Lubrication – is it really that important?

Eddie Martens, business development manager for maintenance products at SKF South Africa, unravels the mystery of lubrication which, he assures, if applied based on the '5 Rs' taught to him during training, will deliver improvements in uptime as well as a visible cost saving.

I have been lucky enough to travel across the country to do presentations at several industrial plants, specifically on our SKF maintenance products. During these travels, we have encountered numerous surprising fitment, removal, and alignment methods. Overall though, standard practices when it comes to lubrication have been the most eye opening. When we consider that 50% of all bearing failures are due to incorrect lubrication or contamination, we should expect alarm bells to be ringing at many industrial sites. But unfortunately, this is not the case.

Any lubrication, be it oil or grease, remains a consumable product and therefore does not receive the attention it deserves. Remember, consumable products include items such as rags and cleaning fluids and, because of this, any cost savings are be looked at as an overall saving on all consumable items rather than trying to reduce consumption on specific consumables. The reaction we receive when a calculation is done on the exact costs of lubrication products alone is therefore usually one of shock. A small plant we recently visited uses in the region of 80 t of grease a year, but if you look at the lubrication methods being followed, you can understand why.

Walk into any lubrication store and I can almost guarantee the only drum standing open is a grease or an oil drum. The standard transfer method for oil will be the empty 2.0 ℓ cold drink bottle closest to hand, or a 5.0 litre container that can be used to transfer anything from distilled water to petrol to oil to thinners. Tell me I'm wrong!

The basic understanding of most technicians/artisans is that you fill a bearing with grease until clean grease comes out the other side of the unit. I joke that I like this method because it enables us to sell more seals as those seals are definitely damaged! The other fallacy is that grease is grease. Our mining community believes in EP2 grease for every application from door hinges to fan applications. To summarise, below are some key problematic misconceptions that ought to be addressed.

Designed to supply from one to eighteen lubrication points, SKF TLMP series multi-point lubrication systems feature pluggable outlets and are easy to install and program via a keypad with an LED display.

- Grease is grease and can be applied in any application.
- A bearing must be full of grease to be properly lubricated.
- Contamination is not an issue provided it is kept to a minimum.
- Grease is a consumable item and therefore costs and consumption need not be controlled.

SKF Battery-driven TLGB-series grease guns include integrated grease meters to help prevent over- and under-lubrication.

Grease is grease

So long as a bearing or unit has grease in it, it is lubricated and will not fail. Correct? A universal grease is all that is needed; after all, why call it a universal grease if it cannot be used universally?

Basic understanding needs to start with how grease works. Everyone knows what it looks like – it's that messy stuff we get all over everything when working with it. That is what lubricates our bearings, or is it?

When we look at a data sheet for grease, several terms are listed including 'Thickener', 'Base Oil Type', etc. If there is no understanding of these terms then grease will forever remain grease.

Starting with a basic test, we would put some grease on a piece of paper. What would happen? A film would start appearing around the grease. That is the base oil 'leaking' out of the thickener/soap.

If we were to warm that grease up, the rate of 'leaking' would increase as the thickener loses its retention properties. From this we can draw a conclusion – as the thickener is heated up, the faster the oil will leak.

The trick here is to remember that the thickener does not lubricate the bearing: the oil does. If we take this further, it stands to reason that if we have a bearing designed to run at a high temperature the oil will 'leak' from the thickener at a much higher rate. If we run a car's engine with several oil leaks, it will eventually fail because there will no longer be any oil to lubricate the motor. Well, guess what? The same thing will happen to the grease. To avoid this we must design a grease that will 'leak' at a slower rate under higher temperature. Now things become more complicated because the oil needs to leak enough to lubricate but not so much that it runs out or separates completely from the thickener.

Every grease is designed to perform to a specific set of parameters and conditions. All greases may overlap in certain areas when it comes to operational temperatures, but it is important to keep within those parameters. This leads to the next problem – selecting the correct grease for the application. If we do not know all the operating conditions under which the bearing or unit is expected to perform, we could end up recommending the incorrect grease for that application.

This is why it is so important not to recommend a grease based on one a customer is currently using. It could be that they have been using the incorrect grease from the start and, if a similar grease is used, all that will happen is that the problem will persist. This is before we take into consideration the possibility that the two greases may be incompatible. Remember, greases are a mixture of chemicals that could well react very differently to each other if mixed. It is very important to know which chemicals can safely be mixed and which cannot. For this reason, always consult an expert if you are unsure. In the MaPro catalogue there is a chart showing which thickeners and base oils are compatible and which are not.

Thickener, as the name implies, adds density to the grease. Some greases may be thick and tacky whilst others may be almost oil like in consistency. There is an international grading standard all greases conform to. It is known as the NLGI (National Lubrication Grease Institute) consistency class and all greases fall into one of the following classes starting at 000, being the thinnest grease, up to 6, which would be the thickest.

Added to the mix are additives that could be incorporated into the grease to enhance its performance. Already, I am sure that it is becoming more obvious that grease is not just grease. Much more in-depth information can be obtained through a course in Tribology.

How much grease should a bearing have in it?

As stated previously, the consensus in the marketplace amongst technicians and artisans is that a bearing or housing should be filled with grease until it exits the other side of the bearing in a clean form. By doing this we are purging all the old grease out of the bearing and ensuring there is only clean grease in it. To understand why this is wrong we first need to look at some of the terminology around a bearing. It consists of the following components: an outer race; inner race; cage; and rolling elements.

When the bearing rotates, the rolling elements must also rotate. If the bearing is filled with grease, the rolling elements lose their ability to rotate and will then slide, causing them to heat up in the same way that your hands heat up if you rub them together. This is due to friction, and friction on the rolling elements of a bearing will cause the bearing to fail in a shorter time.

A calculation can be done for each bearing in every operation to ensure the correct amount of grease is applied. It is known as the initial fill and most engineers can calculate this quantity. Alternatively, there are web sites with calculators for doing this. This is a vital first operation and can have a massive effect on the lifespan of the bearing.

Once the bearing is in operation, the grease will need to be topped up from time to time. Again, this can be calculated based on the operating specifications. Here is where the next potential problem can arise. If we are told that a specific bearing requires 4.0 g of grease every second day, how do we know that the exact quantity is being applied? In the work place most lubrication operations are carried out manually using grease guns. With a gun, the grease is applied in the form of a few pumps of grease and human error comes to the fore. What exactly is meant by "a pump?" It is a stroke of the grease pump's actuating lever, but is it a full stroke? Is my

SKF LAGM Grease Meters accurately measure grease discharge by volume or weight.

SKF System 24 gas-driven single point automatic lubricators are supplied filled with a wide range of high performance SKF lubricants. Tool-free activation and time-setting allow easy and accurate adjustment of lubrication flow.

stroke of the lever the same as the next person's? How old is the grease gun? Have the parts worn to the extent that they no longer deliver the same amount of grease? Has any grease, in fact, been delivered?

This applies to manually and pneumatically operated grease guns. Lubricators have been told that each operation of the air pump delivers a certain amount of grease, and they therefore need only count the number of pumps of the air gun to determine the exact amount of grease that has been delivered. In a recent lubrication audit a lubricator proudly proclaimed, after being asked by one of the auditors how much grease he had used carrying out his duties that day, he was sure he had used 36 kg of grease. This was impressive as he only had a 20 kg drum of grease, which was not replaced during the observed period. In fact, when the drum was opened it was found to be half full. This meant that every lubrication point had been severely under lubricated.

Here, the use of grease meters could have been applied to all the lubrication equipment to determine the exact amount of lubricant decanted. Lubrication points should be clearly marked with the grease type, amount, and frequency of lubrication. One method of doing this would be to use colour coded labels that had the details for that grease point on them, that is, type of grease, amount of grease and the frequency of lubrication.

Contamination

One definition of contamination is 'the action or state of making or being made impure by polluting or poisoning.' The use of the word 'poisoning' I thought was very apt. If you poison drinking water, there is a potential for people to become very unwell or die. Your machine will eventually die through contamination if it remains unchecked.

There are a number of ways of contaminating lubrication. As discussed above, cross contamination of different types of grease can lead to failures. Dust contamination, water ingress or other forms of liquid are also common. This is the reason for units having seals and these sealing systems can be very complicated. But no matter how much money is invested in the 'best' sealing system, if it is being filled with contaminated grease or oil, the bearing will fail.

As outlined above, when a bearing is filled with grease, the lubrication is being carried out by the base oil being 'leaked' into the space between the surfaces of the bearing. Just how thick is this oil film? To gain a better perspective, consider a grain of dirt 10 µm in size. Can this be seen with the naked eye? No. A human hair is, on average, 50 µm thick and would be visible to the naked eye. The lubricating film between the contact surfaces being lubricated, when the unit is at full operating temperature, is between 0.1 and 1.0 µm thick. That 10 µm grain of dirt will push the lubricating film away with ease.

The best illustration of what this can cause is in a simple picture. Consider two identical bearings. They have been manufactured to the same specification in the same factory, but there is one critical difference between them – one will produce 1 000 hours of service whilst the other will provide 10 000 hours service. Why is this? The fitting and lubrication methods used and contamination. These three factors relate to 66% of all bearing failures. As a customer, I would most certainly prefer having to replace my bearings every 10 000 hours as opposed to 1 000 hours.

Also remember that contamination can also be caused by mixing two different types or even makes of grease. While the claim may be made that the grease will perform in the same manner as another type of grease, the components that make up the greases may differ significantly. Even though the basic thickener and the base oil may be compatible, there are certain additives that may react with other components. If a factory is using three different types of grease, there should be three grease guns, clearly marked for each grease type.

Grease is a consumable – disregard the costs

Many customers do not realise how much of a saving can be made by controlling the consumption of grease. An even scarier observation is that most companies are not sure of their exact spend on lubrication. On bigger plants this can, and has been proven to, run into millions. In this age of cost cutting and cost saving, one of the most obvious ways of saving costs is being ignored. Working smart with lubrication and grease purchases and how they are used in the workplace can notably reduce costs; in some cases, by up to 50%.

The use of automatic lubricators, multi-point lubrication systems, lubrication route planning and training can lead to massive savings in the long term.

In the training I received we were taught the '5 Rs' of lubrication, which I now call the 'Lubrication Mantra'. Here they are: Use the Right lubricant; the Right quantity; at the Right time; at the Right point; and using the Right method.

If this mantra is followed, lubrication should no longer be a mystery and there will be an improvement in uptime as well as a visible cost saving.

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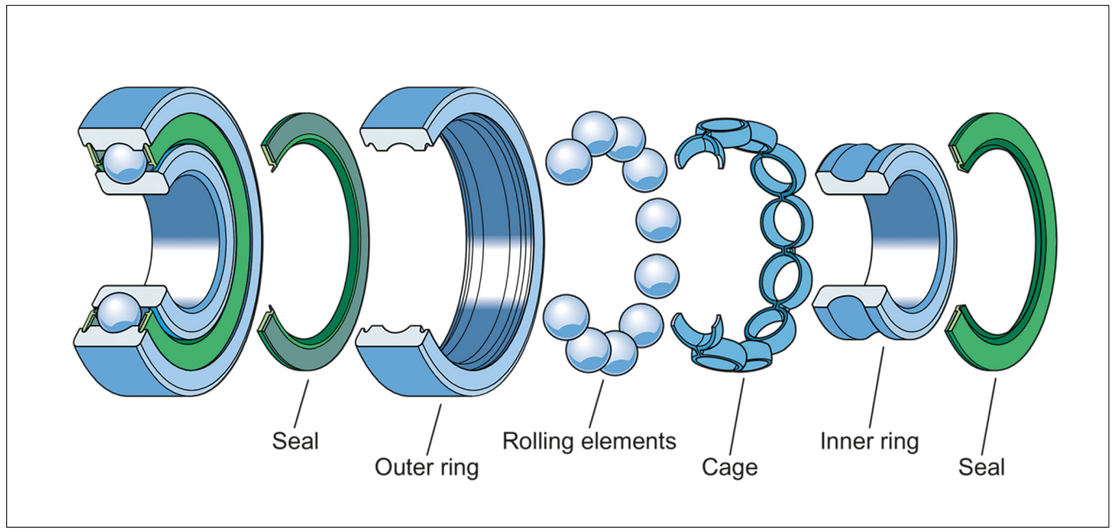

A bearing consists of the following key elements: the outer race, the inner race, the cage, the rolling elements and the seals.