Bearing Up! – Considerations for bearings and lubricants operating in harsh climates

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Kangamiut village in the middle of nowhere, Greenland May 2015

Bearing the harsh environment...

~ Lubrication selection for low temperature operations.

With its freezing climate, the Arctic is one of the most extreme and barren environments on earth. Despite this, four million humans have learned to live there, and these inhabitants expect crucial machinery to operate effectively – even in the depths of winter. Here Chris Johnson, managing director of specialist bearing supplier, SMB Bearings, explains the lubrication requirements for bearings operating in low temperatures and other harsh environments.

(Kim adds: "Although this is, of course, a motoring magazine website, I thought that readers would be interested in this article, which covers the difficulties of operating machinery bearings in low temperatures, since similar physical considerations arise in motor car engines, transmissions and running gear...).

Bearing lubrication choice will affect the rolling resistance, speed, noise and most critically, the lifespan of a bearing. However, when a bearing is required to operate under demanding conditions, the selection of lubricant becomes even more important. In fact, according to an RKB study, improper lubrication is the cause of 80 per cent of bearing failures.

The two basic types of lubricants available are oils and greases. Generally speaking, oils are preferred where free rotation is required but, due to the difficulty in keeping oil inside the bearing, this may be at the expense of bearing life unless complex oil re-circulation systems are used. Lubricating oils were traditionally refined from petroleum but today, there are a wide range of synthetic oils, silicon oils and fluorinated compounds available to choose from. Grease, on the other hand, is a semi-solid or solid lubricant and is simply an oil combined with a thickener and may include anti-wear, extreme pressure or anti-oxidant additives.

Regardless of whether you use an oil or grease, low temperatures can dramatically affect the effectiveness of a lubricant. Operating in reduced temperatures will result in a higher viscosity lubricant, which can restrict the lubrication flow within bearings. Naturally, too high a viscosity can cause excessive friction and, in turn, damage the bearing and the

machinery it is being used in.

Temperature ranges

Lubricants have different optimum temperature ranges. For example, while some low temperature lubricants may be able to operate at sub-zero temperatures, the lubricant may not fare as well when the machinery is up and running and the ambient temperature of the bearing increases. When choosing a lubricant, for low or high temperatures, the entire range of temperatures in which the machinery will function should be taken into consideration. Naturally, it is helpful if the consistency of a lubricant does not change too dramatically over its temperature range.

The pour point of oil describes the lowest possible temperature at which the oil will flow. When the temperature drops below the pour point of an oil, it will become partially or completely solid. In this instance, the oil will either dramatically increase the bearing's rolling resistance or stop it from rotating altogether. When establishing low temperature limits for greases, the pour point of the base oil is an important consideration.

The thickener in a grease acts as a kind of sponge to ensure that lubricating oil stays securely inside the bearing. Thickeners will release and re-absorb oil allowing a lubricating film to form between at the points of friction. At temperatures near to or below the base oil's pour point, they can no longer do this effectively and accelerated bearing wear can occur. In addition, a larger amount of thickener in a grease, while useful at high temperature, can cause the grease to stiffen too much at low temperature.

In very extreme temperatures, lubrication can be a complicated problem. One option could be to run the bearing "dry" without any lubrication at all. Full ceramic bearings will operate quite happily without lubrication but for stainless steel bearings, the rotational speeds must be extremely low. Chromium steel bearings are not an option as they will corrode without a protective coating of oil.

When designing applications to operate in harsh environments, it is easy to forget the

importance of lubrication choice. Incorrect lubrication not only slows down the rotation speed of a bearing, but it could potentially restrict its movement completely. This obviously has disastrous consequences for machinery operating in extreme – and often remote – environments. That's why it's vital that machine original equipment manufacturers approach bearing suppliers that have the skills and industry knowledge to advise on the best lubrication choice, otherwise they could be left out in the cold.

About SMB Bearings:

SMB Bearings originally specialised in miniature bearings, thin-section bearings and stainless steel bearings. By natural progression, the company expanded the range to include other corrosion resistant bearings such as plastic bearings, 316 stainless bearings and ceramic bearings.

Remaining a specialist business, SMB Bearings provide a high level of product knowledge, providing bearing and lubrication solutions to existing or potential customers, whether individuals or large corporations. SMB Bearings does not just sell bearings, but helps to solve your problems.

For further information please visit http://www.smbbearings.com/