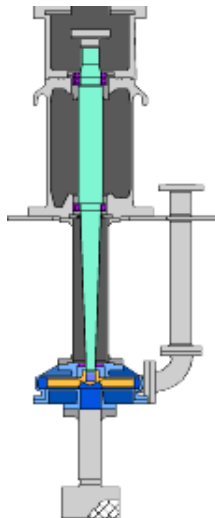


Vertical cantilever pumps offer the potential for increased reliability by means of their design simplicity. Poor lubrication practices however, often prevent users from obtaining the best possible service life from the grease lubricated bearings in these pumps. In this issue we discuss the problem of bearing over-lubrication and the proper re-lubrication methods for vertical pumps.

*Dale B. Andrews*



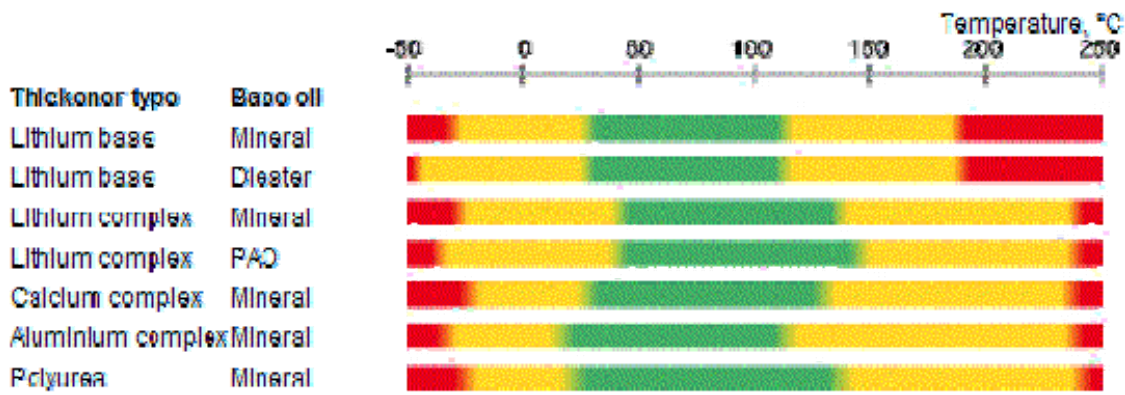
Vertical cantilever pumps are often used in sump applications where solids create problems for product lubricated sleeve bearings. A simple vertical cantilever sump pump is characterized by a single stage overhung impeller supported by grease lubricated rolling element bearings. Most cantilever pumps are of a classically stiff shaft design with a first lateral natural frequency being at least 30% above the maximum pump rotative speed. As pump length increases, the shaft diameter is also increased to provide the necessary stiffness to maintain operation below 1<sup>st</sup> critical. Any increase in shaft diameter is usually accompanied by a corresponding increase in bearing size. One resultant aspect of the cantilever design is that the rolling element bearings are of a larger diameter than found in other vertical pump designs under similar power and load conditions. Shaft diameters that range in size from 75 mm (3 in) to 150 mm (6 in) are not uncommon.

One common cause of bearing failure in vertical cantilever pumps is over-lubrication. Grease is typically supplied to the bearings either by an automatic greasing system or by plant personnel, who, on a routine schedule inject a few shots of grease into the bearing housings. Often, the response to a bearing that is running hot is to add more grease. Over-lubrication is generally the result. An over-lubricated bearing, as shown in the photo at the right<sup>1</sup>, may generate a large amount of frictional heat at operating speed as it plows through the excess grease. If the bearings become too hot, the grease breaks down, and lacquer can form on the bearing surfaces resulting in pre-mature failure. The correct amount of lubricant and frequency of lubrication varies with the bearing size, speed, and load<sup>2</sup>.



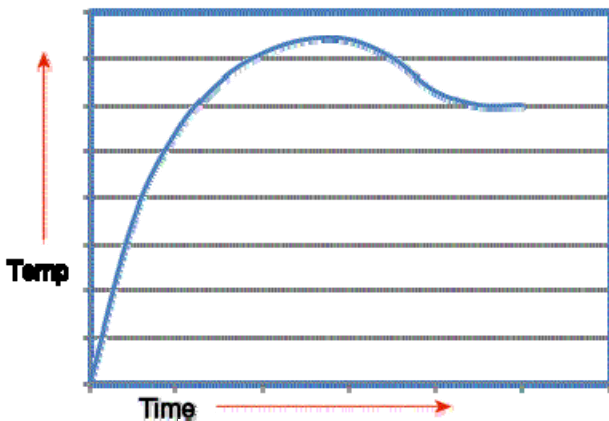
<sup>1</sup> Michael Weigand, Lubricant Consult GMBH, "Lubrication of Rolling Bearings - Technical Solutions for Critical Running Conditions". *Machinery Lubrication Magazine*. January 2006

<sup>2</sup> Either the pump or bearing manufacturer can provide guidance for the proper lubrication frequency and volume



How hot is too hot for a bearing? The correct answer is that “It depends”. Hot to the touch is usually at around 55°C (130 F) and is not a dispositive method for evaluating bearing condition. Large bearings will operate at higher temperatures than smaller bearings under the same conditions. For a large bearing, a temperature at or above 55°C would not necessarily be abnormal. An important consideration in evaluating bearing condition is that the bearing temperature is stable and in the acceptable range for the bearing size and lubricant used. The chart shown above, published by [SKF Bearings](#)<sup>3</sup>, depicts the acceptable temperature range of some common grease lubricants. The green zone shows the continuous allowable operating region.

To lubricate bearings during a maintenance overhaul, the bearings should be hand packed with grease and the internal surfaces of the bearing housing should be coated with grease to prevent corrosion. Filling the bearing housing with grease on a vertical pump has no substantive benefit as any grease beneath the bearing will not assist in bearing lubrication. Ideally, bearing housings should have a provision for venting excess grease in the event that an over-full condition does occur. The extra space in the housing accommodates grease that is cast off from the bearings during operation, and provides a reservoir for future lubricant.



Care should be taken to use the same or compatible grease during re-greasing as used during pump assembly. Mixing of incompatible greases may adversely impact their properties resulting in loss of lubrication.

Following re-greasing, a bearing will generally exhibit a temperature rise characteristic similar to that shown at the left. After an initial temperature rise, the bearing will relieve itself of excess grease, and the temperature will drop before stabilizing. Care should be taken during following any re-lubrication that the peak temperature does not exceed allowable limits.

Although over-lubrication is just one of several factors that can shorten bearing life, it is easy to diagnose and the solution of decreasing the amount of lubrication, in itself, saves money. The amount of lubricant and frequency of lubrication is machine specific and is available from the pump or bearing manufacturer. The pump manufacturer’s service department is also an excellent and often underutilized resource for failure analysis and remediation.

<sup>3</sup> The [SKF](#) site has extensive information of the subject of bearing lubrication and is an excellent resource.