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Condition monitoring by vibration analysis of rotary equipments

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Abstract

Condition monitoring of machines provide knowledge about the condition of machine. Any deterioration in machine condition can be detected and preventive measures taken at an appropriate time to avoid catastrophic failures. This is achieved by monitoring such parameter as vibration, wear debris in oil, acoustic emission etc. The changes in these parameters help in the detection of the development of faults, diagnosis of causes of problem and anticipation of failure. Maintenance/corrective actions can be planned accordingly. The applications of condition monitoring in plants result in savings in maintenance costs, and improved availability and safety.

Key words: Condition monitoring, Vibration, Performance, Cooler fan

INDRODUCTION:

The use of machinery vibration and technology advances that have been developed over the makes it possible not only to detect when a machine is developing a problem but to identify its specific nature of problem for scheduled correction. When a machine fails or breakdown, the consequences can range from annoyance to financial distortion or personal injury and possibly loss of life the vibration analysis of great important and it not only minimizesthe need of extensive experience, but also makes it possible to detect the developing problems which are outside the range of human senses to touch and hearing. Here the introduction of vibration analysis and outline a simple, logical and systematic approach that has been proved successful in pinpointing the vast majority of most common day to day machine problem is done The vibration analysis we have done is a part of conditional monitoring techniques. This technique is mainly used for the improved performance of equipments. Using this we can predict the condition of the internal parts of the equipments. Thus this is a type of predictive maintenance techniques

We are dealing with the vibration analyzing rotary equipments. It includes typical causes of vibration like misalignment of shafts, looseness, bearing faults, unbalance, oil fracture etc. This project explains vibration analysis, methodology, readings.

2. LITRATURE REVIEW

MAINTENANCE

2.1 DEFINITITON

It is defined as the set of activities on all plants and machineries, to maintain the same at prime condition in economic ways, for smooth running of plants for the achievement of organizational objectives. Prime condition refers to that the plant and machinery shall be in good condition for efficient and effective utilization of the same for the functions for which it is designated and installed for.

2.2 OBJECTIVE

To ensure the maximum availability and reliability of their plant and machinery at an optimum cost for uninterrupted operation of all units for the achievement of organizational goals with respect to targets and to meet standards of environment, safety and ISO's standards and conditions.

2.3 AVAILABILITY

It actually means that the equipment should be functionally available for the production when that equipment is put in to operation, it

should function in such a manner it is designed for, without any problems.

2.4 RELIABLITY

It denotes that the equipment shall be relied upon for the services it is designed for any point of time. That is the operating personnel should be able to rely upon the function of the equipment when they need that equipment to be put into operation.

3. CONDITION MONITORING AND VIBRATION ANLYSIS

Condition monitoring is the activity of maintenance for monitoring the condition of the internals of any running equipment without disrupting the operation. The monitoring is done by collection of data of various parameters like rpm, operating temperature, lubrication condition, nature, noise and vibration level, power consumption level etc. Condition monitoring makes use of advanced technologies in order to determine equipment condition and potentially predict failure. It includes, but is not limited to technologies such as,

(a) Vibration Measurement and Analysis

(b) Infrared Thermograph

(c) Oil analysis

(d) Ultrasonic

3.1 IMPORTANCE OF CONDITION MONITORING

Condition monitoring will be considered more or less as a "black art" requiring specialist's in order to perform routine data collection and analysis although specialists will still be required to perform more complex or unusual analysis. Production operators will increasingly use condition monitoring techniques to highlight potential equipment problems - either using hand-held equipment or permanently installed monitors which are integrated with process control systems. Mechanical trade's people will increasingly use this technique to check the quality of their own workmanship. There will be reduced focus on this technique to predict equipment failure, but an increased focus on using this technique to improve equipment and component life thereby performance also.

3.2 ADVANTAGES OF CONDITION MONITORING

- Increased plant reliability and availability.
- Increased plant and personal safety.
- Increased life of machines.
- Reduced maintenance cost

3.3 VIBRATION MONITORING

Since the mid 1950's the measurement and analyses of vibration has become an increasing technique for monitoring machinery condition. All machines will have some vibration because of minor defects or result manufacturing tolerances. Therefore all machines have tolerance of vibration, which may be regarded as normal or inherent.

VIBRATIONCHARACTERSTICS	UNITS OF MEASUREMENT
	ENGLISH
FERQUENCY	CPM
DISPLACEMENT	MLS PEAK TOPEAK
VELOCITY	IN/SEC RMS, IN/SECPEAK
ACCELERATION	GPEAK
PHASE	DEGREES
SPIKEENERGY	GSE

Table.1.Vibration characteristics and common units of measurement

When machinery vibration increases or become excessive, some mechanical trouble is usually the reason, the cause be unbalance worn gears or bearings looseness. Etc, each mechanical defect generates vibration is in its unique way. This makes it possible to identify a mechanical problem by simply measuring and noting its Vibration characteristics. A good vibration analysis program makes it possible to detect an impending problem, analyze it cause and take appropriate correction action before the failure occurs.

4. VIBRATION ANALYSIS

4.1 MEASUREMENT UNITS

4.1.1 PEAK TO PEAK

A number of units are used to describe vibration measurements. Peak to peak values describes the maximum excursion between upper limit and lower limit of travel. Peak measurements are peak to peak value for sinusoidal waveforms or SHM

4.1.2 RMS

The RMS is used where vibrations are random or consist of a number of sinusoidal vibrations of different frequencies. The RMS value is the measure of the effective energy used to produce the vibration of a machine. For a sinusoidal motion the RMS value of 0.07x peak

4.1.3 AVERAGE

The average value of the sinusoidal wave form is 0.637. The peak table summarizes the main characteristics of vibration and includes more common units of measurement.

4.2 MEASURABLE PARAMETERS

- FREQUENCY
- AMPLITUDE
- DISPLACEMENT.
- VELOCITY
- ACCELERATION
- SPIKE ENERGY

5. ANALYSIS TECHNIQUE

5.1 DATA ACQUISTION

It is important for predictive maintenance programs using vibration analysis to have accurate, repeatable data. In addition to the type and quality of the transducer, three key parameters affect data quality: the point of measurement, orientation, and transducer mounting techniques. For example considering a centrifugal pump, The vibrations are measured usually at 4 points in a pump and its drive (in case of motor drive)

PNDE: Pump Non Drive End

PDE : Pump Drive End

MDE : Motor Drive End

MNDE:Motor Non Drive End

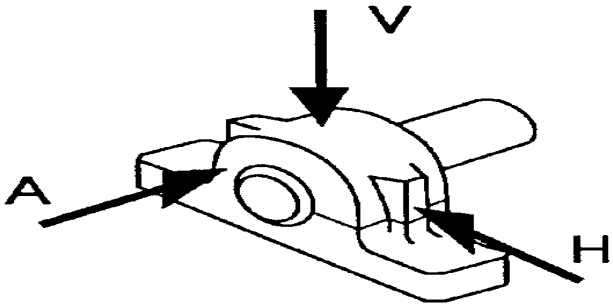

Fig. 1. Measuring positions

If there is coupling reading is taken there too. At each point reading is taken in three mutually perpendicular directions, namely horizontal, vertical and axial Specifically, three basic types of vibration transducers can be used for monitoring the mechanical condition of plant machinery:.

5.2 VIBRATION DATA TYPES AND FORMATS

There are several options regarding the types of vibration data that can be gathered for machines and systems and the formats in which it can be collected. However, selection of type and format depends on the specific application. The two major data-type classifications are time domain and frequency domain.

5.2.1 DATA TYPES

Vibration profiles can be acquired and displayed in one of two data types:

(1) Time domain

(2) Frequency domain.

(1) Time-Domain Data

Most of the early vibration analysis was carried out using analog equipments, which necessitated the use of time-domain data. The reason for this is that it was difficult to convert time-domain data to frequency-domain data.

(2) Frequency-Domain Data

Most rotating machine failures result at or near a frequency component associated with the running speed. Therefore, the ability to display and analyze the vibration

Spectrum as components of frequency is extremely important. The frequency-domain format eliminates the manual effort required to isolate the components that make up a time trace

6. CAUSES OF VIBRATION

The most common day-to-day problems encountered are:

- Unbalance
- Bent shafts
- Misalignment
- Looseness
- Eccentricity problems
- Resonance
- Sleeve or plain bearing problems
- Defective rolling element bearings.
- Aerodynamics/Hydraulic problems

7. NEED OF VIBRATION ANALYSIS:

Reason for performing a vibration analysis:

- Established "baseline data" for future analysis needs.
- Identify the cause of excessive vibration.
- Identify the cause of a significant vibration increase.
- Identify the cause of frequent component failures.
- Identify the cause of structural failures.

RESULT AND DISCUSION

Measurement Place: C bearing
1/16/2017 11:01:28 Displacement DISPLACMENT [µm] 208.68
1/16/2017 11:01:28 Velocity VELOCITY [mm/s] **6.64**
1/16/2017 11:01:28 Acceleration G-Envolop [g] 1.97

Table.2.Vibration analysis report in cooler fan

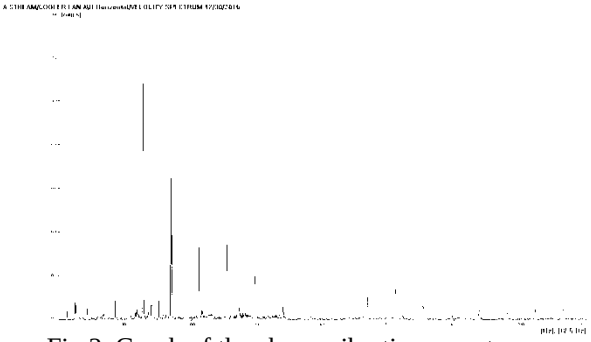

Fig.2. Graph of the above vibration report

Observation

we are checking the cooler fan in c bearing we got the problem Velocity is high in the C bearing (V-6.64,A-1.97). The bearing C for any looseness and ensure proper lubrication on bearing C Slightly high Temperature was noticed on the bearing.

Measurement Place: C bearing
1/20/2017 11:01:28 Displacement DISPLACMENT [µm] 185.28
1/20/2017 11:01:28 Velocity VELOCITY [mm/s] **2.40**
1/20/2017 11:01:28 Acceleration G-Envolop [g] 0.95

Table.3.vibration analysis of cooler fan after maintaing

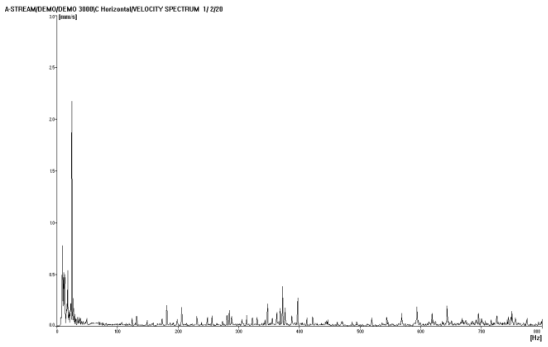

Fig.3. graph of the above vibration report

RESULT

Now reduce the velocity and acceleration of C bearing(V-2.40,A-0.95) when lubrication added the temperature reduced. Now cooler fan is running condition

CONCLUSION

After the completion of the project we have concluded that the benefit of trouble shooting through vibration analysis is as follows. The vibration report contain the velocity is 2.40 and acceleration is 0.95

It gives the information about changing the condition of the equipment. The production of residual life enables the equipment to be stopped before they reach critical condition. And the safe operation is ensured. The increased machine availability and utilization give greater outputs, face-lifting &higher return. Condition monitoring of equipment is used to improve the production quality

REFERENCES

[1] Condition monitoring by vibration analysis of boiler feed pump-Dr.v. chittaranjan Das, G. Suresh babu.2013, voloume 3,PP-2250-3153

[2]The rationale of monitoring vibration on rotating machinery in continuously operating process plant-E Downham,R.Woods-1996 vol 6,PP298-307

[3] vibration analysis of rotating ground support machinery-Mobly R keith 1990,vol3

[4] vibration monitoring of Turbo machinery – Alex Lifson ,Harold.R.simmons 1998,PP-101-118, VOL 13