CHAPTER I

INTRODUCTION

Hard disk drive (HDD) design have continued to evolve over time to meet the changing requirements of applications, performance, and cost. Ball bearing spindle motors have been the common design-in for HDD for many years; however, the market is shifting toward a different type of bearing design known as Fluid Dynamic Bearings (FDB).

Fluid dynamic bearing spindle motor attractive for minimizing Non Repeatable Runout (NRRO), lowering acoustical noise, and improving reliability.

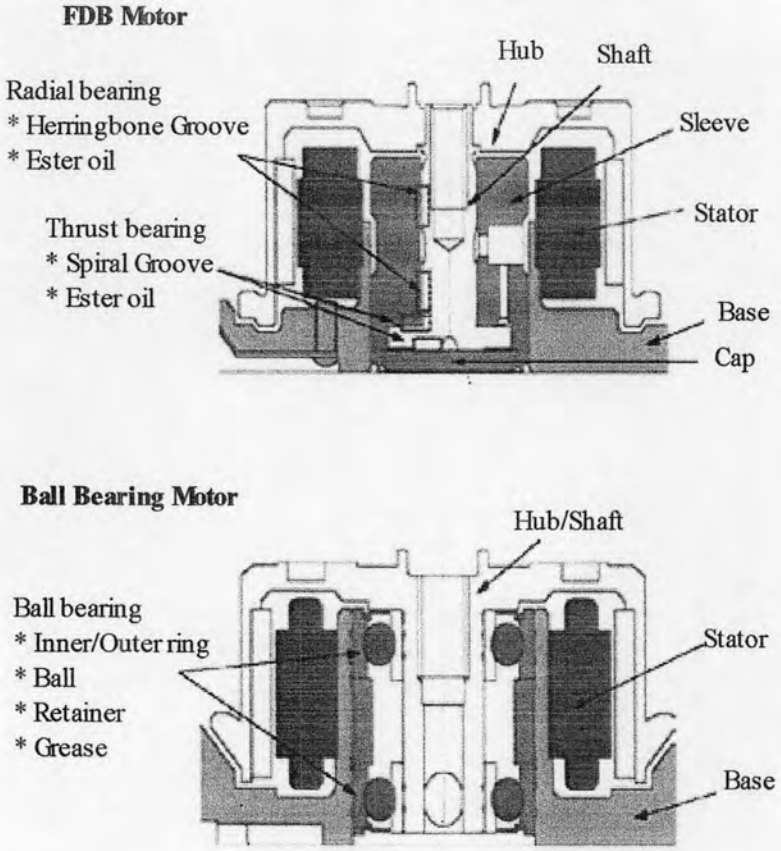
Ball bearing spindle motors comprise the majority of shipments in HDD today. A transition to FDB is starting to occur in the HDD industry. The trend of incorporating FDB motor in HDD designs is a direct result of higher areal densities and much faster spindle speeds being archived for today 's applications.

NRRO is the highest contributor to track mis-registration and track following, thus impacting HDD performance. NRRO is also considered as inhibitor in achieving higher track densities. Ball bearing motors produce larger NRRO due to the mechanical contact with the inherent defects found in the geometry of the race ball interface and the layer of the lubricant film. Ball bearing spindle motors have minimized this issue with tighter tolerances and closer inspections. There is an upper limit at which the ball bearing design can no longer overcome the NRRO problem at the higher areal densities.

By contrast, FDB generates less NRRO due to the higher viscosity of lubrication oil between the sleeve and stator. Other inherent properties of the FDB design are higher damping, better non-operational shock resistance, greater speed control, and improved acoustics.

In addition, FDB spindle motors provide additional shock resistance beyond that of ball bearing spindle motors. A contributing factor is the additional surface area inherent in the FDB design. There is more conforming surface contact through the lubricant as compared to the ball bearings and raceway surface contact of the ball bearing design.

Illustrated below are two drawings depicting a FDB design and ball bearing design used in HDD.



In order to meet demands for design *via* light weight and good performance of computers, the size of hard disk drive is reduced from 3.5 inch to 2.5 inch, and thus the FDB spindle motors must also be reduced in their size. In this matter, currently available lubricant for FDB spindle motors in 3.5 inch HDD gives high torque and unstable starting problem (torque start-up problem) when applied for FDB spindle motors of 2.5 inch HDD.

Currently, only a few reports mention about the base oils which have been used in FDB spindle motor. Schmid, et al [1] reported a low-viscosity lubricant composition which is stable at high and low temperatures conditions. The lubricant contains an ester oil which is the esterification product of an aliphatic dicarboxylic acid having 8 or 9 carbon atoms and a branched alcohol having from 12 to 20 carbon atoms.

Objectives

The objective of this research is to develop a low viscosity lubricant for fluid dynamic bearing (FDB) that can be used in 2.5 inch HDD.

Scope of the research

In initial work, the characteristic of base oils that could effect the potential usage of lubricant in fluid dynamic bearing for 2.5 inch HDD will be studied. Then, a preparation of base oil samples and properties assessment will be performed. Finally, finished lubricants will be prepared and their properties will be assessed and optimized.