A BARDEN

Precision Bulletin

Emerson Bearing
Service. Inventory. Solutions.

Number 5A

This is the first of three technical bulletins on the subject of bearing lubrication. Additional information on oils and greases to follow.

PRECISION BEARING LUBRICATION

Adequate lubrication is essential to successful performance of anti friction bearings.

Increased speeds, higher temperatures, improved accuracy and reliability requirements result in the need for closer attention to lubricant selection for each and every application more than ever before.

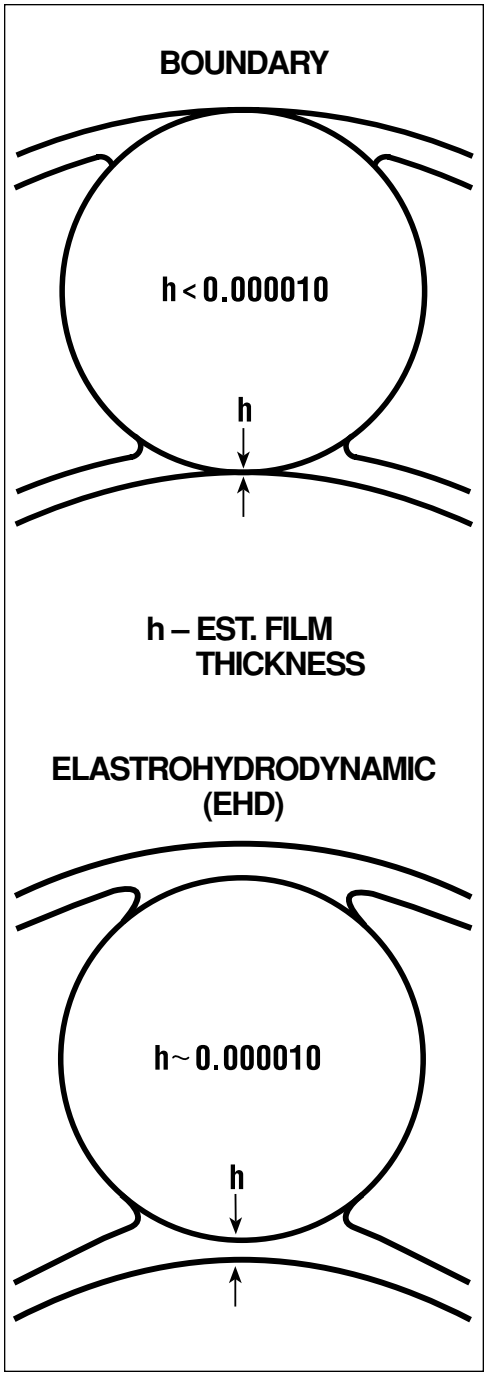
Lubricant type and quantity have a marked effect on functional properties and service life of each application. Properly selected lubricants —

1) Reduce friction by providing a viscous hydrodynamic film of oil to support the load and to prevent metal to metal contact between the balls and raceways.
2) Minimize cage wear by reducing sliding friction in cage pockets and hard riding surfaces.
3) Prevent oxidation/corrosion of rolling elements.
4) Act as a barrier to contaminants.
5) Serve as a heat transfer agent in some cases, conducting heat away from the bearing.

Lubricants are available in 3 basic forms:

1) Fluid lubricants (oils).
2) Greases—solid to semisolid products consisting of an oil and a thickening agent.
3) Dry lubricants, including films. Barden's patented BarTemp® cage belongs to this category. Dry film lubrication is usually limited to moderate speed and very light loading conditions. Consult Barden Product Engineering for additional information.

LUBRICATION MODES



LUBRICANT SELECTION

Selection of lubricant and method of lubrication are generally governed by the operating conditions and limitations of the system.

Three of the most significant factors in selecting a lubricant are:

- Viscosity of the lubricant at operating temperature.
- Maximum and minimum allowable operating temperatures.
- Operating speed.

Tables 1 and 2 provide comparative reference data, including temperature ranges and speed limits, for several of the lubricants used by Barden.

Hydrodynamic films are generated with both oils and greases, but do not exist in a true sense with dry films. Boundary lubrication exists when less than a full EHD is formed with resulting metal-to-metal contact-ball to raceway wear. The formation of an elastohydrodynamic film depends mainly on bearing speed and lubricant viscosity at operating temperature.

The minimum viscosity required at operating temperature to achieve a full elastohydrodynamic film may be obtained from the following formula:

Miniature and instrument bearings (Series R, R100, R1000, M, 30, A500, 500)

$$V = \frac{400 \times 10^6}{nCNC_p}$$

Spindle and turbine bearings (Series 1900, 100, 200, 300, 9000, L)

$$V = \frac{1500 \times 10^6}{nCNC_p}$$

where V = Viscosity in centistokes at operating temperature

C = Basic dynamic load rating in pounds

N = Speed in rpm

n = Number of balls

C_p = Load factor (See Figure 39, page 108 of C-20 catalog)

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TYPICAL LUBRICANTS USED

OILS (TABLE 1)

Barden Code	Designation	Base Oil	Operating Temperature Range ˚F	Maximum dN	Comments
0-9	Exxon instrument oil	Petroleum	– 65 to 150	1,000,000*	Anti-oxidation, anti-corrosion E.P. additives
0-11	Windsorlube L-245X	Diester	– 65 to 175	1,000,000*	Attacks paint, neoprene, anti corrosion additives. MIL-L-6085
0-14	Exxon Turbo Oil #2389	Diester	– 65 to 400**	1,000,000*	Anti-oxidation, additives, MIL-L-7808
0-17	Nyosil M-20	Silicone	– 100 to 350	200,000	Low surface tension, tends to migrate, MIL-S-81087 Type I
0-28	SHF-61	Synthetic Hydrocarbon	– 65 to 350	1,000,000*	Good heat stability, low volatility
0-49	Exxon Turbo Oil #2380	Diester	– 65 to 400**	1,000,000*	Anti-oxidation additives, MIL-L-23699, improved base lubricant for jet engines

*Max dN for continuous oil supply. Max for prelubricated 200,000 dN **Requires circulation system

GREASES (TABLE 2)

Barden Code	Designation	Base Oil	Thickener	Operating Temperature Range ˚F	Maximum dN	Comments
G-2	Exxon Beacon 325	Diester	Lithium	– 65 to 250	400,000	Good anti-corrosion, low torque
G-4	NYE Rheolube 757SSG	Petroleum	Sodium	– 20 to 200	650,000	Anti-oxidation additives, machine tool spindle grease
G-18	NYE Rheotemp 500	Ester & Petroleum	Sodium	– 50 to 350	500,000	For high temperature, high speed
G-33	Mobil 28	Synthetic Hydrocarbon	Clay	– 65 to 350	400,000	MIL-G-81322, DOD-G-24508, wide temperature range
G-42	Rheolube 350-SBG-2	Petroleum	Sodium/ Calcium	– 30 to 250+	650,000	Spindle bearing grease for normal temps & max life at high speed
G-44	Braycote 601	Perfluorinated Polyether	Tetraflour-oethylene Telomer	– 100 to 500+	400,000	Excellent thermal & oxidative stability, does not creep, water resistant
G-46	Isoflex NBU-15	Ester	Barium Complex	– 40 to 250+	1,000,000	Spindle bearing grease for max speeds, moderate loads
G-75	Arcanol L-75	PAO/Ester	Polyurea	– 60 to 250	1,000,000	Spindle bearing grease for max speeds, moderate loads. Requires shorter run-in time than G-46

LUBRICANT VISCOSITY VALUES