BALL BEARING GREASE PROPERTIES

NAME	LITHIUM GREASE			SODIUM GREASE (FIBER GREASE)
Thickener	**Li Soap**			**No Soap**
Property / Base Oil	**Mineral Oil**	**Diester Oil**	**Silicone Oil**	**Mineral Oil**
Dropping Point, Cº	170-190	170-190	200-250	170-200
Working Temperature, Cº	-20-+110	-50-+160	-50-+160	-20-+120
Working Speed, %	70	60	60	70
Mechanical Stability	Good	Good	Good	Good
Pressure Resistance	Fair	Fair	Poor	Fair to Good
Water Resistance	Good	Good	Good	Poor
Rust Prevention	Good	Good	Poor	Poor to Good
Remarks	General purpose lubricant	Good low temperatures and torque characteristics. Often used for small motor and instrument bearings.	Mainly for high temperature applications. Unsuitable for bearings under high speed or heavy load conditions.	Long and short fiber types available. Long fiber grease is unsuitable for high speed.

CALCIUM GREASE (CUP GREASE)	MIXED BASE GREASE	COMPLEX GREASE	NON-SOAP BASE GREASE	
Ca Soap	**Na + Ca Soap, Li + Ca Soap, Etc.**	**CA Complex, A1 Complex, Etc.**	**Silica Gel, Bentonite, Carbon Black, Polyurea, Fluoric Compounds, Heat Resistant, Organic Compound**	
Mineral Oil				
170-190	160-90	240-300	240	240
-130	120-+80	-140	-160	-250
40	70	70	70	40-70
Poor	Good	Good	Good	Good
Poor	Fair to Good	Fair to Good	Fair	Fair
Good	Poor for Na Soap Grease	Good	Good	Good
Good	Fair to Good	Fair to Good	Poor to Good	Poor to Good
Cup grease is not suitable for high temperatures and heavy loads. Extreme pressure grease containing high viscosity oil and extreme pressure additive (pbsoap, etc.) is available	Often used for roller bearings and large ball bearings	Suitable for extreme pressures. Mechanically stable.	General purpose lubricant	Recommended for special environments with very high temperatures, acids, alkalis, radioactivity, and exposure to flames.

The main purposes of bearing lubrication are to prevent metallic contact between the rolling elements, raceways, and cage, and also to prevent the bearing from corrosion and wear. Additional functions are sealing and cooling of the bearing.
Bearings may be lubricated with grease or oil - in special cases with a solid lubricant - the choice of which depends primarily on the temperature range, operating speeds, and loading conditions of the bearings concerned.
All lubricants must be changed from time to time because their properties deteriorate as a result of aging and contamination.

The limiting speeds for both grease and oil lubrication are given in the bearing tables.

Grease Lubrication

Grease lubrication is generally used for bearings operating under normal conditions. Grease has certain advantages over oil because it's easily retained in housing as well as its sealing effect against the entry of moisture and outside impurities.
In general, the bearing should only be 1/3 to 1/2 filled with grease because over filling will cause rapid temperature rise, particularly if speeds are high.
Lubricating greases are thickened mineral oils or synthetic oils. The thickening agents are metal soaps which will determine its consistency. Consistency, temperature range, and rust inhibiting properties are the main factors to be considered.

The most widely used lubricating greases according to their metal bases are as follows:

Calcium-based greases: They are stabilized with 1 to 3% of water. When the operating temperature rises, the grease will separate into mineral oil and soap. The upper limit of operating temperature for these greases is approximately +60 C. For special heat-stable calcium base greases, the operating temperature could be up to +120 C.

Sodium-based greases: They can be used at temperatures between -30 to 80 C. For special greases, it may be used to +120 C. They absorb water to a certain extent and form a rust inhibiting emulsion without impairing their lubricating property. These greases will form a good protection against rust, provided the water will not enter the bearing arrangement. If water enters, such greases will be easily washed away from the bearing housing.

Calcium/sodium-based greases: They have comparatively high drip point and low solubility in water; therefore, they are suitable for bearings running in high speed moist conditions.

Lithium-based greases: They are suitable for use at temperatures between -30 to 100 C and in high speed operation. For special lithium base greases, working temperature up to +150 C could be used. Lithium and calcium-based greases are not soluble in water; therefore, they offer no protection against corrosion. Such greases should not be used unless a rust inhibitor has been added.

Oil Lubrication

Oil lubrication is generally used when high speeds or operating temperatures are beyond the effective range of greases, or when it is so designed that heat developed in the bearing must be transferred away through a lubricating oil circulation system.

Viscosity of the lubricating oil is the main factor to be considered to suit the diverse applications with respect to speed, temperature, and loading conditions. Oil lubrication is effective; however, its oil feeding and sealing devices must be provided. Some of them are recommended as follows:

Oil bath lubrication: This is the simplest method and is only suitable for slow speeds. The oil is picked up by the rotating bearing elements. The oil levels should be slightly below the center of the lowest ball or roller.

Dripping oil lubrication: This method is suitable for the application where a small quantity of lubricating oil is constantly fed into the bearing without interruption. The excessive amount of oil dripped may cause a rise in the temperature of the bearing.

Circulating oil lubrication: For high speed bearing application, an oil circulation system can be used. The lubricating oil, after passing through the bearing, is filtered, sometimes cooled, and then pumped back to the bearing. This method of lubrication is common practice of spindle design for high speed precision machine tools.

Oil jet lubrication: Oil jet provides a very effective lubricating method for high speed applications. It is important to ensure that a sufficient amount of oil will reach the bearing components and will be able to dissipate the heat generated by friction. The velocity of the oil jet, usually 15 M/S, must enable some of the oil to penetrate through the turbulent air membrane surrounding the bearing. The position of the oil jet should be placed between the inner race and cage of the bearing.

Oil mist lubrication: This method is often used for high speed applications, such as grinding spindles. The oil mist is produced in an atomizer. Dry compressed air, after filtered, is used in the oil lubricator. The oil is then introduced into the bearings. The air current will also serve to cool the bearing, and its slightly higher pressure in the housing will also prevent impurities from entering. The small quantity of oil can be regulated so that the lubricant friction is practically negligible.

Solid Lubrication

Sometimes it is found that the addition of a small amount of solid lubricant, such as MoS_2, into the grease will greatly improve the lubricating properties. In some special cases where very high temperature or high vacuum prevails, solid lubrication will be the solution.