Maintenance in Pulp and Paper Industry

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INTRODUCTION

Undoubtedly, today one of the most challenging tasks a maintenance engineer faces is rapid deterioration of machines due to their use and exposure to environmental conditions. Expectations of machine availability have increased and any loss of production due to non-availability of equipments is not pardonable. In today's world the main objective of maintenance engineer could be

- To keep the equipments in ıan optimum running condition,
- To ensure specified accuracy of controls and measurements,
- To have a control over production programme by ensuring minimal downtime,
- To constantly carry out modifications on the equipments to meet the augmented need for production,
- To prolong the useful life of any equipment without sacrificing its efficiency and usefulness so as to avoid any heavy capital expenditure for equipments replacement.

Maintenance in the accounting records is represented as an element of cost and hence this can only earn profit by reduction of total cost on maintenance.

The various elements of maintenance cost can be sub divided into:

- Downtime cost
- Cost of spares and materials.
- Cost of labour
- Cost due to inefficient operation of the machine.

Vital decisions such as manpower requirement, spare parts inventory, frequency of attention, job allocation, machine replacements etc are all dependent on the total elements of cost listed above.

Basic elements of maintenance

This may include all or some of the followings:

- Regular inspections.
- Check ups.
- Lubrication.
- Planning and scheduling.
- Records and analysis.
- Training.
- Storage of spares.
- Identification of spares
- Categorization of machines into important and ordinary machines.

Requirements for good maintenance

Though in present day scenario the engineer often goes for best equipments where least maintenance would be required, but in spite of all his best efforts he, still has to carry out minimal basic maintenance on his equipments such as:

- Effective supervision
- Effective control of work
- Effective planning
- No short cut maintenance techniques
- Prioritize the schedule
- Clear conception of maintenance requirement down to the lowest level.
- Proper recording of jobs executed.
- Optimum stock of spares requirements.
- Good house keeping.
- Good environment in and around machines.
- Proper lighting
- Proper tools
- Proper spares replacement
- Avoid trial and error method of maintenance spares fitment.
- Carefully evaluate the behaviour of the machine after maintenance.
- In doubt always-original manufacturer documents may be referred to.

Types of maintenance

These are categorized into mainly six types:

1. Capital replacement
2. Provision of standby capacity
3. Breakdown maintenance

4. Scheduled maintenance

5. Planned maintenance

6. Preventive maintenance

With the advancements in technology and advanced analyzing equipments such as SPM meter, vibration analyzer, hot spot analysers, infra red thermal hot spot locaters, oil analysers, computer based monitoring and data acquisition maintenance techniques, the concept of predictive maintenance is becoming the need of the production plants.

And finally systematic maintenance

in systematic maintenance the normal practices of maintenance activities and plant requirements are simultaneously planned. As seen below:

Normal maintenance activities

1) Preventive & planned: can be planned well in advance such as

   Lubrication and inspection

   Repairs and replacements

   Overhauls

   Attention to breakdowns

   Components reconditioning

   Manufacture of spares

   Making of drawings

   Noting of dimensions

2) Alterations: these are occasional and irregular in nature

3) New work: these are occasional and irregular in nature

Planning of maintenance:

Here the steps involved can be written down as follows:

- Anticipation
- Visualization
- Determination
- Material arrangement
- Alterations of production plans.
- Job allocation
- Instructions to individuals about schedule and methods
- Follow up and job checking during and after maintenance.
- Evaluation of job after maintenance

Evaluation of maintenance performance:

This can be evaluated by the following:

$$\text{Total downtime} = \frac{\text{downtime hours}}{\text{available hours}}$$

$$\text{Frequency of downtime} = \frac{\text{no. of breakdowns}}{\text{Available machine hours}}$$

$$\text{Effectiveness of planning} = \frac{\text{downtime due scheduled maintenance}}{\text{Downtime due to total maintenance.}}$$

To analyze the breakdown and to have the facts such as actual downtime, reasons good companies follow the work request. The work request format gives the maintenance personnel the basic inputs required for analyzing the breakdowns and aiming at minimizing them. This work request acts as an F.I.R. for planning, scheduling, priority fixing, cost controlling and fixing of an objective for the department.

The advantage of maintenance and analysis of the breakdown finally makes a foundation for effective reduction in down time by:

- Increase in availability of equipment.
- Lesser overtime
- Lower maintenance expenditure
- Increase in confidence by the user department.
- Lower inventory.
- Maximum safety to the employees.
- Lesser fatigue
- Greater output
- More time availability to maintenance engineers for various other planning works
- Lesser contracts
- Better housekeeping
- Longer equipment life

Failure of maintenance:

The main criteria which contributes to a great extent for maintenance of the machine has to be taken care at the time of equipment installation itself during the project stage, for this the factors to be taken care should be:

- Layout
- Equipment selection
- Standardization of equipments
- Suppliers backup for after sales support for spares, services etc.,
- Installation.
- Time given to install equipment
- A reasonable commissioning & observation period.

It is very rare to come across a project, which has all of the above elements well in place project is divided into two parts :

a) Initial installation and

b) Rectification of initial installations.

It is often seen that an engineer who installs any equipment very often is shifted to a next project and the legacy of maintaining the equipment falls on a person who is new and tends to blame the project engineer for all the problems that is faced during the maintenance of the equipment. If an engineer who is in charge of the project also is given to maintain the equipment he has installed. he shall get wiser and make sure that in future installations the mistakes committed are taken care of.

RESULTS AND DISCUSSION

Some case histories where due to proper analysis and timely maintenance downtime were substantially reduced:

Case-I

Frequent electrical flashes in the electrical H.T. breakers causing turbine trippings;

M/s HPCL-NPM have installations of 2 nos 15 m.w., 11 k.v. extraction cum condensing turbo generator sets which are in operation for the past twenty years as a part of the original project. These 2 t.g. sets operate in parallel and cater to all of the plant requirements A.S.E.B. supply is used as standby as also to augument any additional power requirement to the plant as and when the turbine cannot be fully loaded.

The conditions at our agaon paper mills differs from many plants of similar type. This is mainly due to the humidity of the area and rainfall round the year. The humidity is between 53% to 90% and at most of the time it remains above 75% as the rainy season is of five months and due to occasional heavy showers round the year.

For the past several years, engineers of the mill are experiencing frequent t.g. trippings due to flashes in their electrical high tension panels.

One of the major challenges faced by the electrical department is flashing in the 11 k.v. bus, breakers and overhead conductors which suppl power to the river intake well seven kms. away and also the lone feeder to the township. The no. of flashes was as high as almost once a month. Figures and downtime due to consequent ional losses are as given below:

Out of the above nearly 85% of the T.G. trippings are on account of flashing of the 11 k.v. system. Each t.g. tripping causes considerable downtime as can be seen from the Table 1. By the industrial standards such trippings are not acceptable and it became necessary to find out the reasons for the same and to avoid such incidences Table 2.

Observations:

- Out of 42 nos. of trippings about 30 trippings have been caused by flashovers.
- In all the above cases the relays of respective feeders have not tripped.
- All the relays have been tested and calibrated by an external agency (M/S EDCON).
- In all the trippings the first up annunciation shows, "trip oil pressure very low."
- In many instances flashover due to bursting of c.t's were observed.
- At the time of tripping sweating inside the flashed panels have been observed.
- The 11 k.v. bus insulation value rapidly starts falling if, not charged within a couple of hours.
- The township and intake wells fed through overhead lines partially running in rough terrain and partially along the road. In view of the lashing rains and the hilly terrain, the overhead conductors are susceptible to faults.
- The a.v.r. was old and sluggish in performance also maintenance as well as support for spares was not available from M/S B.H.E.L. the original equipment supplier.
- After the project stage on study had been carried out by any reputed expert on the plant electrical power systems.

Maintenance action taken

- During the annual shutdown in the year November 2001. The entire 11 k.v. bus bars were sleeved with Raychem heat shrinkable tapes.
- The breaker bus barriers which had been missing were provideed.

Table 1 : Downtime due to t.g. trippings

Sl. No.	Year	No. of t.g. trippings on electrical fault	Downtime on machines	Production loss
1	1999-2000	12	82 hours	1312 tonnes of paper
2	2000-2001	10	74 hours	1184 tonnes of paper
3	2001-2002	12	68 hours	1088 tonnes of paper
4	2002-2003	6	32 hours	512 tonnes of paper
5	2003-2004 (till date)	2	12 hours	192 tonnes of paper
6	**Total**	**42**	**268 hours**	**4288 tonnes of paper**

Table 2 : Reasons for trippings

Sl. No.	Month	No. of t.g. trippings /stoppages	Reasons machines
1	Nov 2001 to April 2002	Nil	Nil
2	May 2002	2	Commissioning & tuning of new brush less exciter.
3	June 2002	2	Tripping of transformer feeding auxiliary equipments of turbine.
4	July 2002	Nil	
5	Aug 2002	I	Force stopped as main compressor stopped.
6	Sept 2002	Nil	
7	October 2002	1	c.t. burst
8	November 2002 to March 2003	Nil	
9	April 2003	2	Off-load isolator operated on On-load, live bus bar earthed accidentally by maintenance staff in anticipation of dead bus bar.
From the above we can see that except at Sl. no. 7 where open type c.t. had not been replaced by window type c.t.'sand at Sl. no. 9 where maintenance staff had committed a mistake, no trip pings has taken place for poor insulation of the panel.			

- The transformers bus bars were sleeved.
- Unapproachable portion of the panels were painted with STANVAC insulating varnishes and paints which had come in easy to use spray cans.
- In the main switchgear room de-humidifiers were installed.
- All the panel openings of the 11 k.v. panels were blocked and room air-conditioned.
- Some of the open type c.t's were replaced by window type c.t's.
- A reactor was installed in the feeder which fed the township.
- Regular recordings of the panel temperatures were started using a non-contact type of thermometer.
- A numerical relay was installed in the feeder feeding our caustic and chlorine plant.
- A plc based annunciation system was installed.
- Brushless excitor was installed by m/s Elin-VA TECH. in April 2002.
- Relay co-ordination was carried out as per recommendations given by m/s A.B.B. in their system study carried out by them in August 2001.

The cumulative action of the above arrangements and installation gave us very encouraging results and after November 2001 and April 2002 where we had taken a plant shut the flashes have been almost eliminated.

All the trip pings have now been restricted.