



Ball Bearings Importance of Lubrication Selection

When a bearing must perform under demanding conditions, the lubricant selection becomes critical. Lubrication will affect life, torque, speed, noise, grease migration out gassing, temperature and rust prevention.

Lubricant Types

Two basic types of lubricants available are oil and grease.

Applications that require extremely low torque or narrow range of torque variation are suited to use oil as a lubricant. Depending on the application, it is possible that an oil lubricant may not meet a specific requirement. Grease is an oil to which a thickener has been added.

Oil

Oil is the basic lubricant for ball bearings. Previously most lubricating oil was refined from petroleum. Today, however, synthetic oils such as diesters, silicone polymers, and fluorinated compounds have found acceptance because of improvements in properties. Compared to petroleum base oils, diesters in general have better low temperature properties, lower volatility, and better temperature/viscosity characteristics. Silicones and fluorinated compounds possess even lower volatility and wider temperature/viscosity properties.



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Grease

Grease is an oil to which a thickener has been added to prevent oil migration from the lubrication site. It is used in situations where frequent replenishment of the lubricant is undesirable or impossible. All of the oil types mentioned here can be used as grease bases to which are added metallic soaps, synthetic fillers and thickeners.

The operative properties of grease depend almost wholly on the base oil. Other factors being equal, the use of grease rather than oil results in higher starting and running torque and can limit the bearing to lower speeds.

Grease additives include rust inhibitors, extreme pressure additives (EP), oxidation preventatives, etc. Because of the wide variety and complexity of additives, the characteristics of similar greases change considerably from one manufacturer to another.

Oils and Base Fluids

Petroleum Mineral Lubricants

Petroleum lubricants have excellent load carrying abilities and are naturally good against corrosion, but are useable only at moderate temperature ranges (-25° to 250 °F). Greases of this type would be recommended for use at moderate temperatures, light to heavy loads and moderate to high speeds.

Super-Refined Petroleum Lubricants

While these lubricants are usable at higher temperatures than petroleum oils (-65 ° to



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350 °F), they still exhibit the same excellent load carrying capacity. This further refinement eliminates unwanted properties, leaving only the desired chemical chains. Additives are introduced to increase the oxidation resistance, etc.

Synthetic Lubricants

The esters, diesters and poly- α -olefins are probably the most common synthetic lubricants. They do not have the film strength capacity of a petroleum product, but do have a wide temperature range (-65° to 350 °F) and are oxidation resistant.

Synthetic hydrocarbons are finding a greater use in the miniature and instrument ball bearing industry because they have proved to be a superior general purpose lubricant for a variety of speeds, temperatures and environments.

Silicone Lubricants

Silicone products are useful over a much wider temperature range (-100 ° to 400 °F), but do not have the load carrying ability of the petroleum types and other synthetics. It has become customary in the instrument and miniature bearing industry, in recent years, to derate the dynamic load rating (C_r) of a bearing to 1/3 of the value if a silicone product is used.

Perfluorinated Polyether (PFPE)

Oils and greases of this type have found wide use where stability at extremely high temperatures and/or chemical inertness is required. This specialty lubricant has excellent load carrying capabilities but its inertness makes it less compatible to additives, and less corrosion resistant.



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Lubrication Methods

Grease packing to approximately one quarter to one third of a ball bearing's free volume is one of the most common methods of lubrication. Volumes can be controlled to a fraction of a percent for precision applications by special lubricators. In some instances, customers have requested that bearings be lubricated 100% full of grease. Excessive grease, however, is as detrimental to a bearing as insufficient grease. It causes shearing, heat buildup, unnecessarily high torque, and deterioration through constant churning which can ultimately result in bearing failure. Centrifuging an oil lubricated bearing removes excess oil and leaves only a very thin film on all surfaces. This method is used on very low torque bearings and can be specified by the customer for critical applications.

There are many lubricants available for ball bearings. You will find a chart at in the next page that lists a variety of types, one of which should work well for most operating conditions.

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About NMB Technologies Corporation - NMB Technologies Corporation, a Minebea Group Company, is the world's largest manufacturer of miniature precision ball bearings and a volume leader in the design and manufacturing of precision electro-mechanical components, including cooling fans, precision small motors and mechanical bearing assemblies, among others. NMB products can be found in the personal computing, networking, telecommunications, home entertainment, home electronics, automotive, medical and industrial markets.

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Table of Commonly Used Lubricants

Code	Brand Name	Basic Type Oil	*Operating Temp. °F	Uses
L01	Fuchs Windsor L245X (MIL-L6085A)	Ester oil	-60° to +250°	Low speed instrument oil. Rust preventative. Low torque.
Code	Brand Name Grease	Basic Type Oil	*Operating Temp. °F	Uses
LY72	Multemp PS No. 2	Lithium / mineral oil	-58 ° to +248 °	Low friction torque. Deflection rollers, friction-sensitive motors.
LY48	Mobil 28 (MIL-G-81322)	Synthetic oil + clay thickener	-65 ° to +350 °	Developed for aircraft bearings and mechanisms. OK for low-speed oscillation. Low torque. Considered noisy in bearings.
LY121	Kyodo Multemp SRL	Ester oil + lithium soap thickener	-40 ° to +300 °	Very quiet, widely used motor grease. HDD spindle motor applications. OK for low speed oscillation.
LY694	Nippon Oil NIG Ace WS	Synthetic hydrocarbon and refined mineral oil + diurea soap thickener	-50 ° to +300 °	Encoders, HDD actuators applications. OK for high speed oscillation.
LY532	Kluber Asonic HQ72-102	Ester oil + urea soap thickener	-40 ° to +350 °	Suitable for automotive radiator cooling fan applications and other high temperature motor bearings.
LY551	Proprietary	Poly-alpha-olefin oil + urea soap thickener	-40 ° to +300 °	Vacuum cleaner and power tool applications. Low noise and high speed.