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Root Cause Analysis on Failure of Bearing

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Abstract: ***The highly dynamic nature of the loads imposed by the rotating motion of a roller in industry. Makes the machine highly susceptible to fretting fatigue problems. Fretting is a phenomenon that occurs at the contacts of surfaces that are subjected to oscillatory relative movement of small amplitudes. Depending on service conditions, fretting may significantly reduce the service life of a component due to fretting fatigue.we have implement root cause analysis method to predict the potential for fretting damage between the roller and the inner raceway of the bearing.***
Keywords: Bearing Failure, Fretting Fatigue Failure, Improper Sealing, Misalignment, Root cause analysis, Lubrication

I. INTRODUTION

As root cause analysis is a powerful tool for solving majority of problem in industry with less capital investment. We have selected this concept for our case company. The company is manufacturing verity of synthetic fibres like polyester filament yarns and fibres according to the goal set by the management and currently facing with the problems like bearing failure, Maintenance Scheduling and leakages in processing line. We selected the 5 why's techniques used in the analysed phase of six sigma DMAIC (Define, Measure, Analysed, Improve, Control) methodology to remove the losses in the productivity and time saving suggestion for the same.

II. LITERATURE REVIEW

T. A. Harris (2011) stated that an analytical method is presented to determine the effect of misalignment on the performance of cylindrical roller bearings having crowned rolling members. This method utilizes a more representative load-contact deflection relationship than used in previous analyses, and further, can be employed to estimate the degree of crowning required for a given application. H lyons (2009) Proved that Dynamic excitations in machines and structures may lead to a form of wear caused by the phenomenon of fretting, which may cause premature mechanical or structural failure. Fretting-wear has been evaluated under a variety of conditions, and a linear prediction model is compared to experimental results with good agreement.
R.K. Upadhyay , L.A. Kumaraswamidhas, Md.Sikandar Azam (2013) Addresses Rolling Contact Fatigue (RCF) occurs due to the result of cyclic stress developed during operation and mechanism that involve in fretting failure of rolling element bearing. As bearing raceways of non-rotating rolling element bearings exposed to vibration or sliding oscillation false Brinelling occurs. Bearing surface due to false Brinelling tends to damage within a short period, due to cavities created on the bearing raceway. Recommendation towards enhancement of bearing life is also suggested. Hans Pittroff (2011) suggested that if nonrotating rolling bearings are exposed to vibration then the raceways especially in roller bearings can be damaged in a short time. False brinelling in bearings is caused by fretting corrosion. All research in this area therefore belongs to the field of fretting corrosion. Owing to the alternating elastic deformation in the contact area between the rolling elements and the raceway as well as to the shearing strength being exceeded in the micro contact area, surface particles are abraded, which become immediately oxidized.

III. IMPLEMENTATION

A. Flow Process

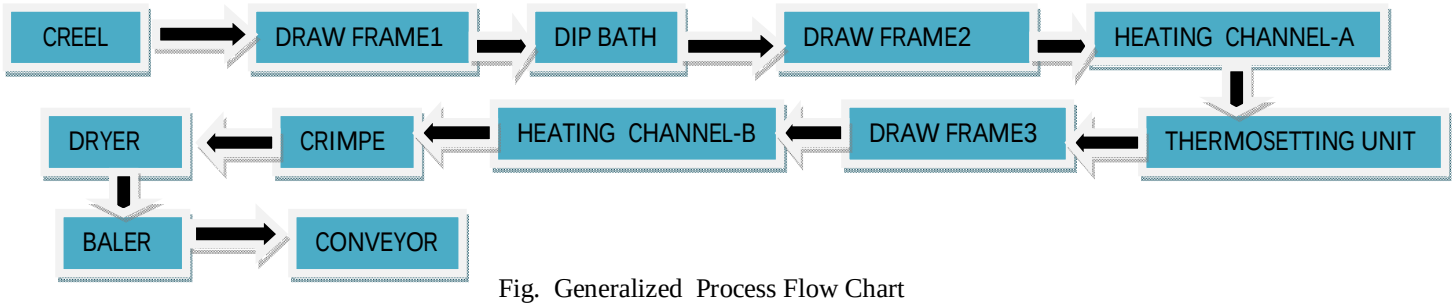

Fig. Generalized Process Flow Chart

B. Problem Identification

1) Bearing Failure

a) Improper Lubrication.
b) Miss-alignment in Bearing Mounting.
c) Fretting Fatigue Failure.
d) Improper Sealing.

C. Identification of 5 why's

While applying the root cause analysis tool in our study we primarily focused on identification of bearing failure causes which affect the productivity of the process. Repetitive bearing failure occurs in the process, unexpected bearing failure may force companies to pay for repairing and replacing the bearing and adjacent components, which may also sustain damage, such as housing and shaft. Bearing failure reduces a plant operating efficiency, increasing down timing, may injured the worker.

1) Why?

a) *Fretting Corrosion Failure:* Fretting is special wear process that occurs at the contact area between two material under the load and subject to minute relative motion by vibration and other force. When the bearing inner race, outer race and roller pressed together by external static load, for example bearing on shaft are subjected to transverse cyclic loading, so that one contacting face is relatively displaced cyclically parallel to the other face, in the presence of high contact stress, wear on the wear surface occurs. If the magnitude of the displacement is less than about 0.003 inches, the wear is termed "fretting".

2) Why?

a) *Improper Lubrication:* Improper lubrication is the measure cause of bearing failure. Issue include: too much lubricant; too little lubricant; using wrong lubricant, mixing incompatible lubricant, incorrect lubrication intervals using old, deteriorated grease or oil and water contamination.

3) Why?

a) Miss-Alignment in Bearing Mounting: Misalignment is a frequent cause of rolling bearing failure it can cause cage fracture, which will result in seizure of the bearing.it can also cause edge loading which will result in early bearing failure .Typical bearing-life calculation tool assume a general acceptable alignment is better than 0.0012 radian (4 arc minutes) per roller bearing.

b) Sources of misalignment

i) Nonconcentric housing bores.
ii) Non-perpendicular shoulders on mating components.
iii) Bent shafting.
iv) Errors during installation.
v) Baseplate irregularities.
vi) Non-flat mounting surface.
vii) Insufficient rigidity of the mounting surface.

4) Why?

a) *Improper Sealing:* When a seal leaks the most common causes is a worn or scored shaft, most often the result of abrasion caused by contamination. The shaft should be replaced or repair to prevent seal damage. If the seal is main function is to exclude foreign matter, the seal lip should face toward the dirt instead of the bearing.

5) Why?

a) *Electrical Damage:* When electric current passes through a bearing. There is arcing and burning at the points between the races and the rolling elements where the current jumps the air gap. Pitting or cratering of a bearing is caused by relatively large charge of electricity. A line of small burns along the line of contact of the rolling element is caused by a low current constantly passing through the bearing. This fluting or grooving is formed on all parts as the current continues to pass through the bearing, and the contact point change as the bearing rotates. The steel melts in the affected zone. Electrical damage will cause early spalling and results in a noisy bearing which will have to be replaced.

D. Solution On Various Problems

1) Solution For Fretting Corrosion Failure: In the industry we observe that most of the Bearing Fail due to Fretting corrosion Failure, In order Prevent Fretting in Bearing It is necessary to provide Continuous flow of Lubricant, if the surface can separated by lubricant , fretting of bearing cannot be occur. It also recommended that increase the hardness of the element as much as possible.

2) Solution For Improper Lubrication Failure: We studied on failure due to lubrication for roller bearing at high speed, load capacity and friction for non-Newtonian lubricant almost equal to those of Newtonian lubricant which has the same amount of viscosity as the plastic viscosity of 000- Newtonian lubricant. Under unsteady load condition, the effect of squeeze film is remarkable. Then, the load capacity tends to increase, while the variation of friction with its average value is nearly equal to that under the constant basic load which is the average value of vibrating load.

3) Solution For Misalignment Failure: In industry we observe that the measuring instrument for clearance between shaft and bearing are not having required accuracy level , value given by instrument not in proper range so we recommended that use modern instrument for measurement.

IV. CONCLUSION

As root cause analysis technique is one of the best tools for improvement and making correction in industries with less investment, We use this approach in order the solve the problem of the industry. The suggested solution is been given to the Management of the case company and they are quite satisfied with the same.

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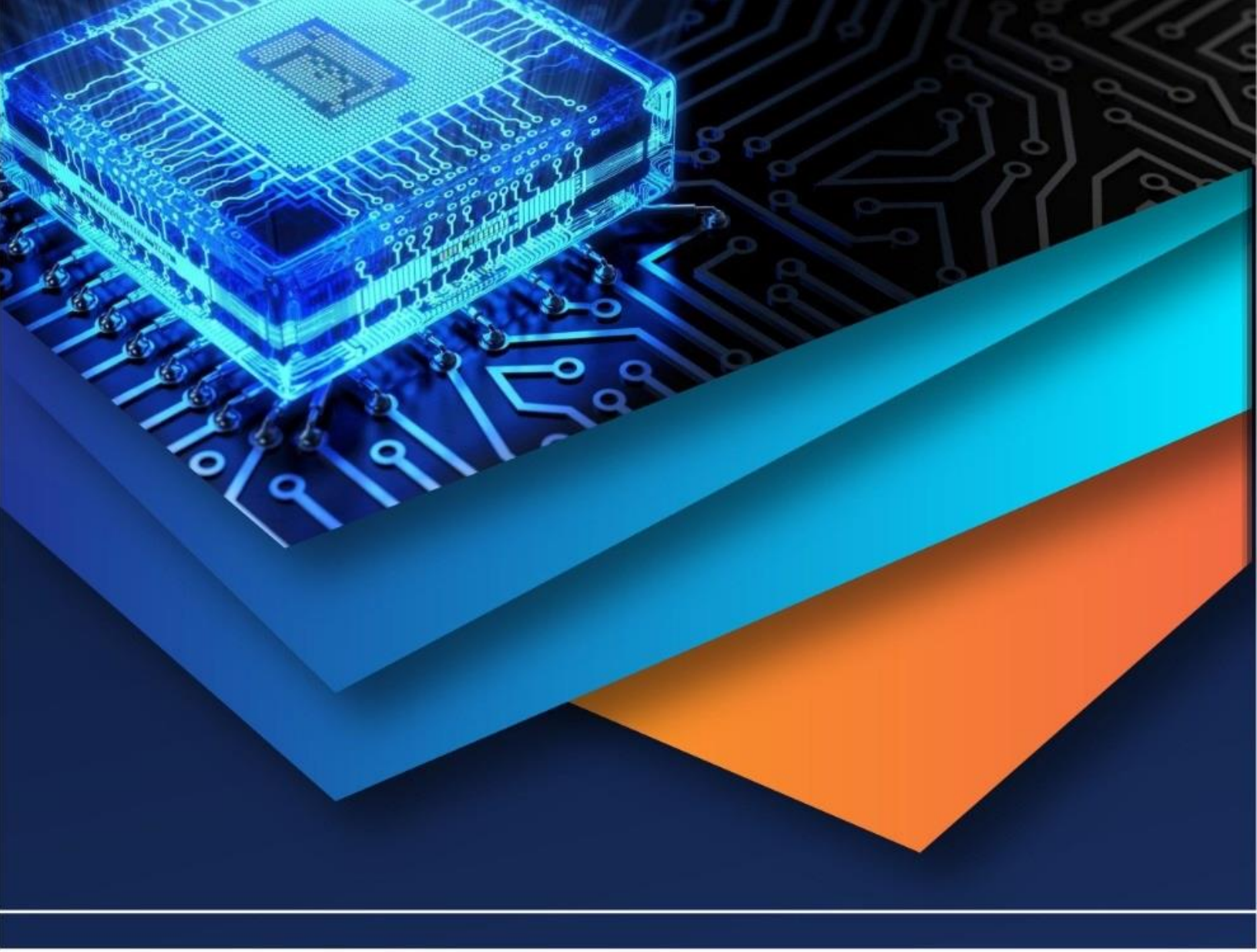

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