Plant Maintenance Strategies In Paper Mills

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ABSTRACT

High maintenance cost due to downtime and non-availability of the proper material at the right time has pressed the paper industry to adopt such maintenance strategy which help to maximise production at minimum cost, with minimum problems and without interruptions in operation. Therefore, maintenance strategy should create plant availability to the maximum possible extent with due regard to safety considerations. A well thought planning, coordination with various departments and good infrastructure of men, material and machinery have been found helpful to increase the production.

INTRODUCTION

Industries in general and paper industry in specific are facing enormous rough weather for the last few years. The globalisation and liberalisation of Indian economy have been responsible for putting pressure for producing quality products with minimum cost. As the world approaches the new millennium, the relevance of productivity is gaining more significance in the present scenario. To increase productivity the maintenance strategy is of utmost importance. In earlier days, maintenance used to be defined as overhauling in repairs of the equipment when it fails but this definition is out dated now. Maintenance is the culmination of group of activities. It is a composite function. In a manufacturing plant it also involves a wide range of other activities such as planning, purchasing, quality control and other technical activities as Engineering, Designing, Trouble shooting, Energy conservations, Cost reduction etc.

OBJECTIVES OF MAINTENANCE

Objective may be defined as 'To keep plant and machinery in optimum condition with the minimum possible expenditure'.

WHY A NEED FOR MAINTENANCE

A need for maintenance shall arise with the installation of machinery to avoid failures that occur for reasons that are difficult to anticipate such as poor design, poor maintenance or mal operation. This is called Unexpected Maintenance load. Although such work is difficult to forecast, experience suggests that it is inevitable especially in the early life of the plant and therefore needs system for its detection, recording and analysing.

A Maintenance Manager is to decide on the best way either to replace or repair the weak component (1) before failure (preventive maintenance) or (2) after failure (corrective maintenance), or (3) design-out the weak component to prevent maintenance.

MAINTENANCE, TYPE AND STRATEGY

Maintenance is a combination of actions carried

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Planned Maintenance

Preventive Maintenance | **Corrective Maintenance**

out to return an item to, or restore it to, an acceptable condition.

Maintenance system may be broadly categorised into (1) Planned maintenance; (2) Unplanned maintenance. We shall focus only on the planned maintenance.

Preventive maintenance is carried out at predetermined intervals or to other prescribed criteria and intended to reduce the likelihood of an item not meeting an acceptable condition.

Corrective maintenance is carried out to restore an item which as ceased to meet an acceptable condition.

The Maintenance Manager's basic task is to-

(a) Determine strategy

(b) Organise and control requisite men, material and machinery.

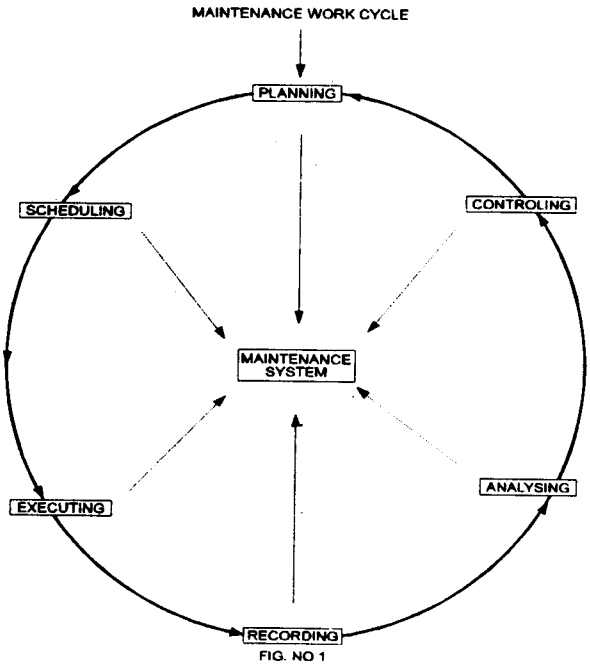


Fig. No. 1 Maintenance Work Cycle

Planned maintenance is not a specific form of maintenance but it implies systematic way of maintenance. The work is organised and is carried out with fore thought, control and record. This planned maintenance is shown in Figure 1 by Maintenance Work Cycle.

By Planning Means :

"What work has to be done". How it has to be done. It means planning anticipates the work activities and the resources well in advance.

Scheduling: When maintenance activities are planned with time schedule, it forms the part of scheduling.

Executing: When the scheduled maintenance work is actually carried out and completed it is called executing.

Recording : When the work has been completed it is to be recorded for future reference.

Analysing : The data should be analysed for the purpose of evaluating the performance.

Controlling : During the analysis stage, it may happen that some thing has been left in original planning, so control provides the feed back information to the planning function to adjust, modify, or incorporate changes in the original plans for accomplishing better results.

In practising planned maintenance, the application of maintenance policy should be clear, maintenance work should be planned in advance, work should be scheduled and executed according to preconsidered plans, historical, and statistical records should be maintained to review the performance and to formulate the guidelines.

STRATEGY

Due to various problems confronting in achieving

the desired results, the maintenance manager has to adopt certain plant maintenance stragey which shall help to run the plant with optimum efficiency such as the following :

1. Inventory of all critical equipments should be made.

2. (a) Most critical equipments should be put on line monitoring even those related to safety such as chlorine.

   (b) Equipments which are considered critical should be put on condition monitoring.

   (c) Those equipments which are critical for production but the cost of condition monitoring is of high order may be put to preventive maintenance.

   (d) Equipments which are non critical in nature and of low value may be put to corrective maintenance category.

3. Analysis of the breakdown jobs should be made.

4. Jobs should be clubbed for doing them during plant stoppage for any reason.

5. Prompt decision should be taken.

6. There must be efficient communication at all levels.

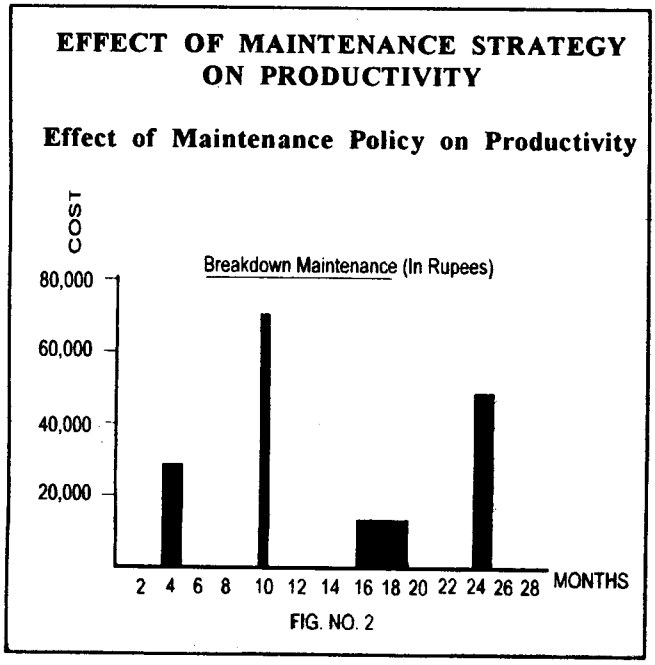


FIG. NO. 2

7. Proper coordination should be maintained between process and maintenance.

8. Job related in house training should be carried at a certain period to update the knowledge of work force.

Most important above all is the farsightedness, senstivity towards the consequences and channelising the synergy in uni-direction for best results.

In this case the machines break down atrandom, production stoppages are not uniform and may some times be of a longer duration because of non availability of maintenance and unplanned man power.

Minor and major overhauls can be planned at regular intervals could be even undertaken during a small stoppage which shall not disturb production.

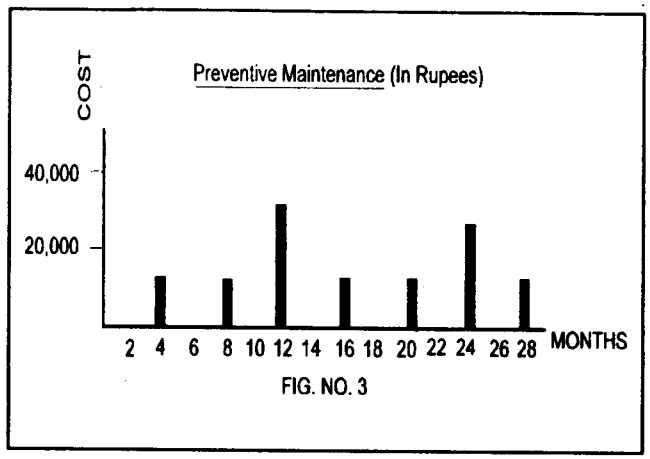


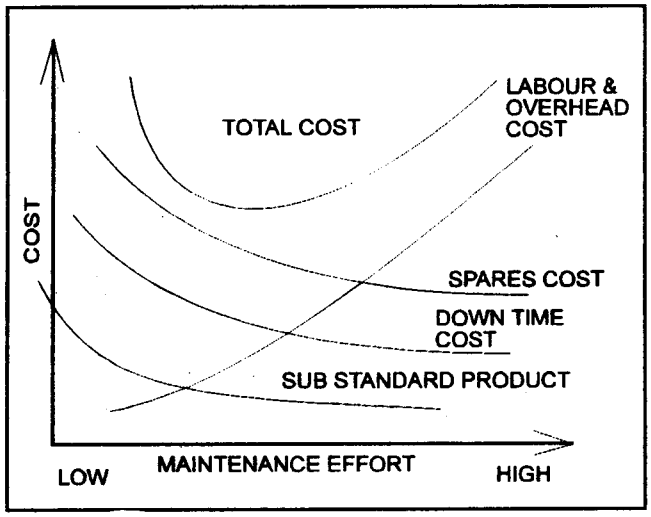
FIG. NO. 3

MAINTENANCE COSTS

One of the salient feature of maintenance strategy is monitoring and control of costs. Cost control and cost reduction are not synonymous. Cost control means containing costs within the predetermined limits. Cost reduction means doing the same thing at a cost lower than the past actual cost or past standard cost.

The Figure 4 shows that a proper strategy for maintenance through planned organised system have a direct impact on cost in relation to varying degree of maintenance efforts.

Here low degree of maintenance efforts refers to extremely hazard state, high degree corresponds to a situations where no breakdowns occurs, controlled lubrication programme adjustments and cleaning would



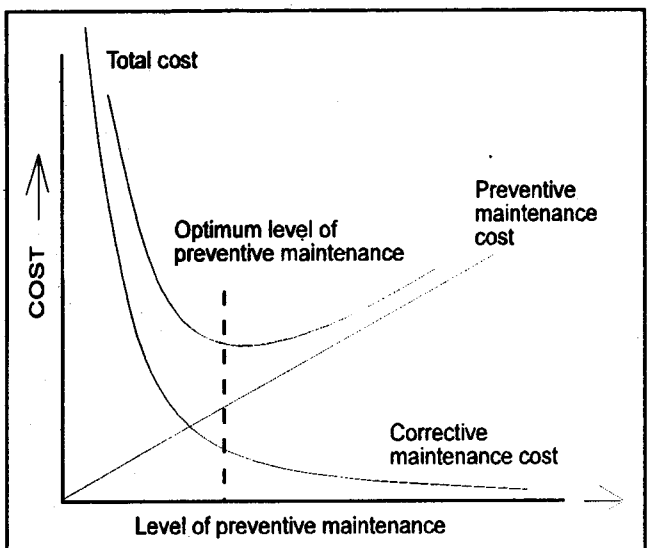


Fig. No. 4 Relationship between preventive maintenance and total maintenance cost

represent the first step in moving from low degree to high degree of maintenance effort.

The maintenance plan should consist of a schedule of preventive maintenance work and the guideliness for the implementation of corrective maintenance work.

MAINTENANCE COST INCLUDES

(a) Labour

(b) Material

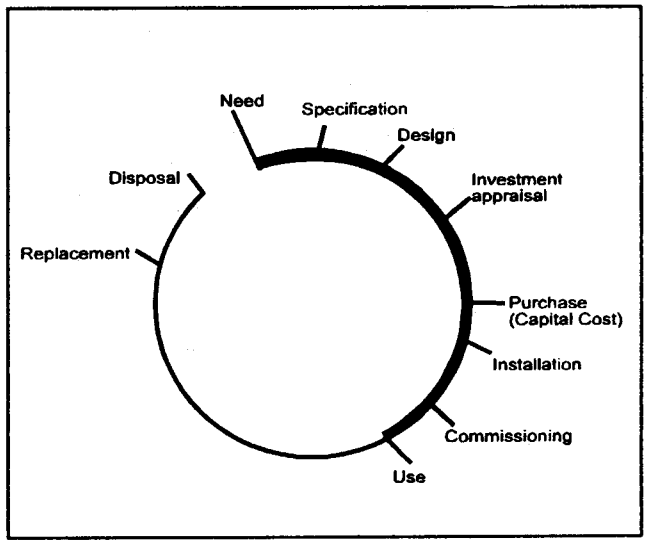
(c) Spare parts holding costs (Stores)

(d) Engineering support costs (Workshops)

(e) Contractors

(f) Overheads (Planners, Supervisors, and Engineers)

PLANT LIFE CYCLE & COSTS



Input money

Net output money

Fig. No. 5 Plant life cycle and costs

Any industrial organisation exist to make a profit, they use equipment and employ labour to convert raw material of relatively low value in to finished product of higher value.

Investment in the plant occurs from its conception to its commissioning.

The return on this investment begins when the plant comes into use and continues until the plant is disposed off.

To maximise profit, the Dead time from conception to first use and the total investment should be as small as possible while the operating life and the total return should be as large as possible.

Maintenance comes into picture which effects

Condition Monitoring Techniques

S. No.	Type	Method	On-line-or Off-line	Comments
1.	Visual	Human Eye	On	Covers a wide range of adhoc methods surface inspection only.
2.	Temp. Monitoring	Temp. Crayons & tapes, Thermometers Thermocouples Infra-red meter	On	Mainly surface temperature over a wide range of temp. Infra-red covers a wide range of temp. but limited area.
		Infra-red Scanner	On	As above but can cover much wider surface area. Can provide surface temperature picture and can be calibrated to give quantitative measures.
3.	Lubricant Monitoring	Magnetic Plugs, filters	On	Analysis of debris picked up by plugs or filter in an oil washed system. Mainly large debris picked up 100-1000 microns.
		Ferrography		Instrument to separate ferrous debris by size to enable micro scopic examination. Non ferrous debris also separated. Direct reading instrument are also available. Wide range of debris size analysed 3-100 microns.
		Spectro-scophy		Spectrographic analysis of oil samples to determine elements present. Analysis for small debris size 0-10 microns. Contract service usually available.
4.	Vibra-tions	Total signal	On	Monitors vibration signal from rotating or reciprocating machines as an averaged no. Problems on one frequency can be masked by overall signal.
		Freq. analysis	On	Records vibrations signal over wide frequency range and monitors. Can establish out of balance or roller element bearing problems.
		Shock pulse monitoring (SPM)	On	All three techniques use high frequency signals for roller element bearing monitoring SPM can also be used for leak detection.
5.	Crack detection	Dye penetrant	On & off	Detects cracks bearing surface.
		Magnetic flux	On & off	Detects cracks at/near surface of ferrous materials.

S. No.	Type	Method	On-line-or Off-line	Comments
to		Elect.	On & off Resistance	Detects cracks at surface and can be used estimate depth of crack.
for		Eddy Current	On & off	Detects cracks near to surface. Also useful inclusion and hardness etc.
		Ultrasonic	On & off	Detects cracks any where in component, directional sensivity, therefore general searches lengthy.
		Radiography	Off	Detects cracks anywhere in components, Section and source (Steel/Access to both sides of component necessary. Radiation hazard.
6.	Corrosion monitoring	Weight loss coupons	off	Coupons weighed when plant off-line.
		Corrosometer	On	Electrical Element and potentiometer. Detects less than 1 mm corrosion loss.
		Polarisation resistance	On	Only indicates corrosion, No. accuracy with estimate of rate.
		Pulse indicat or holes	On	Indicates that present amount of corrosion has occurred.

the life cycle profitability and hence it is of paramount importance.

CONTINUAL IMPROVEMENT - A KEY TO SUCCESS

Transforming problems into opportunities pave the way for tangible progress in achieving goals of any organisation. A maintenance exercise undertaken at Star Paper Mills Ltd. has resulted into considerable savings, developments and improvements in the overall system. Some of the case studies are cited below under the heading of achievements.

ENERGY SAVINGS

In our pulp mill, one washing street is having four stage vacuum filters. Due to building layout and space problems, the seal tanks are not installed vertically below the filters but away from them such as in case of filter No. 1, the seal tank is 4.5 metre away, in case of filter No. 2 the seal tank is 16 meter away and in case of filter No. 3, the seal tank is 3.5 metre away. The filter are installed at a height of 10.5 metres from ground floor.

The drop legs did not create sufficient vacuum by themselves, hence a 200 HP vacuum pump was running for the system. By the modifications in the drop leg design, seal chambers of seal tanks and rectifying the suction head, it was possible to run the washing street with smaller 50 HP vacuum pump only.

The diameter of drop leg was increased from 10" to 12" and made vertically straight as far as possible. The horizontal portion was given a long radius bend and connected tangentially to seal chamber inside the seal tank. Pipe diameter was made one size larger than drop leg dia. For filter No. 2, where horizontal portion was longer than 12 metre, two sizes larger, pipe diameter (400 mm) was used.

DOWN TIME REDUCTION

On our old paper machines, there used to be major production loss (around 6 hrs per month) due to general breaking/bearing damage/rolls shearing of

dryer section felt rolls, because these were designed for cotton felts with low felt tension and low machine speeds. Now the machine speeds have increased and synthetic dryer screens having higher felt tension have replaced cotton felt. The identification of critical rolls with more than 90° wrap angle was made and replaced with modified higher diameter and stronger journal felt rolls with self-aligning roller bearings inside single bearing housings in place of dumb bell housing. This has resulted in elimination of the down time on this score even on increased speeds of paper machine.

GAIN BY CONDITION MONITORING

On paper machine No. 2, the temperature of M.G. surface was showing varying temperature in the whole width (varying from 78° C to 98° C). There was no abnormal sound coming from M.G. even then the manhole was opened during planned shut and found one of the inside scoops in wornout condition and hanging. It was repaired thus avoided a major production loss.

INNOVATIVE REPAIRES

Though many of the equipments are repaired, overhauled and even parts replaced by new in our mechanical workshop. On the same line, one breast roll made of bronze for paper machine no. 3 which was in discarded condition due to bending of surface (Maximum 5 mm in centre) was successfully repaired by S.S. Cladding the roll surface. This roll was made serviceable and new running smoothly on paper machine. This has resulted into increased confidence among the crew by saving around 2.75 lacs Rupees for roll.

CONCLUSION

This has been observed that by adopting the planned maintenance strategy, the breakdowns may be minimised with reduction in cost and production can be maximised. The condition monitoring with proper maintenance system helps to improve the runnability of the plant and prevents expensive breakdown to a great extent. This can further control the inventory of the spares and helps reduce expenditure on spares which lie as frozen chunks of capital in the stores.

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