Timothy Lyne

Friction-Reducing Ferromagnetic Fluid

This project explored possibilities of using ferromagnetic fluid and neodymium magnets as low-friction bearings. Ferrofluid surrounding a magnet virtually eliminates friction. The goal was to engineer a bearing using this observation that could outperform the efficiency of commercially available thrust bearings. Field research was conducted to identify various vertical motor assemblies at Pawnee Power Plant. A vertical motor was designed, modeled, and constructed to represent a basic assembly from the motors observed.

Each bearing was tested in this motor assembly. The voltage of a power supply was adjusted to drive the shaft of the constructed assembly at 450 RPM, a common vertical motor speed. Using collected data, the power, in watts, was calculated and compared. An average power of 1.62 Watts was required to operate the ferrofluid bearing which was an improvement from the roller thrust bearing (3.08 W) and comparable to the radial roller thrust bearing (1.37 W). It was observed that the ferrofluid bearing produced the least amount of heat after each trial. It also ran at the most constant speed. The results proved that ferrofluid bearings are a feasible alternative to traditional roller thrust bearings.

The enhanced efficiency of the ferrofluid bearing results largely from the hydrodynamic characteristics of the ferrofluid in addition to reduced vibrations in the system. Ferromagnetic bearings may be used by industries to minimize cost and decrease energy usage reducing pollution in the environment. The concepts gained in this project can be used for systems in energy production, transportation, and other industrial machines.