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VIBRATIONS ANALISYS OF A MOTOR-COUPLING-PUMP SYSTEM SUBJECTED TO MISALIGNMENT

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ABSTRACT

Proper shaft alignment of rotating machinery is very important part of safety operation. Shaft misalignment through couplings often leads to severe machinery problems [1], such as overload of bearings, high casing temperatures at or near the bearings, excessive amount of oil leakage, higher than normal energy consumption, excessive coupling abrasion. Experimental studies were performed on a test apparatus to determine the relationships between the types of couplings (rigid, flexible and Oldham) and the RMS of vibration velocity.

The experiments were performed on a test apparatus, which are firmly mounted on a steel base plate. During the experiments the pump remained fixed, while the electric motor was adjusted vertical and horizontal directions.

The derived spectra show that unbalance and misalignment can be characterised primarily by one and two times shaft running speed, respectively. However, misalignment effects at times may not be apparent because the forcing frequency of misalignment (two times shaft running speed) is not close enough to one of the system natural frequencies to excite the system appreciably.

On the other hand, if 2 x shaft running speed is at or close to one of the system natural frequencies, the misalignment effect can be amplified and a high frequency density level at 2 x shaft running speed is pronounced in the frequency spectrum.

1. INTRODUCTION

Quite often, more than one problem exists on a piece of rotating machinery, such as a combination of imbalance, misalignment, and damaged bearings that will all appear on the vibration spectrum. The goal of this work is to examine the types of vibration signatures misaligned rotating equipment exhibit and the forcing mechanisms involved to generate this signal. You can be detected by the following symptoms: high, one or two times running speed frequency components, high axial vibration levels, a 180 degree phase shift will occur of couplings. The above symptoms can happen during shaft misalignment, but not always.

2. MATERIALS AND METHODS

The experimental studies took place at Diagnostic Laboratory of SZTE SZÉF. The pump and motor arrangement as shown figure 1 was used to study what effect different kinds of shaft alignment have on the vibration of this equipment. The motor used for the test was a 2.2 kW, 2880 rpm, cast iron construction supported by antifriction bearings.

The pump was a bracket- type centrifugal cold water equipment, the rotor was supported by antifriction bearings. The mounted couplings were flexible types and an Oldham compensating one. Vibration data was taken at five points on each unit using a hand held vibration meter with an accelerometer sensor to record overall readings on the bearings on the bearing houses.

In order to study shaft misalignment effects, the shafts must first be aligned. Then the aligned system is used as a basis for creating the desired misaligned system.

Our measuring tools are the CMVA10 MICROLOG Multi Parameter Monitoring Instrument PRISM^4 for Windows and the FIXTURLASER SHAF50 alignment system [2].

3. CONCLUSIONS

The measured spectra show that unbalance and misalignment can be characterised by 1x and 2x shaft running speed respectively. However, misalignment effects sometimes may not be apparent because the forcing frequency of misalignment (2x shaft running speed) may not be close enough to one of the system natural frequencies to excite the system appreciably. Therefore, in some cases the misalignment is hidden and does not show up in the vibration spectrum. On the other hand, if 2x shaft running speed is at or close to one of the system natural frequencies, the misalignment effect can be amplified, and a high frequency density level at 2x shaft running speed is pronounced in the frequency spectrum. In this case, either shaft alignment is needed or the shaft running speed needs to be changed in order to avoid excessive vibrations.

The importance of a flexible coupling on the system vibration is determined by its influence on the system natural frequencies. Change of the flexible coupling in a misaligned system may shift system natural frequencies.

REFERENCES

[1.] J. Piotrowski 1986 Shaft Alignment Handbook. New York: Marcel Dekker.

[2.] G Simon 1992 Prediction of vibration of large turbo-machinery on elastic foundation due to unbalance and coupling misalignment. Proceedings of the Institution of the Mechanical Engineers 1992.