Bearings

By Seamus Dolly

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by: **Seamus Dolly**

Since Murphy or whoever it was, took credit for the round wheel, rolling technology has changed somewhat.

Today, friction whether static or dynamic, is reliant on bearings to reduce motor or engine load. What is sometimes overlooked is the inherent features and design of a bearings to reduce temperature where it is not necessary.

The basic requirement is to reduce contacting surface areas.

More extreme requirements are to reduce vibration, reduce allotted space required to house such a bearing, and extend their life.

Needle roller bearings are used where the load is spread length ways, and a typical or common application would be the "big end" bearings of motorcycles.

Plain bearings are still used in the big ends, of cars and most other crankshaft scenarios. The principle behind a plain bearing is that the thinner a material is, the harder it is to compress or displace it.

Plain bearings, often called bushings, can be "steel backed" with a relatively thin coating of white metal applied to the bearing contact surface. This would be the common type in the automotive big end applications, and should a piece of offensive hard material contaminate the oil, it can be safely embedded within the white metal. Should it be small enough then it is not an issue.

More plain bearings can be of a bronze base with impurities cast or sintered into them. The purpose is to absorb oil or lubricant before application, and become "self−lubricating, for a limited time anyway.

Many years before the industrial revolution, bearings were made from anything available that was considered appropriate. Timber, sometimes from apple trees but not in any way exclusive to them, have been used in windmills and water mills.

Indeed, stone bushings were not unusual.

You've heard of the more expensive watches been said to contain "X number of Jewels"? The purpose of such jewels was to reduce friction and associated loads. This would be a loose example of metal to stone contact.

Thrust bearings are designed to work through a different axis, and may be ball−type, cylindrical roller type or a combination of both. Taper roller bearings are an example.

High temperature bearings have in−built allowance for expansion, or to put it another way; they have more clearance.

High−speed bearings often have "cages" made from non−metallic materials. Typically, this material is tufnol or plastic.

Incidentally, in low−speed, combustion−risk situations, the cages can be made from brass as well. This is to help reduce any incidence of "sparking" between the balls/rollers and the cage itself. The reason for a cage in the first place, is to maintain distance between rollers/balls, because it is only in the cases of high low to space ratios, where no space is needed that cages are unnecessary and these are low speed applications.

Other low speed bearing/plain bushings are also "steel backed" with a coating of P.T.F.E. or other plastic on them. Again, this is to give some self lubrication properties, as well as to reduce friction.

P.T.F.E. happens to be excellent, as it has a low coefficient of friction.

Bearing failure is primarily due to misalignment and contamination. Of course, there are many variables, such as instances where undue load/other mechanical failure happens to be the case.

A common cause of failure in the case of automotives, is lack of oil or insufficient oil pressure.

Absence of proper cooling, generally, will bring excessive loads.

Bearing failure is all too often due to improper installation or fitting practices. Indeed, bearings can be "on the way out" almost immediately.

Induction coil heaters are readily available from manufacturers to ease the fitting operation, and spare the bearings undue trauma.

Mechanical shock from abuse with a hammer has destroyed many new bearings and they are destined to fail, as little actual work will verify. Indeed, I've seen a case where a six−year old machine was overdue some maintenance, and got new bearing fitted six times in six months. It would have been best to leave it overdue; such was the fitting skill of the men involved.

Even without the hammer, contamination while fitting, poses massive problems. Allowing foreign bodies to migrate into the bearing will have a detrimental effect.

Once fitted even, contaminants from its oil/grease/air supply can make running conditions unbearable. Clean lubricants and environments are the answer, and in the specific case of oil; clean filters, lines and the oil itself, will provide an up−time saving.

Seamus Dolly is the webmaster at

www.CountControl.com

and his background is in engineering.

Greasing Bearings − How Much is Enough?

By Thomas Yoon

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Previously, we have talked about using suitable greases for different applications. Basically, we want to use low temperature greases for low temperature applications and high temperature greases for high temperature applications. The reason is quite simple − we want the grease to form a thin film of lubricating oil between the rubbing surfaces.

If we use high temperature grease for normal temperature applications, the chances are the grease will still be in semi−solid state and will not flow to cover the contact surfaces of the moving components during operating conditions.

Assuming you have chosen the correct grease, how do you determine how much you need to put into the bearing?

Excessive grease lubrication can easily cause overheating. The grease gets churned around within the moving parts of the bearing and has nowhere to go. The temperature rises. The grease becomes the wrong temperature selection even though the application is correct.

A general rule to follow is that the bearing should be filled completely but the free space in the housing only partially. This gives room for the grease to be ejected from the bearing on start−up.

However, there is some grease, the so−called "totally−filled" greases like lithium soap greases that can allow filling up to 90% of the free space in the housing, without risk of a temperature rise. This is because they are special. Their stability at high temperatures is excellent and can be utilized over a wider temperature range than sodium soap greases.

By filling up all the free space, impurities are effectively prevented from entering and damaging the bearings and the lubricating intervals can be extended.

For most other greases, the general rule applies.

Bearings can be divided into two categories − non−separable and separable bearings. No matter which bearing type it is, the general

practice is to fill up the space between inner race, the outer race, and the rolling components (ball or roller) on both sides of the bearing. Because of its consistency, the grease should be able to remain in place without dropping off. In this way, we can ensure that the rubbing contact surface actually has grease on it.

For relubrication, how much is enough? The following formula gives a good indication:

G = 0.005 DB

where,
G = grease quantity in grams
D = bearing outside diameter in mm
B = total bearing width in mm

By practicing proper lubrication, the bearings should be able to last for a long time. However, bearings can still fail if it has not been installed properly or for other reasons.

Until next time...

for Industry and Home.

Thomas Yoon's skill in illustration/writing has enabled him to producenumerous ebooks on engineering subjects that can be downloaded at

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. He has also produced an ebook

on

"50 Secrets of Truth and Life"

that is fully illustrated with cartoons in a humorous way.

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