Condition-Based Maintenance Benefits for the Maintenance Function

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1. INTRODUCTION

Nowadays, it is possible to affirm that the maintenance that was practiced in the past has been gradually acquiring a new set of actions, which are also important, in addition to the frequent and unwanted repairs. The idea based on repairing equipment when it loses its capacity to perform its function is slowly giving way to a new one that arises from the need to keep it operational for longer, trying to predict when it might fail, in order to act on it in a timely manner.

Taking this as a starting point, it is assumed that it is necessary to constantly monitor their physical condition. In an increasingly technological age, there are many resources that companies can use today to control the condition of their assets. Over the years, due to these technological advances, the monitoring and measurement equipment (known by the abbreviation, MME) have become a more accessible resource and, therefore, easily found in the daily lives of companies that perform preventive maintenance.

Based on the condition of the equipment, it becomes possible to predict in a good time when it might fail, and thus to carry out maintenance only when necessary. This type of maintenance is called Condition-Based Maintenance (hereafter CBM).

The purpose of this article is to inform the reader about Condition-Based Maintenance and to present benefits that may result from its implementation, along with some factors that should be taken into account when doing it.

2. CONDITION-BASED MAINTENANCE

We can define Condition-Based Maintenance as a type of preventive maintenance that includes: the evaluation of the physical conditions of the assets, their analysis, and the resulting maintenance actions [1].

There are many everyday cases that we can take as examples of this type of maintenance, from the replacement of two bearings that are gradually de-grading, to the replacement of a filter in which there is an abnormal pressure differential between the inlet and outlet [2].

The constant monitoring and control of these conditions allows us to identify changes that occur during the normal operation of an asset and to act preemptively to minimize the risks that such a change may cause.

2. CBM TECHNIQUES

There are several techniques used in CBM. Within the main ones, the following can be highlighted:

• Vibration Analysis

Vibration analysis is a technique that monitors the levels and patterns of vibration signals within a component, machine or structure, in order to detect abnormal vibration events and evaluate the condition of the test object.

This technique can be used to measure the vibrations of components that are constantly rotating, such as: bearings, gears or gearboxes, shafts, motors, among others.

• Thermographic Analysis

Thermographic analysis studies the thermal characteristics of an object from its infrared image, captured using a non-contact thermal imager.

By analyzing the energy emitted by the equipment, it is possible to detect more clearly areas where the equipment may be overheating. In addition, thermographic analysis also allows the detection of: gaps, leaks, oxidation, dust deposits, among others [3].

• Ultrasound Analysis

This technique is based on the emission of high frequency sounds on the surface to be analyzed. When the sound strikes the surface, it causes the mechanical vibration of the equipment's constituent material and is dependent not only on the frequency and amplitude of the excitation caused, but also on the material, geometry and mass of these components [4].

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• Lubricant Oil Analysis

The purpose of this analysis is to determine whether the oil maintains both its physical and chemical properties, by testing parameters such as: viscosity, contamination, oxidation, flash point, among others.

• Visual Inspection

Being a fairly common technique, visual inspection has the purpose of detecting "with the naked eye" signs that lead to equipment failures. Although it is a low-cost technique, it is usually applied simultaneously with others, and it is essential that the operator is specialized in the area, so that the evaluation of the situation in question is as correct as possible.

3. BENEFITS OF CBM

This constant monitoring allows for the suitable planning of equipment (or production line) shutdowns, which will reduce downtime costs and unexpected downtime losses.

This type of maintenance is directly associated with an increase in reliability (frequency with which equipment will fail) and in equipment availability (more uptime) [5].

Since this maintenance also allows detecting performance and/or efficiency losses of equipment, it will be possible to obtain a greater control of the production rate, keeping it at the desired level.

4. KEY FACTORS NECESSARY FOR A GOOD CBM IMPLEMENTATION

For a condition control system to work optimally, there are several factors to consider, such as:

• Identification of critical assets that need to be monitored.

Critical assets are understood as equipment whose failure causes high costs at the production level. The identification of potential risks related to their operation, as well as their failure, are other factors to be considered in their selection.

• Appropriate choice of EMM.

Paying attention to the data collected, ensuring the same data collection with the same MME.

• Technician skills.

Train the technicians on how to interpret the data collected and the right treatment that should be given to it.

• Corrective actions.

In the presence of anomalies in the readings, the necessary actions (thought through in advance) must be carried out for their correct resolution.

5. FINAL CONSIDERATIONS

The constant monitoring of parameters (such as: noise; pressure; temperature; vibrations, etc.) helps with decision-making regarding production planning, spare parts management, and the improvement of equipment reliability.

The growing interest and developments in this area are notorious, as shown by the emerging of new techniques for analysis such as motion vectors and maps, transient analysis, phase maps, among others. This wide range of techniques allows companies to choose the ones that best fit their work environment.

All things considered, it is a type of maintenance that should be thought through in advance before it is implemented, because there are a number of factors that should be taken into account, including: the equipment and parameters to be controlled, the initial cost of acquiring equipment that assists the monitoring, and the environment where this equipment is located.

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