Trends and Ideas on Maintenance Strategies and Practices

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ABSTRACT

New millennium welcomes globalisation that stresses to accept change in the existing model of maintenance strategies and practices.The main objectives of plant maintence are making available plant facilities at lowest cost and optimum safety standards, optimising maintenance resources and minimising inventory on hand.It is achieved by the effective application of Planning scheduling, Preventive maintence predictive maintenance, receive and proactive maintnance, breakdown maintenance and failureanalysis.For better results, special altertion is required on team work with members having multi-skill and multi-trade, outsourcing of all permissible parts of maintenance activities not to keep specialist and get the services of specialists from out side only when it is required.

INTRODUCTION

Maintenance manager and engineers are trying to get answer to the question "What strategy should be applied to the existing variables of maintenance to reach the world class bench mark level? The goal and objectives of maintenance are (a)maximum availability of facilities at the lowest cost, highest quality and optimum safety standards (b) optimise maintenance resources (c) optimise capital equipment life (d) minimise energy use and (f) minimise inventory on hand.

Manpower is one of the most important factors. Effective utilisation of manpower brings down the maintenance cost and downtime. In the new millemium, importance is being given to multi-skill. For its effective implementation, the people in all levels of the maintenance organisation should be given inspiration to welcome change. In addition to this, effective application of planning and scheduling, preventive maintenance, predictive maintenance, reactive and proactive maintenance, break down maintenance, and failure analysis are to be carried out to achieve the goal and objectives of maintenance.

Maintenance People

There are a good number of specialists in the maintenance organisation. Experience shows that teamwork gives better reesults at lowest cost but in a team if each specialist sticks strictly on his trade, a few member of the team will always be idle while the working is going on. Here is the necessity of multitrade and multi-skill. If the team members get training in multi-trade and acquired multy-skill, all the team members can work altogether without any one being idle, which will reduce down time as well as maintenance cost. Whenever the services of highly skilled specialist is found essential, such services will be got from external sources, as and when required. HNL introduced it step by step and it is found highly successful. Followings are few examples :

1. Riggers were trained to operate EOT Cranes and crane operators the rigging work. Now they will do both rigging as well as Crane Operation as and when required. This reduced idle time of both the categories and also imporved work output.
2. Fitters were trained to operate Roll grinding Machine. The existing roll grinding operators are qualified fitters. This multiskill helped to utilise the idle time effectively.
3. Welders were trained to do fabrication and erection of pipelines and structures. No welder or fitter will be idle in a team to any time while they were engaged in work.
4. Operators were trained to do routine maintenance like attending gland leak, oil level tapping up, etc.

All the recurring nature works are outsourced. Outsourcing helped to reduce the excess manpower. Followings are few of them :

(a) Chipper knife changing

(b) Maintenance of pipe lines and structures

(c) Operation and Maintinance of Vehicles

(d) Tube cleaning of evaporators

Planning and scheduling

Maintenance planning is identified as determining "What" resources: personnel numbers, skills needed, material, spare parts, and skill hour estimates are required. Scheduling of maintenance decides "who" will perform the work and "when" the work (order) will be accomplished. Planning and Scheduling should be to achieve world class levels. Planning and scheduling of daily maintenance and shutdown maintenance, performance should be rated according to the four following categories.

- Planned and scheduled
- Planned, but not scheduled maintenance.
- Scheduled, but not planned maintenance
- Break-in work

According to World class, the performance of Planning and Scheduling are :

Daily :

1. Planned and scheduled - 75%
2. Only planned or only scheduled - 20%
3. Break- in jobs - 5%

Shut down :

(a) Planned and scheduled - 90%

(b) Only planned or only scheduled - 10%

(c) Break- in jobs - 0%

Proper planning and scheduling brought down the production down time of HNL. The target is to reach World-Class level for which . Continual improvement is require.

Maintenance Practice

Maintenance incorporates the following types

(a) Preventive Maintenance

(b) Predictive Maintenance

(c) Reactive and Proactive Maintenance

(d) Break down Maintenance

(e) Shut down analysis

Preventive Maintenance

It is the programmed maintenance performed at predetermined intervals to prevent the need for corrective maintenance by actions such as cleaning the parts, lubrication, replacing worn out parts, etc. Good preventive maintenance is invisible. Only the lack of preventive maintenance is visible. Preventive maintenance programme contributes to the elimination of environmental damage, personal injuries, production losses in quality and volume, excessive maintenance costs, and deterioration of physical assets.

Predictive Maintenance

It is also termed as condition based maintenance which consists of the activity performed to identify the need for corrective maintenance at an early date so that planning and scheduling of maintenance can be done. The actions here include subjective methods such as look, listen, feel and smell, and objective methods such as measuring the temperature, pressure, clearances, vibration, metal particle analysis, etc. based on these observations, failure developing period is assessed, corrective maintenance is planned and scheduled. Fig. 1 and 2 show the vibration spectrums of the non-drive side (NDS) bearing of dryer No. 19 of the paper machine

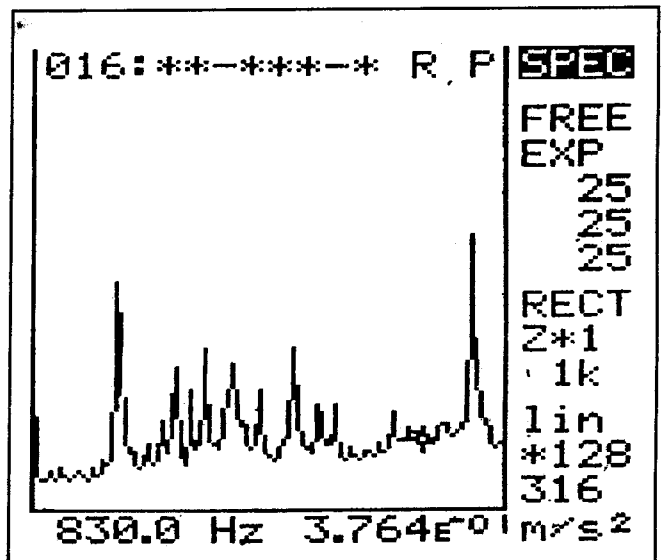

Fig. 1 Vibration spectrum of NDS bearing (nearing failure) of dryer No. 19 (Acceleration-Vertical)

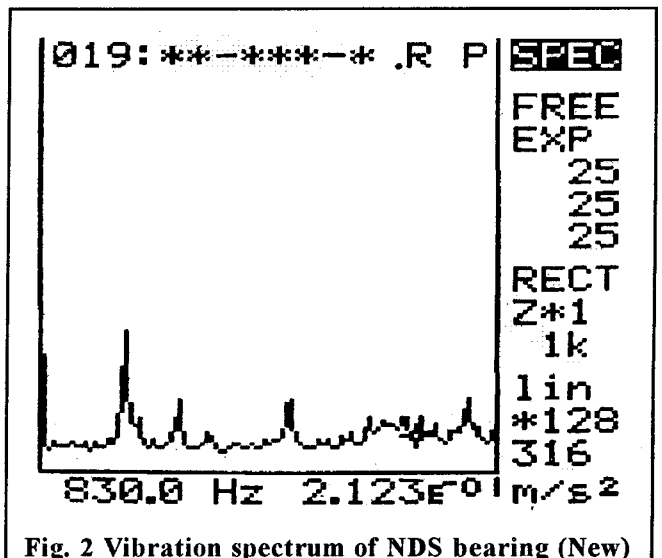

Fig. 2 Vibration spectrum of NDS bearing (New) of dryer No. 19 (Acceleration-Vertical)

in HNL.

With the implementation of condition based maintenance, 95% of the maintenance activities shall be planned and scheduled and overall equipment

efficiency shall be more than 90%.

Proactive Maintenance

It is a replacement of deteriorating or defective components before they can fail. This scheduling of the repairs eliminates the high cost related to a breakdown. These components are usually found during the inspection of routine service. One caution should be noted: replacement should only be for components in danger of failure.

Breakdown Maintenance

Corrective maintenance is resorted to when a machine failure occurs and can also be called as breakdown maintenance. Failures can be divided into two major categories:

(a) Random or non-predictable faults occur completely irregularly and are distributed in time in such a way that they cannot be foreseen. An example of a random fault is one resulting from a temporary overload.

(B) Regular or predictable faults have a progressive development sequence that follows a known pattern. Examples of their causes are wear and tear, changes in materials as a result of drying out, crystallisation, etc.

Consequence of failure includes environmental damage, personal injury, lost production, and excessive maintenance cost and reduced asset value.

Maintenance systems

Industrial maintenance is a subsystem of an industrial ogranisation with the function of adjusting, repairing, replacing and modifying the parts of industrial plants in order that the plant should be able to perform its specified functions over some specified period. The function of the maintenance system and the way in which this function might be affected by the dynamic relationship between the maintenance system and production system need to be clearly understood. The production strategy drives the maintenance strategy. The maintenance system can be either manual or computerised. Computerised maintenance system has several advantages over the manual system. The most important thing is the availability of data for analysis. This will help in decision making. Because of the availability of inventory and cost details, the control of cost and inventory is possible. HNL has a computerised maintenance management system as part of its BaaN ERP package.

It has the following modules.

1. Equipment module

- Complete equipment master
- Maintenance history
- Failure analysis
- Preventive maintenance schedule
- Maintenance cost analysis

2. Work order module

- Ability to plant and schedule maintenance jobs.
- Procurement initiative for maintenance jobs
- Progress monitoring of work orders
- Estimate costs
- Preparation or work orders.

Table 1 Failure rate of NDS bearings of Paper Machine Dryers- (1) Before Failure Analysis, and (2) After Failure Analysis & Corrective Action.

Sl.	Period	Oil flow rate to the bearings	Failure of NDS bearings of Dryers
1	1982-1992	0.50-0.60 LPM	18 Nos. Brg. No. N. 3044 KC5
2	1993-2003	1.00-1.50 LPM	2 Nos. Brg. No. N 3044 KC5

Table 2 Reduction in downtime achieved at HNL after implementation of Computerised maintenance system

Quality objectives	Unit	Base 2001-2002	Target 2002-2003	Achieved 2002-2003
Reduction in paper machine maintenance downtime	%	1.96	1.90	1.91
Reduction in pulp mill (CP & CMP) maintenance downtime	%	2.55	2.50	2.16

- Estimation of resource requirements.
- Variance analysis of cost incurred vs. Estimates.

3. Preventive maintenance module

- Automative generation of preventive maintenance work order.

4. Break down maintenance module

- Preparation of work orders
- Resource and time planning
- Financial Commitments
- Parallels from equipment history for maintenance help.

All these modules are working well in HNL. This has enabled us to reduce maintenance cost by about 25% from previous averages. There is continual improvement in down time reduction also. Because of the availability of maintenance equipment-wise cost details, the equipment replacement decision is supported. Top ten analysis is helping in design changes or material changes. Due to the availability of proper data on the vendor and the spare parts, quality of spare parts is also improved.

CONCLUSION

Maintenance strategies and practices pave the way to achieve the goals and objectives of maintenance. Implementation of multi-trade, multi-skill, and teamwork along with the effective utilisation of modern maintenance tools, techniques, and packages are found highly successful to make plant maintenance cost effective.

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