STUBBORN LUBRICANTS FOR TOUGH APPLICATION

MOSIL LUBRICANTS

LUBRICATING ASPECTS OF ANTI FRICTION BALL AND ROLLER BEARINGS

OPERATING PRINCIPLE-

Anti-friction bearing is a precision device and a miracle of engineering. There's rarely any other mass-produced item that is machined to such close tolerances. The basic principle of ball & roller bearings is the rolling of balls or rollers over the inner and outer races, some sliding friction is generated during the operation of anti-friction bearings. The successful operation of an anti-friction bearing requires an optimum lubricating film in the areas of sliding contacts. In cage less bearing, the rolling elements slide against each other. And in the cage, the rolling element slides against the ring guiding surfaces.

When a ball under load rolls in a curved bearing raceway, pure rolling occurs and following zones as per the action are recorded- (Fig 1)

- The forces of slippage between zone #1 and zone #2 are equal in magnitude.
- The slippage in zone #1 is in opposite direction as one in zone #2.
- Technically there is a narrow zone of pure rolling in #3 but there are larger areas that approach pure rolling.
- These conditions exist, even when loads are lighter and ball paths narrower, although less obvious.

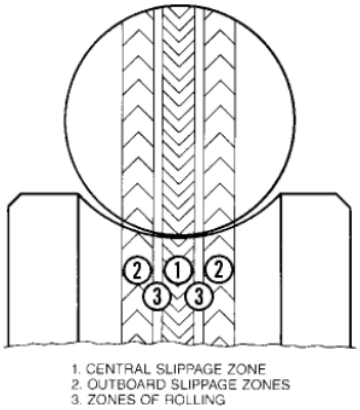


Figure 1

When an anti-friction roller bearing is acted upon by the load, the load gets distributed along with the line contact of the cylindrical rollers and the races of the bearing. A rectangular area of contact results between the roller and the race. The rollers flatten out in the lower front quadrant and bulges in the lower rear quadrant as in Fig 2.

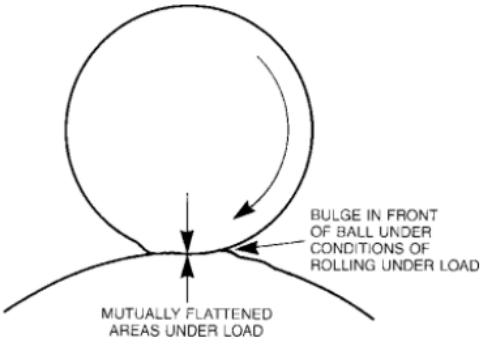


Figure 2

OIL OR GREASE

The ideal lubricant for rolling elements from bearing is Oil. Greases are simply a means of effecting greater utilization of rolling bearing. The major use of grease has been guided by the possibilities of simpler housing designs, less maintenance, less difficulty with leakage, and better sealing against dirt.

The quantity of lubricant needed to maintain a necessary lubricant film in an anti-friction bearing is very small. The minimum quantity required is only a few micro-inches of thickness. Once this small amount of lubricant has been supplied, more is required only to replace that lost by vaporization, atomization, and creepage from the bearing surfaces. A small amount of oil can satisfactorily lubricate a bearing, and much more oil is needed to dissipate heat generated in high speed or heavily loaded bearings.

VISCOSITY OF BASE OIL

The viscosity of lubricating oil, however, varies with temperature. It decreases with increasing temperature therefore, the viscosity at the operating temperature must be used, rather than the viscosity grade (ISO VG) which is based on the viscosity at the ref temperature 40 deg C. Tapered and spherical roller bearings usually have a higher operating temperature than ball bearing or cylindrical roller bearings under comparable conditions.

Here from Figure 3, the minimum required viscosity is yield as a function of bearing size and rotational speed. And Figure 4 can be used to determine the actual viscosity or Viscosity Index at the operating temperature, which however varies with bearing design. All oils are thicker when cold and become thinner when heated. Some oils resist this change in viscosity, these oils are said to have a higher viscosity index. A high viscosity index is usually associated with good oxidation stability and can be used as a rough indication of such quality.

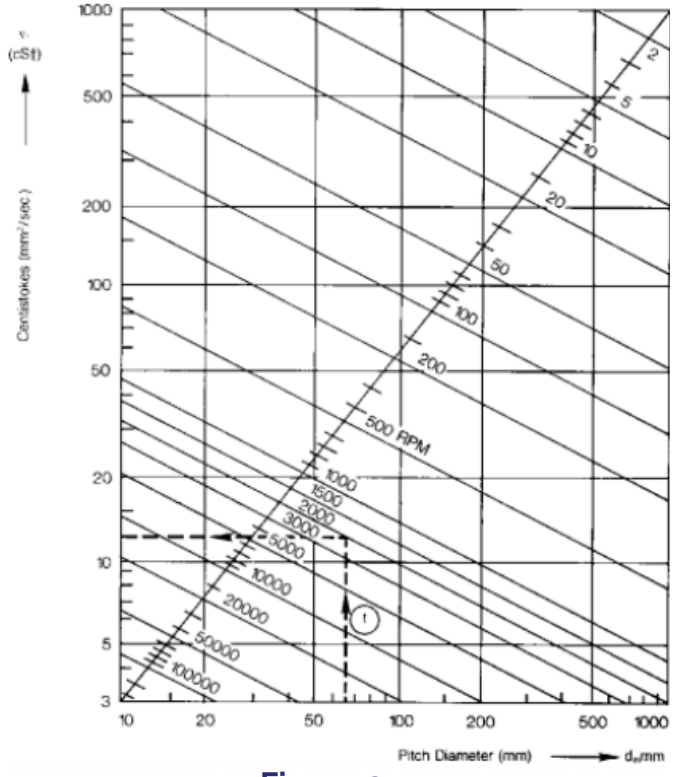


Figure 3

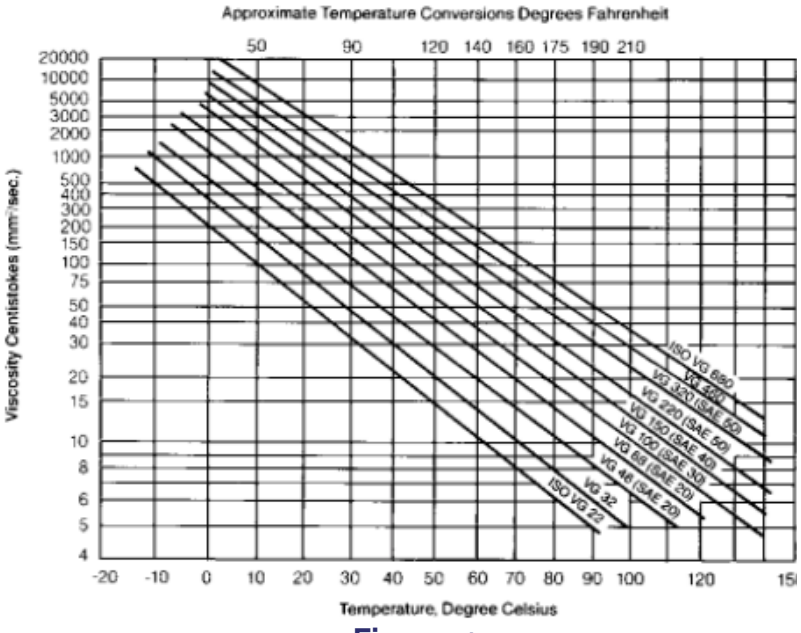


Figure 4

Other parameters are also necessarily important which are helpful in lubricant selection of the bearings like-

1. Flashpoint/pourpoint/drop point of the lubricant

2. Additives / solid lubricants.

3. Water resistance/oxidation stability.

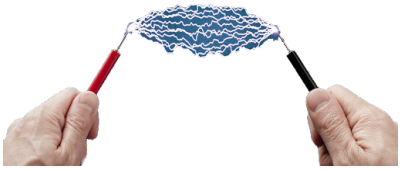
Greases vary in consistency and become pliable when subjected to mechanical working action. Most rolling bearings greases fall in class #1 to #3 and the greater portion of bearing applications use NLGI # 2 greases.

There are some special properties to meet the unusual requirements -

1. Extra tackiness/adhesiveness

2. Chemically inert

3. Electrical conductivity/resistance



4. Radiation resistance

5. High vacuum effect resistance

6. Food grade (NSF certified)

OPERATING CONDITIONS

Temperature

If the lubricant subjected to a low-temperature start-up but operates at higher temperatures, a high viscosity index is desirable. The rate of oxidation of lubricants increases rapidly with rising temperatures. The rate of oxidation doubles for each 10 deg rise in temperature above 60 deg C. above 121 deg C petroleum oils tend to oxidize rapidly and sometimes it becomes necessary to use highly refined mineral oils or synthetic oils to increase the service life of the lubricant. If the operating temperature is high, a lubricant with higher base oil viscosity is selected as temperature and viscosity are directly proportional to each other

Speed

Small size anti-friction bearings are often successfully greased at high-speed applications. Larger sizes usually require oil to remove heat and carry the wear debris along with it, and extensive cooling is required in high-speed roller bearings operating with high frictional heat hence oil lubrication should be considered

Pressure / Load

Various extreme pressure agents are compounded into some greases and oils. These include additives such as sulfur, phosphorous and chlorine compounds, graphite, and Moly. For most applications, higher viscosity oils are required to prevent metal to metal contact in high loads. In heavily loaded bearing operating at high speed, the selection of oil viscosity must compromise between a heavy oil which is desirable for heavy loads, and light oil which is desirable for high speed.

Other operating conditions are also in consideration like-

1. Wet conditions

2. Fretting

3. Dust and dirt conditions

OPERATING TEMPERATURE RANGE

The following table gives the operating temperature ranges for the type of grease normally used for rolling bearing lubrication. Greases based on synthetic oils; viz, ester oils, hydrocarbon oils, silicone oils, PFPE oils may be used at temperatures above and below the operating temperature of mineral oils based greases. Some of the synthetic oils can provide lubrication up to 300 deg C. and for low temperature, some can sustain up to -40 deg C.

Grease Type (thickener)	Recommended Operating Temperature Range °C			°F		
Lithium base	–30	to	110	–22	to	230
Lithium complex	–20		140	– 4		284
Sodium base	–30		80	–22		176
Sodium complex	–20		140	– 4		284
Calcium base	–10		60	14		140
Calcium complex	–20		130	– 4		266
Barium complex	–20		130	– 4		266
Aluminum complex	–30		110	–22		230
Inorganic thickeners (bentonite, silica gel, etc.)	–30		130	–22		266
Polyurea	–30		140	–22		284

STUBBORN LUBRICANTS FOR TOUGH APPLICATION

MOSIL LUBRICANTS

SCOPE

A good lubricating solution is always offered by properly studying the application and its operating conditions. We at MOSIL Lubricants recommend precise lubricating solution once we study the application and its challenges or pain points in operating conditions. To know more about our products and the product range kindly visit our website - www.mosil.com or share your required lubrication details at enquiry@mosil.com for your satisfactory lubricating solution.