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Analysis of Flat Belt Conveyor Shaft Failure

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Abstract:*The shafts which are used for transmission of power or torque between two moving elements of machines which are used in different applications in our industries and day to day life, to give an overview on the various possible types of failures of shafts and identifying reason of their failures. For this purpose some papers on failure of shafts have been reviewed in which mechanical properties, material structure, design and various methods of stress analysis have been considered as the primary parameters for their study.*
The objective of present work is to study various methodologies used for the shaft failure analysis and to choose best methodology which are suitable for the failure analysis of shaft used in conveyor belt for material handling.
Keywords: *conveyor shafts, finite element analysis, failure analysis, fatigue testing.*

I. Introduction

A shaft is a rotating member usually of circular cross-section (solid or hollow), which is used to transmit power and rotational motion in machinery and mechanical equipment in various applications. Most shafts are subjected to fluctuating loads of combined bending or torsion with various degrees of stress concentration. For such shafts the problems are fundamentally fatigue loading. Failures of such components and structures have engaged scientists and engineers extensively in an attempt to find their maincauses and thereby offer methods to prevent such failures

Material handling is a vital component of any manufacturing and distribution system and the material handling industries areaccordingly active, dynamic and competitive. Overhead belt conveyor is used for material handling purpose and hence it is very useful for any industry

1. Problem Statement:-

- To identify the failure of flat belt conveyor shaft and the stresses generated on the shaft.

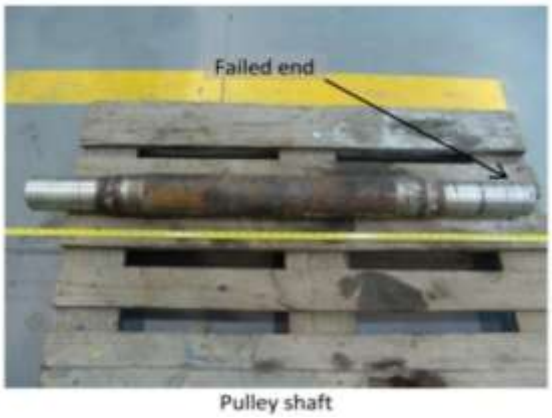
II. Background of failure analysis

Failure analysis is the process of collecting and analyzing data to determine the cause of a failure and how to prevent it from failing. It is a important factor in many branches of manufacturing industry. Such as the electronics industries where background of failure analysis is a vital tool used in the development of new products and for the improvement of existing products. However, it also applied to other fields such as business management and military strategy. Failure analysis and prevention are very important functions to all of the engineering field. The material engineers often plays a important role in the analysis of failures, whether a component or good fails in service or if failure occurs in manufacturing or during production processing. In any case, engineer must determine the cause of failure to prevent future failure or to improve the performance of the device, component or structure.

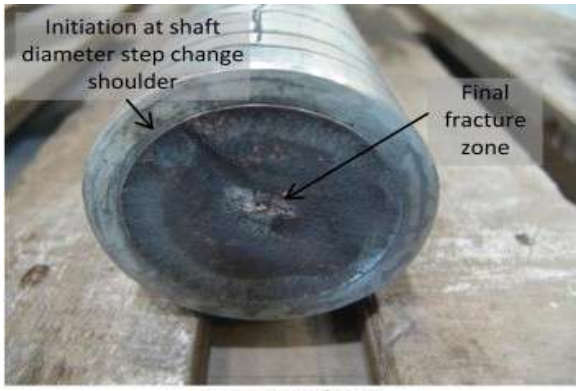
Failure analysis can have three broad objectives.
1. Determining modes
2. Failure Cause
3. Root causes.

Failure mode can be determined at field or in the laboratory, using methods such as fractography, metallographic and mechanical testing. Failure cause can be determined from laboratory studies and knowledge of the components and its loading and its environment. Comparative sampling or testing of the failure component in the laboratory may be necessary to determine the cause. Main causes of failure cause is determined using knowledge of the mode, the cause and the particular process or system. Determining the main reason of failure requires complete information about the equipment's design, operation, maintenance, history

and environment. A traditional failure analysis might include fractography, metallographic and chemical analysis.



Pulley shaft



Fracture surface B

III. Causes and Analysis of Shaft failure

Causes of failure Austin H. Bonnett, discuss the causes of shaft failures. XU Yanhui says that shaft damaged can be induced by sub synchronous resonance(SSR). J.feller fatigue loading on wind turbine drive trains due to the fluctuating nature of wind is major cause of premature failure of gearboxes. The shaft fail due to fatigue, which arises due to following reasons:-

a. Presence of cyclic over-loads

b. Stress concentration. They may be due to production or operation causes e.g. under cuts, machining, traces, knotches, etc.

c.Wrong adjustment of bearing, insufficient clearances.

In corrosion failures, the stress is the environment and there action it has on the shaft material. At the core of this problem isan electrochemical reaction that weakens the shaft. Eccentric Shaft is widely known for its features like corrosion resistanance, long service, effective performance and reliability. Corrosion is a process that occurs when oxygen, water, acids and salts mix together. The temperature must be above 0˚C, when the relative humidity is below 40% almost no corrosion from 40-60% (relative humidity) significant corrosion is to be expected. The redox (reduction-oxidation-reaction) is a chemical reaction. Thus happens when one electron is transferred to the other. In such an electron transfer reaction the electron cuts (oxidation) through a material on an electron uptake (reduction). Many structural alloys corrode merely from exposure to moisture in air [3] but the process can be strongly affected by exposureto certain substances. Corrosion can be concentrated locally at a particular point to form a pit or crack or it can extend across a wide area more or less uniformly corroding the surfaceof componant. Because corrosion is a diffusion-controlled process it occurs on a surface which is exposed to atmosphere. As a result, methods to reduce the activity of the exposed surface such as passivation and chromate conversion can increase a material's corrosion resistance. However, some corrosion processes are less visible and less predictable. Many times corrosion will act simultaneously with fatigue loading to cause a shaft failure. According to Osgood all machine and structural designs have problems in fatigue. Failure of an elevator shaft due torsion-bending fatigue was given in. Overload failures are caused by forces that exceed the allowable limit of yield strength or the tensile strength of a material. The cause of an overload failure depends on whether the shaft material is brittle or ductile.

IV. Finite Element Analysis Of shaft

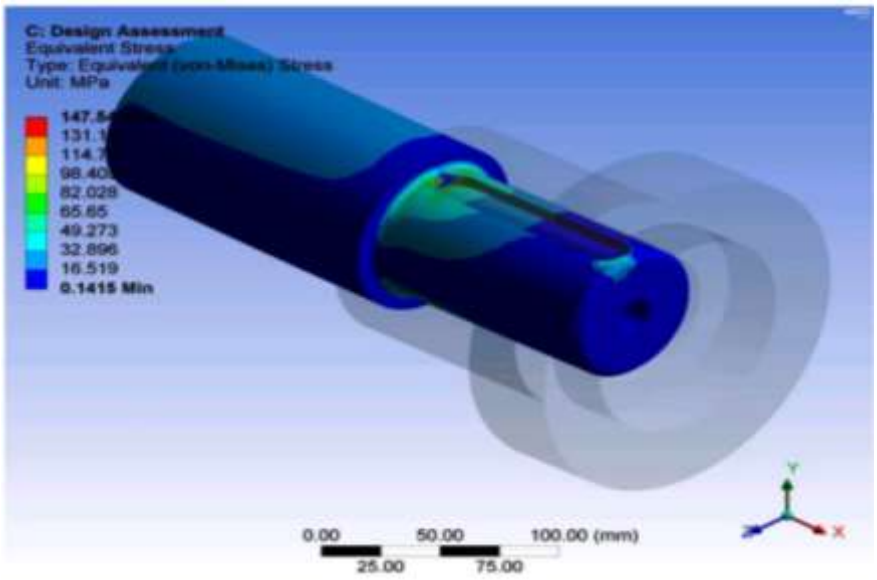


Fig. FEA Analysis of Shaft

V. Conclusion

The various failure analysis of shafts which are mentioned above do not follow any specific approach. To analysis the root cause of failure it essential to follow various examinations and comparing the results. A mechanical shaft may fail due to various reasons such as improper engineering design, chemical composition, negligence in operations and maintenance, welding repairing works. To overcome the above disadvantages precautions should be taken. failure analysis of the heavy nip roller shaft is to done by following methodology

1. Visual inspection of the failed component
2. Metallographic inspection of failed specimen.
3. Analyzing stress concentration at major step down.
4. Finite element analysis of roller shaft using ANSYS software.

References

[1]. Devendra Kumar, R.K. Mandloi "Analysis & Prospects ofModification in Belt Conveyors - A Review" IJERA Vol. 3,Issue 1, January -February 2013, pp.581-587.

[2]. VINOD M. BANSODE, ABHAY A. UTPAT "Fatigue Life Prediction of A Butt Weld Joint In A Drum Pulley Assembly Using Non-Linear Static Structural Analysis" Dept. of Mechanical Engineering, College of Engineering, Pandharpur,India.

[3]. X. Oscar fenn Daniel, A. Hussain lal "Stress Analysis in Pulleyof Stacker-Reclaimer by Using Fem Vs Analytical"Department of Mechanical Engineering, JJ College ofEngineering and Technology, Tiruchirappalli. IOSR Journalof Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN:2278-1684, p-ISSN: 2320-334X PP 52-59.

[4]. Gys van Zyl, Abdulmohsin Al-Sahli "Failure analysis ofconveyor pulley shaft" Materials and Corrosion Section,SABIC T&I, Jubail, Saudi Arabia ,Received in revised form 27 APRIL 2013.

[5]. Vinit Sethi and Lawrence K. Nordell "Modern Pulley DesignTechniques and Failure Analysis Methods" conveyorDynamics, Inc.1111 West Holly Street Bellingham, WA98225.

[6]. Terry King Pr. Eng "Belt Conveyor Pulley Design - Why theFailures?" B.Sc Mech. Engineering (Hons.) Design Engineerto the Bosworth Group of Companies.

[7]. Leo J. Laughlin "A comparison of turbine pulley design philosophies historicalperspective" Product Marketing Manager, Precision Pulley & Idler 300 SE 14TH St.Pella, IA 50219

[8]. I.G.Mulani "Engineering science and application design for belt conveyors" Formerly Head of Project Engg.Dept.Krupp – India.

[9]. S.P.Dash and M.C.Pal "Stresses and deformations of a conveyor power pulley shell under exponential belt tensions" Department of Mathematics, Regional Engineering College, Durgapur 713 209, west Bengal, India.

[10]. N. Siva Prasad and Radha Sharma "A finite element analysis for the design of a conveyor pulley shell" Department of Mechanical Engineering, Indian Institute of Technology, Madras 600 036, India.

[11]. Ch. Affolter G. Piskoty, R. Koller, M. Zgraggen, T.F. Rutti "Fatigue in the shell of a conveyor drum" EMPA, Swiss Federal Laboratories for Materials Testing and Research, Ueberlandstrasse 129, CH-8600 Duebendorf, Switzerland.