

Plant Maintenance Strategies in Paper Mills

Thomas Palampadom, Parameswaran N.S.

ABSTRACT

The main objectives of Plant Maintenance are making available plant facilities at lowest cost and optimum safety standards, optimising maintenance resources and minimising the inventory on hand. Plant Maintenance Strategies in Paper Mill include planning and scheduling of the maintenance with minimum break in jobs, carrying out the maintenance by Maintenance Teams through Work Order systems, using Computer Maintenance Management System, building technical skills of workmen and engaging a flexible work force on Millwright basis. Predictive Maintenance practice based on Condition Monitoring is the presently adopted maintenance technique in Paper Mills for achieving the various maintenance objectives.

INTRODUCTION

The goals and objectives of maintenance influence to a great extent in determining the type of maintenance organisation. If these are progressive and the maintenance organisation is recognised as a contributor to the corporate bottom line, variations of some of the more conventional organisation structures can be used. The goals and objectives are as follows:

a) **Maximum production or availability of facilities at the lowest cost, highest quality and optimum safety standards.**

The sub objective is the keep-it-running character of the maintenance. Inspection of equipment and facilities is the practice adopted towards preventive/predictive maintenance for reducing breakdowns and interruptions.

b) **Provide accurate maintenance records**

Accurate record keeping of the maintenance activities is important, if the maintenance is really going to maintain the equipment.

c) **Collect maintenance cost information**

The cost information is more detailed than repair information, as there are various costs viz. Labour costs, material costs, tool and equipment costs, contract costs, lost production costs and miscellaneous costs. This cost information helps the manager to prepare maintenance budgets.

d) **Optimise Maintenance Resources**

As we find that maintenance resources are in

**Hindustan Newsprint Ltd.,
Newsprint Nagar,
Dist- Kottayam-686 616 (Kerala)**

shortage, viz. maintenance personnel, material, tools etc. these are to be used carefully and optimally. Good planning and scheduling practices can achieve this.

e) Optimise Capital Equipment Life

Industrial equipment has its life cycle optimised by an effective preventive maintenance schedule.

f) Minimise energy use

Equipment and facilities that are maintained properly with a good schedule will require less energy to operate.

g) Minimise inventory on hand

Since spare parts cost more than 40% of total maintenance costs, the objective is to reduce the on hand quantities of the various items. As the holding cost of the inventory is about 30% of the actual price, any reduction in inventory results in compounded saving.

MAINTENANCE STRATEGIES IN PAPER MILL

With the various objectives mentioned above, we may try to evolve and implement the various Maintenance Strategies in paper mills. Production is a joint venture between operations and maintenance and maintenance function is responsible for the delivery of equipment efficiency through cost effective. Therefore it is highly essential to evolve and implement necessary Maintenance Strategies in a paper mill to attain smooth production and to reduce downtime.

MAINTENANCE IS CLASSIFIED INTO FOUR GROUPS

1. Corrective Maintenance
2. Preventive Maintenance
3. Predictive Maintenance
4. Design out Maintenance

The Corrective Maintenance is resorted to when a machine failure occurs and can also be called as Breakdown Maintenance. Preventive Maintenance is the programmed maintenance performed at pre-determined intervals to prevent the need for corrective maintenance by actions such as cleaning the parts,

lubrication, replacing worn out parts, etc. Predictive Maintenance also termed as Condition Based Maintenance is the activity performed to identify the need for corrective maintenance at an early date so that planning and scheduling of maintenance can be done. Actions 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 assessed, corrective maintenance is planned and scheduled.

With the implementation of Condition Based Maintenance, 95% of the maintenance activities shall be planned and scheduled and the Overall Equipment Efficiency shall be more than 90%. The plant is now in a position to implement Design Out Maintenance and thus to continuously improve the equipment and the maintenance procedures. This is a process of identifying the root cause failure of an equipment and carry out modification in preventing the recurrence. By DOM method, increased plant reliability shall be achieved by continuously improving the equipment design and the maintenance practices.

PRACTICES OF PREVENTIVE, PREDICTIVE, AND DESIGN OUT MAINTENANCE

A good maintenance programme will incorporate all the following type of preventive maintenance practices.

- a. Routine inspection, lubrication, cleaning etc.
- b. Proactive Replacement
- c. Scheduled Refurbishings
- d. Predictive Maintenance
- e. Condition Based Maintenance
- f. Reliability Engineering (Design Out Maintenance).

Routine maintenance such as lubrication, cleaning and inspections, is the first step in beginning a preventive maintenance programme. These service steps in beginning a preventive maintenance programme. These service steps take care of small problems before they cause equipment outages. The inspections may reveal deterioration that can be

TABLE 1 DAILY PREVENTIVE MAINTENANCE SCHEDULE

Area:		Month:					
Equipment	Name of the	Days					
No.	Equipment	1	2	3		30	31
1-811-01	Pump-HD-CP						
1-811-14	Pump-LP Showers						

Note: Carry out general checking of each equipment daily. Tick mark the equipments checked and record the abnormalities, if any, in the shift log book.

TABLE 2 LUBRICATION SCHEDULE

Area:		Weeks							
Equipment	Name of the	1	2	3		15		51	52
No.	Equipment								
1-8511-35	Suction Couch Roll	GSB		GSB				GSB	
1-851-36	Forming Roll		GSB						GSB
11-851-38	Wire-Rolls 9 Nos	GB				GB			GB
1-851-51	Felt Rolls (Press Part) 9Nos		GB			GB		GB	

GSB : Greasing Suction Box Bearing

GB : Greasing the Bearings

repaired through the normal planned and scheduled work order system. Table 1 & 2 give a typical daily preventive maintenance schedule and a schedule of lubrication respectively.

Proactive replacements is a replacement of deteriorating or defective components before they can fail. This scheduling of the reparis eliminates the

high cost related to a break down. 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.

Scheduled refurbishings are generally found in paper mills. During shutdown or outage, all known or suspected defective components are changed out.

TABLE 3 MONTHLY PREVENTIVE MAINTENANCE SCHEDULE

Area:		Month								
Equipment No.	Name of the Equipment	Jan	Feb	Mar						Dec
1-8511-34	Head Box	CL		CL						CL
1-851-35	Couch Roll	RC								RC
1-851-65	Dryer 1* Sectn	CB								

CL : Opening, cleaning and checking
 CB : Bearing condition physical check up
 RC : Roll Change

TABLE 4 VIBRATION READINGS RECORDING SHEET

Date : 15-03-1999		Machine Speed: 790 MPM			
Equipment No.	Name of the Equipment	Bearing Location	Vibration Reading : Velocity in mm/sec		
			Axial	Vertical	Horizontal
1-851-20	Wire Roll No.1	Drive Side	0.60	0.40	0.70
		Tender Side	0.40	0.50	0.60
1-851-27	Wire Roll No.7	Drive Side	0.60	0.50	0.80
		Tender Side	0.40	0.50	0.40

The equipment or facility is restored to a condition where it should operate relatively trouble free until the next outage. These projects are scheduled using a project management type of software, allowing the company to have a time line for starting and completing the entire project. Table 3 gives a typical monthly preventive maintenance schedule followed in a paper mill.

Predictive maintenance is a more advanced form of routine inspections. Using the technology presently available, inspections can be performed that detail the condition of virtually any component of a piece of equipment. Some of the technologies include

- Vibration Analysis
- Spectrographic Oil Analysis
- Infrared Scanning

The vibration readings of Wire Roll bearings recorded in a paper mill is given in Table 4.

Condition-based maintenance takes predictive maintenance one step further, by performing the inspections in a "real-time" mode. This is done by taking the signals from sensors installed on the equipment and feeding the signals into the computer.

Trend graphs of the Drive Side bearings of two Drying Cylinders of Paper machine recorded by a continuous condition monitoring system

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LR/HR - > SPHERICAL ROLLER BEARING

PMI-DYR - 29-DRS CMS SYSTEM:1, MEASURING UNIT : 3, CHANNEL: 14

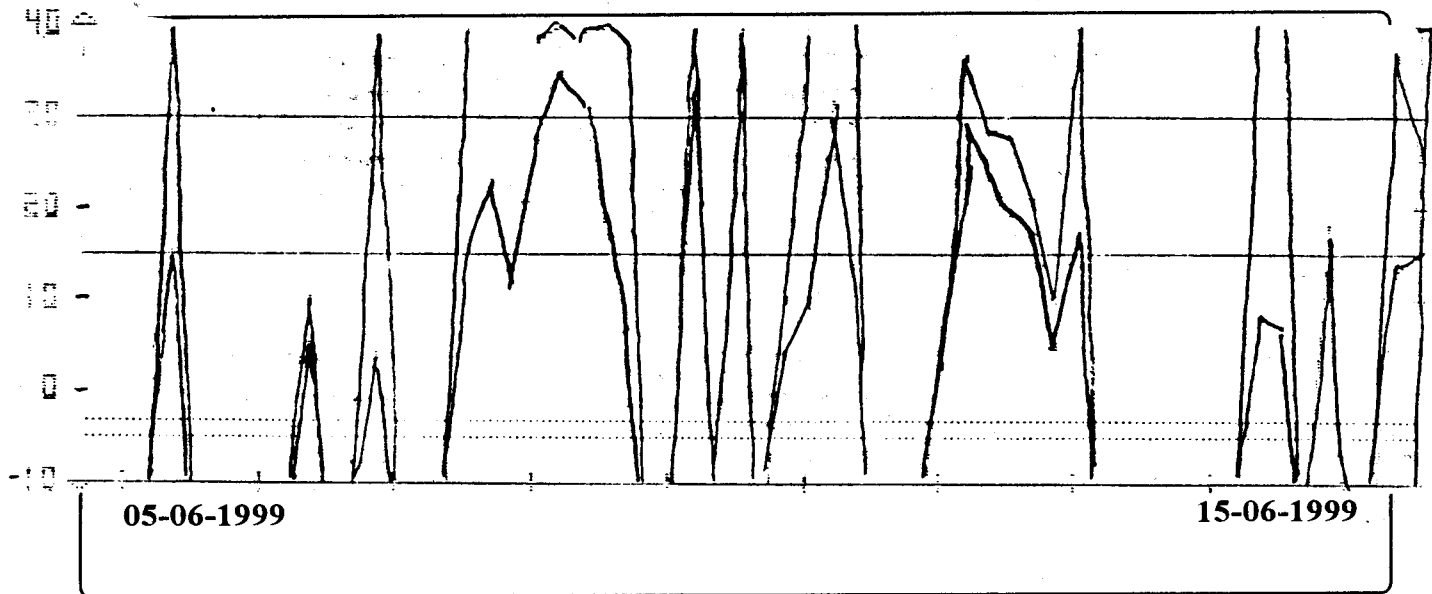


FIG. - 1 TREND GRAPH OF A DEFECTIVE BEARING

LR/HR - > SPHERICAL ROLLER BEARING

PMI-DYR - 27-DRS CMS SYSTEM : 1, MEASURING UNIT : 3, CHANNEL: 16

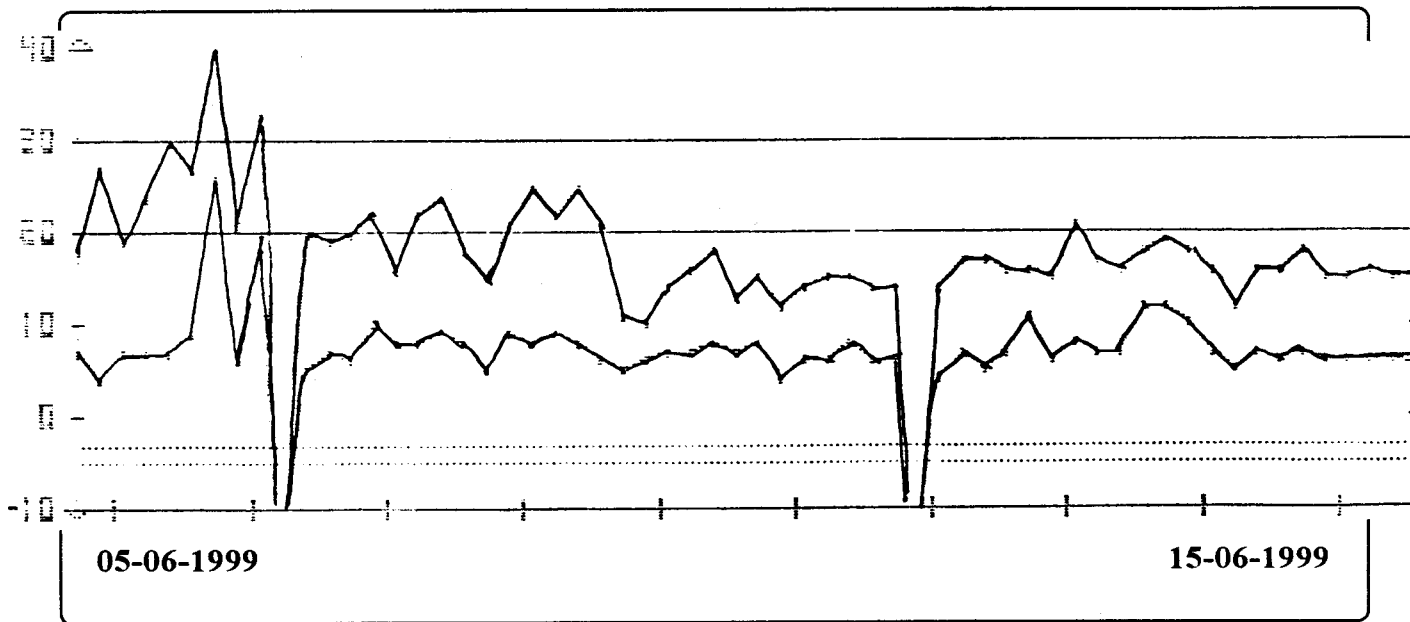


FIG. - 2 TREND GRAPH OF A GOOD BEARING

The computer monitors and trends this information, allowing maintenance to be scheduled when it is needed. Figure 1 & 2 show the trend graphs recorded by a continuous condition monitoring system of the Dryer part of a paper machine.

Reliability Engineering is the final step in preventive maintenance, involving engineering. If problems with equipment failures persists after using the previously mentioned maintenance tools and techniques, Engineering should begin a study of the total maintenance plan to see if anything is being neglected or overlooked. If not, then a Design Engineering Study should be undertaken for possible modifications to the equipment to correct the recurring problems.

In brief it can be concluded that maintenance Strategies pave the way to achieve cost effective

maintenance of equipment and to attain the production target in a Paper Mill. Condition Based Maintenance carried out by Maintenance Teams is presently followed in paper mills and this is found to be cost effective and result oriented.

REFERENCE

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