Ten Best Steps For Increasing Performance Of Preventive Maintenance

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ABSTRACT: Planned maintenance has to begin with a plan in mind. Developing preventive maintenance tasks or procedure for plant or facility without a solid plan will result in inconsistent and unreliable procedure. A maintenance procedure by letting down all maintenance standards always creates inconsistency and ineffectiveness in maintenance plan and also increases the cost of maintenance. Hence it is important to document the development process, build-in consistency, and develop a good understanding of expected results for a good equipment maintenance plan. The aim of this study is to stop the maintenance personnel to conduct the maintenance tasks in a non standard way and to motivate them to follow a set standard procedure. Hence ten steps are described, which are necessity of a good preventive maintenance plan to improve the effectiveness and to reduce maintenance cost. A simple procedure for equipment maintenance plan is developed, which include EMP header, Maintenance task description, Task Support Information, Planning and Budgeting.

Key words- Equipment maintenance, Preventive maintenance

1. Introduction

One of the most important goal of competing industrialists is to ensure safe operation of their plants: characterized by maximum availability throughout the entire life cycle, with optimized cost structure that ultimately permit specific production costs to be minimised. Industries world wide spend a huge amount of money on maintenance of production machinery. Each year US spends over $300 billion on plant maintenance and production (Dhillon, 2002). The primary objective for managers of facility and infrastructure maintenance is reducing the adverse effects of breakdowns and maximizing facility availability for lowest cost possible (Shue&Krajewski,1994).Under most circumstances though, infrastructure operability is directly related to the expenditure of resources usually results in a diminished level of operability. Fortunately, there are ways for maintenance managers to apply their resources to attain higher level of operability for lower proportional increase in the amount of resources expended-one such method that is commonly utilized is Preventive maintenance. The primary intent of PM is to prevent common equipment failure modes, and it is particularly useful when the risk of failure is unacceptable (Hiatt,2003). These maintenance actions can take many forms, to include inspections, adjustments, calibrations, cleaning, lubrications, replacements and rebuilds (Brown,2003;Dunn, 2007).PM will extend expected life of equipment and enable equipment to run more efficiently, thereby decreasing the chance and number of catastrophic failures; this will result in maintenance and capital cost savings (Sullivan, Pugh, Melendez & Hunt, 2004).But most of the time PM loses its effectiveness due to lack of knowledge or carelessness of operators and maintenance personnel while implementing the systematic procedure of PM. In that case it proves uneconomical and it leads to increase in maintenance cost and decrease in availability. Thus PM should be done in a systematic way. To gain the maximum advantage best practices should be checked for PM. Reasons should be checked, why PM programs might not always work as well as would like it to work. Then an effective and systematic procedure should be developed, keeping in view all these elements. A proper systematic approach of PM leads to reduction in the cost of preventive maintenance.

2. TEN BEST PRACTICES FOR PREVENTIVE MAINTENANCE :

2.1 DEFINITION OF PREVENTIVE MAINTENANCE:

The preventive maintenance should have only one definition for whole employees rather than having different definition for a different employ. If maintenance is not properly defined it creates confusion among the employees. The preventive maintenance should be documented, understood and well communicated across the plant.

2.2 NECESSITY OF AN ALIGNMENT STANDARD: There should be a well defined alignment standard explaining how to set up, clean, check for pipe strain, check for soft foot etc. In a world class reliability and maintenance organization, all alignments are done to 0.002in (.05mm) for equipment running below 3600 rpm and 0.001in (0.025mm) for equipment running below 3600 rpm.

2.3 NECESSITY OF LUBRICATION STANDARD: There should be a well documented lubrication standard. The cleanliness standard for equipment should be set in such a manner that it match the cleanliness in equipment lubricated surfaces. The size of oil particles can't be more than 3micron for hydraulic unit where as 12micron for gear box.

2.4 COST EFFECTIVE INSPECTIONS: All the inspections should be documented and scheduled. An inspection list or hand held computer can be used for this purpose. Most of the inspections are completed while equipment is operating. This save a valuable time by avoiding shut down. However some equipment's inspection is only valuable when they are running. For example: The inspections of pumps don't give best results in shut down condition because there are no vibrations, no operating pressure etc. However maintenance program should be designed so that most of the inspections can be perform in running conditions to avoid unnecessary shutdowns.

2.5 WELL DETAILLED CLEANING OF EQUIPMENT: Detailed cleaning of equipment can be done consistently. To protect the equipment from contamination dirty areas can be redesign. A leak in a clean hydraulic unit can be detected in 10 sec by looking in the pan underneath where as a dirty hydraulic unit takes 20-30mins.Hence cleanliness of equipments saves time in inspection.

2.6 USE OF ULTRASONIC MONITOR DURING GREASING: In order to apply correct amount of grease vibration and ultrasonic levels are checked while greasing. Without the aid of measuring tools it is impossible to know that how much grease is applied to bearing. These tools indicates when grease hits the bearing and monitor the vibration or ultrasonic levels as grease is squeezed into the bearing. This method avoid the under or over greasing.

2.7 DOCUMENTATION AND TRAINING: When a right systematic PM procedure is prepared the need of its documentation arises. PM only deals with basic inspection methods rather than predictive maintenance methods such as vibration analyses, wear particles analyses etc. These procedures are generally called as condition monitoring standards. Pictures are more easier and safer to describe a method rather than words. The documentations should clearly define that what, how and why an inspection should be done. It is time consuming and laborious work to develop condition monitoring standard documents but if once developed for a particular equipment then this can be reused for all other equipments of this type. Thus a proper documentation further leads to a time saving. A route list should be prepared which contain frequencies and other unique values to individual component. PM documentation as monitoring procedures as possible.

2.8 ASSIGN THE RESOURCES: To attain the best results assign special people to do inspection on a full time basis. If dedicated resources assign to do basic inspection of equipments it will lead to-

a. Right people to do inspections, adjustments and repairs. They can do them during their routes, or after routes.
b. The right people trained in this unique work.
c. The ownership and interest for PM that is necessary for continuously updating and improving the PM work.
d. An easier situation to manage.

The PM inspector should work closely with supervisor in the area they inspect. The inspector should report their findings twice a day to supervisor. After completing their results, they should do some repairs and adjustments that are results of their inspection.

2.9 RIGHT CONTENT: If PM program has not been thoroughly updated in last five years, it probably contains wrong activities and don't generate the desired results. A PM should be designed in such a way that it perform 90+% of PM activities done as inspections while equipment is running and less than 10% are PM activities that require to shut down the equipment. Most of guards are designed in such a way that the components can not be inspected while equipment is operating. Many guards are so heavy, that it takes several hours to take off the guards to do the inspection and replace the guards during shut down. If guards are designed in the right way the only PM to be done should be inspection on run. Hence most of the machine components should be designed in such manner that it become easier to inspect the machines and equipments in running condition.

2.10 CONSEQUENCES OF BREAKDOWN:

Breakdown is defined as an equipment ceases its function. The consequence of breakdown can be prioritized in following groups-

a. Personal or environment damage
b. High cost for production losses
c. Preserve value

When an equipment go break down then time consuming evaluation to find the criticality of equipment is never advisable. In case of a sudden break down a fast approach should be followed to evaluate criticality. The fast approach have following steps-

i. Ask yourself what will happen if this equipment break down?
The answer to this question may be given by reading the nameplate of equipment and by understanding the process.
ii. Ask the operator if you don't know the answer to the first question.
iii. Consult process and instrumentation drawings.

With this screening you need to analyse what is important to analyse and it save more than 90% of time as compared to processes suggested in reliability cantered maintenance and similar processes.

3. DEVELOPING MAINTENANCE PLAN:

Equipment maintenance plan is commonly known as document, in table format, that is used when developing the tasks needed to properly maintain facility, plant or process equipment. Each equipment plan consist of following defined sections:

EMP HEADER:

Equipment Type	This identify the equipment type or class to which maintenance task apply. i.e. fans, centrifugal pumps, compressors etc.
Description	Identify the specific equipment that is covered by EMP
Location	Identify physical location of equipment within plant
Documentation	Number lists what technical documentation is available and where it is stored and maintained
Validated	Requires a "yes" or "no" indication of whether or not the equipment nameplate data has been validated

MAINTENANCE DESCRIPTION:

Item Number	Identify each of maintenance task listed on EMP, giving each a line item number
Maintenance Task Description	Description of the work to be performed is entered
Frequency	Identify the frequency at which the maintenance is to be performed

TASK SUPPORT INFORMATION:

Craft	Identify the type of craft or skill required to perform the maintenance task
Craftsmen Required	Indicates the number of persons required to perform maintenance task
Equipment Condition	Indicates if the equipment must be running or shutdown when

	certain maintenance task are performed
Type	Type of maintenance task required i.e. PM, PdM, CM etc.
Procedure	Unique procedure or task number is entered
Estimated time	Estimated time to complete the task is entered
Special tools/Materials/remarks	Identify any special tool not usually in a craftsman's tool box i.e. torque wrench, man lifts etc.

PLANNING AND BUDGET SECTION:

Annual Hrs	Used to calculate the total annual hours required to perform each specific maintenance task
Annual Scheduled Maintenance Hrs	Used to total all annual hours required to perform all maintenance tasks listed on EMP
Annual Shutdown Hrs	Used to calculate required hours of shutdown needed to perform all maintenance tasks on EMP
Annual Operators Hrs	Used to calculate the total hours of operator time needed to perform the maintenance tasks on EMP
Annual Mechanic Hrs	Used to calculate the total hours of mechanic time needed to perform maintenance tasks listed on EMP
Annual Electrician Hrs	Used to calculate the total hours of electrician time needed to perform maintenance tasks listed on EMP
Annual Contractor Hrs	Used to calculate the total hours of contractor time needed to perform the maintenance tasks listed on the EMP

EMP can be developed for each equipment item, type of equipment or system. Generally a common EMP is developed for same type of equipment, but in different operating environments, then it requires a different EMP and different frequencies, man-hours and special tools to each. EMP is very flexible document and can be used to accommodate almost any need for maintenance requirement development. It can be used in the way it best fit our needs and requirements

CONCLUSION: The purpose of this study is to develop a proper systematic procedure for performing best PM program. The history of industrial maintenance shows that maintenance personnel don't take maintenance tasks seriously and violation of set standards leads to a continuous decline in PM performance and also increase the maintenance cost.

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