RISK ASSESSMENT BY STRUCTURAL ANALYSIS AND VIBRATION MEASUREMENT EQUIPMENT OPERATING AT OIL FACILITIES

Lecturer PhD Marius **STAN ,** Petroleum - Gas University of Ploiesti
mstan@upg-ploiesti.ro

Abstract: *Vibration analysis applications in operation is one of the diagnostic methods of operation of the facility. Analysis of these types of failures indicated the existence of specific features prints and related equipment vibration spectra. Modeling and identification of these particular aspects in the spectrum of vibration machines help to control the operation of oil facilities built safely.*

Keywords: analysis, vibration, diagnostic methods, modeling

1. INTRODUCTION

Vibro-diagnosis is one of the applications of fault diagnosis methods using vibration analysis. Analysis of these types of defects indicated the existence of specific features prints and vibration spectra related machinery. Knowing and identifying these particular aspects of machine vibration spectra contributing to the installations safer.
Vibration Diagnosis grew quickly, its application practice proved highly effective, with the development of measurement techniques and signal processing. Vibration Diagnosis is preferred, with rare exceptions, diagnose the noise is too much affected by ambient noise sources, methods and equipment requiring either special or particular conditions of measurement.

Vibrations caused by mechanical weakening the trees are the most dangerous in the whole range of vibrations that are caused by weakening (weakening structural weakening fixing machinery) because they lead to additional demands by shock shaft and bearings. Of these two camps are the components most susceptible to impact and present their demands lead to their rapid deterioration.

2. IDENTIFYING FAULTS BY VIBRATION ANALYSIS

General characteristics of mechanical weakening trees in vibration spectra are the increase in the fundamental frequency acceleration amplitude (frequency of rotation of the shaft) but also of its harmonics. This event is linked to a loss of rotational energy - energy that is the main flow through the tree - the tree of micro-movements in the existing games offered. These trips have very low values, from a few microns to tenths of a millimeter, which makes the vibrations to take shocks as a source due to these trips and not displacement of large masses and implicitly energy transfer as if structural weakness or fixing, vibrations manifesting obvious and velocity spectra.

Therefore the identification of such defects begins with vibration acceleration spectrum analysis FFT (Fast Fourier Transformation). To correct exposure modes of

manifestation of this type of faults to be used spectra of a single machine (an electric motor with an output of 15 kW and speed of 1500 rev / min.). Figure 1. is represented such a spectrum shows how a typical event of any such failure. Event of such a defect has characteristic high amplitude acceleration in the fundamental frequency (in this example the frequency of 25 Hz corresponding to a speed of 1500 rev / min) and its multiples (up to the 13 multiple). Multiple acceleration amplitude 2, 3 and 4 are higher than the fundamental frequency fundamental which locates this type of weight loss in the camp, manifested by clearance between the bearing and the bearing housing.

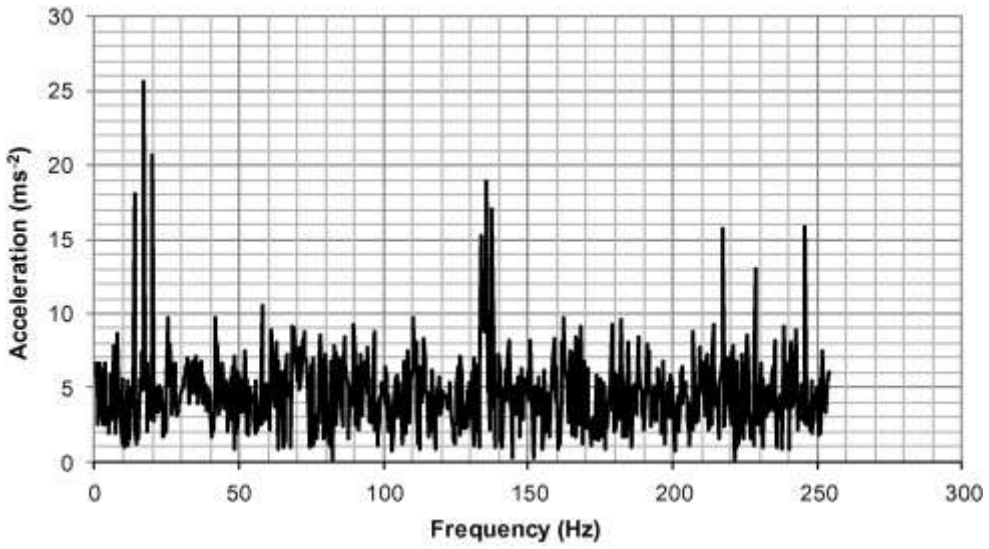


Fig. 1. Sample vibration spectrum (X axis).

3. VIBRATION ANALYSIS OF CENTRIFUGAL PUMPS

The pump is a machine which converts mechanical energy received from a driving source (for example, an electric motor) hydraulic energy. Transport of the liquid by the pump can only be achieved in a hydraulic system. Such a system typically consists of: pipes, fittings, meters and of course the pump, as the main element.

The pumps are classified in two broad categories: centrifugal and positive displacement pumps

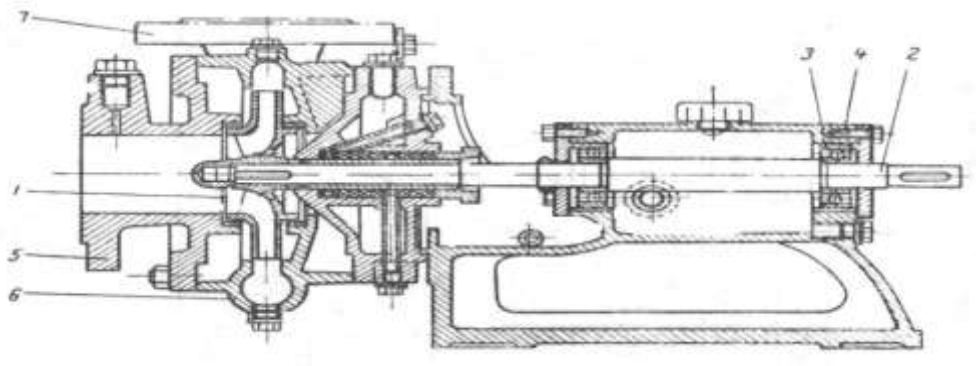


Fig. 2 Construction of centrifugal pumps

Fluid enters the pump through the conduit aspirație1. The rotor 2 is fixed to the arborele3. By turning the rotor is spun on its outskirts water where the water is collected in room 6 and headed to discharge spiral 7 in speaker 5. The water exits through the high-pressure pipe 4 in Figure 2.

Causes wear

Functional parameters of a pump do not keep constant values throughout her life. This is explained by the fact that the parts which comprise pump wear over time. If nature centrifugal pumps wear parts is of two types:

- Mechanical;
- Cleaning.

Whatever the nature of wear, it has the effect of changing geometric shapes of the parts, which are ultimately reflected in the modification of the hydraulic pump functional parameters (flow, pressure, pump head)

Assemblies that wear out frequently

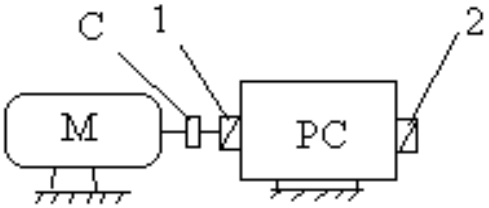
Centrifugal pumps, parts most exposed to wear, both abrasive and corrosive are:

- rotor;
- bearings and measuring point 1,2 ;
- the shaft protection sleeve;
- mechanical seal;
- soft linings;
- camps.

During unit shutdown to perform maintenance stage wear is found and pass the parts replaced. For vibration analysis VIBROTEST we use the data collector device 60 being at the same time balancing tool, Figure 3.

a)

b)



c)

d)

Fig. 3 RMS vibration measuring their various centrifugal pumps

Rules Concerning the correct measurement:

Always on bearings;
Is Measured in three directions (H, V, A);
The sensor firmly attached to the field;
Using the same numbering system on all machines Measured bearing;
Using the setting for the type of measurement.

Table 1 Experimental results from the analysis of vibrations multistage centrifugal pumps

Discharge Pressure [kPa]	BEARING 1 (speead 2960 rot/min)			BEARING 2 (turatie 2960 rot/min)		
	orizontal [mm/s]	vertical [mm/s]	axial [mm/s]	orizontal [mm/s]	vertical [mm/s]	axial [mm/s]
1	0.130	0.354	0.154	0.124	0.242	0.106
0.8	0.261	0.390	0.272	0.129	0.122	0.125
0.6	0.302	0.380	0.288	0.121	0.117	0.129
0.3	0.279	0.327	0.257	0.120	0.128	0.143

Vibration measurement will indicate if the vibration rms is normal, still admissible or inadmissible, but we will provide information on what is defective and where it is located. Their values, compared with the permissible levels recommended by the manufacturer or

dynamic machine ISO 2372 and ISO 10816, figure 4, indicate that the machine works safely.

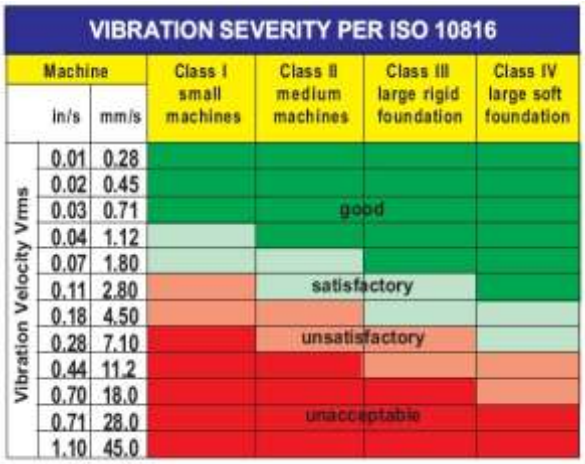


Fig.4 Machine works safely

4. INTERPRETAREA REZULTATELOR

The result is the assurance of design integrity prior to equipment installation and use. MechRel then extends these cost savings to actual equipment usage through early identification of an optimum maintenance philosophy, logistics support requirements and real time calculations of remaining life.

MechRel is used to perform different types of reliability analyses of mechanical designs and determine logistics support requirements. Using MechRel saves considerable expense during the early development phase by determining the reliability, availability and maintainability characteristics long before the expensive "test analyze and fix" phase of design development.

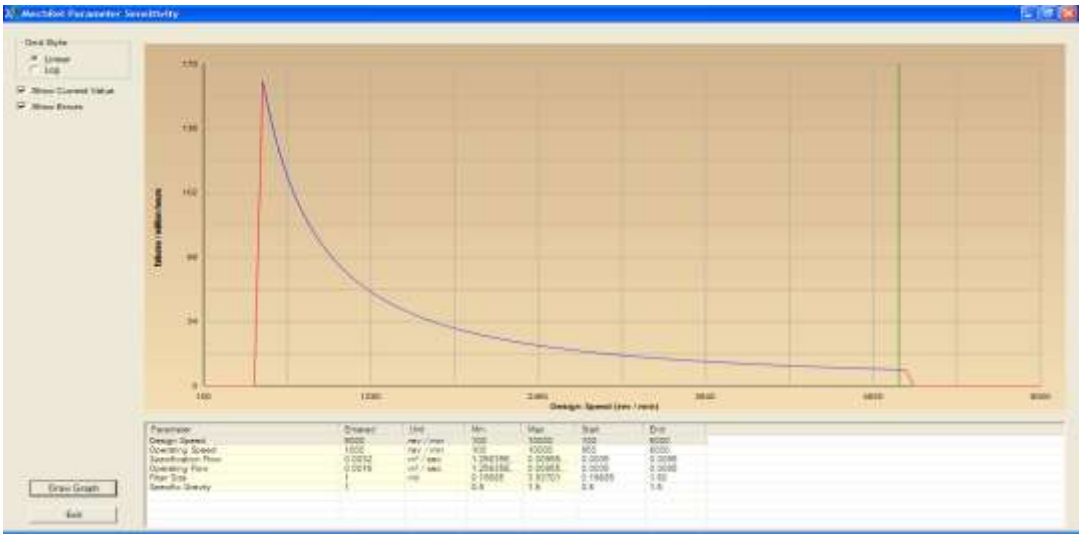


Fig. 5 Failures / million hours function according design speed

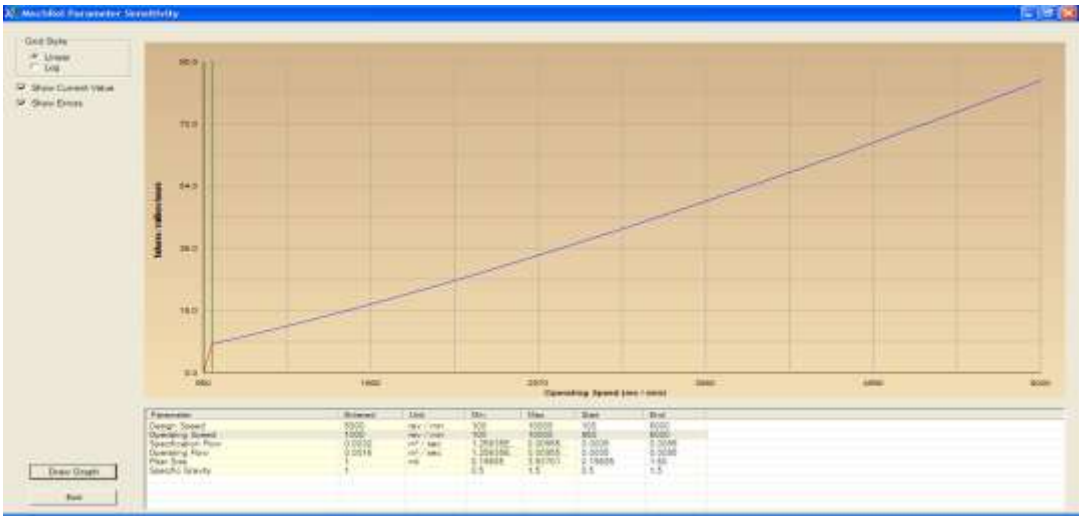


Fig. 6 Failures / million hours function according operating speed

MechRel is an enhancement to any platform analysis. It provides a more accurate determination of failure event probabilities, probabilities of occurrence for individual failure modes, and supports the transition from hard time maintenance to conditioning monitoring and condition based maintenance. For example, CDNSWC engineers have demonstrated the use of MechRel remaining life equations for an automated diagnostic and prognostic system.

5.CONCLUSIONS

Centrifugal pumps are machines that convert mechanical energy into hydraulic energy by the active part (rotor), with different structural forms: single-stage, multistage horizontal or vertical multistage multistage oblique.

The main causes of wear centrifugal pumps may be of mechanical or chemical nature and the parts most affected are: rotor, bearings, shaft protection sleeve, soft gaskets, and mechanical seals labirintii.

Vibrations caused by mechanical weakening trees are the most dangerous because they lead to additional demands by shock shaft and bearings.

Diagnosis of mechanical loosening vibration analysis method has several advantages such as reducing maintenance costs, increased operational safety, reduce wear in bearings etc.

Vibration on bearings is one of the global indicators of quality, they manifested either by direct effects or by indirect effects.

With measurements of vibration can cause defects such as dynamic imbalance, poor alignment, games and weakening, specific defects of bearings, etc. ..

In vibration analysis performed on three types of centrifugal pumps, namely: single-stage pump, horizontal multistage pumps with four rotors and ten horizontal multistage pump impellers, it follows that these machines do not require repair surgery because the vibrations are within the limits prescribed.

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In vibration analysis performed on three types of centrifugal pumps, namely: single-stage pump, horizontal multistage pump with four rotors and ten horizontal multistage pump impellers, that these machines do not require repair job because the vibrations are within the prescribed limits. An analysis of a design for reliability and maintainability identifies critical failure modes and causes of unreliability, and provides an effective tool for designing the most cost effective logistics support plan for the product.

Applying MechRel to a new product design provides a sound basis for determining spare parts requirements, needed redesign efforts, and reallocation of logistics resources to assure that R&M requirements for a particular system will be met.

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