibrations are major issue of any machine and they are mainly caused due to high rotational speeds of rotating parts.To avoid such vibrations of rotating parts various bearings are used such as roller bearing,sliding bearing,radial groove bearing etc.*

KEYWORDS: Rotating parts, ball bearing, roller bearing

INTRODUCTION: Mechanical systems performance mainly depends on its rotating parts which are moving at high speed. Operating at high speeds can cause too much of vibrations which can lead to catastrophic failure.Catastrophic failure means sudden failure which is very interruptional affecting the performance of machine & resulting in lower productivity. Various bearings can be used to reduce vibrations which will act as damper supporting radial & axial loads caused due to high rotational speeds of rotating parts. Operation of rotation-based mechanical systems is a synonym for vibration, reliable operation of a system, efficiency and other technical indices that can provide only an indication of the system functionality during its safe exploitation. Rotation is the motion most commonly found in machinery. Gears, belt pulleys, electric motors, automobile wheels, etc., all represent rotating machines or machine parts.

The rotating parts often carry heavy loads, and are almost always vital parts of the machine. It follows, then, that these parts must be carefully designed if trouble-free operation is to be obtained for a long period of time.

METHODOLOGY:

Various methods for supporting loads of rotating parts are discussed in following section:

1) **Ball bearing:** This is the most widely used of all the rolling types of bearings. Note that the balls roll in grooves in both the inner and outer races. Because of these grooves, this bearing is capable of holding axial, or thrust, loads as well as radial loads. Furthermore, it can carry the axial loads in either direction. It is the ability of this bearing to carry both radial and axial loads, individually or in combinations, and in any direction, that makes this bearing so useful to designers. This same basic bearing is also made with various combinations of shields, seals, and retainer rings. The beginning designer is referred to manufacturers' catalogs for further information on this bearing and its variations. Because of the angular contact races, it is possible to get more balls into the bearing, and these bearings, therefore, have somewhat more radial load capacity than the deep groove bearings. In one direction only, they have a large axial load capacity.

This bearing is commonly used in installations where no clearance is permissible in the bearings. By using the bearings in pairs and providing a small axial pre-load at assembly, the small amount of clearance present between the balls and the races can be removed. Excessive axial pre-loading will greatly shorten the life of the bearings, so means of carefully controlling this pre-loading should be provided in most cases.

International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 5, Issue 2
February 2018

2) **Straight roller bearing:** these bearings have a greater radial load capacity than a ball bearing of the same size, in most cases they can carry no axial load whatsoever. *The* bearing shown in figure can in some cases retain parts where no real axial loads exist. Notice, however, that axial loading causes the ends of the rollers to slide under load on the shoulders of the race, thus defeating the purpose of using a rolling type of bearing. Roller bearings can be used with or without races, hence can be effectively utilized where space is limited in such a way that the bearing outside diameter must be small. As with these ball bearings, the designer should look through the catalogs of the roller bearing manufacturers for further information on these bearings and their uses. In this case the ball bearing holds the parts axially in both directions, while the roller bearing carries the large radial load caused by the belt tensions.

3) **Tapered roller bearing:** Tapered roller bearings are primarily intended to support radial loads. Because of their conical construction, however, they can also carry very substantial axial loads, but in one direction only.

If the inner race is pushed axially toward the left by forces on the shaft, the bearing can hold the shaft so it cannot slide to the left, but that an axial force to the right would cause the cone and roller assembly to simply pull out of the outer race or cup. Because they can carry axial loads in one direction only, these bearings must always be used in pairs, and must be mounted in such a way that axial loads in either direction can be successfully carried. Because of the conical construction of these bearings, means must be provided at assembly to adjust axially the position of one race relative to the other to hold the bearings together. Otherwise, manufacturing tolerances on various parts might combine so as to force the inner and outer race so tightly together that no rotation is possible, or might have them so far displaced from one another that excessive radial clearance results.

4) **Sliding bearings:** A sliding bearing is one in which the shaft slides on the surface of the bearing as it rotates. In its simplest form, such a bearing would consist of nothing more than a hole in the housing wall or frame into which the end of the shaft was inserted. To operate with reasonable loads and speeds, however, a relatively soft metal bearing is inserted between the housing and the shaft slides on the surface of the insert. These bearings are commonly made of bronze, formed by the powdered metal process and are available in a large number of standard sizes. If necessity demands, they can also be machined quite easily to almost any size other than standard. One of the nice features of the sliding bearing is the fact that it can be made in two halves and placed around the shaft. This often lends itself to an assembly that would otherwise be difficult if not impossible. The main design features of sliding bearings are most often dictated by lubrication requirements, hence no extensive coverage of this is included here. The principles illustrated in the following paragraphs applies equally well to both sliding and rolling types of bearings.

5) **Ball & roller thrust bearing:** Ball and roller bearings can also be made in such a way that they can carry axial loads only. Such bearings are known as thrust bearings.

Note that the bearing races are perpendicular to the shaft rather than parallel to it; hence, these bearings can carry no radial loads. These bearings are generally used together with radial ball or roller bearings when large axial loads must be carried.

6) **Locknut & retainer rings:** Locknuts and retainer rings are commonly used to hold parts together on a shaft. The locknuts commonly used have shallow threads, and are round instead of hexagonal in shape. A series of grooves cut into the cylindrical surfaces allows the nut to be gripped for tightening by a "spanner" wrench. A lockwasher, which is keyed to the shaft, is used to prevent the locknut from coming loose. Retainer rings are generally purchased as a standard item and manufacturers' catalogs should be consulted to determine available sizes. In addition to holding parts on the shafts, they can be used to hold parts in housings.When retainer rings are used on a shaft, extreme caution must be exercised by the designer so as not to place the groove which must be cut in the shaft in such a position as to greatly reduce the bending fatigue strength of the shaft.

7) **Needle roller bearing:** Needle roller bearings have relatively small diameter cylindrical rolling elements whose length is much larger than their diameter. Compared with other types of rolling bearings, needle roller bearings have a small cross-sectional height and significant load-bearing capacity and rigidity relative to their volume. Also, because the inertial forces acting onthem is limited, they are an ideal choice for applications

with oscillating motion. Needle roller bearings also work well in compact and lightweight machine designs and they serve as a ready replacement for sliding bearings. Like all bearings, they are used to reduce the friction of a rotating surface. Compared to ball bearings and ordinaryroller bearings, needle bearings have a greater surface area in contact with the races, so they can support a greater load. Compared to ball bearings and ordinary roller bearings, needle bearings have a greater surface area in contact with the races, so they can support a greater load. They are also thinner, so they require less clearance between the axle and the surrounding structure. They are used for reducing friction of rotating surface helps in achieving higher speeds. Needle roller bearing with thrust bearing comprises a radial needle roller bearing for supporting radial load and a thrust bearing for supporting axial load which are assembled integrally. Both thrust ball bearing type and thrust axial roller bearing type are available as the bearing intended to support axial load. The thrust bearing with dust-proof cover is also available, which has a good effect in preventing scattering of oil and grease and invasion of external dust, etc. This complex bearing comprises a radial needle roller bearing for supporting radial load, a ball bearing for supporting comparatively small axial load and a machined inner ring which are all assembled integrally. Both angular ball bearing and three-point contact ball bearing are available as the ball bearing intended to support axial load. The complex needle roller bearings (NKIA Series)using an angular ball bearing as the thrust bearing can support one-directional angular load. The complex needle roller bearings (NKIB Series) using a three-point contact ball bearing as the thrust bearing can support double-directional axial load and furthermore its position in axial direction can be fixed, too.Needle roller bearing with thrust bearing is a complex bearing wherein a thrust needle roller bearing or a thrust cylindrical roller bearing intended to support axial load is configured at the double sides of a radial needle roller bearing for supporting radial load. It Can support large axial load acting thereon from the double sides. It is used as the bearing (precision bearing) for supporting the ball screw of a machine tool.

8) **Radial groove ball bearing:**The purpose of a radial bearing, also known as a deep groove bearing, is to reduce rotational friction and support loads. This is achieved by using two races to hold the balls and to spread the load through the balls. As the bearing race rotates it causes the balls to rotate. The ball provides for substantially less rolling resistance and coefficient of friction than if two flat surfaces were rotating. Single-row, deep groove radial ball bearings are the most common bearing type, having a wide range of applications. Radial bearings are made with very high levels of precision and used in applications where rotational performance and low torque is necessary, but load is a secondary issue. Deep-groove bearings however do have higher load ratings for their size than shallow-groove ball bearings, but are also less tolerant of misalignment. Grooved raceways on inner and outer rings sustain moderate axial loads in both directions in addition to radial loads. Balls separated by steel cages permit high-speed operation. Deep groove, or single row radial, ball bearings are the most widely used bearings. They utilize an uninterrupted raceway that makes them optimal for radial loads.This design permits precision tolerance, even at high-speed operation.

CONCLUSION:

Among various approaches used for supporting loads of rotating parts like ball bearing, roller bearing, sliding bearing, thrust bearing, tapered bearing, needle roller bearing, radial groove ball bearing it is finally concluded that all these bearing are very important for supporting various loads of rotating parts & reduces friction to a greater extent but among them radial groove bearing can be extensively used since it supports both axial & radial loads unlike others either supporting axial or radial load. So radial groove bearing are used widely for its paramount operations in various machines having large number of rotating parts.

REFERENCES:

[1] SijackiZeravcic, V.; Bakic, G.; Djukic, M.; Milanovic, D.; Vlajcic A.; Maksimovic P.: Effect of material quality on the reliability of thermal power plant equipment, Elektroprivreda, Vol.LIV, No 4, pp. 64-70, 2001.

[2] SijackiZeravcic, V.; Milanovic, D.; Markovic D.; Bakic, G.; Djukic, M.; Krstovski G.: The importance of preventive engineering and maintenance in assuring the reliability of complex systems, Proceedings of Conf. Preventive maintenance and safety of motor vehicles, motorized vehicles, machines, transportation means, systems and equipment, Belgrade, Serbia, pp. 28-31, december 2000.

[3] SijackiZeravcic, V.; Milanovic, D.; Bakic, G.; Djukic, M.: Some problems concerning the exploitation of components of coal dryers from the point of view of metal damages, Proceedings of Conf. Possible means of exploitation, preparation and combustion of coal, BanjaVrucica, Teslic, Republic of Serpska, Bosnia and Herzegovina, pp. 572-579, October 1999.

[4] Sijacki Zeravcic, V.; Bakic, G.; Djukic, M., Milanovic, D.; Andjelic B.: Failure of fresh air fan shaft of of fresh air fan AN33 e6, unit 2, Thermal power plant Nikola Tesla-B, Report 12-14-12.04/2001, Faculty of Mechanical Engineering, University of Belgrade, Belgrade, 2001.

[5] Sijacki Zeravcic, V.; Bakic, G.; Djukic, M.; Andjelic B.; Milanovic, D.: Failure of fresh air fan shaft No.1, unit 2, Thermal power plant KostolacB, Report 12-07-12.04/2003, Faculty of Mechanical Engineering, University of Belgrade, Belgrade, 2003

[6] Plavsic N.; Lazovic T.; Stamenic Z.: Vibration diagnostic of rolling-bearings, Proceedings of Conf. IRMES 2002, Jahorina, Republic of Serpska, Bosnia and Herzegovina, pp.577-582, September 2002.

[7] Hrisafovic N.: Reliability of space systems in accordance with the ISO 14622, Proceedings of Conf. MES 2002, Jahorina, Republic of Serpska, Bosnia and Herzegovina, pp. 277-282, September 02.