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Causes of Coupling Failures and Preventive Actions

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Abstract— Couplings are critical parts of any transmission system, providing the smooth transmission of power from drive to driven equipment. If properly designed, selected and maintained, the coupling can last long and give satisfactory service on drive and driven equipment. In this Paper some factors are discussed due to which flexible coupling failures takes place. Corrective actions over the coupling failure are also stated so that coupling can last for long time.
Keywords— Coupling failures, Coupling bolts, Flexible coupling, misalignment.

I. INTRODUCTION

Coupling is a power transmission device which transmits mechanical power from driver to driven equipment. Coupling transmits power, accommodates misalignment, compensates end float, vibration dampens, gives overload protection, insulates driver – driven units and tune a system out of a torsional critical mode. A flexible coupling subjected to torque, misalignment and speed reacts on the connected equipment. These reactions not only affect the life of the coupling but the life of the equipment as well. Due to some factors the life of flexible coupling is limited but if proper care taken these failures can be lowered down with proper cure. Following it is discussed.

II. CAUSES OF COUPLING FAILURES

The useful life of flexible coupling is limited due to following factors: A. Human Errors, B. Corrosion, C. Wear, D. Fatigue, E. Hardware failure and F. Shaft failure. Investigating the causes of coupling failure and to eliminate them is important.

A. Human Errors

Human errors relating to coupling failures are inevitable. They can be divided into: Improper selection, improper manufacturing, incorrect installations and lack of Periodic Maintenance [3].

1) Improper Selection: Many coupling failures happen because of incorrect type and size of coupling that cannot accommodate the requirement of the application as shown in Fig.1. Coupling manufacturers can guide in the selection of the best coupling for an application. An oversized coupling is specified with the hope that it will last longer as shown in.

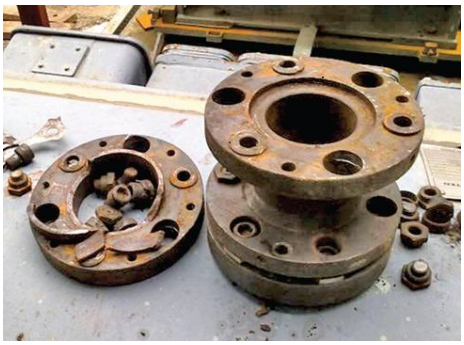

Fig. 1.Improper selection.

However, this may not be true, as it will increase the radial loads on the shafts if misalignment exists. If the load transmitted is too low, the oversized coupling may actually wear out much faster. When oversized coupling is selected due to shaft sizes, care must be taken to align the coupling more accurately than usual. Coupling failures that are caused by improper selection are usually very

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costly.

2) Improper Manufacturing: It is not only important to design & select proper coupling; but it should also be properly manufactured, installed and maintained to get satisfactory performance. Finish bore and key way with appropriate tolerances as per various international standards also needs to be maintained. Concentricity of finish bore with respect to power transmitting part is very important.

3) Incorrect Installation: There are many reasons why incorrect installation results in coupling failure, the most frequent being improper tightening of bolts, use of low quality bolts, keys made of soft steels, incorrect hub spacing, incorrect hub installation, guards that are too close to elastomeric elements, improper coupling sealing etc. It has been observed that lack of Installation and alignment procedure results in improper installation. As shown here in Fig.4 the horizontal coupling is used vertically so due to incorrect installation failure takes place. Also due to excessive interference fit cracks appears on the coupling.

4) Lack of Periodic Maintenance: Coupling maintenance is generally a simple matter. It requires a regular scheduled inspection of each coupling. The inspection can include: Performing visual inspection, checking for abnormal operating characteristics such as unusual noise, excessive component temperature, vibrations, and signs of wear or fatigue [2]. Checking and changing lubricant if the coupling is lubricated. This maintenance is required at regular interval say twice in a year for most couplings and more frequently for couplings operating in adverse environments or in demanding operating conditions. Documenting the maintenance performed on each coupling, along with the date. With today's optimized equipments, alignment is a vital part in the daily maintenance work. The costliest failures are those where maintenance is not performed even when alarms are triggered by high vibrations, temperatures, or high noise. Overfilling of grease should be avoided, as it locks the movement of hubs.

B. Corrosion Induced Failures

Corrosion affects every type of couplings: Salt, chlorides, hydrogen among others corrode ferrous components. Aluminium is corroded by alkali and salt. Rubber elements are affected by some hydraulic oils and by ozone. There are applications which suffer from corrosion namely: Air born corrosion: Flexible couplings create air movement through and around them. Air / gases / steam / hydrogen gas enters into a coupling above the shaft key depending on the environment in which the coupling is running, corrosion takes place. Just as air or corrosive gases can enter into a coupling over the key, so can water. Oil borne corrosive elements are normally found in oil lubricated gear couplings, corrosive agents carried into couplings by oil.

C. Failures Caused By Wear

Abrasive wear can occur in all couplings that accommodate misalignment through sliding. Wear particles mix with the remaining lubricant, creating an abrasive lubricant. If couplings are not periodically cleaned of the contaminated lubricant, the wear rate becomes higher and higher, and coupling teeth can become so thin that they fail in bending [6].

D. Fatigue Failure

All types of couplings suffer from fatigue failures. Fatigue is the type of failure that occurs gradually. Fatigue failure of metallic disc coupling is very different than the gear coupling, and most often the failures of metallic discs occur without any kind of warning. Once the stresses in a flexible disc exceed the endurance limits, failure occurs within a short period without alarm of failure [1].

E. Hardware Failure

Coupling bolts main function is to clamp together various components. Failures of coupling bolts occur exclusively in fatigue, which in turn occurs whenever bolts are not properly tightened. Bolts can fail if the holes in the coupling flanges are not equally spaced as shown in Fig. 8. Bolts can also fail if they have the wrong geometry, or too weak material.

Fig. 8.Incorrect Selection / Incorrect Installation

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F. Shaft Failures

Machine shaft failures can be caused by couplings in an application that had a relatively large offset between shafts. Loosely fitted hub on the shaft generates cyclic forces in the shaft. Another reason of the higher stress is improper surface finish of the parts coming in contact with each other. When power transmission equipment fails, user often blames the coupling rather than looking for the real causes [7]. If more time is spent on selecting the coupling with proper analysis to suit the power transmitting train, it will result in fewer failures. The majority of the problems described are caused by vibrations, and the phenomena of vibration are as complex as they are misunderstood. Misalignment is the principle source of most vibrations [4].

III.MISALLINGMENT DATA

Excessive misalignment is the killer of flexible couplings. Any rotating equipment works well when it is well aligned and the coupling's misalignment characteristics act as a fall back when something goes wrong. Better initial alignment of the coupling enhances its survival chance and that of the driving and driven equipment [5].

A. How To Recognize Misalignment

There are several symptoms indicating misalignment. By keeping eye on them, one can find the fault without any special instruments. These include:

Premature bearing, seal, shaft and coupling failure.

Excessive radial and axial vibrations.

High casing temperature at or near the bearings or high temperature discharge oil.

Excessive amount of oil leakage at the bearing seal.

Loose foundation bolts.

Loose or broken coupling bolts.

The coupling is hot while it is running and immediately after the unit is shut down. Look for rubber powder inside the coupling shroud.

Excessive amount of grease on the inside of coupling guard.

The shafts are breaking (or cracking) at or close to the inboard bearings or coupling hubs [5].

B. Few Failure Modes And Fault Diagnosis

TABLE I
FAILURE MODES AND FAULT DIAGNOSIS

Sr. No.	Failure mode	Probable cause	Corrective action
1	Worn Flexible Element, Shaft Bearing Failure	Excessive shaft Misalignment	Realign coupling
2	Ruptured elastomeric flexible element, Sheared hub, Loose hubs on shaft	Torsional shock, overload	Find and eliminate Cause of overload Use Torsionally soft Coupling
3	Fatigue of elastomeric element, Overheated Flexible element	Torsional vibration Excessive starts and stops High peak to peak Torsional overload	Use larger coupling Add flywheel to hub
4	Swollen or cracked Flexible member Severe hub corrosion	Chemical attack	Use more chemically resistant flexible member and hub. Coat hub with anti Corrosive coating.
5	Distorted or deteriorated Elastomeric element	Excessive heat	Heat resistant flexible member
6	Shattered Flexible Element	Low Temperature	Special low temperature Rubber compound

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IV. CONCLUSIONS

Coupling should be properly selected and maintained so that it will work for a longer time. Preventive action should be carried out so that the failures in the coupling bolt will be lower down. As the failure modes has discussed it will further help to minimise its occurrence. The coupling and coupling bolt should be designed so that the misalignment would be lowered. In the table content the failure modes and fault diagnosis the steps should be followed so that the failures will be reduced.

V. ACKNOWLEDGMENT

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REFERENCES

[1] McGraw hill education publication, Machine tool design handbook, Central machine tool institute, 1985.
[2] Chen Hongxia, Chen Yunxia, Yang Zhou, “Coupling damage and reliability model of low-cycle fatigue and high energy impact based on the local stress–strain approach”, Chinese Journal of Aeronautics, 18 March 2014.
[3] D. Croccolo, M. De Agostinis, N. Vincenzi, “Failure analysis of bolted joints: Effect of friction coefficients in torque–preloading relationship”, Engineering Failure Analysis, 2011.
[4] Fastenal, Technical reference guide, Rev.9, 2005.
[5] Franklin D Jones, Henry H Ryffel, Machinery’s handbook, 27th edition, 2004.
[6] Jon R. Mancuso, “Couplings & joints- design, selection & application”, Marcel Dekkar Inc., second edition, 1999.
[7] Joseph Edward Shigley, Charles R. Mischke, Mechanical Engineering Design, McGraw-Hill Book Company, New York, Sixth Edition, 2000.

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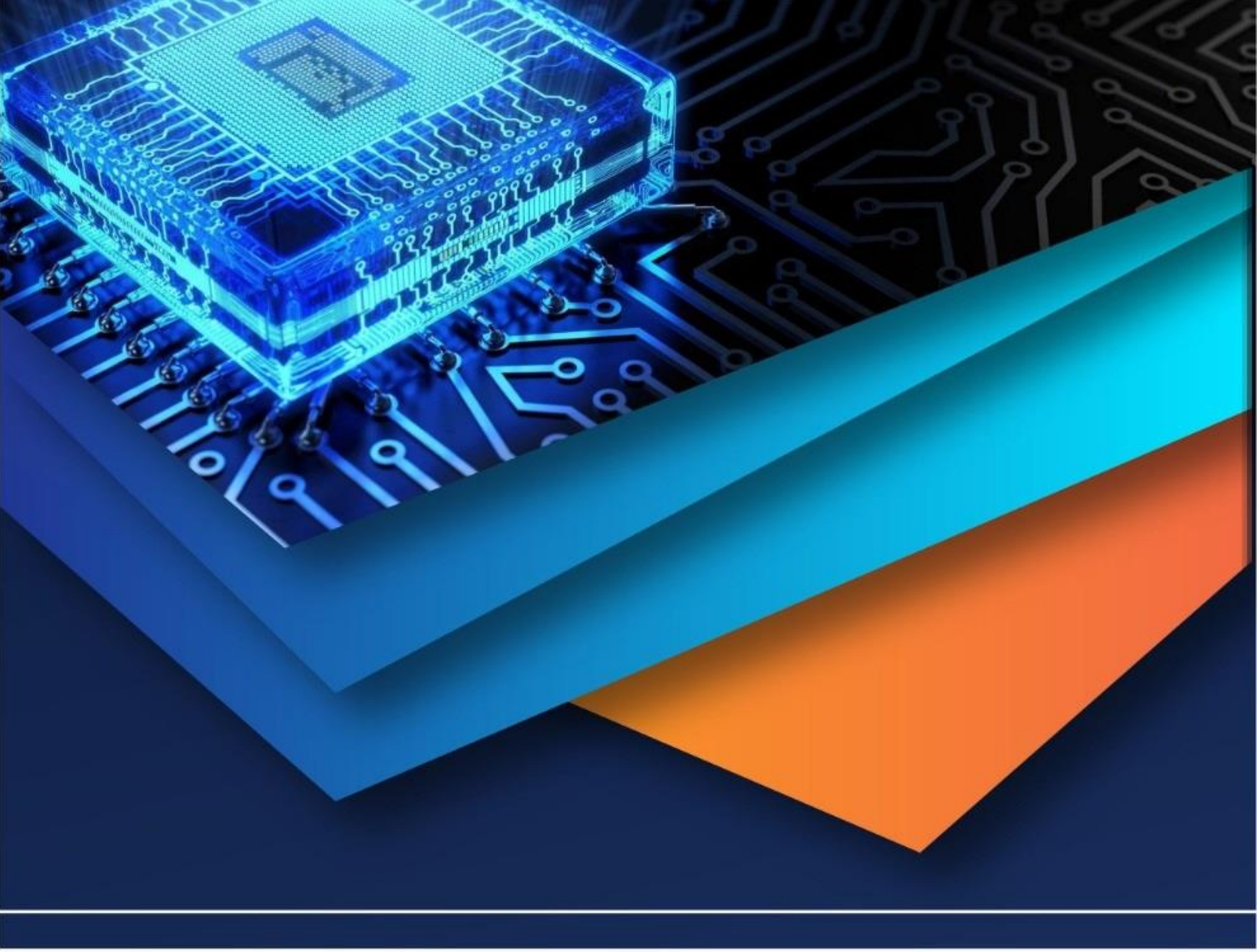

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