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Experimental Evaluation of Performance Parameters of Journal Bearing Operating in Boundary/ Mixed Lubrication Regimes

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Abstract: The journal bearing is used to support the shaft. Hence it is necessary to evaluate the performance of journal bearing operating under the boundary or mixed lubrication regimes in boundary or mixed lubrication regimes as there is direct contact in boundary regime while it is partial contact in mixed lubrication regimes. As wear is considerably more in boundary or mixed lubrication regimes hence it is necessary to measure the wear experimentally. These performance parameters to be evaluated by using the experimental set-up to study the influence of various parameters such as Temperature, frictional torque, coefficient of friction of the journal bearing.

Keywords: Journal Bearing, Boundary, Mixed Regimes.

I. INTRODUCTION

The main application of the journal bearing is to support the shaft and these bearings are commonly used in various industrial applications. Journal bearing operating parameters mainly focussing on the Lubricationregime in which the bearing is lubricated,Viscosity of the lubricant, loading conditions for industrial applications. These parameters are useful to study and evaluate the performance of the journal bearing operating in boundary or mixed lubrication regimes.Generally journal bearing is operating under three lubrication regimes such as boundary, mixed, and hydrodynamic lubrication regimes. These three lubrication regimes are studied using the Stribecks curve. In boundary lubrication regime there is direct metal to metal contact while in case of mixed lubrication regime there is partial contact between shaft and bearing hence wear is considerably high in these two regimes and in hydrodynamic lubrication regime shaft and bearing is fully separated by the lubricating oil hence wear is considerably less. Hence it is necessary to evaluate the performance of the bearing operating under boundary or mixed lubrication regimes and these performance parameters are temperature profile, frictional torque, coefficient of friction and wear of the bearing. These parameters to be evaluated by using the Experimental test set up.

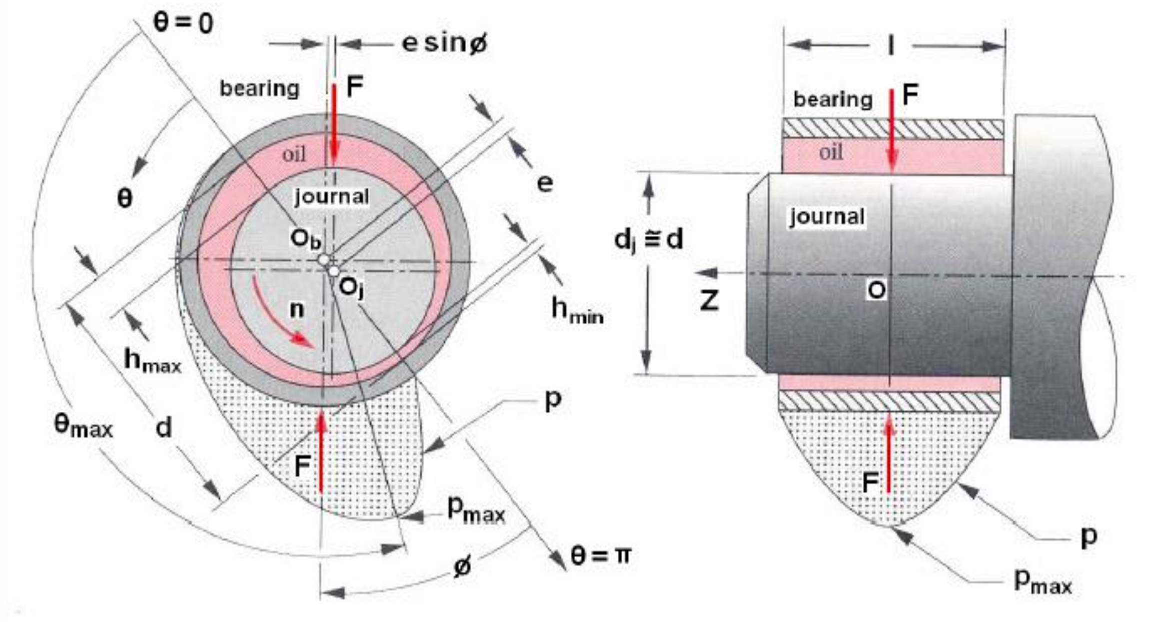

Fig. 1 Journal Bearing

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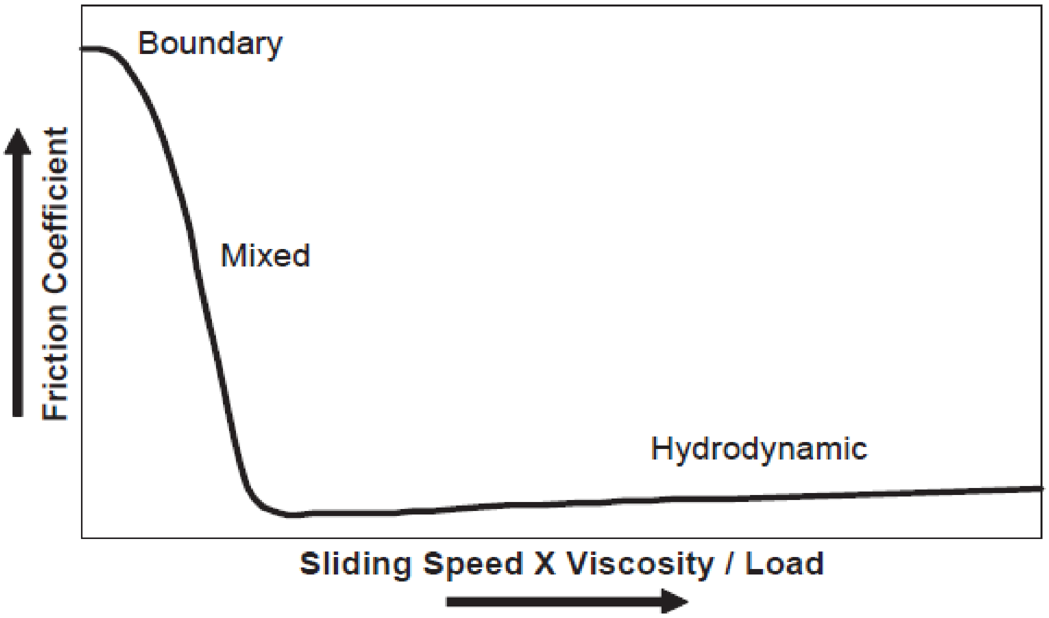

Fig. 2 Stribeck Curve

II. EXPERIMENTAL SET UP

Journal bearing is to be tested by using the journal bearing test rig, in which bearing is made up of gun metal while the shaft is made up from the mild steel. This bearing is to be tested on test rig using lubricant SM120. The variable frequency drive is provided to adjust the speed of shaft and to measure the voltage and current of the DC motor. This motor shaft is connected to the journal using coupling and bearing is mounted on the journal using gaskets and side plate to avoid the leakages. Ball bearing is provided to support the journal bearing assembly. Five Temperature sensors are provided on the upper and lower half of the bearing at 45 degree to measure the temperature.

Fig. 3 Journal Bearing Test Rig

The journal bearing test specimen was made up by using gun metal in which length to diameter ratio was kept 1 that is length 60mm and diameter of the bearing is also 60mm. This bearing is to be tested under the specified operating conditions for the 8 hours. For load 40kg and speed 100 rpm obtained.

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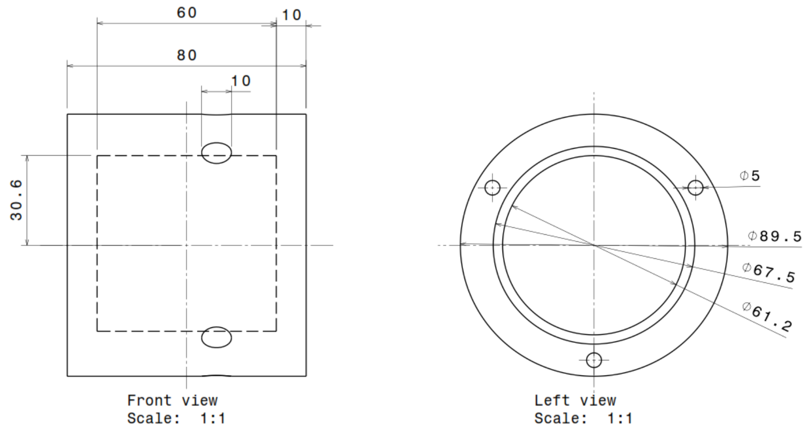

Fig. 4 Journal Bearing Drawing

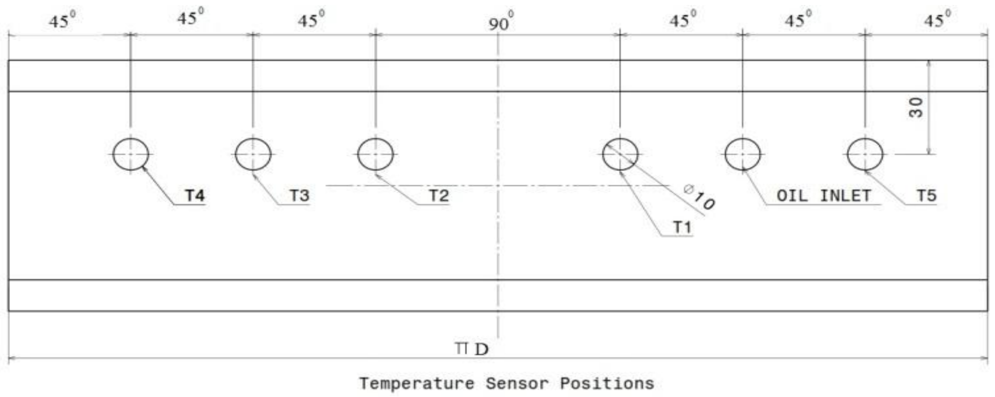

Fig. 5 Temperature Sensors Position on Bearing

Fig.6 Journal Bearing Test Specimen

III. RESULT AND DISCUSSION

After testing the bearing for 08 hours temperature is to be measured at five different locations on the bearing and current is to be measured using VFD with an interval of 30 minutes. These readings are measured for five different loading conditions according to the operating conditions obtained.

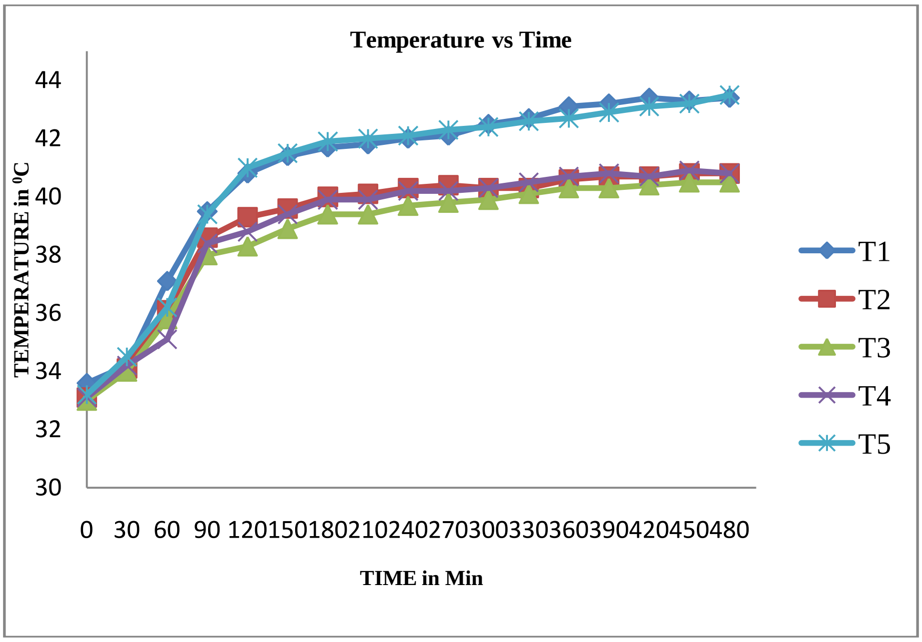

Fig.7 Temperature vs. Time

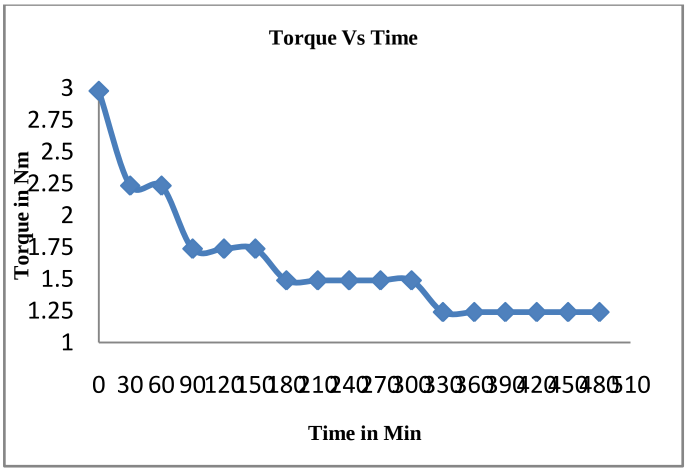

Fig.8 Torque vs. Time

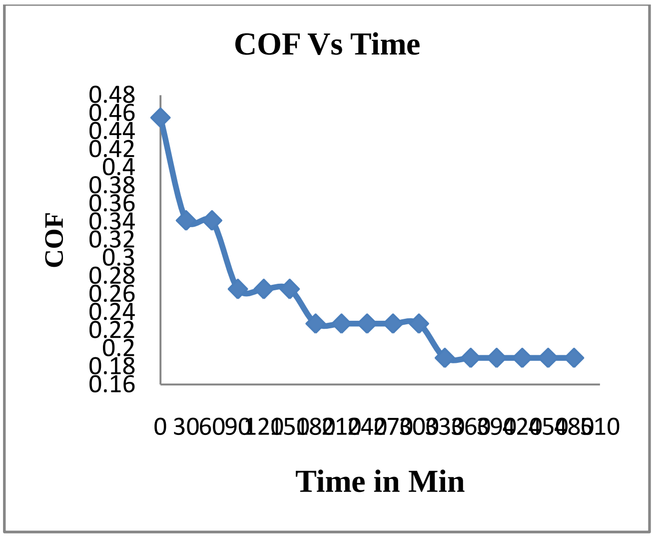

Fig.9Coefficient of friction vs. Time

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IV. CONCLUSION

Bearing is to be tested for evaluation of performance parameters such as temperature, coefficient of friction and frictional torque verses time. Here temperature goes on increasing with respect to time and frictional torque and coefficient of friction goes on decreasing and then it becomes constant after 4-5 hours. Thermal characteristics for journal bearing have been measured experimentally. It has been concluded that the thermal behaviour of journal bearing is affected significantly by rotational speed at constant load and type of oil used.Coefficient of friction and frictional torque of the bearing shows that it is more at starting and then it decreases but after running the bearing as per operating conditions after 04 hours it remains constant. This may be due to the rise in temperature of lubricating oil which decreases the viscosity and coefficient of friction. As load increases coefficient of friction also increases.

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