TECHNI/TIPS

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LE'S 1250 ALMASOL® HIGH TEMPERATURE LUBRICANT

Effective lubrication at high temperatures requires a grease of exceptionally high quality. Quality is not a fundamental property of a lubricating grease, but the result of many factors which collectively lead to the desired performance level. The problems which arise from lubricating greases in high temperature applications are a result of oxidation and evaporation of the base oil.

In general the requirements for a grease which is capable of performing in high temperature applications are:

- High temperature thickener - high dropping point.
- Oil of heavy viscosity.
- Oil of high flash point - low evaporation.
- Firm consistency.
- Oxidation resistance.

LE's 1250 ALMASOL High Temperature Lubricant utilizes a clay thickener system which has one of the highest temperature capabilities of any grease thickener technology currently available in the industry. Clay greases are considered nonmelting from their performance in the ASTM D2265 Dropping Point Test. The maximum temperature measured in this test is 580°F (304°C), and clay greases do not "drop" even at this temperature. The base oil used in this lubricant has a heavy viscosity and high flash point as well as a high natural viscosity index. Viscosity index is a mea-sure of an oil's ability to maintain its viscosity at high temperatures and thus provide an adequate film for lubrication. The lubricant is manufactured to an NLGI 2-1/2 grade which provides the firm consistency required for high temperature lubrication. The oxidation resistance is outstanding due to its utilization of 100% paraffinic base stock and a proprietary blend of synergistic antioxidant additives. ALMASOL, LE's proprietary wear-reducing additive, has higher temperature capabilities than the wear-reducing materials commonly used in commercial grade greases. Finally, LE's 1250 ALMASOL High Temperature Lubricant is specially formulated to minimize softening in service and during storage.

Softening, running and/or bleeding of clay-thickened greases in high temperature applications is not a result of thickener melting. Rather these problems are a result of the chemical action of surface active oil and additive oxidation/deterioration product on the surface of the clay particles. This results in an irreversible degelling of the grease structure and a corresponding loss of consistency. Another common cause of softening in clay greases is contamination from greases of other thickener types, fluid lubricants and nonlubricating materials in the environment of the application.

The cardinal rule for application of clay grease is to avoid mixing them with greases of other thickener types. When changing over to LE's 1250 ALMASOL High Temperature Lubricant from a lithium or aluminum grease, it is impossible to prevent mixing of grease types.

In the changeover process, the bearing should be flushed initially with a quantity of grease which will fill the entire bearing while it is running. This should be allowed to run for a short period of time to intermix the two grease types and then flushed again with enough grease to purge out the mixture of the two greases. This flushing procedure should be repeated as needed, with close monitoring until the purged grease appears to be uncontaminated by the previous product. The color and consistency of the grease that is being purged out of the bearing should be similar to that of the new grease that is being installed. This will be a good indication that the bearing has been flushed of the old grease and that grease mixing is no longer occurring. In a laboratory evaluation of a sealed 2-1/2" diameter, double row spherical bearing, 1.2 pounds of grease was required to sufficiently flush and purge the old grease from the bearing. Grease that has softened due to mixing presents no lubrication problems but can be undesirable from cleanliness, safety and process/product contamination considerations.

Other factors that can cause grease to leak from bearings include overfilling, thermal expansion and displacement by moving elements within the bearing. The amount of leakage from a bearing due to thermal expansion depends on the magnitude for the temperature change the grease encounters. This is especially true if a bearing is completely filled with grease.

Approximate percent changes in volume from ambient (i.e. 60°F, 15.6°C) to various temperatures for LE's 1250 ALMASOL High Temperature Lubricant are given below:

100°F	(37.8°C)	- +1.7%
150°F	(66°C)	- +4.0%
200°F	(93°C)	- +6.2%
250°F	(121°C)	- +8.4%
300°F	(149°C)	-+10.7%
350°F	(177°C)	-+13.0%
400°F	(204°C)	-+15.3%
450°F	(232°C)	-+17.5%

These volume change figures are based on API volume expansion factors for the base oil. Actual measurements for a 2-1/2 inch diameter, double row spherical, sealed pillow block bearing at 300°F(149°C) were 1 % - 3% higher than the thermal expansion of the base oil. The additional quantity of grease expelled from the bearing is probably due to the internal movement of the bearing forming a channel in the mass of grease.

The maximum useful lifetime for a grease in high temperature bearings depends on many factors. These factors include:

- Temperature.
- Size and speed of bearing.
- Amount of oxygen available to the grease in the bearing.
- Load on the bearing.
- Degree of external contamination.

Approximate maximum useful lifetime guidelines for LE's 1250 ALMASOL High Temperature Lubricant are given below:

Temperature	Hours
200°F (93°C)	10,000
300°F (149°C)	100
400°F (204°C)	1-4

These lifetimes assume that bearing sizes and speeds are not excessive. At high speeds and with large bearings, lubricant temperatures can be significantly higher than that of the machine environment due to fluid friction at high speeds and metallic friction with large bearings. In addition, the shear rates in these two situations are high and tend to destroy the grease structure in relatively short times. In the temperature range of 200°F (93°C) - 400°F (204°C), the amount of oxygen present determines the rate of oxidation of the grease. With unlimited oxygen present, the rate of oxidation is approximately doubled for each 18°F (10°C) that the temperature increases. The approximate useful lifetimes listed above assume that there is unlimited oxygen available to the grease. This is probably a pretty safe assumption due to the fact that virtually all base oils contain significant amounts of dissolved air.

Lubrication interval recommendations for LE's 1250 ALMASOL High Temperature Lubricant are much lower than the maximum useful lifetimes. This is because normal bearing relubrication practices replenish only a relatively small portion of the grease and the bulk of the grease in the bearing, at any given time period, has been there for a much longer time than the lubrication interval. Laboratory and field testing of LE's 1250 ALMASOL High Temperature Lubricant has provided data for lubrication interval guidelines at various temperatures. These guidelines are listed below.

Temperature		Hours
200°F (93°C)	.	24
300°F (149°C)		16
400°F (204°C)		1-4

These guidelines apply to relatively low speed bearings (less than 1,000 rpm). The amount of grease to be applied at each relubrication is determined by the temperature, size, speed and degree of contamination of the bearing. A common practice is to relubricate until grease is first noticed being forced from the bearing. This practice is recommended for most situations; however, if the conditions of application are unusually severe, more grease may need to be applied. This will replenish more of the oxidized and otherwise deteriorated grease. These comments on amount and time of relubrication are only guide-lines. They are no substitutes for determining the lube frequency and amount for specific types of applications and temperature conditions. On-site lube interval determinations can be implemented by good record keeping and close monitoring of the specific application. Once this data has been com-piled, it can be applied to similar applications:

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